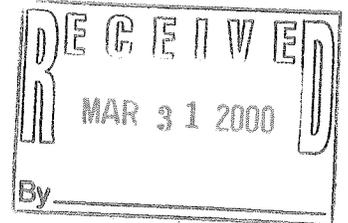
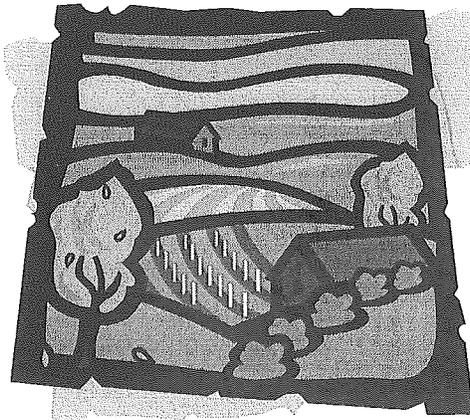


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DEERFIELD MASTER PLAN
MARCH 2000



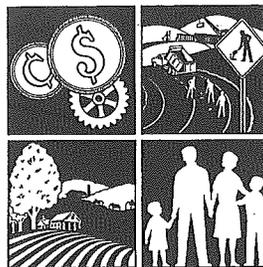
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DEERFIELD MASTER PLAN

MARCH 2000

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DEERFIELD MASTER PLAN

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction

A Master Plan is a long range plan that guides development in a town towards a vision of what residents would like the future to be. It is a comprehensive document that looks at all aspects of a community including Farmland, Open Space, and Natural Resources, Community Facilities and Services, Housing, Historic and Scenic Resources, Transportation Resources, Economic Development, and Land Use and Zoning. This includes mapping, inventory, analysis, and recommended strategies for accomplishing the objectives of the town. Most importantly it is a plan created by and for the citizens of the community.

The Town of Deerfield began their Master Planning process with an extensive community survey distributed to two thousand, three hundred and twenty-four (2,324) Deerfield households in February of 1999. This survey is an integral part of the Master Plan (*see Appendix I*) and provided guidance and a framework for the completion of this document. Approximately thirty-three percent (32.8 %) of households responded to the survey by the deadline date providing an excellent sample of Deerfield residents' vision for the future of their community.

The purpose of this Executive Summary is to present the highlights of the Master Plan developed by over seventy Deerfield residents and Town Officials. The Master Plan is organized into seven chapters pertaining to resources that Deerfield residents value the most. The following text includes three main parts for each chapter: the community survey results that guided the research; the findings from the inventory and analysis of available information; and, selected recommendations, which were developed by the Master Planning Committee.

Farmland, Open Space, and Natural Resources

Community Survey Results

Overall eighty-nine percent (89%) of the community survey respondents felt it was either important or very important to preserve working farms, wildlife habitat, stream corridors, and scenic views. The goals therefore are:

- To preserve the rural character by protecting and supporting the Town's rich farming heritage and continued agricultural productivity; and.

- To maintain and protect critical natural resources including farmland, forests, public water supplies, wildlife and their habitat areas, rivers and streams, and ponds.

Findings

The Master Planning Committee discovered the following trends based on an analysis of the available information:

Farming

- In Franklin County the numbers of farms are decreasing but the size of farm operations are increasing.
- The number of acres of cropland in Deerfield has decreased by nine percent (464 acres) between 1971 and 1997 due to residential and industrial development.
- When farmland gets fragmented, by residential development, farming costs increase and scenic and historical agricultural landscapes are changed forever.

Open Space

- There are two thousand, seven hundred and sixty-three (2,763) acres of permanently protected open space in Deerfield, nearly half of which is farmland. This represents approximately thirteen percent (12.92%) of the total land area in Deerfield
- Open Space includes lands with varying degrees of protection. Chapter 61, 61A and 61B lands, for example, do not provide protection from future development.

Natural Resources

- Within the Town of Deerfield's boundaries, the Deerfield River is considered clean enough for fishing and swimming despite the presence of pollutants upstream. The Connecticut River contains PCB's and other pollutants from upstream that make eating fish caught there prohibitive.
- The poor water quality of Bloody Brook is probably caused by road salt runoff, some agricultural practices, homeowner fertilizer use, and septic problems, which may threaten populations of endangered species downstream in Whately.
- The amount of water that South Deerfield Water Supply District customers have used every day on average, has exceeded the District's current registered withdrawal rate in 1995, 1997, and 1998.

Selected Recommendations

- Establish an Agricultural Protection Overlay District covering prime farmland soils that will seek to direct development and maximize farmland preservation.
- Continue to contribute to the Land Preservation Fund to protect open space including contributing five percent of the cost of development rights for farmland entering the Agricultural Preservation Restriction (APR) Program.
- Delineate the recharge areas for all existing and future public water supplies and support regional watershed planning efforts.

Community Facilities and Services

Community Survey Results

A majority of the community survey respondents are satisfied with the public water and waste management services but are dissatisfied with the public sewer system. The selected goals therefore include:

- To protect the quality and quantity of public and private drinking water supplies.
- To maintain and renovate the sewer system to provide service to areas constrained from using other methods.
- To plan any expansion of wastewater treatment to be consistent with the Master Plan, which would minimize loss of farmland and fragmentation of open space.

Findings

The Master Planning Committee discovered the following trends based on an analysis of the available information:

Public Water Supplies

- The South Deerfield Water Supply District may in the future be required to identify additional sources of water within, or outside of the district and encourage its customers to adopt water conservation practices.

Wastewater Treatment

- The South Deerfield Wastewater Treatment Plant (SDWWTP) is operating at ninety-eight percent (98%) of its design capacity due to both the amount of wastewater coming into the plant and the high percentage of nutrients within it.
- Some of the water coming into the system (hydraulic loading) is from storm water entering cracked pipes, which are often very expensive to fix.
- Extending new sewer lines to areas with septic problems will increase hydraulic loading at the SDWWTP and will threaten existing farmland with development pressures.

Selected Recommendations

- Establish a Watershed Protection Overlay District to protect the Roaring Brook Reservoirs from land uses that produce water pollution.
- The Select Board and Planning Board should explore the application of shared conventional or alternative septic systems where the costs of sewer line expansion, threat of residential development, and the reduction in the viability of farm operations far outweigh the benefits.

Housing

Community Survey Results

Overall seventy percent (70%) of the community survey respondents want to curb residential development, sixty-eight percent (68%) support building of elderly housing, fifty-one percent (51%) endorse programs for first time home buyers, and a majority oppose building low and moderate income housing. The selected goals therefore include:

- To encourage a mix of housing densities, prices, and building types to serve diverse households consistent with the character of the community.

Findings

The Master Planning Committee discovered the following trends based on an analysis of the available information:

- Deerfield's elderly population, residents over sixty-five years of age, increased by over four percent (4.3%), or twenty-one (21) people between 1990 and 1995 while the same group showed declining numbers in Franklin County and steady figures for the State as a whole. However the next generation of elders in Deerfield, residents between forty-five and sixty-four years of age grew by over eighteen percent (18.2%) or two hundred and seventy-eight (278) people between 1990 and 1995. The elderly in Deerfield will be requiring new housing within the next twenty years.
- Deerfield, like every town in Massachusetts, is required by State mandate, Executive Order 215, to offer ten percent (10%) of its housing stock for low and moderate income households. The State defines low and moderate income housing as housing developed with a state or federal subsidy, in which at least twenty-five percent (25%) of the units are reserved for households with incomes less than eighty percent (80%) of the median. Deerfield has only twenty-four (24) units that are considered by the State as housing for low and moderate income households, which represents little more than one percent (1.15%) of the Town's housing stock. The State mandate allows a developer who will guarantee long term low and moderate income housing, to obtain a comprehensive permit from a town's Zoning Board of Appeals. If a town's percentage of low and moderate income housing is less than ten percent (10%) of its total housing stock, it can not deny the permit but can require reasonable changes. Deerfield currently needs one hundred and eighty (180) low and moderate income housing units to comply with the State's directive.
- Deerfield can develop elderly housing in South Deerfield for Deerfield residents that can count towards the State's mandate of ten percent (10%) low and moderate income housing.

Selected Recommendations

- The Select Board and Planning Board should work with the Franklin County Regional Housing and Redevelopment Authority to establish an elderly housing complex that will give priority to Deerfield residents and will contribute to meeting the State's ten percent (10%) goal for low and moderate income housing.

Historic and Scenic Resources

Community Survey Results

Overall eighty-five percent (85%) of the community survey respondents felt it was important to preserve historic buildings and landscapes. The selected goals therefore include:

- To identify and protect historic resources including buildings, sites, and landscapes.

Findings

The Master Planning Committee discovered the following trends based on an analysis of the available information:

- Deerfield has over two hundred and sixty-two (262) historically significant structures and sites yet, only a third of them are officially recognized by the Massachusetts Historical Commission (MHC).
- The integrity of Deerfield's thirteen (13) historically significant landscapes and seven scenic roads are often dependent on continued agricultural activities.

Selected Recommendations

- The Town of Deerfield should work with all interested parties to officially inventory all of Deerfield's historic resources and submit a complete application to the MHC.
- Implement historic and scenic landscape preservation in conjunction with farmland and open space protection efforts with willing landowners.

Transportation Resources

Community Survey Results

Community survey respondents felt that traffic safety and congestion were among the top five planning issues facing Deerfield. The goals include:

- To improve the condition of the road system, pedestrian infrastructure, and traffic patterns at key locations, and to expand transportation choices for Deerfield residents.

Findings

The Master Planning Committee discovered the following trends based on analysis of the available information:

- Traffic volume, congestion, accident, and level of service data suggest that Route 5/10, the South Deerfield village center, and Route 116 are already showing the negative traffic impacts of growth and development.

Selected Recommendations

- Conduct a traffic flow study of the South Deerfield village center roads including Conway Street, and the four-way intersection of Elm, Sugarloaf, and the Main Streets and determine the best ways for managing the increasing traffic.
- Request that the Recreation Committee work with the Franklin Regional Council of Governments to explore and designate a bicycle route that connects the different villages in Deerfield.
- Encourage land uses, which minimize traffic generation and support open space protection efforts.

Economic Development

Community Survey Results

Overall, seventy-seven percent (77%) of the community survey respondents support some combination of commercial and industrial development. The top three types of businesses supported were agriculture, professional offices, and light industry. The goal therefore is:

- To support and promote commercial and industrial development that will maintain existing jobs and provide new employment opportunities, which are compatible with Deerfield's environment and historic character, and which have minimal impacts upon existing farmland.

Findings

The Master Planning Committee discovered the following trends based on an analysis of the available information:

- Deerfield is a regional employment center with fifteen (15) major employers providing eighty percent (80%) of all employment in Town, and these are mostly full time manufacturing jobs.
- Agriculture is one of the competitive industries in Deerfield.
- There is a need to provide existing businesses with land and infrastructure for expansion.

Selected Recommendations

- Work with the Deerfield Economic Development and Industrial Corporation to conduct an engineering study of the C-II Commercial District adjacent to the East Deerfield Railyard to determine the potential for establishing a new industrial park.
- Conduct an infill analysis in the C-I Small Business District in the South Deerfield village by evaluating each parcel and determining what potential square footage could be developed for new and existing businesses consistent with the zoning bylaws.

Land Use and Zoning

Community Survey Results

Community survey respondents felt that Deerfield's top five planning issues are, in order of importance (from most to least): loss of open space, tax increases, traffic safety and congestion, population growth, and lack of public sewer system throughout town. The goals therefore are:

- To protect the rural and historic character of Deerfield.
- To sustain the Town's natural resources and open space through appropriate zoning measures.
- To encourage light industry to locate in appropriate areas in Town.
- To design future development so that, traffic patterns remain light near residential areas and that public safety concerns remain a priority.

Findings

The Master Planning Committee discovered the following trends based on an analysis of the available information:

- Deerfield's current pattern of growth is the beginning of sprawl.
- Generally speaking Deerfield loses money with residential development and sees a net gain with industrial and commercial development. Protected open space permanently reduces the amount of residential development that can ultimately occur and has a positive fiscal impact in terms of taxes.
- Deerfield's current zoning districts will ultimately allow development to sprawl across the landscape resulting in:
 - An estimated 18,000 new residents, including 3,167 additional school children;
 - An increase in drinking water consumption of almost 2.3 million gallons per day; and,
- Only enough farmland for two large farms.

Selected Recommendations

- Establish and fund a Town Open Space Protection Program.
- Establish a Watershed Protection Overlay District to protect the Roaring Brook Reservoirs from land uses that are associated with non-point source pollution.
- Establish an Agricultural Protection Overlay District to direct development away from prime farmland soils, target farmland protection efforts, and provide economic support to farming operations.
- Rezone the land around the East Deerfield Railyard from C-II Commercial to C-III Industrial if the engineering study demonstrates that an Industrial Park for major employer expansion is feasible.

CHAPTER 1

FARMLAND, OPEN SPACE, AND NATURAL RESOURCES

This chapter, Farmland, Open Space, and Natural Resources, addresses some of the most important assets of the Town of Deerfield, its pastoral, and working agricultural landscapes, ample forests, dramatic hills and ridges, aquifers, wetlands, rivers and streams. What people commonly refer to as rural character is epitomized by over four fifths of Deerfield's terrain including the cultivated floodplains of the Deerfield River, portions of River Road along the floodplains of the Connecticut River and the orchards and wooded hills along West Deerfield's Upper Road.

This chapter identifies the quantity, quality, and the spatial relationships between Deerfield's farmland, open space, and natural resources. Due to the similar subject matter, the 1999 Deerfield Open Space Plan Update was incorporated into the contents of this chapter. This work has been supplemented with mapping and inventories with respect to farmland, wetlands, and ridgelines. In addition, available information related to water quality and fisheries is provided. This information is compiled on a watershed basis, since sources of pollution upstream have a direct impact on the quality of water, wildlife and fisheries which move through Deerfield. Deerfield is located in two main watersheds, the Connecticut River and the Deerfield River. The Mill River watershed is a subwatershed of the Connecticut River Basin.

In 1999, the Town of Deerfield completed their Open Space and Recreation Plan Update. As part of this effort a community survey was distributed to 2,324 households and over thirty-two percent (32%) of the surveys were returned (*see Appendix I*). The responses to questions concerning agriculture, open space, natural resources, and the Town's rural character were utilized in preparing the goals and objectives listed below. Although the community survey does not represent the opinions of every Deerfield resident nor every age and income bracket, it provides the best current assessment of the issues and resources residents believe are most important and worthy of attention.

Goals:

- To preserve the rural character by protecting and supporting the Town's rich farming heritage and continued agricultural productivity.
- To maintain and protect critical natural resources, including farmland, forests, public water supplies, wildlife and their habitat areas, rivers and streams, wetlands, and ponds.

Objectives:

- Assess the current quantity and quality of agricultural land in Deerfield and determine which farmland parcels are most threatened by development.
- Develop a means of tracking farm and forestland parcels about to be removed from Chapter 61 land classification and taxation programs for conversion to residential uses.
- Pursue gifts and bequests of open space, and other natural resources to the Town, local land trust, or State or Federal agencies as appropriate.
- Support growth management strategies which protect agricultural land and open space.
- Support public and private initiatives to protect agricultural land, open space, and natural resources, including the use of conservation restrictions, tax incentives, and fee simple purchases.
- Identify and protect the water quality and quantity of aquifers for existing and future public drinking water supplies and private wells.
- Maintain and preserve the water quality and related environmental resources of the Deerfield and Connecticut Rivers and their tributaries.
- Avoid development of floodplains and direct development away from environmentally sensitive areas.
- Identify and protect important ridgelines and viewsheds. Implement measures to direct telecommunications towers away from highly visible ridges in Town.
- Identify measures to protect environmentally sensitive areas and resources including wetlands, woodland, rare and endangered species habitats, vernal pools, deer wintering areas and other critical wildlife habitat areas identified by the Massachusetts Natural Heritage and Endangered Species Program.
- Advocate for the adoption of techniques by commercial, industrial, forestry, and agricultural businesses that would result in the sustainable use of natural resources including prime soils, farmland, forests, rivers, and drinking water supplies.

This chapter is presented in four main sections. First, a general overview of Deerfield's landscape character and a selective inventory of the town's natural resources are presented. This provides an overview of the general trends and issues covered in greater detail in the following sections focusing on farmland, open space, and natural resources. The second section presents an inventory of the farmland resources within the Town of Deerfield and identifies the areas most in need of protection. The relationship between the proposed sewer extensions and existing farmland highlights parcels most threatened by new residential development and therefore in need of protection.

Deerfield's open space resources have been inventoried (*see Open Space Map*) including those lands that are enrolled in temporary protection programs such as Chapter 61 and 61A, those

properties permanently protected under conservation restriction, farm properties protected through the Agricultural Preservation Restriction (APR) Program, and lands owned by the Town or water districts. The relative values of these properties are assessed taking into consideration their natural resource and recreational values. For instance, the permanently protected parcels surrounding South and North Sugarloaf Mountains provide opportunities for two types of landscape level corridors, those that provide mobility for wildlife and those that offer greenways for recreational activities (*See Composite Environmental Assessment Map*).

The natural resources section of this chapter provides inventories and analyses of the town's geology, soils, topography, water resources including rivers, wetlands, reservoirs, aquifers, vegetation, and wildlife, fisheries and their habitat. The chapter concludes with an outline of mapping products prepared to assist with the inventory and analysis and recommendations prepared by the Farmland, Open Space and Natural Resources subcommittee.

Landscape Character, Land Use, and Land Use Change

The Town of Deerfield contains within its boundaries several different landscapes: the eastern facing slopes of the foothills of the Berkshires, the floodplains of the Connecticut and Deerfield Rivers, and the north-south running Pocumtuck Range. The floodplains of the Connecticut River, the deposits left by glacial Lake Hitchcock, certainly do not stop at Deerfield's southern boundary. However, a quick study of a regional topographical map reveals interesting features. The floodplain landscape is narrower in Deerfield, for the distance between the foothills to the west and the Pocumtuck Range is not as great as in other towns in the Connecticut River Valley. The Green, Deerfield, and Connecticut Rivers join forces within view of the town's northern boundary with Greenfield.

Table 1-1 below lists the area, in numbers of acres, of selected natural resources and agricultural land uses in Deerfield. Note the large extent of both farm and forestland. In 1997, forestland accounted for fifty-eight percent (58%) of the total land area of the Town of Deerfield.

Agricultural land, consisting of cropland, pasture, and orchards or nurseries comprised twenty-four percent (24%) of the land area. According to the United States Fish and Wildlife Service's National Wetlands Inventory (NWI), Deerfield contained one thousand five hundred and eighty-six (1,586) acres of wetlands or eight percent (8%) of the total land area.

Although the landscapes are mostly permanent, being based on glacial and geomorphic processes, their uses are not. For example, the floodplains of Deerfield have historically been prized for their prime soils and thus farming has been a dominant activity there. However, as residential development consumes more and more farmland, the use of those prime soils changes.

Table 1-1: Natural Resources and Agricultural Land Acreage in Deerfield in 1997

	Acres	Percentage of Total Area
Surface Water	593	3%
Non-Forested Wetlands*	1,012	5%
Forested Wetlands*	574	3%
Forest	12,340	58%
Cropland	4,463	21%
Pasture	345	2%
Orchard, Nursery, etc.	197	1%
Total Land Area in Deerfield	21,388	

Source: 1997 Massachusetts GIS Land Use Coverage except for wetlands data.

* These figures were determined from calculations using National Wetlands Inventory data.

In Table 1-2, a comparison of the types of land uses, and their acreages in Deerfield between 1971 and 1997 demonstrates which natural resources are most susceptible to development pressures. Cropland and forestland have been the primary resources converted to other uses, particularly to residential development. As residential development of one quarter acre or larger has increased, both cropland and forestland acreages have decreased (*see 1997 Land Use and Land Use Change Map in Chapter 7*).

Table 1-2: Changes in the Land Area of Different Natural Resource, Agricultural, and Development Land Uses Between 1971 and 1997

	Land Use Acreages in 1971	Land Use Acreages in 1985	Land Use Acreages in 1997	Change in Acreage Between 1971 and 1997
Cropland	4,927	4,704	4,463	-464
Pasture	357	361	345	-12
Forestland	12,898	12,574	12,340	-558
Non-Forested Wetland	114	114	113	-1
Mining (Gravel, etc.)	107	160	212	105
Open Land	418	403	423	5
Participation Rec.	128	142	144	16
Spectator Recreation	6	6	0	-6
Residential-Multi	0	14	14	14
Residential <1/4 acre	0	0	0	0
Residential 1/4 - 1/2 acre	519	723	765	246
Residential > 1/2 acre	507	609	845	338
Commercial	45	86	106	61
Industrial	30	89	149	119
Open Land - Urban	122	158	185	63
Transportation	457	464	461	4
Waste Disposal	14	18	33	19
Surface Water	593	593	593	0
Orchard, Nursery, etc.	146	171	197	51
Total Area	21,388	21,388	21,388	

Source: MacConnell 1997 Massachusetts GIS Land Use Coverage

The land use tradeoffs between 1971 and 1997 were primarily a loss of forest and farmland and a gain in residential and industrial development. Larger lot residential growth has resulted in the loss of five hundred and eighty-four (584) acres of farmland or forestland. The loss in natural resources may go beyond simply the loss in acreage. When forestland is developed in Deerfield it is more than likely fragmenting an existing block of contiguous forestland. Therefore, the impact development has on wildlife habitat may be more significant than the acreage loss alone might suggest. Similarly farmland which is fragmented by residential development impacts the future viability of farm operations in the region.

Many Deerfield residents value both the working farms and the scenic values they provide. Overall, eighty-nine percent (89%) of the community survey respondents felt that each of the following natural resources were either important or very important to maintain or preserve: working farms; wildlife habitat and stream corridors; and scenic views. Also, when asked for the most important concerns relating to future growth along the Route 5/10 corridor, two of the top three choices were loss of farmland and loss of scenic character. In a related question, the most preferred type of new recreational facility desired for the future was "Trails and paths (hiking, ski, bike)." In summary, the community survey respondents expressed their appreciation for agricultural landscapes, open space, natural resources, and the scenic views they help to create.

Farmland

" What happened to the highly visible agricultural system around Boston? The change when it came was rapid: Vibrant into the 50's, and then going downhill at an ever accelerating rate thereafter. Super-markets appeared in the late 40's, their buyers even then told farmers what they would pay. Cost of production was not a consideration. Improving transportation systems permitted bringing in produce from ever greater distances. "If those growers out there are willing to sell it for so much less, why can't you?" And probably most important, there was the tremendous pressure for that farmland, so easy on which to build houses and industrial structures and apartment complexes, so much more money. So much more money that a farmer could actually retire and not have to work, and work...and work. And so they sold, not all, but many. There was no other way they could realize the value of their investment. Sort of a 401K plan. The State certainly had no interest then in keeping that land in agriculture. Much better to build houses and apartment complexes for people to sleep in and industries for them to work in. No thought that a harried citizenry might come to value farms and the open spaces associated with them. No thought of attempting to preserve some of this farmland. No agricultural preservation restrictions (APR), or the like, in which the State buy's the landowner's right to develop his land the most profitable way possible; the land can be farmed, or sold as farm land, but no buildings, not even a house for the farmer or his heirs. The concept of preserving farmland (APR) came too late for much of Eastern Massachusetts. The results? Try driving in those towns around Rte. 128, or now between Worcester and Boston. Buy a home?"

"...It seems entirely reasonable to project that, except for the land under Agricultural Preservation Restrictions (APR), or a similar such mechanism, the vast majority of farmland {in Deerfield}, not all but most, will end up as it has in eastern Massachusetts and other urbanized areas of the country." – H.V. Marsh, vegetable farmer, Deerfield.

The 1999 Master Plan's community survey found that eighty-nine percent (89%) of the respondents felt that it was either important or very important to protect working farms. When asked about their most serious concerns for land along the Route 5/10 Corridor in light of the potential for future development, respondents to the survey felt that traffic issues, loss of farmland, and loss of scenic character were most important.

Farmland and the business of farming are valued resources in Deerfield but the pastoral landscape and the industry itself are vulnerable to both the choices of individuals, Town spending priorities, and regional development trends. Although there are one thousand and forty-two (1,042) acres of farmland permanently protected in Deerfield, that's only approximately twenty percent (20%) of the approximately five thousand acres (5,000) of crop, pasture and orchard lands in Town.

The Farmland section of this chapter will take stock of the current agricultural resources within Deerfield including the quality and quantity of farmland and the types and numbers of farms in Town. In addition the trends that characterize farming both in Franklin County and in Deerfield

are used to put the most recent year's figures into perspective. This section then considers the breadth of issues and challenges that farmer's face in Deerfield today including the potential expansion of the sewer collection system. Lastly, an analysis of agricultural land protection priorities in Deerfield is presented.

Current Conditions and Recent Trends

According to the Massachusetts' Department of Food and Agriculture (Executive Office of Environmental Affairs), soils throughout the central portion of Deerfield are among the "most fertile agricultural soils in the country." These prime soils contain the best combination of physical characteristics for producing food, feed, forage, fiber, and oilseed crops. The soils are without rocks, highly permeable, and easily worked (Crolius et al; 1989). This area has been extensively farmed and is highly productive, yielding cash crops that include corn, potatoes, onions, pickling cucumbers, carrots, winter squash, and flowers. These soils appear near population centers and their flat, often well-drained character has also made them attractive to residential and commercial development.

Deerfield farmers face a number of economic pressures that threaten the ongoing existence of working agricultural landscapes. Crops will continue to be cultivated as long as it remains profitable for farmers to work the land. Rising land values caused by growth in infrastructure (e.g. roads, utilities, sewer) and residential development create opportunities for individuals to convert their farmland to other uses. Residential development on pre-existing farmland takes acreage out of production and often puts homeowners next to a working farm with all the dust, odors, and noises that are normally associated with farming. Farmland that is aggregated in large blocks facilitates the economic viability of farming operations. In contrast, fragmenting existing farmland areas into units separated by long travel distances and conflicting land uses presents a significant burden and expense to a farm operation and reduces its chance for success (Natural Resource Conservation Service (NRCS); 1999).

How important is farming in Franklin County? In 1997, Franklin County was ranked the number one county in the State of Massachusetts for the following agricultural categories: broiler inventory (poultry), total nursery acres, and the number of maple trees tapped. It was listed second in the State for the value of livestock and poultry, dairy products, other crops including potatoes, cattle and calves sold, ducks, geese and other poultry inventory, and for the number of acres it has for silage corn. It was also ranked as the third most important county in the State for tobacco production (value of sales), number of poultry sold, and in the number of acres in hay crops (USDA, Census of Agriculture - County Data; 1997).

There are thirty-one farms in Deerfield according to information compiled by the Natural Resources Conservation Service in Greenfield, Massachusetts and by FRCOG Planning Department staff (See Table 1-3 below). Of those farms, eight are primarily vegetable farms, six are primarily dairy farms, ten are primarily livestock farms, four are mixed product farms, and four are nursery, turf, or orchard farms. In Deerfield, vegetable and livestock are by far the most common types of farm.

Table 1-3: Farms in Deerfield by Primary Agricultural Product

#	Name of Farm	Vegetables	Dairy	Livestock	Mixed	Nurseries/Turf/ Orchards
1	Cool Water Farm	X				
2	Galinski	X				
3	Karas	X				
4	Kolakoski Farms	X				
5	Kozikowski	X				
6	Maiewski	X				
7	Marsh	X				
8	Ripka	X				
9	Barway		X			
10	Bolton		X			
11	Chickering		X			
12	Crowley or Bittersweet Farm		X			
13	Tatro		X			
14	Yazwinski		X	X Sheep		
15	Ciesluk	X Sweet Corn		X Dairy Replacement		
16	Gewanter			X Horses		
17	Gorey			X Sheep		
18	Lyons			X Sheep		
19	The Farm (formerly "The Stillwater Farm")			X Horses		
20	University of Massachusetts			X Dairy Replacement		
21	Wal Chris Farm			X Dairy Replacement		
22	William			X Goats		
23	Woolman Hill			X Sheep		
24	Mill River Farm				X	
25	Rose				X	
26	Williams Farm Inc.				X	X Nurseries
27	Young				X	
28	Clark					X Orchards
29	Pioneer Gardens					X Perennials
30	Savage	X Potatoes				X Turf
31	Stewart's Nursery					X Nurseries

Source: Natural Resource Conservation Service (NRCS), Greenfield, MA; 10/99. K. Melnik, personal communication; 11/99

How has farming in Deerfield changed in the past ten to twenty years, if at all? If you have lived in Deerfield for the past twenty-five years, you may have noticed changes in the practice, look, and feel of farming in Town. Between 1971 and 1997, the numbers of acres devoted to cropland in Deerfield decreased by four hundred and sixty four (464) acres, which is a ten percent (10%) reduction. During the same time period the number of acres of land in Deerfield containing housing on lots 1/2 acre or larger expanded from five hundred and seven (507) acres to eight hundred and forty five (845) acres, an increase of sixty-seven percent (67%). Approximately

ninety percent (90%) of residential development built between 1971 and 1997 occurred on land containing farmland soils considered prime, unique, and of Statewide importance. These are soils targeted for protection by the Agricultural Preservation Restriction Program (APR). Table 1-4 below describes these significant losses in cropland. It also shows a slight decrease in pasture acreage and an increase in orchard and nursery acreage.

Table 1-4: Changes in Agricultural Land Uses (in acres) in Deerfield 1971 to 1997

Land Use	1971	Change	1985	Change	1997	Change 1971 -1997
Crop Land	4,927	-223	4,704	-241	4,463	-464
Pasture	357	+4	361	-16	345	-12
Orchard, Nursery	146	+25	171	+26	197	51

Source: MASS GIS; 1971, 1985. Source for 1997 data is a land use coverage prepared by D. Goodwin, GIS Specialist at the University of Massachusetts.

Table 1-5: Trends in Agricultural Statistics for Franklin and Hampshire Counties and the State of Massachusetts between 1992 and 1997

Factor	Franklin County	Hampshire County	Massachusetts
# of Acres in Farms	Up by 1%	Down by 3%	Down by 2%
# of Full Time Farms	Down by 4%	Down slightly by 1%	No change
Total Market Value of Agricultural Products Sold	Up 36%, Crop sales 62% of value, livestock 38%	Up by 43%, Crop sales 71% of value, livestock 29%	Up 30%, Crop sales 79% of value, livestock 21%

Source: USDA New England Agricultural Statistics Service, 1999 and the 1997 Census of Agriculture.

A selection of County and State agricultural trends is presented in Table 1-5 above. Between 1992 and 1997, the numbers of acres in farms increased slightly in Franklin County while decreasing in Hampshire County and the State overall. The number of full-time farms has decreased while the market value of the agricultural products sold has increased in both counties and the State. In Franklin County between 1992 and 1997, the total market value of the agricultural products sold on average per farm increased by thirty percent (30%) from fifty-eight thousand dollars (\$58,000) to seventy-five thousand dollars (\$75,000) per year. The average net cash return from these sales per farm increased from six thousand dollars (\$6,000) to fifteen thousand dollars (\$15,000) per year. Even with the increase, this low return is precisely why young people are finding other occupations. The average age of farm operators in Franklin County is fifty-three (53) years (USDA New England Agricultural Statistics Service; 1999).

There is a growing concern amongst farming proponents in Deerfield and the Pioneer Valley concerning the average age figure. Because the average age of farm operators is fifty-three (53) years, Deerfield and other towns in the region will see much of their farmland transferred in the next ten to fifteen years. Some operators will pass on the ownership of the farm to family members. Others may find a young farmer interested in buying, and taking over, their farm. However, some farmers are concerned that there is a shortage of young people knowledgeable and skilled in the agricultural sciences ready to be the region's next generation of farmers. This could translate into a rapid loss of farmland as retiring farmers may place their properties on the

real estate market for sale. Farmland is often readily developed for housing stock as illustrated by the change in land use over the last several decades.

Over a longer period, 1987 to 1997, there is an interesting trend in farming in Franklin County. Table 1-6 below shows that the total number of farms in Franklin County decreased by twelve percent (12%) between 1987 and 1997 and the number of acres devoted to farming decreased by nine percent (9%). However, the overall average size of farms increased by two percent (2%). If we look carefully at the figures for the changes in the number of farms in each size category, an important trend appears, which is a movement towards larger farming operations.

There was a significant drop in farms with less than five hundred (500) acres between 1987 and 1997 in all size categories. In contrast, larger farms, with five hundred acres or more increased, with eight new farms in the larger size categories. This suggests that farmers are consolidating their operations and expanding their acreage to remain economically viable. This is illustrated by the statistics for dairy farms and vegetable farms in Franklin County. The number of dairy farms has dropped steadily by thirty-two (32%) in the past ten years while the number of milk cows has only declined by thirteen percent (13%). That would indicate a larger number of cows per farm. Finally, although there has been an increase in acreage used expressly for growing vegetables, there's been a decrease in the number of vegetable farms.

The move towards bigger farms is also reflected by the growth in farms having over one hundred thousand dollars (\$100,000) in sales (*See Table 1-6*). The movement towards large farms indicates the need to preserve large blocks of contiguous farmland in order to support farming operations. Currently, Deerfield has approximately thirty-one (31) farms utilizing five thousand (5,000) acres of farmland. Farm operations are currently concentrated in three main areas of town and these areas should be targeted for protection efforts and zoning revisions which support the protection of farmland (*see Agricultural Lands & Proposed Strategic Plan for Sewer System Expansion Map*).

In the past ten years farmers have consolidated available resources so that today there are fewer farm operations than ten years ago. Each successful farm operation today generally has access to more acreage whether it is for corn silage or hay crops. Vegetable gardening and other crops appear to have taken a similar track.

If these are the trends in Franklin County can we assume that similar things are happening in Deerfield? Anecdotally, Natural Resource Conservation Service (NRCS) staff discussed the broad reductions in the number of farms in Franklin County as well as in the Town of Deerfield. For example, the number of cows a dairy farm needs to sustain its operation has risen and hayfields are currently considered a scarce resource in Deerfield. During the previous drought period, farmers that did not have their own hay fields found themselves painfully tied to the volatile pricing of the hay market.

Table 1-6: Agricultural Trends in Franklin County 1987 to 1997

Factor	1987	1992	1997	Change 1987 - 1997
Number of Farms	616	519	543	- 12%
Land in Farms (in acres)	82,864	74,484	75,134	- 9%
Avg. Size of Farm (in acres)	135	144	138	+ 2%
Farms by size:				
1 to 9 acres	60	41	53	-12%
10 to 49 acres	156	123	137	-12%
50 to 179 acres	245	220	220	-10%
180 to 499 acres	139	112	109	-21%
500 to 999 acres	15	21	22	+47%
1,000 acres +	1	2	2	+100%
Number of Milk Cow Farms	151	125	102	-32%
Number of Milk Cows	6,562	6,475	5,699	-13%
Acres in Orchards/# Farms	1,157/61	1,050/57	590/41	- 49%/-33%
Acres in Hay	15,587	14,906	14,018	-10%
Acres in Corn Silage	3,923	4,648	4,297	+10%
Acres in Vegetables/# Farms	1,403/99	1563/93	1429/78	+ 2%/-21%
Farms by Value of Sales				
Less than \$2,500	227	144	157	-31%
\$2,500 - \$4,999	89	73	83	- 7%
\$5,000 - \$9,999	73	67	71	- 3%
\$10,000 - \$24,999	57	73	57	0%
\$25,000 - \$49,999	52	34	35	- 33%
\$50,000 - \$99,999	54	49	54	0%
\$100,000 or more	64	79	86	+34%

Sources: 1992 and 1997 Census of Agriculture.

Economies of scale favor larger farming operations. If we assume that some farmers have been consolidating and expanding their own land base in Deerfield, what are the issues that challenge the sustainability of farming operations and farmland in Deerfield beyond the lack of accessible fields.

Challenges to Sustaining Farming in Deerfield

A public forum on farmland retention and growth management issues and strategies was sponsored by a core group of non-profit and government organizations in July of 1999. It brought together over forty farmers, local business leaders, State and Town officials, planners, and residents of Deerfield and five other communities in the Valley. The forum was co-sponsored by the Massachusetts Department of Food and Agriculture, the American Farmlands Trust, New England Small Farms Institute, the Franklin Land Trust, the Franklin Regional Council of Governments, and the Pioneer Valley Planning Commission. The main purpose of the forum was to reach consensus amongst the various interest groups on the main issues that challenge the region's agricultural industry and on the strategies that would best address each issue. The results of this forum are described below.

There are three sets of issues that forum participants characterized as being the main challenges to a sustainable farming industry in Deerfield and the entire Pioneer Valley. These issues revolve around the broad topics of public awareness and education, land use policy and practices, and the economics of agriculture. The issue of public awareness and building support for local farming operations has been recently addressed by the “Support a Local Hero” advertising campaign. Buying local produce directly from a farming operation instead of a national supermarket chain can improve the profit margin and contribute to the long-term economic viability of an agricultural business. A recent example of this is “Our Family Farms,” a local dairy farm cooperative, which is producing and marketing its own brand of milk. Other issues have more to do with local and regional land use policies that affect farming including poor growth management planning and zoning. Finally there are economic practices and policies that actually discourage the business of farming.

Public Awareness and Education Issues and Strategies

The main public awareness and education issues and strategies address the perception by forum participants that there is an overall lack of understanding or appreciation for the role farming plays in sustaining many community resources. The table below identifies the main farming awareness issues, the best strategies, and the segment of the community most capable of affecting change.

Table 1-7: Top Issues and Strategies Identified by Public Awareness & Education Sub-Group in Order of Importance

ISSUE	STRATEGIES	AUDIENCE	PRIMARY IMPLEMENTATION RESPONSIBILITY
1. Lack of knowledge of the multiple benefits that support of locally grown agricultural products provide. 2. Lack of knowledge regarding where our food comes from. 3. Difficulty in accessing sources for locally produced agricultural goods and services.	<ul style="list-style-type: none"> • A well planned and executed Valley-wide "Buy-Local" Campaign • Farm awareness education programs for the classroom 	General Public	Department of Food and Agriculture and CISA
4. Lack of knowledge of the true cost to communities of residential development vs. farmland.	<ul style="list-style-type: none"> • Provide an educational forum for local decision-makers on the issue. 	Local Officials and Local Citizens	Regional Planning Agencies
5. Farmers and farming need additional support from local government to be a sustained and thriving resource in the community.	<ul style="list-style-type: none"> • Establish Town 'Agricultural Advisory Commissions' to represent farming issues at the local level. 	Local Officials and Local Citizens	Local Select Boards and Planning Boards
6. Need for sustained funding for farmland protection programs like the APR Program.	<ul style="list-style-type: none"> • Campaign all levels of government as to the great need for farmland protection now. 	Local, State, and Federal Governments	Land Trusts and the Executive Office of Environmental Affairs

Source: Growing Together Focus Group Results Summary; 1999.

Land Use Planning Issues and Strategies

Although public awareness and education strategies are an appropriate method for changing how well people understand the relationship between permanently protected open space and local farmland retention efforts, there are other issues that require shifts in the types of land use patterns that a community encourages and discourages. Land use planning issues and strategies may be seen as the next level of effort after public education to sustain local farming. Such strategies should be long term and focus on the sustainability of agricultural operations. The land use strategies in the table below address: sprawl type development; the lack of estate planning amongst farmers; conflicts among land uses; the need for farming/business enhancement and promotion that can take place on a regional level; and, sewer and water line extensions that put farmland in jeopardy.

Table 1-8: Top Issues and Strategies Identified by Land Use Planning Sub-Group

ISSUE	LOCAL /REGIONAL STRATEGIES	PRIMARY IMPLEMENTATION RESPONSIBILITY
1. Sprawl development of single-family homes on large lots is consuming farmland.	<ul style="list-style-type: none"> • Adopt Transfer of Development Rights and other creative development bylaws with incentives. • Purchase Scenic Easements along roads capable of supporting Approval Not Required (ANR) lots. 	Local Planning and Select Boards
2. Farms are being sold off for development due to farmers retiring or development value being much higher than the agricultural value.	<ul style="list-style-type: none"> • Establish a community land bank to help match APR program. • Match new farmers with retiring farmers. • Provide estate planning to all farmers through Mass DFA 	Land Trusts and MA Department of Food and Agriculture
3. Development in prime farmland areas causes conflict between farms and non-farming activities.	<ul style="list-style-type: none"> • Establish local Agriculture Districts under Right-to-Farm legislation to protect farmers from nuisance lawsuits and use conflicts. • Use TEA-21* Enhancement funding and scenic byway funding to purchase development rights along scenic corridors. 	Local Planning and Select Boards
4. Farm businesses need to be enhanced in order to preserve farmland.	<ul style="list-style-type: none"> • Promote agri-tourism through programs such as the Connecticut River Scenic Farm Byway Program. 	Regional Planning Agencies and Chambers of Commerce
5. Extension of sewer and water lines into farmland areas increases development pressure.	<ul style="list-style-type: none"> • Establish local bylaws or policies to limit extension of sewer and water lines into Agricultural Districts. 	Local Planning and Select Boards

Source: Growing Together Focus Group Results Summary; 1999.

* TEA-21: Transportation Equity Act for the 21st Century is Federal transportation legislation which provides funding for road, bridge and enhancement projects.

Economic Development Issues and Strategies

The major economic development issues that affect the sustainability of Deerfield's agricultural base exist at both a regional and national level. Individual farmers in Deerfield and throughout the Pioneer Valley are challenged to maintain profit margins in the face of national competition and unpredictable Federal policies on issues such as milk pricing. Just as in any industry the requirements for sustaining a business are adequate labor, capital and human investment, good markets, and a stable supply of raw materials. Farming in Deerfield is a business. Its supply of raw materials are the land, water, and soil. The markets are at different scales. They include the national milk market, the regional grocery chain, and the local farm stand. Capital and human investment requires both the retention of successful family farms and the training of young people in the business of farming. Investments are also made in the technology of farming including the use of machines, energy and chemicals. These must be used in an ecologically and economically sustainable manner. Finally, a labor force is needed in all aspects of farming especially, in the harvesting of fruit and vegetables.

Farmland is by far the most important raw material needed for sustaining farming in Deerfield. In addition, it must be affordable and accessible. Most big farms in Deerfield rent some of the land they use. Land that is rented may be sold for development with very little notice jeopardizing the farming operations, which rely on rented land to support production. One Deerfield farm has reduced their cowherd so that now, only their own land is required to support the dairy operation. Another farm, which owns only half of the land they use, is seeking to purchase some of the land they currently rent.

The only farmland that is generally affordable for purchase is that which has been protected permanently from development, through the Agricultural Preservation Restriction (APR) Program. There is consensus among conservation organizations in the Pioneer Valley that protecting farmland from development is the single most important effort required in the next decade. Without affordable and accessible farmland, farming will surely collapse in Deerfield.

Sustaining farming in Deerfield is also dependent on human resources. Labor is a constraint for all farms in Deerfield but especially for the larger farms. Using migratory labor requires the farmer to pay for all transportation and housing costs and this places a considerable burden on an already slim profit margin. Investing in, and attracting, the next generation of farmers is another labor issue that may be addressed both at the local and regional levels. Ultimately, from the Town's perspective, supporting the retention of family farms and the enterprises of new farmers, may be the single best investment it could make in retaining Deerfield's rural character and its favorable property tax rate. A willingness by consumers to support local farms by paying the full price of agricultural products is also essential.

The markets represent the interface between economics, land use, and community support for farming. On a regional and national level, markets for farm produce from milk to vegetables are not supportive of medium sized New England farms. Participation in regional and national markets is not economic for small farms since profits in dairy farming are based on a very slim margin. A strategy for dealing with these issues is by developing specialty products such as

organic vegetables or establishing local cooperatives such as Our Family Farms. Our Family Farms, was established by six dairy farmers in Franklin and Hampshire Counties. The cooperative sells directly to stores and better controls the price and profits of its milk sales.

The future for farming in Deerfield must begin with permanently protecting the most valuable cropland. Farmland protection will require the support of a majority of Deerfield residents. Funds will need to be set aside in the Town budget towards protecting parcels of farmland in conjunction with the APR Program. The Deerfield Land Trust has been a principal advocate for open space protection in Town and residents can contact the Deerfield Land Trust to support their efforts.

At the same time solutions must be found that adequately address problems with labor, new farmers, and markets. The Farm Viability Program, which is administered through the Massachusetts Department of Food and Agriculture, helps farm operators produce a business plan to help them evaluate their farming operations to improve profitability.

Proposed Sewer Expansion and Farmland

One of the issues identified in the Land Use Planning Issues and Strategies table is the impact that sewer and water lines have on farmland resources. This is a particularly important issue for Deerfield and is one of the primary reasons the Master Plan process was initiated. As explained further in the Community Facilities and Services chapter, the Town of Deerfield hired Weston and Sampson Engineers, Inc. to prepare a wastewater strategic plan. Their strategic plan, completed in 1999, presented a series of alternatives that would attempt to solve the extensive septic failures experienced by residents around Town. This plan has increased concern for the remaining farmland and open space because extending sewer lines across or adjacent to farmland will increase development pressures.

The Agricultural Lands & Proposed Strategic Plan for Sewer System Expansion Map at the end of this chapter combines the Weston and Sampson Engineers' design with a quarter mile and a half mile sewer expansion buffer. Beneath this is a land use coverage showing active farmland and permanently protected land. The Weston and Sampson Engineers (WSE) Proposed Strategic Plan contains three different septic system options for addressing areas characterized as having continuous and consistent septic problems. The primary cause of the septic problems identified by WSE is an historic high water table in the affected areas. As a result, many people have to pump out their septic tank two or three times per year. The three levels of changes proposed are: sewer line extensions, shared Title 5 septic systems, and alternative or conventional on-site systems. Table 1-9 identifies the type of system each problem area would receive under the proposed strategic plan.

Of the three treatments (sewer line extension, shared septic systems, and on-site systems) prescribed as part of Weston and Sampson's proposed strategic plan, the sewer line extension has the most immediate and direct impact on active farmland. The shared systems may need additional open space for a more extensive leach field but this does not immediately affect the

development value of abutting properties. The conventional and alternative on-site systems may have some impact on surrounding farmland by demonstrating that on-site septic systems can work on lands with a high water table.

Table 1-9: Septic Problem Areas by the Types of Treatments they are to Receive Under the Weston and Sampson Engineers Strategic Wastewater Plan

Problem Area	Extended Sewer Line	Shared Septic System	Alternative/Conventional On-Site System
Whately Rd./South Mill River Rd.	X		
Beaver Drive	X		
Captain Lathrop/Hillside Rd.	X		
Mill Village Rd.	X		
Greenfield Rd./Steam Mill Rd.	X		
Boynton Rd.		X	
Stage Rd.		X	
Jones Cross Rd.		X	
River Rd./Hillside Rd.			X
River Rd.			X
Keets Road/Greenfield Rd.			X
West Deerfield Lower Rd.			X
West Deerfield Upper Rd.			X
Conway Rd./Lee Rd.			X
Chapman/Hawks Rd.			X

Source: Weston and Sampson Engineers, Inc. Wastewater Strategic Plan; 1999.

Sewer line extensions have the most potential for being a powerful catalyst for additional farmland conversion. An initial review of the areas to be served by sewer extensions helps to clarify several issues. The first is that extending the sewer lines is not by itself a bad idea. One of the areas to be reached by new sewer lines, Beaver Lane, is located on the floodplains of the Connecticut River, less than one quarter of a mile from the South Deerfield wastewater treatment plant. All the farmland surrounding the small subdivision is owned by the University of Massachusetts and is thus considered permanently protected. Extension of sewer lines to this area would probably have little impact on abutting farmland in terms of conversion to residential uses.

There are four other areas that are proposed to receive sewer line extensions and each is reviewed separately.

Conway Road/Whately Road/South Mill River Road

A triangular shaped area of land bordered to the north by Conway Street, to the west by South Mill River Road, to the south by Whately Road, and to the east by a service road, is proposed to receive a sewer line extension. The current land use of the area to be covered by the extension is primarily farmland and forestland with patches of residential development along both sides of the roads. There are no permanently protected parcels of land within the triangle although a majority of the land is under Ch. 61A and Ch. 61. This means that if any of these parcels were to be sold

by their owners, the Town would have a one hundred and twenty-day period during which they have the right of first refusal to purchase the land at the fair market value.

Extending sewer lines along these roads would further widen the gap between the value of land for agricultural uses versus residential use, significantly increasing the threat of development. Losing this farmland, which probably supports the Tatro or Crowley Dairy Farms, to residential uses would have multiple impacts. Most homes going in would be on lots of 1-1/2 acres or larger. New subdivisions would likely increase public school enrollment as well as the percentage of the watershed covered by roads and other impermeable surfaces. New residential development of this type would also result in increased runoff problems, increased demand on public water supplies, more road maintenance and traffic congestion, loss of wildlife habitat, potential impacts to endangered species in the Mill River, and increased taxes to support police, fire, and other community services.

Captain Lathrop/Hillside Rd.

Both Captain Lathrop Drive and Hillside Road, which run parallel to each other, are proposed to receive a sewer line by WSE's plan. Although the homes on Captain Lathrop Drive already have a sewer line on their road, a replacement is planned because the current sewer pipe is responsible for some of the district's worst Infiltration and Inflow problems (*See Agricultural Lands & Proposed Strategic Plan for Sewer System Expansion Map*). The sewer extension would run east on the south side of Hillside Road.

The current land use pattern along Captain Lathrop and Hillside Road is one half-acre residential development with active farmland parcels to the north and south. No portion of the land that is covered by the proposed extension is permanently protected and only one small parcel is enrolled in the Ch. 61 program. Although Captain Lathrop Road appears completely built-out, Hillside Road is not, and a sewer line extension could convert open lands north of Hillside to residential development.

Mill Village Road

Parcels straddling Mill Village Road to the east of Route 91, north of Plain Road East, and south of Lee Road make up the fourth problem area proposed to receive a sewer line extension. Currently, this area contains a small cul-de-sac on Evan's Lane and several two-family homes along Plain Road East and Boynton Road East. Surrounding the homes are large parcels of active farmland. According to the most up to date open space coverage, only part of this area is permanently protected. However, most of the farmland parcels not in the APR program are at least under Ch. 61A. Two more tributaries of Bloody Brook might be negatively affected by more residential subdivisions if they are constructed on the targeted farmland patches. Current habitat for deer, turkey, rabbit, raptors and other wildlife would also be lost or degraded.

Greenfield Road/Steam Mill Road

This most northern section of Town is also proposed to receive sewer line extensions. The area is shaped like a long rectangle and straddles both Greenfield Road and Steam Mill Road. This ribbon begins just north of Clarks Cross Road and proceeds north to the intersection of Wapping and Greenfield Roads. The land uses within this targeted area include crop and pasture,

residential, and industrial land. The southern half of this strip is void of any permanently protected land but, the northern half contains a recent addition to the APR roster in Deerfield that straddles both sides of Greenfield Road. The eastern side of Steam Mill Road is included as an area WSE thinks should receive a sewer extension, though based on the 1997 land use coverage there is currently very little development along this road.

Both quarter and half mile extensions are drawn on the map titled Agricultural Lands & Proposed Strategic Plan for Sewer System Expansion. This is to identify the resource areas that would be potentially impacted if the sewer lines were extended by those lengths. A one half mile extension of the sewer lines in both the Old Deerfield and the South Deerfield wastewater treatment districts would raise the development value on land that is currently farmed or in the floodplain area.

It would be advisable to closely compare the costs for sewer line expansion to the costs of shared septic systems in areas where the loss of prime farmland is an issue. The long-term costs of additional community services and impacts to the current tax rate should also be carefully evaluated. It is unclear whether the proposed sewer extension to Evans Circle, and the rest of the problem area along Mill River Road, might be better served by shared and conventional systems. This would likely result in a slower pace of development by requiring particular types of shared and conventional septic systems.

Prioritizing Farmland for Protection

It is vital that the Town of Deerfield, in cooperation with State and local conservation organizations, determines the most important farmland to protect. Other values of the land such as aesthetic, historic, water quality protection, wildlife habitat, and general rural character should also be considered

To address this problem, a methodology was used to determine those farmland areas that should be protected first. The methodology used is explained in Appendix II and is summarized below. The results are demonstrated in the map titled, "Deerfield Agricultural Lands Preservation Priorities by Land Use."

The methodology used in mapping the highest priority farmland areas for protection involved a three-step process taking into account the value of the farmland and the threat of its conversion to residential, commercial or industrial use. The value of the agricultural land was based on the size of the farmland area, the predominant MacConnell land use type (cropland, orchard, or pasture), and other collateral environmental objectives. The collateral environmental objectives were: 1) adjacency or proximity to other permanently protected lands; 2) location relative to a water protection district; and 3) whether the farmland contained rare and endangered species habitat. The second step ranked the farmland areas by their relative risk of conversion to development. The threat of conversion was based on the farmland area's proximity to commercial areas, the current zoning of the farmland, and the distance to available sewer service. The third map

combined the points for both maps and separated the rankings into High, Medium, and Lower Priority.

The results of this analysis identified approximately one third of the Town's remaining unprotected farmland as the highest priority for protection. This high priority farmland is located in two main areas. The northernmost priority area is within the National Historic Landmark area. Specifically it includes farmland located north of the Bars, and south of Old Deerfield Village, land just east of Route 5/10 and the North Meadows. The second priority area includes farmland within and to the north and east of the Central Village Residential District, to the west of the Pocumtuck Range, and to the east of Route 91, reaching just north of Clark Cross Road. This second farmland area covers the upper drainage basin to Bloody Brook as well as a portion of the land that is currently zoned commercial/industrial.

Open Space

Another way that community members express their concern for the quality and quantity of their natural resources is through the community-based land protection efforts that have been accomplished over the past several decades. The Deerfield Land Trust in partnership with the Massachusetts Department of Food and Agriculture, the Department of Environmental Management (DEM) and the Division of Fisheries and Wildlife (DFW) have worked to protect hundreds of acres in Deerfield over the years, the majority of it working farmland. Below, Table 1-10 lists the types of permanently and temporarily protected land in Deerfield and the number of acres protected within each (*see Open Space Map*).

Table 1-10: Number of Acres of Protected Open Space

Protected Land	
<i>APR* Land</i>	1,042
<i>Conservation Restriction</i>	275
<i>DEM and DLT</i>	658
<i>UMASS (under Ch. 97)</i>	358
<i>Water Districts</i>	430
Total	2,763
Temporarily Protected Land	
<i>Chapter 61 – Forestry</i>	1,089
<i>Chapter 61A – Agriculture</i>	3,284
<i>Chapter 61B – Recreation</i>	65
Total	4,438

* Agricultural Preservation Restriction Program

Source: 1999 Deerfield Open Space Plan Update

It is important to understand the level of protection the different categories listed above provide. The term "protection" usually refers to any number of mechanisms that help to keep land from being developed or converted to commercial, industrial, or residential land uses. The term

"permanently protected" for the purposes of this Master Plan indicates that no development may take place and a conservation restriction or some other legal mechanism is attached to the deed. In addition land is considered permanently protected when State conservation agencies like the Department of Environmental Management (DEM) and Division of Fisheries and Wildlife (DFW) are the owners of the land. Land is also considered permanently protected when it is owned by a town or land trust for conservation purposes. For the purposes of this Master Plan one additional type of ownership is considered permanently protected. Land owned by water districts or municipalities for purposes of public water supply protection is considered permanently protected. Changing the level of protection for any parcel of land that is owned by a State conservation agency, a land trust, a water supply district, or by a town for conservation purposes requires a vote by two thirds of the State Legislature.

Temporarily protected parcels are those that are enrolled in the Chapter 61 tax abatement programs. They offer landowners a reduction of their property taxes in return for signing a contract promising that the predominant use of the land will not change during an agreed upon time (ten years for Chapter 61, one year for Chapter 61A). The program helps farmers by reducing their taxes while they farm their land. It also helps lower the expenses of maintaining actively managed forestland. One of the benefits of the Chapter 61 programs to the community is that the Town is guaranteed a one hundred and twenty (120) day waiting period during which it can exercise its right of first refusal to purchase property for sale, which is enrolled in the Chapter 61 program. According to the Deerfield Land Trust, there is a need for a more direct system of notification that would give land conservation groups enough of a warning to help the Town take advantage of the one hundred and twenty (120) day waiting period.

It is important for the Town of Deerfield not to consider land under Chapters 61 or 61A as permanently protected. At the same time, the value the program offers to the Town should not be disregarded. Taking advantage of the right of first refusal is valuable if you have the ability to protect land that becomes available. Identifying key parcels and building partnerships with local land trusts and landowners can be an effective planning process resulting in land protection. Deerfield may not need to purchase the land itself. The right of first refusal can be sold to, or given to, a land trust which can often respond much more quickly than the Town can.

The total of two thousand seven hundred and ten (2,710) acres of permanently protected land in Deerfield represents nearly thirteen percent (13%) of the total land area of the town (21,388 acres). Of that total, one thousand and forty-two (1,042) acres are enrolled in the APR program. What these figures demonstrate is that while farm and forestland is being converted to other more intensive land uses, some land is being protected. By assessing the spatial relationship between Deerfield's natural resources and future potential growth pressures presented by the proposed sewer expansion, the most important natural areas and prime farmlands in need of protection will become apparent (*see Agricultural Lands & Proposed Strategic Plan for Sewer System Expansion Map*). These areas should be prioritized for protection.

Inventory of Lands of Conservation and Recreation Interest

The following inventory lists parcels by private, public and non-profit ownership and then by protection status: permanent, temporary, or unprotected. These resources are identified on the Open Space Map found at the end of this chapter.

Massachusetts has adopted several initiatives aimed at curbing the rapid rate at which farmland and other open spaces are converted to industrial, commercial and residential development. Privately owned parcels contribute to the amount of open space in Deerfield through deed restrictions, conservation easements and tax abatement programs. However as mentioned above, these programs offer varying degrees of protection. For instance, lands under the Farmland Assessment Act (various Chapters of 61) can be taken out of the program at the landowner's will while lands enrolled in the Agricultural Preservation Restriction Program are permanently protected.

Adopted by the State Legislature in 1977, the Agricultural Preservation Restriction Program (APR) ensures the permanent protection of large blocks of farmland by making it economically feasible for farmers to keep farming. Administered by the Massachusetts Department of Food & Agriculture, this program offers farmers the difference between the "fair market value" and the "agricultural value" of their land. In exchange, a permanent deed restriction is placed on the property, which precludes uses that may harm the agricultural viability of the land. The farmer continues to own the land and can sell it, but only for agricultural uses.

Since the intention of the program is to attain a fair distribution of APR lands throughout Massachusetts, priority is given to areas suffering from intense development pressure. Throughout the State, one hundred and thirty-one (131) municipalities now have land in the program. In Deerfield alone, one thousand and forty-two (1,042) acres are protected in perpetuity. Two areas concentrated along the Connecticut River and to the west of I-91 will help to ensure that Deerfield's agricultural heritage is preserved.

The Farmland Assessment Act was enacted by the State Legislature in 1973. Chapter 61, 61A and 61B enables qualifying forest, farm, and recreational lands to be taxed at their use value rather than full market value so as to promote their conservation. Chapter 61 applies to forested parcels of ten or more contiguous acres that are managed under a 10-year forest management plan. Chapter 61A parcels must be at least five contiguous acres, must be "actively devoted" to agricultural or horticultural uses, and must earn at least five hundred dollars (\$500) in annual gross sales. Chapter 61B lands are a minimum of five acres and are devoted to open space or recreational uses. According to assessor's records, Deerfield contains thirty-three (33) lots or one thousand eighty-nine (1,089) acres in Chapter 61, one hundred and ninety-nine (199) lots or three thousand, two hundred and eighty-four (3,284) acres in Chapter 61A, and two (2) lots or sixty-five (65) acres in Chapter 61B.

Tax abatement programs offer some benefits to those interested in preserving the rural character of a community. Landowners are required to notify certain Town boards by certified mail if they intend to sell these lands or discontinue the forested or agricultural use. Not only is the Town

granted the right of first refusal if a landowner sells or converts the classified land to another use, but a penalty in the form of either a conveyance tax or a roll back tax is assessed. Unfortunately, while this program does offer financial incentives to continue these open space uses, it does not guarantee that lands will be permanently maintained in their current state. If a landowner is presented with an attractive offer from a developer, a Town can often do little unless there is an active program in place to acquire land. Since July 1, 1998 four of Deerfield's agricultural parcels (6.7 acres) have been rolled out of Chapter 61A to make way for three new house lots and one business. However, when combined with other protection tools, tax abatement programs can be an effective method of preserving open spaces.

Private Unprotected Open Space Parcel

Channing L. Bete Soccer Field: The publishing company, Channing L. Bete, maintains a soccer field on land adjacent to their office complex. Recognizing that Deerfield does not possess a sufficient supply of recreational space, the corporation grants the community permission to use the field for local sporting events.

Public and Non-Profit Parcels

A few public and non-profit entities own parcels of land throughout Deerfield that contribute to the town's supply of recreational open space. While these properties do not comprise a significant portion of Deerfield's total acreage, they do play an important role in satisfying wildlife and community needs. The following inventory includes the significant public and semi-public lands in town and highlights their potential as conservation or recreation areas.

Permanently Protected Parcels

Nature Sanctuary: Located near Hillside and Stage Roads, this thirty-four (34) acre parcel owned by the Town of Deerfield offers residents access to the habitat of a variety of small New England birds. Two dirt roads skirt the area in a mile-long loop but the sanctuary itself is difficult to access without trespassing through private yards. According to one frequent user, the sanctuary is currently used by only a handful of neighborhood residents. The potential does exist for a trail network that, if publicized, may satisfy residents' demand for more areas for passive recreation. If this occurs, the natural beauty of this woodland may be experienced by a larger segment of the population. In addition, Assessor's maps reveal that this property abuts the University of Massachusetts forest, which lies adjacent to the Mount Sugarloaf State Reservation. With this in mind, the potential exists to create a continuous greenway network that extends from the Sugarloaf Mountains to the Pocumtuck Ridge Nature Preserve by way of the Nature Sanctuary.

Mount Sugarloaf State Reservation: Mount Sugarloaf is a dominant geologic formation and an unmistakable gateway to South Deerfield. Consisting of more than five hundred and thirty-seven (537) acres, the Reservation is a favorite destination for hikers, picnickers, and other outdoor enthusiasts. An auto road winds to the summit where commanding views of the Connecticut River, the Pioneer Valley, and the Pocumtuck Range can be observed from an observation tower and visitors can relax in the shade of an outdoor pavilion. Restrooms are also available and the area is handicap accessible.

South Deerfield Water Supply District and Deerfield Fire District Lands: These properties incorporate over two hundred and eighty (280) acres of densely wooded land. The area is safeguarded for the districts' water supplies and therefore can only support certain limited recreation uses such as hiking, hunting, and birdwatching.

Pocumtuck Ridge Nature Preserve: This one hundred and twenty-one (121) acre site is composed of three parcels that were donated or purchased by the Deerfield Land Trust in 1993. In 1998, this preserve was conveyed to a new local non-profit group, the Pocumtuck Stewards of the Land. Located on the southern end of Mount Pocumtuck, this woodland contains a few popular and well-maintained trails and is open to the public for hiking, bird watching, horseback riding, and cross-country skiing. The Pocumtuck Stewards of the Land hopes to eventually complete the ridge trail by achieving public access through abutting properties or acquiring additional land.

Third Island: This island is located on the Connecticut River, four and a half miles north of the Rt. 116 Sunderland/ Deerfield Bridge and south of the confluence of the Saw Mill River in Montague. On October 4, 1998, the Silvio O. Conte Refuge, a National Fish and Wildlife Refuge, acquired Third Island from the Connecticut River Watershed Council. Already a popular picnicking and boating destination, the Conte Refuge's acquisition of the island may lead to enhanced recreation activities there.

Mount Sugarloaf Field: This small parcel is presently owned and maintained by the Department of Environmental Management (DEM) as a playing field. Frequently enjoyed by local sport leagues, permission to use this field rests with DEM.

Town Memorial Forest: The Town of Deerfield owns this twenty (20) acre, World War II memorial located off of Pine Nook Road. The public can access the parcel from Pine Nook Road although no sign attests to its exact location. Currently, the Baystate Forestry Service of Shutesbury actively manages the woodland for forest products. An informal trail passes along the border of this parcel, extending from the Pocumtuck Ridge Nature Preserve to the summit of Mount Pocumtuck. The Town also owns two adjacent parcels for a grand total of one hundred and ten (110) acres.

University of Massachusetts: The University owns a three hundred and fifty-eight (358) acre tract of land along River Road in South Deerfield. Although the main dairy herd was relocated in 1994, approximately eighty cows and a few dozen pigs remain and are used for research. The University also uses turf and vegetable plots for agricultural research. The University insists that the land is secured for agricultural use under Chapter 97 of the General Laws, but over the years there has been considerable debate over what will become of this prime farmland. Discussions concerning the protection of this parcel continue.

Unprotected Parcels

Frontier Regional High School: The school property encompasses roughly twenty-three (23) acres upon which there is a large playing field, a running track, basketball courts, and tennis courts. The field is used during the school's athletic seasons and in the summer by softball leagues. An additional field is not currently in use due to drainage and construction problems.

There are two gymnasiums: one full size, and one half size. The facilities appear in good condition overall.

Old Deerfield Grammar School: A few years ago the bulk of this parcel was purchased by the Pocumtuck Valley Memorial Association, although a small area of recreational open space remains in Town ownership. Maintained for the Town by the Association, the lot doubles as a little league and soccer field.

Proposed Town Field: The Recreation Committee recently gained the necessary funds to cover the cost for the final design, construction, and completion of a community park on land adjacent to the Deerfield Municipal and Police Building. The park will include a multi-use recreational area for field games such as baseball, soccer, and general recreation use. Since the park will link the Tilton Library, Deerfield Senior Center, and St. James Church, it may also be the optimal location for community events and summer programs.

Deerfield Elementary School: The new Deerfield Elementary school was built on nearly twelve (11.9) acres in 1992. The lot has one multi-use playing field, two basketball courts, a tot lot, a playground for young children, and an obstacle course for older children. The facilities are in good condition and are frequented by children throughout the Town.

Natural Resources

Geology, Soils and Topography

Deerfield is located within the Connecticut River Valley, a 400-mile long stretch of fertile bottomland that extends from the Canadian border to Long Island Sound, in Connecticut. The valley as it appears today developed over millennia of geologic activity, climatic change, and human influence (Little; 1984). Deerfield's rich, alluvial soils are the result of deposition in glacial Lake Hitchcock as well as annual flooding of local streams and rivers. Over thousands of years, sediments ran off the hills surrounding Lake Hitchcock and collected on the lake bottom. When the lake drained, the rich sediments were left behind. The Connecticut and Deerfield Rivers carved valleys and terraces into these deep, varied glacial deposits of sand, gravel, silt, and clay. Regular flooding of these rivers and their tributary streams enhances the rich soils by leaving alluvial deposits within the level areas of their floodplains. As a result of this activity, over twenty percent (20%) of the land in Deerfield is still in active agricultural use.

Geologic activity and the last glacier also left a deep imprint on Deerfield's topography, resulting in the formation of the hills and valleys that Deerfield residents value. In the eastern portion of Town, the Pocumtuck Range rises sharply from the floor of the Connecticut River Valley to an average height of nearly eight hundred (800) feet above sea level. Mount Sugarloaf State Reservation lies to the south of this range and contains two peaks, South and North Sugarloaf Mountains, with heights of six hundred and fifty-two (652) feet and seven hundred and ninety-

one (791) feet, respectively. A ridge stretches north from the Sugarloafs, steadily climbing until it reaches Pocumtuck Rock with an elevation of eight hundred and fifty-two (852) feet. The range declines in elevation, then rises again to Trap Rock Ledge and Woolman Hill with respective heights of four hundred and fifty (450) feet and four hundred (400) feet. A significant amount of sand and gravel deposits are found in this area which are currently mined. The range then plunges to the confluence of the Deerfield and Connecticut Rivers. With the exception of a narrow strip of relatively flat land along the banks of the Connecticut River, extremely steep slopes of exposed bedrock dominate the area.

According to the Franklin County Soil Survey (1967) most of the soils throughout the Pocumtuck Range are of the Holyoke-Sunderland-Cheshire Association, which is characterized in part by ridges of reddish bedrock locally referred to as "redrock." The range tends to be densely wooded, with State and local park areas occupying a large part of the terrain in which these soils appear.

The land adjacent to the Connecticut River consists of the Hadley-Winooski-Limerick Association, which are silty, predominantly stone-free, well-to-moderately well-drained soils that lend themselves easily to both development and agriculture, except for small depressions where surface drainage is impeded and water is ponded for long periods. According to the Soil Survey, these soils are the most productive in Franklin County (Fuller et al; 1967). Presently, this area is intensively farmed. The Massachusetts' Department of Food and Agriculture (Executive Office of Environmental Affairs) also reports that the soils throughout the central portion of Deerfield are among the "most fertile agricultural soils in the country." These prime soils contain the best combination of physical characteristics for producing food, feed, forage, fiber, and oilseed crops. The soils are without rocks, highly permeable, and easily worked (Crolius et al; 1989).

To the west and extending north into Greenfield and west into Conway are foothills of the Berkshire Range. These are split by the Deerfield River and form a gorge. This area of steep slopes and dense forest has not been subject to much development pressure. The foothills are grouped in the Westminster-Colrain-Buckland Association, which makes up roughly one-sixth of the Town's soils. They are shallow soils, generally steep, with numerous ledge and rock outcroppings (Fuller et al; 1967). This section of Town is dominated by forested hills and narrow valleys with swift flowing streams. The range contains several major peaks, including Boyden Mountain, eight hundred and forty (840) feet; Pine Ledge, six hundred and ninety-four (694) feet; and Arthur's Seat, the highest point in Deerfield at nine hundred and sixty (960) feet.

The remainder of Deerfield's soils are comprised of the Hinckley-Windsor-Merrimac Association, which are sandy and gravelly soils typically found in the Connecticut River valley. The soils are used extensively to support farming.

Surface Waters

The Town of Deerfield lies in both the Deerfield and Connecticut River watersheds. The Deerfield River basin includes the northern half of the Town west of the Pocumtuck Range while the Connecticut River basin includes the eastern slopes of the Pocumtuck as well as the southern half of the Town. One can most easily see this by identifying the limits of the many small streams and brooks that begin as tributaries along the outer fringe of the basins and then join either of the major rivers. Although there are no significant ponds or lakes located within the town boundaries, wetlands typically adjacent to a brook or river are extensive. According to land use data generated by the University of Massachusetts using aerial photographs from 1997, five hundred and ninety-three (593) acres in Deerfield are covered by surface water. Additionally fifteen hundred and eighty-six (1,586) acres in Deerfield are classified as wetlands according to the National Wetlands Inventory of the United States Fish and Wildlife Service. The most significant water bodies, the Connecticut River and its main tributary, the Deerfield River, are discussed below (*see Water Resources & Wildlife Habitat Map*).

A number of other rivers, streams, and brooks flow through Deerfield before eventually converging with the Connecticut River. The most significant of these is the Mill River, which contains Massachusetts' most diverse community of freshwater mussels. According to Laurie Sanders, the Mill River Watershed Project's research coordinator, nine of the Commonwealth's twelve (12) mussel species, four State-listed endangered species and the Federally-endangered Dwarf Wedge Mussel inhabit the Mill River Watershed (Sanders personal communication; 1999). Other tributaries include Pole Swamp Brook, Clapp Brook, Fuller's Swamp Brook, Hawks Brook, Shingle Brook, and Bloody Brook. Many of these water bodies are popular fishing spots.

Connecticut River

The Connecticut River, which comprises the Town's eastern boundary, has provided, like the Deerfield River, floodplain soils unparalleled in the region. These soils lie under both the cultivated fields and houses along River Road. The banks of the Connecticut are steep, often forming two steppes between the normal daily flow and the floodplain itself. These banks provide portions of a woody vegetative riparian corridor. However, where farmers have fields right up to the river's edge, soil erosion along the banks of the Connecticut River has resulted in the loss of farmland and negative water quality impacts downstream.

Years of deforestation, industrialization, and widespread dumping took their toll on the river's water quality causing a mass disruption of ecological processes. The effects were more pronounced in the urban sections of the river, although pollution and erosion were concerns in Deerfield and areas far to the north (US Fish and Wildlife Service; 1995). In recent years, the water quality of the Connecticut has been improved. Fish and wildlife that virtually disappeared from the region twenty years ago have begun to return including the Atlantic salmon, American shad, the peregrine falcon, and the bald eagle. However, present threats to the river are many. They include increased development resulting in nutrient and heavy metals loading and hydroelectric generation as it relates to fisheries. In addition, there are documented toxic and

bioaccumulation effects on fisheries resulting from historic discharges or waste sites (Connecticut River Watershed Assessment and Management Report; Massachusetts Department of Environmental Protection; March 1995). In 1999, President Clinton declared the Connecticut River one of ten American Heritage Rivers in the United States. Under this program, communities within the Connecticut River Watershed enjoy special access to Federal programs that will help to conserve, protect and enhance the resources of the watershed. To coordinate and administer the various fisheries and wildlife programs taking place within the watershed, the Silvio O. Conte National Fish and Wildlife Refuge (“Conte Refuge”) was formed by an act of Congress in 1991.

The main stem of the Connecticut River between Turners Fall Dam and the Route 116 bridge in Sunderland includes riverine and riparian habitats and several river islands. American shad, blueback herring, and shortnose sturgeon spawn within this stretch of the river which forms the eastern boundary of Deerfield. In addition, there are over thirty (30) rare plant and animal species found within this habitat area (Final Environmental Impact Statement; Silvio Conte National Fish and Wildlife Refuge; U.S. Fish & Wildlife Service; 1995).

There is limited public access to the Connecticut River in Deerfield, due in part to the predominant use of the floodplain for farming. The Connecticut River has a wide variety of untapped recreational opportunities from wildlife viewing and canoeing, to fishing and camping. Up to this point, attempts to make the river accessible in Deerfield have not succeeded. The Connecticut River Water Trail, an established canoe route, extends south through Deerfield to the Hatfield Boat Ramp, but there is no direct public access point in Deerfield itself. This may soon change, however, since the Conte Refuge and the Deerfield Land Trust are actively working to obtain easements along the river’s banks. On October 4, 1998, the Conte Refuge acquired Third Island, a popular picnicking and boating destination. Third Island is located in the Connecticut River along a line drawn between the intersection of River Road and Pine Nook Road and the confluence of the Sawmill River in Montague, which is about four (4) miles north of the Rt. 116 Sunderland/Deerfield Bridge. A number of other islands in the river are under semi-public and private ownership and are informally used for picnicking and camping by boaters.

The Connecticut River has the potential for being a recreational “greenway” in Deerfield if there are enough canoe and kayak put-ins. Secondly, the Connecticut represents a wildlife corridor for anadromous fisheries as well as for mammals like the bobcat that may use the riparian forests to move between habitat areas. The Department of Environmental Management (DEM), the Division of Fisheries and Wildlife (DFW), and the Kestral Trust have been working to protect land linking the Mt. Toby ecosystem in Montague and Sunderland to the Connecticut River riparian corridor by protecting land near the Sawmill River's confluence with the Connecticut River. In this case the role of the Connecticut River as a wildlife corridor from Mt. Toby to habitats found in the Pocumtuck Range is real given the large permanently protected parcels located in Deerfield right across the river.

The Connecticut River has a Class B designation from the New Hampshire-Vermont Border to Holyoke and is classified as a warm water fishery. Class B waters are supposed to provide

suitable habitat for fish and other wildlife, and to support recreational purposes such as fishing and swimming. The water should also be suitable for irrigation and other agricultural uses. A Report entitled *The Health of the Watershed* published in January 1998 by the New England Interstate Water Pollution Control Commission (NEIWPC) listed bioaccumulation and toxicity as specific water quality issues for the entire length of the Connecticut River in Massachusetts and specifically identified polychlorinated biphenyls (PCBs) in fish. Also in 1998, the Massachusetts Department of Public Health issued a public health advisory for certain species of fish contaminated by PCBs in the Connecticut River (Commonwealth of Massachusetts Summary of Water Quality; Department of Environmental Protection; 1998). The general public should not eat any affected fish species, which include Channel and White Catfish, American Eel and Yellow Perch. Pregnant women and nursing mothers are advised not to eat any fish from the Connecticut River. There is a paucity of current, comprehensive water quality data for the main stem of the Connecticut River due to a severely curtailed DEP water quality monitoring program. Monitoring and follow-up investigations regarding the source and extent of pollutants are urgently needed.

Published water quality information for the Connecticut River is limited. There are numerous point sources of pollution along the Connecticut River such as wastewater treatment plants and industries with National Pollution Discharge Elimination System permits. While a listing of NPDES permit holders exists, there is no published analysis of the water quality testing required to be conducted by the permit holders and many point sources have permits which have expired (Connecticut River Watershed Assessment and Management Report; Massachusetts Department of Environmental Protection; March 1995). Table 1-11 summarizes the information available from the Department of Environmental Protection. Clearly additional water quality testing and an evaluation of existing NPDES permits testing results is needed to determine the health of the Connecticut River ecosystem and to clearly identify which uses the river supports.

A 1998 publication issued by the U. S. Geological Survey as part of the National Water Quality Assessment Program (*Water Quality in the Connecticut, Housatonic, and Thames River Basins*; USGS Circular 1155; 1998) identified various pesticides used by agricultural operations as pollutants in the Connecticut River in Franklin County. While current drinking water standards were not exceeded, the report noted that existing drinking water standards do not include some pesticides detected or their breakdown products. In addition the current drinking water standards do not consider the cumulative impacts of more than one pesticide in the water. As a result, the actual health concern posed by these results is uncertain according to the U.S. Geological Survey report.

Table 1-11: Summary of Surface Water Quality Information for the Connecticut River

Location	Water Quality Information
Connecticut River from New Hampshire to Route 10 Bridge Northfield	<p>Class B – Fishable/Swimmable <i>Pollutants include Priority Organics and Pathogens (1998 Massachusetts 303(d) List of Waters; Department of Environmental Protection)</i> <i>This stem of the Connecticut River is listed as Non-Supporting of one or more designated uses in the 1992 Summary of Water Quality published by the Department of Environmental Protection. There is a fish advisory because of the presence of polychlorinated bi-phenyls (PCBs) in resident fishes and accordingly the “Fishable” use is not supported.</i></p>
Route 10 Bridge to Confluence with the Deerfield River in Greenfield	<p>Class B – Fishable/Swimmable <i>Pollutants include Priority Organics (1998 Massachusetts 303(d) List of Waters; Department of Environmental Protection)</i> <i>This stem of the Connecticut River is listed as Non-Supporting of one or more designated uses in the 1992 Summary of Water Quality published by the Department of Environmental Protection. There is a fish advisory because of the presence of polychlorinated bi-phenyls (PCBs) in resident fishes and accordingly the “Fishable” use is not supported.</i></p>
Confluence with Deerfield River to Holyoke Dam, Holyoke	<p>Class B – Fishable/Swimmable <i>Pollutants include Priority Organics and Pathogens (1998 Massachusetts 303(d) List of Waters; Department of Environmental Protection)</i> <i>This stem of the Connecticut River is listed as Non-Supporting of one or more designated uses in the 1992 Summary of Water Quality published by the Department of Environmental Protection. There is a fish advisory because of the presence of polychlorinated bi-phenyls (PCBs) in resident fishes and accordingly the “Fishable” use is not supported.</i></p>

Source: (Connecticut River Watershed Assessment and Management Report; Massachusetts Department of Environmental Protection; March 1995)

Mill River

The Mill River is a tributary to the Connecticut River. Water quality testing at several points along the Mill River and its tributaries took place throughout 1997 as part of the Mill River Watershed Project. Supported by the Conte Refuge, this multidisciplinary, multi-year study includes an assessment of water quality, geology, ecological integrity, fish, freshwater mussels and vegetative patterns as part of the process of developing a Mill River Watershed Protection Plan. Testing revealed that Bloody Brook, which flows through agricultural fields and pastures, residential lawns, and below Route 5 and Interstate 91, contains high concentrations of coliform bacteria and nitrates. This, in combination with low alkaline and dissolved oxygen levels, makes it difficult for aquatic life to thrive. Both the relatively high acidic nature of the water and the low dissolved oxygen levels are mostly due to natural causes. The bedrock below Bloody Brook lacks normal buffering capacities in comparison to other streams in the area. The meandering nature of the brook and low stream flows contribute to the low dissolved oxygen levels. A survey of invertebrates in the Mill River and its tributaries found invertebrates in all of the tributaries except Bloody Brook (Mill River Watershed Assessment Project Summary; 1997).

The high concentration of coliform bacteria and nitrates are most likely due to cultural uses. Most of the vegetation surrounding Bloody Brook consists of row fields, cropland, pastures and grassland, and there are no native vegetated strips to act as buffers. Polluted runoff from nearby

roads and farms is therefore not filtered through plant roots but is instead directly deposited into the brook. Studies indicate that the presence of a fifty (50) to seventy (70) foot forested buffer improves water quality significantly and can even reduce harmful concentrations of phosphorous and nitrogen by eighty to ninety percent (80-90%) (Report on the Mill River Watershed Project; 1998).

Deerfield River

The Deerfield River is the main tributary to the Connecticut River in Deerfield. It starts in southern Vermont and flows southeast through the Berkshires. In the north central portion of Deerfield, the river meanders northward until its confluence with the Connecticut River along its border with Greenfield. From the Vermont/Massachusetts border to the confluence with the Connecticut, the Deerfield River is forty-four (44) miles in length. Throughout its length, nine hydroelectric facilities take advantage of extreme drops in elevation (1,000 feet) to supply thousands with power (Jenkins et al; 1992). The Deerfield River watershed covers all or part of twenty municipalities. In 1990, the population of the watershed was over thirty-five thousand (35,000). Land use in the watershed is approximately eighty-one percent (81%) forest, thirteen percent (13%) agricultural and open land, four percent (4%) developed, and two percent (2%) surface water (Deerfield River Watershed Assessment Report; Executive Office of Environmental Affairs; 1995/1996).

The Deerfield River provides spawning habitat for the blueback herring and the American shad. The Deerfield River is one of Massachusetts' premier Atlantic salmon restoration rivers. The river and its tributaries are nursery habitat for juvenile Atlantic salmon. Adult sea-run salmon are expected to use the river for natural reproduction (Final Environmental Impact Statement; Silvio Conte National Fish and Wildlife Refuge: U.S. Fish & Wildlife Service; 1995).

Although the river's flow has been heavily regulated because of the requirement of power generation, the Deerfield River contains one of the best fisheries in the Commonwealth (Franklin County Planning Department; 1990). In 1985 and 1986, of all the water quality parameters measured in the Deerfield River, bacteria was the principal water quality problem. This was due in part to the lack of treatment of sewage entering into the river from certain towns in the watershed. Ten years later this water quality problem has largely been resolved with the construction of wastewater treatment facilities.

From June 1995 to June 1996, monthly sampling was conducted at several locations along the Deerfield River for nutrients and general water chemistry. In addition, fish samples were collected and analyzed for toxins including selected metals, PCBs, and organochlorine pesticides. A summary table of the results for segments of the Deerfield River is presented in Table 1-12 below. Uses may be fully supported, threatened, partially supported or non-supported.

Table 1-12: Summary Table of Testing Results for Deerfield River

Location	Aquatic Life	Fish Consumption	Primary Contact (e.g. swimming)	Secondary Contact (e.g. Boating)	Overall Ranking of Segment
Deerfield River from Vermont Line to Cold River	Threatened <i>Possible increase in temperature threatening cold water fisheries</i>	Non-Support <i>High levels of mercury found in Yellow Perch</i>	Full Support	Full Support	Class B <i>Sherman Reservoir should be placed on 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
Deerfield River from Cold River to North River	Partial Support <i>Unknown sources of toxicity, metals, and chlorines</i>	Not Assessed	Not Assessed	Not Assessed	<i>This segment should be placed on 1998 303(d) list of impaired waters. Noncompliance of Charlemont Wastewater Treatment Plant for fecal coliform and BOD & unknown sources of toxins</i>
Deerfield River from North River to Green River	Full Support	Full Support	Full Support	Full Support	Class B

Source: 1995/1996 DRAFT Deerfield River Watershed Assessment Report; Massachusetts Department of Environmental Protection)

Table 1-12 above illustrates that despite the rural character of the watershed, water quality issues exist in the upper portion of the Deerfield River watershed. While one might expect conditions to worsen downstream as pollutants from wastewater treatment plants, manufacturing facilities and other point and non-point sources add up, the stretch of the river in Deerfield has a better rating than the segments above it. This is likely the result of the process of dilution, since several tributaries empty into the Deerfield River before it reaches the Town boundary.

Fortunately, the segment of the Deerfield River in Deerfield supports all recreational uses and has tremendous recreation potential. Angling for trout and other species is a popular pastime for many Deerfield residents who enjoy the natural beauty of the river and surrounding landscape. The public can access the river at the Stillwater Bridge where canoes and kayaks can be launched. Swimming, tubing and canoeing are also popular uses of the river from the Bardswell Ferry Bridge in Shelburne to the Stillwater Bridge area in Deerfield. In 1998, the Massachusetts Division of Fisheries and Wildlife received a donation of approximately fourteen (14) acres that lie adjacent to the Deerfield River along Mill Village Road. The Massachusetts Department of Environmental Management also acquired a small parcel of land between the river and Route 5/10 (approximately one acre) which will soon provide additional public access for the disabled for fishing and kayaking (Blunt personal communication; 1999).

Wetlands and Floodplains

Wetlands help ensure good water quality. The National Wetlands Inventory identified one thousand five hundred and eighty-six (1,586) acres of wetlands in Deerfield, many of which lie on the floodplains of the Connecticut and Deerfield Rivers as well as their tributaries (*see Water Resources & Wildlife Habitat Map*). Wetlands represent unique and special habitats that help to maintain biological diversity and support approximately forty-three percent (43%) of the nation's threatened and endangered species (Kinne; 1999). Both inland wetlands and floodplains are important natural resources that are of tremendous value to the community. They provide flood storage and control, pollution filtration, and habitat for fish and wildlife. Since they are commonly recharge zones for groundwater sources, it is important that communities identify and protect their wetlands and floodplains.

Unfortunately Deerfield's wetlands are only marginally mapped. The Wetlands Protection Act requires a permit for any alteration of wetland areas or for any landscape disturbance within one hundred (100) feet of wetlands bordering a river or stream, or within one hundred (100) feet of isolated wetlands larger than one quarter of an acre. Permits are also required for landscape alterations within two hundred (200) feet of rivers and perennial streams. The loss of wetlands in Deerfield has not yet been determined. Several towns in the Pioneer Valley (Hatfield, Sunderland, Amherst, Northampton, Shutesbury, and Pelham) have adopted local wetlands bylaws which protect wetlands more stringently than the State Wetlands Protection Act.

The conversion of wetlands is a serious problem with high-priced consequences. Watersheds with degraded or destroyed wetlands experience substantially higher flood peaks. Moreover, wetlands replicated with engineered solutions do not function nearly as well ecologically as undisturbed natural wetland systems. The identification, mapping, and protection of all Deerfield's wetlands should be considered a high priority.

Wetlands also help wildlife, providing habitat for both prey and predators. Wetlands and other types of surface water are interconnected to another water related resource that is extremely valuable to Deerfield residents, ground water and drinking water supplies. Special protection should be afforded to this important natural resource.

Stronger measures enacted to avoid some of the detrimental effects of building on Deerfield's Flood Plains have not been as effective in practice as anticipated. Development can still occur in flood prone areas. The Flood Plain Overlay District Bylaw, which was adopted in 1980 to help ensure an adequate quality and quantity of water, needs to be evaluated and updated. The District regulates land uses in all special flood hazard areas designated as Zone A, A1- 30 on the Deerfield Flood Insurance Map and the Flood Boundary- Floodway Maps (Deerfield Planning Board; 1998).

Ground Water, Aquifers and Water Supplies

The water that Deerfield residents drink may come from private wells or public water district supplies. Water district supplies have both groundwater and surface water sources. Groundwater sources are springs and wells while surface water sources include reservoirs and rivers. A well pumps water from underground. The underground water collects in layers of sand and gravel called aquifers. Rain permeating through layers of soil can reach groundwater, which in turn may replace water within an aquifer.

Wells are placed to take advantage of existing underground sources of water called aquifers. Aquifer levels are maintained from areas called aquifer recharge areas. When rain falls in the hills in the northwestern portion of Deerfield, for example, some of it ends up in the small streams that course down to the Deerfield or the Mill River but much of it enters the ground water. That ground water slowly moves through the aquifer ultimately to arrive at your home or your favorite restaurant. Protecting groundwater and aquifers from contamination by hazardous materials, sewage, salts pesticides, etc. is critical to the quality of both community and non-community water sources.

A number of aquifers are known to underlie the Town of Deerfield (*see Water Resources & Wildlife Habitat Map*). A large, high volume aquifer lies beneath the Interstate 91 corridor, in the floodplain deposits of the Deerfield River. The Deerfield Fire District taps into this aquifer along Stillwater Bridge Road (Perkins; 1985). A shallow unconfined aquifer, known as the Sugarloaf Street aquifer, lies in the central part of South Deerfield. Bounded on the east by the Pocumtuck Range and on the south and west by Sugarloaf Brook, this aquifer is recharged from the surrounding hills and by infiltrating rainwater along its entire length (Perkins; 1985). The Sugarloaf well field pumped water from this source until it was shut down in 1984 due to excessive ethylene dibromide (EDB) levels. EDB is a chemical found in pesticides commonly used in the cultivation of shade tobacco. EDB levels (7.8 parts per billion) still exceed drinking water standards today (Larson, DEP, personal communication; 1999). Because of this contamination, it is doubtful that the aquifer will provide a satisfactory supply of groundwater without costly treatment.

A deep confined aquifer system of three separate valleys exists between the bottom deposits of Lake Hitchcock and the underlying bedrock. While the extent of the aquifer has been documented by the United States Geological Survey, the recharge areas are not yet mapped. A significant amount of the recharge may originate from the eastern slope of the Berkshires, the Deerfield River, or the glacial Deerfield River delta (Perkins; 1985).

Another productive aquifer may lie beneath the Connecticut River, and its recharge areas are also unknown at this time. Extensive testing of both the quantity and quality of the water is required before determining if a viable supply exists. Since the area above this aquifer is predominantly used for agriculture, which normally entails the use of chemical fertilizers and pesticides, testing would also focus on these potential pollutants. Even if chemicals common to pesticides and fertilizers were not found in the aquifer, its use as a public drinking water source would need to be balanced against the use of the land for farming purposes.

There are ten public ground water supply sources in the Town of Deerfield. One of these is in the South Deerfield Water Supply District and nine are located in the Deerfield Fire District. Public water supplies are classified as community and non-community sources. Community sources supply water to a public distribution system. Non-community public water supply sources are broken down into non-transient non-community, and transient non-community water sources. A non-community source is one that serves twenty-five (25) or more persons, such as a school, factory, campsite, or restaurant and is not part of a public distribution system. This may be transient or non-transient, depending upon the usage period. Sources that are in use for less than six months are considered transient. Non-transient non-community, public water sources are those located at private locations where people stay for longer than six months. This could be a boarding school like Deerfield Academy or a condominium association where people are drinking from the same source of water day after day.

The types of public water systems determine the level of testing required by the Massachusetts Department of Environmental Protection (DEP). Transient non-community water sources must test for coliform bacteria, sodium, nitrates, and nitrites but not for pesticides. Non-transient non-community water sources must test for a more extensive list of contaminants because the people at these locations are drinking from the same sources for a potentially longer period of time.

Community ground water sources (i.e. wells) are required by the Massachusetts Department of Environmental Protection to be surrounded by a wellhead protection area so that the water in the well does not get contaminated. The wellhead protection area is designed to restrict the types of land uses allowed within that zone. Gas stations are typically prohibited, as are industries that work with a significant quantity of hazardous materials. The interim wellhead protection area is drawn on a map as a circle with a radius of one half a mile. That protection area is approximately five hundred and three acres in size. Usually, the recharge area (DEP Approved Zone II Wellhead Protection Area) for a given well is much larger. The recharge area's boundaries are the farthest areas from which the well draws during a dry period. The Zone II water recharge area has been delineated for only one of Deerfield's public water supply wells, DFD's Stillwater Well. The recharge area can only truly be determined by pumping tests typically conducted during a dry season. Wells have been known to pull water from streams as far away as one thousand (1,000) feet. Thus, excessive pumping from wells can dry up nearby streams and impact their use by fish and wildlife and other downstream users. As the public supply well draws a significant amount of water per day, the importance of restricting land uses within this wellhead protection area becomes apparent.

Public water sources are also further defined as using groundwater supplies or surface water supplies. Groundwater supplies include wells and springs while surface water supplies take water directly from reservoirs and streams. In the Town of Deerfield, an analysis of the water supply system requires a separate discussion of the two water districts. Each utilizes a different system of public water sources, aquifers, and each has different issues and concerns.

Table 1-13: The Types and Status of Water Sources within the SDWSD in the Town of Deerfield

Source Name/Type	Ground/ or Surface	Availability or Status	Total System Registered Withdrawal (in gallons per day)	Total System Average Daily Use in 1998 (in gallons per day)
Well # 1	G	Inactive (Contaminated with ethylene dibromide)	0	0
Roaring Brook Service and Dam Reservoirs in Whately and Conway	S	Active	650,000	764,223
Total			650,000	764,223

Sources: Department of Environmental Protection; 1998. Registered Withdrawal and Average Daily Use figures from personal communication with Roger Sadoski, SDWSD, 1999.

South Deerfield Water Supply District

The South Deerfield Water Supply District (SDWSD) utilizes a water distribution system that withdraws water from two reservoirs connected to each other by way of Roaring Brook. The primary source is a service reservoir located in Whately with a total water volume or capacity of six million seven hundred thousand (6,700,000) gallons. The secondary reservoir located upstream in Conway has a capacity of one hundred and sixty-six million (166,000,000) gallons. In comparison, the Roaring Brook Reservoir system has a safe yield of one million four hundred and twenty thousand (1,420,000) gallons per day. The safe yield is the amount of water which can be utilized on a continuous basis during an extended dry period (Dumais;1980) without adverse hydrological or ecological impacts (Skiba, DEP, personal communication; 1999).

Table 1-13 above identifies the types of drinking water sources in the SDWSD and introduces terms used in describing the water supply. The registered amount is the volume of water, which can be withdrawn from the district's sources per year. Registration was initially developed as a method of protecting downstream interests as part of the State's Water Management Act. The registered withdrawal rate is based on five years of historical use and population data. Average daily use is calculated by taking the total yearly use divided by the number of days in a year. The registration volume is intended to equal the volume of water that is currently being used. It is assumed that this same volume will continue to be needed in the future with additions made for projected growth in population. In addition, the permitting process for registration includes an analysis of potential local impacts that may result from the water withdrawal. The local impact analysis addresses resources which are impacted by water level fluctuations (Connecticut River Watershed Assessment and Management Report; Massachusetts Department of Environmental Protection; March 1995).

A public water supplier is able to legally withdraw ninety-nine thousand, nine hundred and ninety-nine (99,999) gallons of water in addition to its registered withdrawal rate. Once a water

supplier's average daily use exceeds its registered withdrawal volume by one hundred thousand (100,000) gallons or more, that supplier is required by DEP to apply for a permit to legally withdraw this additional amount. The SDWSD in 1998 had an average daily use of seven hundred and sixty-four thousand, two hundred and twenty three (764,223) gallons per day. This figure was well over the registered withdrawal rate in 1998 of 510,000 gallons per day.

The 1998 volume of water that the SDWSD was registered to withdraw (510,000 gallons per day) was underestimated. Both the Department of Environmental Protection and the South Deerfield Water Supply District agree that there was an incorrect calibration of the master meter determining the initial registration volume. The master meter normally measures the exact amount of water flowing into the system from the reservoir. The SDWSD master meter had been measuring at a rate twenty-five percent (25%) below actual flow. Accordingly, when the registered amount was determined to be five hundred and ten thousand gallons per day, it was underestimated.

In 1998 the SDWSD applied to DEP for a permit to increase the volume of water withdrawn from the reservoir. The permitting process addresses any problems that may be associated with increasing withdrawals from the water source. In August of 1999, DEP provided the SDWSD with an amended registered withdrawal rate of six hundred and fifty thousand (650,000) gallons per day. This figure was based on data provided by the SDWSD to DEP that described total water usage for the years 1981 to 1985 based on historical water service meter readings, instead of the faulty master meter.

Table 1-14 identifies the average actual withdrawal, or the number of gallons used per day from 1995 to 1998. This is then compared to the registered withdrawal volumes in 1998 (510,000 gallons per day) and 1999 (650,000 gallons per day) plus the allowed overrun of ninety-nine thousand, nine hundred and ninety-nine (99,999) gallons per day allowed by DEP. The final column shows that for three of the past four years, the average daily use was above the permitted water withdrawal volumes given the amended 1999 registered withdrawal volume and the allowable overrun.

Table 1-14: The Average Number of Gallons Used per Day in the SDWSD Between 1995 and 1998

Year	Registered Withdrawal/Day (1995-1998) (gallons/day)	Average Actual Withdrawal/Day (gallons/day)	Average Number of Gallons Used In Excess of 1998 Registered Withdrawal Plus Allowable Overrun (gallons/day)	1999 Registered Withdrawal/Day (gallons/day)	Average Number of Gallons Used In Excess of 1999 Registered Withdrawal Plus Allowable Overrun (gallons/day)
1995	510,000	814,713	204,714	650,000	64,714
1996	510,000	713,794	103,795	650,000	(36,205)
1997*	510,000	809,047	199,048	650,000	59,048
1998*	510,000	764,223	154,224	650,000	14,224

Source: Public Water Supply Annual Statistical Reports Years 1995-1998 in DEP files.

Even with the amended withdrawal rate, usage between 1995 and 1998 still exceeded the new registered volume by more than one hundred thousand gallons per day. The SDWSD is working to secure a permit to withdraw the amount of water it currently needs from the Roaring Brook Reservoirs or another source within the district's environs. The registered withdrawal rate and a permitted allowable increase are for the whole supplier's system, not simply one source.

The SDWSD has several options for gaining access to clean drinking water for its use now and in the near future. The SDWSD will first seek to withdraw more water from their current source, the Roaring Brook Reservoirs. This option is dependent on the DEP determining whether increasing water withdrawals from this system will threaten endangered species downstream in the Mill River or reduce the level of water available within the watershed to dangerously low levels.

The Mill River Watershed Project, a partnership of State, Federal, and university personnel, has been researching various stream and watershed parameters to understand the habitat requirements of a number of threatened or endangered species and the impact of reduced stream flows on these populations. Also, according to the Whately Conservation Commission, an increase in the amount of water withdrawn from the reservoirs may negatively impact the natural resources downstream. These include the Federally endangered dwarf wedge mussel, two State-listed species of special concern, wild trout habitat, wood turtles, and Nasami Farm. Reducing the stream flow in Roaring Brook may also impact the brook's future potential as a site for salmon reintroduction in the watershed. Finally, there is the possibility that the Northern Spring Salamander is located in the area.

The Mill River Watershed project is expected to identify the possible ways reduced stream flow could impact the habitats of eight State and Federally listed rare and endangered species located downstream. The negative impacts to Federally listed endangered species must be considered by DEP during the water withdrawal permitting process.

Another issue that may concern the DEP in considering SDWSD's permit to withdraw additional water from the Roaring Brook Reservoir is the relationship between the peak usage rates and the safe yield. According to the Surface Water Filtration Master Plan completed in 1980 by Tighe and Bond Consulting Engineers, the Roaring Brook Reservoir system has a safe yield of one million four hundred and twenty thousand (1,420,000) gallons per day. The safe yield is the amount of water which can be utilized on a continuous basis during an extended dry period (Dumais;1980) without adverse hydrological or ecological impacts (Skiba, DEP, personal communication; 1999).

In the month of July 1998, and in the summers of the past four years, peak water usage exceeded one million two hundred thousand gallons per day (Sadoski personal communication; 1999 and DEP Public Water Supply Annual Statistical Reports; 1995-1998). According to these figures, demand during these peak usage periods is already approaching capacity based on the safe yield figure. Although the safe yield has not yet been reached, the SDWSD may require more water in

the future if increasing residential, commercial, and industrial development is connected to the public water supply.

The permit that the SDWSD is currently seeking from DEP is for water withdrawals in excess of the amended registration of six hundred and fifty thousand (650,000) gallons per day. In addition, the permit will allow increases every five years for the permit's twenty-year life based on population projections if the basin can sustain the withdrawals (Skiba, DEP, personal communication; 1999). Expecting to get additional water entirely from the Roaring Brook Reservoirs may not be an option for the SDWSD due to the needs of Federally endangered species as well as the limited capacity of this source.

Other sources or ways of increasing the supply of drinking water may include seeking water from sources within the District or from other public water suppliers outside the district. Identifying the locations for new wells and springs within the district's basin is one option. This would entail considerable exploration of potential ground sources including springs and aquifers. In the following chapter, Community Facilities and Services, the process for establishing a new public water source is explained in depth.

The SDWSD may also consider purchasing water from surrounding water districts. By purchasing water from another supplier, the SDWSD would be able to consume more water than its permitted amount. The water supplier that agrees to sell water to the SDWSD would be required to either have excess capacity within its own registered withdrawal volume or would need to apply for a permit to withdraw the amount to be sold to the SDWSD. Which communities may be appropriate for negotiations requires additional study, but there are some important general concepts to keep in mind. Typically, towns do not purchase water from abutting towns in another watershed, or across a river unless the quantity purchased is nearly one million gallons. This quickly reduces the potential list to Whately, the Deerfield Fire District, and Greenfield. The Deerfield Fire District is currently using the Greenfield water main as an emergency water source and has limited amounts available during peak demand periods in the summer. Whately water district staff do not currently have enough excess capacity to sell additional water to the SDWSD. It is unknown if Greenfield has any excess supplies which it would be willing to sell.

To limit future demands, the Town of Deerfield may also adopt zoning bylaws that limit the types of new commercial and industrial development to low water usage companies. The SDWSD may encourage the adoption of district-wide, water conservation practices through a new block rate fee structure and other methods. These methods are covered in more detail in the Community Facilities and Services chapter.

Deerfield Fire District

The Deerfield Fire District (DFD) provides its customers with water primarily from two areas (See Table 1-15 below). The first is located southeast of the Stillwater Bridge. A collection box receives water from the Harris and Stillwater Springs located on the north-facing slope of the hill, south of the bridge. These springs are extremely productive with average daily flow rates of seventy thousand (70,000) gallons per day. Also in the vicinity is the Stillwater well, with an

average daily flow rate of forty-three thousand, eight hundred and thirty-six (43,836) gallons per day. The Stillwater well taps into an aquifer straddling the Deerfield River between the bridge and Interstate 91. The Deerfield Town Landfill which has been recently capped is within the DFD Water Resources District. The Town has proposed a 30-year post-closure monitoring program to the DEP which is currently under review. The proposal calls for seventeen (17) monitoring locations downgradient of the landfill including testing of two private wells (Personal communication; Mark Haley; DEP – Division of Solid Waste Management; 1999). The monitoring wells around the dump will provide information on water quality and will identify pollutants which might leach from the landfill.

The second water source area is located off of Pine Nook Road near Eagle Brook School. The Wells and Keats Springs, with their source the Pocumtuck Range, fills a tank reservoir that feeds into the distribution system. The Wells and Keats springs produce average daily flows of six thousand eight hundred and fifty (6,850) gallons per day. The DFD's total water supply system's registered withdrawal is one hundred thousand (100,000) gallons per day.

The Wapping well located along Route 5/10 just south of Childs Cross Road is currently inactive. It used to be considered as the emergency well. Road salts used along Route 5/10 have contaminated this well. Currently, the Deerfield Fire District can purchase water from Greenfield in the case of an emergency. For example, when a railroad accident in Charlemont dumped thousands of gallons of liquid latex into the Deerfield River during the spring of 1999, the Deerfield Fire District was prepared to take the Stillwater well off line and use Greenfield water instead.

Table 1-15: The Types and Status of Water Sources within the Deerfield Fire District

Source Name/Type	Ground or Surface	Availability or Status	Registered Withdrawal (in gallons per day)	Average Daily Use in 1998 (in gallons per day)
Keats/Wells Springs	G	Active		6,850
Harris/Stillwater Springs	G	Active		70,000
Stillwater Well	G	Active	100,000	43,836
Wapping Well	G	Inactive (Contaminated by Road Salt Use)		0
Total			100,000	120,686

Sources: DEP; 1998. Registered Withdrawal and Average Daily Use figures from personal communication with Joseph Kostiuk, DWD, 1999.

Each well or spring is surrounded by land owned by the water district which is considered permanently protected. According to Robert Lawrence, Commissioner of the Deerfield Fire District, the water withdrawal rate rarely exceeds its registered amount, has no contamination problems, and has no apparent concerns with respect to future water demands. Originally, the Deerfield Fire District used the Stillwater Well as their primary drinking water source. That explains the seemingly large surplus of water currently available from that well. Over the years the district has developed its spring water sources with new pipes and collection boxes. Overall, sixty-six percent (66%) of the DFD's water comes from springs.

The Deerfield Fire District provides water to a stable customer base of primarily residential users with a small amount of agricultural, commercial and industrial services. The DFD increased its customer base by only three residential water services within the past several years. A breakdown of the average daily water use from 1995 to 1998 is described below in Table 1-16. The use for the past four years exceeded the registered withdrawal volume, but was within the allowable overrun of ninety-nine thousand, nine hundred and ninety-nine (99,999) gallons per day. The last column in the table below shows the volume of water available to the DFD per day. This was calculated by subtracting the average actual withdrawal from the sum of the registered withdrawal plus the allowable overrun. This is an average figure and should be viewed with the understanding that in peak usage periods and dry periods, this amount of water may already be consumed.

Table 1-16: The Average Number of Gallons Used per Day in the DFD Between 1995 and 1998

Year	Registered Withdrawal/Day (1995-1998) (gallons/day)	Average Actual Withdrawal/Day (gallons/day)	Average Number of Gallons Available Given Registered Withdrawal Plus Allowable Overrun (gallons/day)
1995	100,000	119,205	80,794
1996	100,000	122,122	77,877
1997	100,000	119,833	80,166
1998	100,000	123,316	76,683

Source: Public Water Supply Annual Statistical Reports Years 1995-1998 in DEP files.

The DFD has maintained its distribution system and has been able to keep up with normal increases in residential development. However, the proposed sewer expansion in both districts could place additional demands on the DFD's supply if new sewer system clients also request extensions of the district's water distribution system. It would be advisable to determine both the capacity of the water sources and the potential increase in water demand stemming from sewer extensions.

Vegetation

Deerfield is rich in a variety of plant life including coniferous and deciduous forests, meadows, cropland, wetlands, and riparian vegetation. Soil type, elevation, and climate largely determine the types of vegetation that exist. Most of Deerfield's forested areas lie in the eastern and western portions of Town where the Pocumtuck Ridge, North and South Sugarloaf, Arthur's Seat, and Pine Ledge are located. These forests are largely dominated by hardwood species such as northern red oak, sugar maple, American beech, white birch and white ash; although eastern hemlock and white pine are also prevalent. Common shrub and herbaceous species that are important food sources for local wildlife are flowering dogwood, choke cherry, high bush and low bush blueberry, mountain laurel, witch hazel, aster, dandelions, goldenrod, sweet fern, cattail, and water lilies (Franklin Regional Council of Governments; 1998).

The Natural Heritage and Endangered Species Program, a program of the Massachusetts Department of Fisheries and Wildlife, identified two hundred and forty-one (241) native plant species as rare in the Commonwealth. Twenty-four of these species are located in Deerfield, which places it among those towns in Massachusetts that contain the most rare species. Two of the rare plant species found have not been identified anywhere else in the Commonwealth. These are Snowberry (*Symphoricarpos albus* var. *albus*) and Boreal Wormwood (*Artemisia campestris*). These plants, as well as two others found in Deerfield, Nodding Pogonia (*Triphora trianthophora*) and Spiked False Oats (*Trisetum spicatum* var. *molle*), are endangered. The rare plant species that are located in Deerfield are shown Table 1-17.

Table 1-17: Rare Plant Species found in the Town of Deerfield

Scientific Name	Common Name	Taxonomic Group	State Status
<i>Artemisia campestris</i> ssp. <i>borealis</i>	Boreal Wormwood	Vascular Plant	Endangered
<i>Deschampsia cespitosa</i> ssp. <i>glauca</i>	Tufted Hairgrass	Vascular Plant	Endangered
<i>Symphoricarpos albus</i> var. <i>albus</i>	Snowberry	Vascular Plant	Endangered
<i>Triphora trianthophora</i>	Nodding Pogonia	Vascular Plant	Endangered
<i>Trisetum spicatum</i> var. <i>molle</i>	Spiked False Oats	Vascular Plant	Endangered
<i>Arisaema dracontium</i>	Green Dragon	Vascular Plant	Threatened
<i>Asclepias verticillata</i>	Linear-leaved Milkweed	Vascular Plant	Threatened
<i>Asplenium ruta-muraria</i>	Wall-rue Spleenwort	Vascular Plant	Threatened
<i>Carex lenticularis</i>	Shore Sedge	Vascular Plant	Threatened
<i>Ludwigia polycarpa</i>	Many-footed False-loosestrife	Vascular Plant	Threatened
<i>Alnus viridis</i> ssp. <i>Crispa</i>	Mountain Alder	Vascular Plant	Special Concern
<i>Amelanchier sanguinea</i>	Roundleaf Shadbush	Vascular Plant	Special Concern
<i>Aster tradescantii</i>	Tradescant's Aster	Vascular Plant	Special Concern
<i>Corallorrhiza odororhiza</i>	Autumn Coralroot	Vascular Plant	Special Concern
<i>Lophopodella carteri</i>	River Moss Animal	Moss	Special Concern
<i>Minuartia michauxii</i>	Michaux's Sandwort	Vascular Plant	Special Concern
<i>Podostemum ceratophyllum</i>	Threadfoot	Vascular Plant	Special Concern
<i>Prunus pumila</i> var. <i>depressa</i>	Sandbar Cherry	Vascular Plant	Special Concern
<i>Salix exigua</i>	Sandbar Willow	Vascular Plant	Special Concern

Source: 1999 Deerfield Open Space Plan Update

Vegetation along the banks of the Deerfield and Connecticut Rivers as well as their tributary streams provides several important benefits. Forested buffers purify water by filtering out harmful nutrients from road run-off, lawns, and agricultural fields, therefore reducing the amount of suspended solids and phosphates that may enter the river. On Deerfield's floodplains willow, birch, trembling aspen, and red maple decrease erosion and sedimentation by slowing water velocity. Vegetation also adds to the organic matter content of local soils, shelters and feeds wildlife, and cools water temperatures, which inhibits excessive growth of algae and aquatic vegetation (Franklin County Planning Department; 1990). Vegetation acts as a natural sponge

that absorbs, holds, and slowly disperses water toward rivers. This is particularly important during major storm events and the springtime thaw when flooding may be an issue. Floodplain forests are considered to be among the most threatened, globally significant wetland community types in New England. Unfortunately due to their high soil fertility and scenic qualities, many floodplain forests throughout the country have been converted to agricultural uses or cleared for residential and commercial development (Kearsley; no date).

An inventory of Massachusetts floodplain forest communities undertaken by the Massachusetts Natural Heritage Programs and The Nature Conservancy revealed six examples of Floodplain Forests in Deerfield. These are North Meadows Island, Wapping Floodplain, South Meadows, Academy Island, the Pine Hill Floodplain, and the Deerfield Academy Playing Fields Woods. While all of these sites should be protected from development, the South Meadows site was listed as particularly important due to its size and unusual diversity (Kearsley; no date).

Wildlife and Fisheries

Deerfield's landscape consists of a valley and floodplain filled with patches of cultivated fields, pasture, and woodland surrounded to the east and west by sparsely populated hills. The region's wildlife flow across the landscape in patterns that disregard the political boundaries of towns. There are fourteen major habitat types within Deerfield. Rivers, wetlands, hardwood, coniferous, and mixed forests, open meadows, croplands, and mountain ridges provide sustenance, mating grounds, and vegetated cover to the wildlife who dwell within. Since many species rely on a variety of habitats during different periods of their life cycle, species diversity is greatest in areas where several habitat types occur in close proximity to each other. With this in mind, the protection of all habitat types is vital for maintaining and enhancing biodiversity in Deerfield.

How do we determine the quality of the wildlife habitat in Deerfield and the most appropriate conservation strategies? There are three general paths to follow in conserving the health of wildlife populations. One way is to protect the habitat of specific species that are rare, threatened, or endangered. It is thought that while protecting their habitats other species will benefit. A second path is to conserve certain landscape level resources like a large contiguous forest or riparian habitats along rivers. This helps to conserve the habitats of a large number of species but it might lose sight of some rare and endangered species. The third method is a combination of the two. Conserving the long-term biodiversity of the management area requires efforts to protect unique habitats, networks of habitats that assist population dynamics, and landscape level resources like large contiguous forest patches and riparian areas.

Recognizing the general areas where wildlife mate, feed, and travel is often the first step. The forested hills in south and northwest Deerfield provide large blocks of contiguous forestland. Large forest patches of more than seventy-five hectares provide interior forest habitats for a variety of birds and mammals, as well as protection of first and second order stream tributaries (Formann; 1995). The Pocumtuck Range contains large contiguous forest patches running parallel to the Connecticut River floodplain. Wildlife biologists believe that ridges are used as travel corridors by wildlife (*see Slopes Map*). The forest field interface and the extensive

network of hedgerows provides extensive opportunities for both edge species, predatory activity by birds and mammals, as well as travel lanes from one contiguous forest to another. Large expanses of open farmland are important to species such as the Northern Harrier, turkey vultures, hawks, and flocks of migratory birds.

The Connecticut and Deerfield Rivers play a dual role for the region's wildlife. Riparian corridors often contain a greater degree of species diversity than any other portion of the landscape. The rivers also serve as important regional migration corridors. In 1996 the Conte Refuge sponsored a survey of migratory birds along the Connecticut River that revealed that one hundred and thirty-three (133) species, mostly woodland species, use the riverside habitat as a migratory corridor (Silvio O. Conte National Fish and Wildlife Refuge; 1997). Also, the Natural Heritage and Endangered Species Program considers the riparian areas along the Deerfield and Connecticut Rivers as critical habitats. In addition, there are over thirty (30) rare plant and animal species found within this habitat area (Final Environmental Impact Statement; Silvio Conte National Fish and Wildlife Refuge: U.S. Fish & Wildlife Service; 1995). Finally the rivers provide clean water habitats for native freshwater fisheries as well as anadromous fish species. American shad, blueback herring, and shortnose sturgeon spawn within the stretch of the Connecticut River, which forms the eastern boundary of Deerfield. The Deerfield River provides spawning habitat for the blueback herring and the American shad and is one of Massachusetts' premier Atlantic salmon restoration rivers.

Periodic logging of forestland has created early successional habitats favored by deer and certain bird species. The Massachusetts Division of Fisheries and Wildlife (DFW) uses a percentage of the income derived from hunting and fishing licenses for the purchase of wildlife habitat and important research into wildlife management. Sporting associations such as the Franklin County League of Sportsman and the South Deerfield Rod and Gun Club take advantage of the variety of prime game habitat in Town. Hunters in Deerfield typically target white tail deer, turkey, snowshoe hare, raccoon, black bear, cottontail, ruffed grouse, and gray squirrel. Beaver, red fox, gray fox, bobcat, weasel, coyote, and fisher are also found in the area.

The DFW has sponsored several programs aimed at subsidizing local wildlife populations. The ringed-neck pheasant, which is not native to North America, is stocked annually as game for Deerfield hunters (Franklin County Planning Department; 1990). Another successful program involves the reintroduction of the wild turkey. Since the 1960s, wild turkeys have been captured in other states and released in Massachusetts. When the Pilgrims landed at Plymouth Rock, an estimated seventy-five thousand (75,000) wild turkeys lived in New England. Unfortunately unrestricted hunting and deforestation led to the eradication of the species from the State in the mid-1800's. Yet since their reintroduction, Massachusetts' wild turkey population has soared. Estimates point to as many as eight thousand (8,000) turkeys living within Massachusetts' borders (Pelletier; 1998). This is largely due to strict hunting regulations and reforestation.

Fishing has been an important economic and recreational activity in Deerfield since the early days of European settlement. The rivers did not originally support a diversity of species but the creation of new habitats and the degradation of others led to the reduction of native fish numbers and the introduction of exotic species. The Massachusetts Division of Fisheries and Wildlife

stocks a variety of trout species (non-native rainbow, eastern brook, and brown) for sport fishing on both rivers. The Deerfield is the most intensively fished and managed trout fishery in Massachusetts (Franklin County Planning Department; 1990). This is due to the fact that the river has relatively clean water, is accessible, and there are a variety of fish habitats along its length. Limited access to the Connecticut River in Deerfield has meant that it is generally a less utilized fishing destination. Resident fish species include walleye, channel catfish, northern pike, small and largemouth bass, and pickerel.

Anadromous fish species (those which are born in fresh water, migrate to salt water where they mature and then return to freshwater to spawn) include striped bass, sea lamprey, blueback herring, American shad, Atlantic salmon and shortnose sturgeon. The Conte National Fish & Wildlife Refuge is responsible for restoring migratory fish to the Connecticut River Watershed and is presently funding a number of projects to enhance present populations. One project involves stocking river herring in streams where they are absent to determine where fishways will be most appropriate (Silvio O. Conte National Fish and Wildlife Refuge; 1997).

Unfortunately dams along both the Deerfield and the Connecticut Rivers threaten many species, especially Atlantic salmon, blueback herring, and American shad, by blocking fish passage and altering natural flows. During spawning season fluctuating water releases sweep away fish eggs and larvae. Dams also have a detrimental effect on young fish and place stress on older fish that must constantly alter their feeding and resting areas due to habitat changes resulting from fluctuating flows. Fish may be killed by turbines or stranded in isolated pools when high flow releases recede.

The construction of fishways at key points on the Connecticut River has reduced some of the harmful effects of dams. Regular stocking has led to marginal populations of Atlantic salmon and increased populations of American shad. Lamprey eel numbers have also increased significantly which indicates improving water quality throughout the Connecticut River Watershed and more efficient fish passage installations (Franklin County Planning Department; 1990).

Many anadromous fish are threatened by a variety of human actions. Fisheries in the Massachusetts portion of the Connecticut River Watershed are threatened by sedimentation, erosion, toxicity, bacterial contamination, elevated stream temperatures, bioaccumulation, and low flow due to damming for hydroelectric operations (Connecticut River Forum; 1998).

Deerfield provides habitat for a diversity of wildlife species that are either threatened, endangered or considered to be of special concern by the Massachusetts Natural Heritage and Endangered Species Program. The species that most often catch the public's eye are those that are considered "glamorous" such as the Atlantic Salmon, the Dwarf Wedge Mussel and the Peregrine Falcon, all of which have been found in Deerfield. While the importance of these species is undeniable, lesser known species should not be overlooked since all play a crucial role in Deerfield's ecosystems. Permanently protecting the habitat areas of these species should be a top priority.

Table 1-18: Rare Fish and Wildlife Species Found in the Town of Deerfield

Scientific Name	Common Name	Taxonomic Group	State Status
<i>Acipenser brevirostrum</i>	Shortnose Sturgeon	Fish	Endangered
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Bird	Endangered
<i>Lampsilis cariosa</i>	Yellow Lampmussel	Mussel	Endangered
<i>Ambystoma opacum</i>	Marbled Salamander	Amphibian	Threatened
<i>Clemmys guttata</i>	Spotted Turtle	Reptile	Special Concern
<i>Clemmys insculpta</i>	Wood Turtle	Reptile	Special Concern
<i>Desmocerus palliatus</i>	Elderberry Long-horned Beetle	Beetle	Special Concern
<i>Gomphus vastus</i>	Cobra Clubtail	Dragonflies/Damselflies	Special Concern
<i>Gomphus ventricosus</i>	Skillet Clubtail	Dragonflies/Damselflies	Special Concern

Source: 1999 Deerfield Open Space Plan Update

Mapping Products

The creation of maps of Deerfield's natural resources is important to provide an understanding of the spatial relationship of natural resource areas to each other and to developed areas in the town. This is an essential step to be able to prioritize areas that are important to protect. Maps of Water Resources and Wildlife Habitat, Open Space, Prime Farmland Soils, Agricultural Lands & Proposed Strategic Plan for Sewer System Expansion, Slopes have been created to inventory and study the current conditions in Deerfield. A Composite Environmental Constraints Map then shows the culmination of the spatial analysis conducted by the Farmland, Opens Space, and Natural Resource Subcommittee.

Water Resources and Wildlife Habitat Map – This map synthesizes information about the locations of significant water and wetland resources with information about significant wildlife habitats. MassGIS data is used to show the surface water (rivers and streams), certified vernal pools, public water supplies, DEP Zone II interim wellhead protection areas, aquifers, and outstanding resource waters in Deerfield. Wetland information for the Town was obtained from the National Wetlands Inventory generated by the United States Fish and Wildlife Service. Aquifer Potential is determined and mapped by the United States Geological Survey (USGS) based on an analysis of an area's surficial geology. The MassGIS Surficial Geology data is used in conjunction with the USGS map to identify aquifer potential in Deerfield. The map identifies aquifers with potential yield of 50-200 gallons per minute (gpm) and aquifers with potential yields of less than 50 gpm. Finally, the Natural Heritage and Endangered Species Program (NHESP) has estimated habitats of rare wildlife in wetlands and identified priority habitats for rare species, which include both wetland and upland habitats. This information on important wildlife habitats has been combined with the knowledge of the Farmland, Opens Space, and Natural Resource Subcommittee to identify potential wildlife habitat corridors and habitat areas shown on the Composite Environmental Assessment map.

Open Space Map – This map shows the permanently protected open space as contained in the MassGIS data with 1999 updates completed by FRCOG planning staff and members of the Deerfield Master Planning Committee. This data has been supplemented with some parcel level verification done by Farmland, Open Space, and Natural Resource Subcommittee members for lands enrolled in the State Department of Food and Agriculture’s Agricultural Preservation Restriction (APR) Program, and those under Chapter 61 and Chapter 61A.

Agricultural Lands & Proposed Strategic Plan for Sewer System Expansion Map – This map shows the spatial relationship between prime farmland, the existing sewer system in each district, the proposed sewer extensions, and protected open space. APR lands are shown on this map to identify which farmlands are protected and which are not.

Deerfield Agricultural Lands Preservation Priorities by Land Use Map - This map shows the highest priority farmland areas for protection based on a three-step process taking into account the value of the farmland and the threat of its conversion to residential, commercial or industrial use.

Slopes Map – The slopes map identifies areas with slopes greater than 25%, which are virtually unbuildable, and areas with slopes between 15% and 25%, which pose a constraint for industrial and commercial development.

Composite Environmental Assessment Map – This map shows many important natural resources including protected open space, steep slopes, prime farmland, and aquifers.

Recommendations

- Establish an Agricultural Protection Overlay District covering existing farmland and prime farmland soils which requires developers to submit both a standard and cluster development (conservation) plan for subdivisions, residential, commercial or industrial.
- Consider establishing an Open Space Protection program funded by property taxes to establish an active farmland and open space protection program particularly for high priority areas identified in the Land Use & Zoning Chapter.
- Consider adopting a Transfer of Development Rights (TDR) Bylaw in Deerfield that would allow development rights to be transferred away from significant natural resource and prime farmland areas identified by the Town (sending zone). Development rights would be transferred to designated areas such as village centers where sewer and water infrastructure is available and development is desirable (receiving zone).

- Consider establishing a policy for the Town to contribute five percent (5%) of the cost of purchasing development rights for any farmland entering the Agricultural Preservation Restriction (APR) program in order to increase the chance for farms in Deerfield to be accepted into this program.
- Work with the Deerfield Land Trust to sponsor a forum on the long term protection of open Space and farmland in Deerfield which includes “estate planning options” and tax benefits available for major landowners interested in the long term protection of their property.
- Request that the Select Board notify the Deerfield Land Trust and other interested conservation agencies about land parcels to be removed from Chapter 61 land classification and taxation programs for conversion to residential uses.
- Obtain approval from the Executive Office of Environmental Affairs for the recently completed Open Space Plan in order to become eligible for grant funding from the Self-help program for open space protection efforts.
- Delineate Zone II Water Recharge Areas for all existing and future public water supplies and expand the Aquifer Protection Overlay District to encompass these areas and prevent contamination from hazardous materials.
- Write letters of support to the Connecticut River Basin teamleader for additional water quality monitoring and analysis, and research on fisheries and wildlife in the Connecticut River Watershed given the limited information available on this topic.
- Support watershed and planning efforts in the Deerfield and Connecticut River Basins to improve water quality and habitat areas for fisheries and wildlife.
- Request that the Department of Environmental Protection’s Wetlands Conservancy Program and MassGIS provide new wetlands mapping in digital format.

CHAPTER

2

COMMUNITY FACILITIES AND SERVICES

The community survey identified facilities and services including public water supplies, wastewater treatment, solid and hazardous waste management, and recreational facilities as important issues to be addressed in the Master Plan. Expansion of sewage treatment capacity and the collection system were considered to be the second highest priorities by survey respondents for capital expenditures. The top priority was periodic road maintenance and improvements (*see Chapter 5 – Transportation Resources*).

When asked about the quality of public services in Deerfield, a majority of the respondents to the community survey stated that they were satisfied with the public water system and recycling and waste management. However, a majority of respondents were dissatisfied with the public sewer system. Expansion of the sewer line and treatment system may negatively impact property taxes and natural resources, particularly farmland. The ultimate decisions as to the degree and location of sewer expansion requires full, open, and objective discussion of all interested parties.

The five most popular recreational areas and facilities as reported by community survey respondents are in order of importance: Mount Sugarloaf State Reservation, Deerfield and Connecticut Rivers, Tri-Town Beach (Whately), Pocumtuck Ridge Nature Preserve, and the South Deerfield Elementary School gym, playground, and fields.

The community facilities and services chapter addresses: public water supplies, waste disposal of both solid and hazardous waste, wastewater treatment, and recreational facilities and services (*see Community Facilities Map*).

Public Water Supplies

This section presents information about the main issues for both public water supply districts in Deerfield. Following this is a presentation of alternatives to address current and future concerns regarding water supply and demand. The Goals and Objectives provide direction for the preparation of the Public Water Supplies section of this chapter, Community Facilities and Services.

Goal:

- To safeguard both the quality and quantity of public and private drinking water supplies.

Objectives:

- Plan for the future by identifying potential water supply problems and their solutions, and developing contingency plans for alternate water supplies.
- Maximize water conservation when planning for development in order to limit demands on the water supply to support the sustainable usage of water.
- Establish a growth boundary for the water mains to be consistent with areas where future development, which is ecologically sustainable, is being encouraged.
- Pursue State financial assistance to identify future ground water supplies and Zone II recharge areas for all existing public water supply wells.
- Safeguard Zone I and Zone II Wellhead Protection Areas by implementing appropriate land use regulations and land protection measures to protect all ground water supplies and resources.
- Support leak detection and repair programs as needed and remove underground storage tanks over 20 years old.
- Encourage the adoption of best management practices in all town departments, especially for the use of road salt by the highway department.
- Identify and map the general locations of private wells to prevent contamination from road salt, herbicides and other contaminants by limiting applications near those locations.
- Support the Board of Health's strict adherence to Title 5 requirements and encourage the use of alternative septic systems in situations where enhanced wastewater treatment is needed to protect ground water supplies.

Existing Conditions

In the Farmland, Open Space, and Natural Resources Chapter, the two water districts in Deerfield, the South Deerfield Water Supply District (SDWSD) and the Deerfield Fire District (DFD) were introduced. Information on the quantity and quality of each districts' drinking water supplies were presented with emphasis placed on the potential for drinking water deficits in the SDWSD now and within the next decade. This section focuses on issues and alternatives to balancing water supply and demand.

The SDWSD utilizes a chain of surface reservoirs in Conway and Whately that theoretically contain enough water for the district's annual use. Drinking water supplies are measured in terms of total system capacity, the safe yield, and the amount of water that DEP permits the district to withdraw on an average daily basis. The total system capacity is simply the amount of water the surface water reservoir can hold when full. The safe yield is equal to the amount of

water that can be withdrawn from a reservoir each and every day of the year without impeding the natural and minimum stream flow needed to sustain the watershed's hydrological and ecological integrity. The last figure, the registered withdrawal rate, is determined by considering factors such as the safe yield, population growth projections, and historic use. The amount of water that the State allows the district to withdraw is their registered withdrawal. The SDWSD has already exceeded their 1999 registered withdrawal rate.

Although water usage in the SDWSD is currently within the safe yield for the Roaring Brook Reservoir system, the daily use figures routinely exceed the new registered withdrawal rate approved by DEP in August of 1999. The new registered withdrawal rate of six hundred and fifty thousand gallons per day is based on historical water service figures for the period from 1981 to 1985 compiled by the SDWSD. The registered withdrawal rate is the permitted average daily use calculated by taking the yearly water use and dividing it by the number of days in a year. The SDWSD will probably ask to withdraw a volume of water above and beyond their registered withdrawal rate that is equal to their current average daily withdrawal volumes in the permit application they are currently preparing. DEP will also provide the SDWSD with increases to their permitted withdrawal rate every five years over the next twenty years. The rate of increase will be based on population projections developed by demographers at the Department of Environmental Management and approved by the Water Resources Commission of the Massachusetts Executive Office of Environmental Affairs.

The immediate issue for the SDWSD centers on their permit application and the rate of increase over the next twenty years that the DEP approves. The permit process to withdraw water, in addition to their registered withdrawal rate of six hundred and fifty thousand gallons per day, takes into account a variety of factors. One is the potential impacts of reduced stream flows within Roaring Brook on State and Federally listed rare and endangered species in the Mill River. Also important is the management of the water resource after it leaves the reservoirs. DEP will require evidence of adequate water conservation and leak detection programs before determining the appropriate volumes they will permit the SDWSD to withdraw over time.

There are other issues beyond DEP's determination of an appropriate withdrawal volume. For instance, if it is determined that the current stream flow in Roaring Brook is adequate to support the endangered species, and that increased withdrawal volumes in the future will not severely impact their populations, there still may be a supply problem. Water demand during the peak usage periods, typically the summer months, has approached the safe yield of the reservoirs in three of the past four years. The Roaring Brook Reservoir system cannot provide an unlimited water supply particularly during periods of drought and peak usage in the summer.

The threat of a shortage may be more immediate if DEP fails to provide the SDWSD with the permission to continue to withdraw the district's total drinking water needs from the Roaring Brook Reservoirs. The SDWSD has considered its alternatives and they include developing a groundwater source within the district and purchasing water from suppliers outside the district (Sadoski personal communication; 1999).

The DFD utilizes a series of springs and wells that together provide enough water for its customers now and probably for the next decade. Currently, the DFD can withdraw, on an

average daily basis, another eighty thousand gallons without requiring a permit. This is roughly equivalent to two thirds of their average daily withdrawal in 1998.

The Deerfield Fire District (DFD) supplies water to its customers from three springs and one well year round. Its Keats spring typically dries up in June. The DFD also relies on a connection to Greenfield's water delivery system, as an emergency source of water during power outages. DFD's total water supply system has a registered withdrawal rate of one hundred thousand gallons per day. In 1998, the Stillwater Well contributed just under forty-four thousand gallons per day to the system on average. The other sources are springs. Both springs contributed approximately seventy-seven thousand gallons per day in 1998. The safe yield of the Stillwater Well is two hundred and thirty (230) gallons per minute, or three hundred and thirty-one thousand, two hundred (331,200) gallons per day.

In conclusion, it is uncertain whether the water supply in the SDWSD is adequate even in the short term given the potential limitations that may be placed on the withdrawals from the Roaring Brook Reservoirs by the DEP and the current peak demand during summer months. Secondly, it is vital for the SDWSD to determine how much water can be withdrawn before consumption exceeds the needs of local ecological systems. The DFD has adequate supplies now and probably for the near future. Only if demand for drinking water were to remain steady for the DFD and were to be reduced in the SDWSD would there be reason to end the discussion here. This is unlikely since demand for water will rise with new residential, commercial, and industrial development. How much more water will be needed will depend on the types of future development and on whether new residences, businesses, and industries are connected to the public water supplies. An increase in demand will depend on both the number of customers and water services and the amount of water used by each customer.

Potential Alternatives to Ensure Adequate Water Supplies

The relationship between wellhead, surface water sources, aquifer protection and land uses is identified as a basis for developing potential recommendations for the safeguarding of Deerfield's drinking water supplies. Potential alternatives available to the SDWSD, the DFD, and the Town of Deerfield include: purchasing water from other sources during peak usage periods; developing other sources within the districts; permitting only low water usage businesses and industries to locate in Deerfield; establishing a growth boundary for the water mains; identifying the recharge areas of all groundwater sources; adopting strict water conservation policies for district customers; and developing a pro-active open space and land protection program to reduce future demand from new development.

Purchasing Water from other Public Water Suppliers

The Deerfield Fire District (DFD) uses drinking water from the Greenfield Water District during emergencies. The choices for the SDWSD are not as clear. Identifying which neighboring water supply districts may have water to sell is a difficult prospect. The decision of whether a district has a surplus to sell is dependent on its permitted withdrawal rate, its demand projections, and its safe yield. A potential source might also need a permit for the amount of water it would withdraw to sell. Another limitation is the Interbasin Transfer Act. Any transfer of water from

one watershed or basin to another is regulated to ensure the integrity of the watersheds involved. Another impediment is the Connecticut River. The engineering required to pipe drinking water from either Montague or Sunderland across the Connecticut River would be prohibitively expensive unless the volumes were at least one million gallons per day (Skiba, DEP, personal communication; 1999).

Water supply districts the SDWSD may consider working with include the Deerfield Fire District and the Town of Whately. The DFD has its own peak usage demand deficits during those times the SDWSD is in need but there may be an opportunity to utilize other springs or wells not yet developed. Whately may be considered for the same reasons. Suffice to say that purchasing water from neighboring districts may be an option but one that requires analysis beyond the scope of this Master Plan.

Developing Other Drinking Water Sources Within the Districts

The development of additional wells and springs within Deerfield has not been ruled out (Sadoski personal communication; 1999). The rate of water flow required for a public water source depends on the needs of the district. The potential well should tap into an aquifer large enough to sustain the targeted flow rates for the required length of time (e.g. 150-250 gallons per minute), either seasonally or year-round depending on the needs of the districts. Given the limited knowledge concerning the recharge areas of existing wells in Deerfield and the exact quality and quantity of other aquifers within the districts, identifying an appropriate groundwater source will require further exploration.

The process of developing new public water sources can be found in the Department of Environmental Protection's "Guidelines and Policies for Public Water Supply." It describes the fifteen-step process that a public water supplier must follow prior to DEP's approval of the water source. The first step, "Explore Potential Sources of Groundwater," involves drilling a small diameter well to assess both rate of flow and water quality. If contaminants are found during the exploration phase, the source may still be satisfactory but treatment will be required and the additional cost may be considerable. A contaminated water source would require additional steps as outlined below:

1. Design and conduct a pumping test;
2. Conduct standard pumping test water quality sampling;
3. Review of water quality results by DEP's Office of Research and Standards (ORS);
4. Design and construct wellhead treatment facility;
5. Design and implement raw water monitoring program to assure early warning of dramatic changes in raw water quality that may adversely impact treatment; and,
6. Refer site to DEP's Bureau of Waste Site Cleanup (BWSC) for investigation of contaminant source.

Step two, "Request Site Exam," requires detailed information about land use around the well head, historical water use, leak detection, potential sources of contamination, etc. Step three involves a site exam, which is conducted by DEP's regional source approval staff, the water supplier, and a consultant. It includes a land use/sanitary survey of the preliminary Zone II and a

review of proposed observation well locations for the pumping test. Special conditions for pumping test design and performance are also discussed. The status of Zone I ownership or control should be discussed. Steps four through ten require collecting information about the source's water quality and quantity towards seeking approval for, and conducting, an approved pumping test. Once this is approved by DEP, designs for permanent water works associated with the new source require approval. Finally, in step fifteen, the supplier must meet requirements of the surface water treatment rule. The Surface Water Treatment Rule (SWTR), an amendment to the Federal Safe Drinking Water Act, requires DEP to notify the U.S. Environmental Protection Agency (EPA) of groundwater sources determined to be under the direct influence of surface water and at risk for carrying waterborne diseases such as giardiasis. Water suppliers developing groundwater sources must demonstrate compliance with the SWTR by either receipt of a DEP SWTR exemption, institution of appropriate wellhead/watershed protection, or installation of adequate filtration. Exemptions are granted based upon well siting, well construction, or the results of microscopic particulate analysis.

Successfully establishing a new public water supply well including drilling typically costs between three hundred and fifty thousand (\$350,000) dollars and five hundred thousand (\$500,000) dollars per well source. If treatment is required, the cost increases to as much as one to two million (\$1 - 2 MM) dollars. The total cost is influenced by factors such as the depth of drilling, distance to existing infrastructure, and the need for treatment (Skiba, DEP, personal communication; 1999).

Encouraging Low Water Usage Businesses and Industries to Locate in Deerfield

The historic record for both districts show markedly different consumption patterns. The two types of land use, which consume the majority of the drinking water in the SDWSD are industrial and residential development (*see Table 2-1 below*). In the Deerfield Fire District, residential users are the primary consumers of drinking water and have been for the past four years (*see Table 2-2 below*). The largest user of water in the DFD is Deerfield Academy, particularly for irrigation purposes. In contrast, most of the drinking water in the SDWSD is currently being used for industrial and residential purposes.

Table 2-1: The Percentage of Total Daily Water Use by Land Use in 1997 and 1998 and the Number of Water Services in 1998 for the SDWSD

Land Use	% of Total Water Consumed in 1995	% of Total Water Consumed in 1996	% of Total Water Consumed in 1997	% of Total Water Consumed in 1998	# of Water Services in 1998
Industrial	29%	44%	43%	42%	28
Residential	29%	34%	39%	36%	1,352
Commercial	18%	6%	11%	11%	85
Municipal	9%	3%	4%	9%	20
Agriculture	9%	3%	3%	2%	12

Source: Personal communication with Roger Sadoski, SDWSD, 1999 and the DEP Public Water Supply Annual Statistical Reports.

Table 2-2: The Percentage of Total Daily Water Use by Land Use in 1997 and 1998 for the Deerfield Fire District

Land Use	% of Total Water Consumed in 1997	% of Total Water Consumed in 1998	# of Water Services in 1998
Residential	90 %	90 %	292
Agriculture	6 %	6 %	19
Commercial	2 %	2 %	7
Industrial	2 %	2 %	6

Source: Personal communication with Joe Kostiuk, DFD Superintendent, 1999 and the DEP Public Water Supply Annual Statistical Reports.

Permitting only low water usage industries and commercial enterprises to locate in Deerfield would be one method of managing the water resource. The Town would need to work with the SDWSD and amend their zoning bylaws. The Town of Deerfield can assist the SDWSD in minimizing the impact that increased commercial and industrial development can have on drinking water supplies by providing incentives for industries that are low-water users. It is important to note the low water usage of agriculture in both districts. This suggests that protection of farmland should help limit future increases in demand for public water supplies. The low water usage of agriculture may reflect the practice of irrigating fields directly from the Deerfield and Connecticut Rivers.

Establishing a Growth Boundary for the Water Mains

This recommendation is an option for containing both the number of residential water services and the cost of supplying service to an increasing population. Even though the SDWSD reports that its residential consumer base has been consistently three thousand eight hundred people for a number of years, population figures and estimates from both the Massachusetts Institute for Social and Economic Research (MISER) and the Town Census, show an increase in residents for the entire town. The Town of Deerfield Resident's List shows a population increase of over seven percent (7%) between 1995 and 1999. MISER estimates an increase in population of four percent (4%) between 1995 and the year 2000.

The relationship between population growth and water usage is not a precise one as evidenced by the figures in Table 2-3. Consider the fact that Deerfield's population has been increasing steadily between 1995 and 1998. This is in part due to the difficulty in ascertaining the location of population increases estimated for the entire town. The SDWSD's position that its residential customer base has not changed significantly in the past few years may be in part due to new development using private wells.

Table 2-3: Total Water Usage by Residential Uses in the South Deerfield Water Supply District (SDWSD) and the Deerfield Fire District (DFD) Between 1995 and 1998

Year	Total Water Used By Residential Use in the SDWSD (In Gallons)	Total Water Used By Residential Use in the DFD (In Gallons)
1995	103,675,565	39,158,868
1996	96,026,640	40,116,985
1997	112,716,088	39,365,122
1998	97,355,760	40,010,252

Source: DEP Public Water Supply Annual Statistical Reports.

One possible explanation for the fluctuations shown in the figures above is that overall water consumption among residential uses depends on weather conditions that might motivate users to consume more water. According to the 1980 Surface Water Filtration Master Plan by Tighe and Bond, residential consumption is significantly affected by the amount of lawn and garden watering which occurs throughout the service area (Dumais; 1980).

In the future not all, residential development needs to be connected to the SDWSD. Typically a developer will apply to the public water supply district to have his/her housing units in a subdivision connected to the main water lines. The district does not automatically grant the developer access. Developers also have the option of using private wells to service the development. Therefore, since there is no set policy for new development to be connected to district water, it is recommended that a growth boundary be established for the water mains to encourage residential development where it is most appropriate, near the village centers for example. This would do several things. It would reduce future demand on the districts' water supplies that might be expected if all new development were to be connected. It would also assist in controlling sprawl type development if the use of private wells were also subject to water conservation policies set town-wide (*see Adopting Water Conservation Policies below*). Finally, it would keep the overall costs of maintaining water lines to current levels.

Adopting Water Conservation Policies

Most of the information included in this discussion of water conservation policies is from "Water Conservation Standards for the Commonwealth of Massachusetts," prepared by the Water Resources Commission of the Massachusetts Executive Office of Environmental Affairs. According to the DEP Public Water Supply Annual Statistical Reports, less than a half of one percent of the total yearly water use is considered to be unaccounted for. Even so, a leak detection program will be a condition of any approved permit. Leak detection seeks to regularly keep unaccountable losses to a minimum. The costs for leak detection, which requires trained personnel can be included in the cost of water pricing.

Currently, in the SDWSD, funds are raised by both a flat rate of eighty cents per thousand gallons of water used, and a water tax based on property values. The DFD does not use a water tax. Instead, it charges its customers \$1.50 per one hundred (100) cubic feet of water consumed. The State's Water Resources Commission recommends full cost pricing and a rate structure that encourages water conservation. Full cost pricing refers to price levels, which recover all the direct and indirect costs associated with providing water. One example of an indirect cost associated with the delivery of public drinking water is water testing. According to the DFD, the types of water testing the DEP requires steadily increases. This cost reduces funds available for maintenance and improvement of the system. Ultimately, the DFD will have to raise additional revenues through an increase in its flat rate to cover rising costs.

Charging the true cost of water creates an appreciation of the importance of conserving water and fosters an understanding of the environmental implications of individual water use especially during seasonal or drought shortages. All direct and indirect costs could be covered by water fees based solely on use allowing consumers to understand the relationship between their rate of use and the resulting cost to them. The districts should consider adopting increasing block rates or increased seasonal rates to moderate peak demands and protect supply levels.

Once full cost pricing is established, a second level of conservation practices may be implemented with a greater chance of success. If residential users are paying the full cost of water they will presumably want to use less of it. The Town and water districts should encourage homeowners and builders to use the following water saving devices: low-flow shower heads, faucet aerators, toilet displacement devices and/or low-flow toilets, and toilet leak detection kits. The Town Building Inspector could distribute educational literature about water saving devices and conservation practices, including outdoor watering and xeriscaping (landscaping with low-water demanding plants and shrubs) when permits are applied for.

Industrial and commercial users can also adopt practices that may serve to save them money in a full cost pricing structure. Demand management, leak detection and repair, preventative maintenance, employee education, and reducing the diameter of lines at the meter are all examples of methods available to industrial and commercial users. In addition companies can carry out a water audit to determine the amount and location of water used for heating, cooling, processing, sanitary use, and outdoor use. This audit could result in the identification of actions which could be taken to conserve water. For example, businesses could adopt closed-loop cooling, use of non-potable water, use of heat-sensitive valves to control cooling equipment, replacing water cooling with gas or air cooling, retrofitting sanitary devices, meter maintenance and calibration, and xeriscaping.

Identifying the Recharge Areas of all Groundwater Sources

Understanding which land areas are responsible for recharging the aquifers containing the districts' drinking water is important to make sure surrounding land uses are not jeopardizing the quality of the water within the aquifers. The risk of water supply contamination is evident in tests seen throughout the State. According to the DEP, two hundred and thirty-one (231) public water sources were permanently closed due to ground water contamination in eighty-nine (89) Massachusetts communities as of January 1998. Volatile organic compounds were the cause of contamination in fifty-nine percent (59%) of cases; twenty-seven percent (27%) were closed due to inorganic compounds, synthetic organic compounds and natural causes; eight percent (8%) were discontinued due to a combination of these; and the rest were closed due to varied causes. Because preventive measures are much more cost effective than remedial efforts, protection of public water supplies is best done before problems arise. Contaminants may be residential, agricultural, or industrial in origin. Approximately one-half of all homes in Deerfield rely on septic systems to dispose of human waste. The large number and widespread use of these systems makes them a serious possible contamination source. Contamination of ground water results from hazardous material leaks, agricultural and golf course runoff, road salt, landfills, surface impoundments, sewers, pipelines, and underground storage tanks (USTs). Waste disposal practices for sanitary, solid, and industrial waste are the most serious sources of ground water pollution.

Ground water conductivity is determined by gravity, pressure, material permeability, and slope. Well pumping alters the natural movement of ground water. When pumped, ground water around the well is pulled down and into the well. This area may extend to many miles, depending on local hydrogeological conditions. Replenishment of the ground water aquifer is known as recharge and occurs primarily from precipitation percolating through the land's

surface. Under certain conditions, surface waters also provide ground water recharge, called induced recharge. A Zone II wellhead protection zone should encompass the entire pumped and recharge area.

In general, the protection of water resources, particularly wellheads, is crucial because ground water pollution is difficult to correct and the cost of clean-up and remediation is usually prohibitively expensive. The purpose of delineating wellhead protection areas is to define the geographic limits most critical to the preservation of a wellfield. Properly identifying the recharge area is critical because the introduction of contaminants into the recharge area can cause aquifer contamination and loss of the public water supply.

The EPA lists a five-part process for wellhead protection including: forming a community group, mapping water protection areas, identifying potential contamination sources, managing the protection area, and planning for the future. Identification of water protection areas should include overlay maps of watersheds, aquifers and their recharge areas; wellhead zones of influence and contribution; direction of ground water flow, soil, geology; FEMA floodplain maps; and all wetlands, streams, lakes and ponds from which wells may induce recharge.

The EPA designated zones of protection comprise several levels of safety. The Zone I designation is a 400' radius around the wellhead for primary resource protection. Because any breach within this first zone of defense could directly and immediately impact water quality, acquisition or control of land in this zone is imperative for protection. The Interim Wellhead Protection Area reaches to a radius of one half mile and is intended to be a temporary designation until a Zone II protection area can be established by a pump test. The Zone II designation extends to the area drawn upon if no rain falls for 180 days. Zone II areas supply recharge to the public supply well under the most severe pumping and recharge conditions that can be realistically anticipated. Local regulation of land use activity in this area is critical to maintain potable water supplies. Contaminants that percolate down through the unsaturated zone to the aquifer have the potential to move with the ground water flow and pollute a public supply well. Unlike the mixing and dilution that occurs between pollutants and the water in surface water bodies such as lakes and streams, pollutants in the ground water often remain concentrated in a contaminant plume.

The Safe Drinking Water Act of 1974 designated the Environmental Protection Agency as the Federal authority for implementation of this new law. In Massachusetts, authority was delegated to the DEP to govern the oversight of public water supplies in the State. Because the double protection of Federal and State-mandated restrictions is in place, municipal public water supply systems are closely regulated and monitored for quality.

It is very important that the Town of Deerfield work with the water districts and the DEP to identify the location and extent of the recharge areas for all current public water supplies. Recharge areas are typically much larger than the Interim Zone II Wellhead Protection Areas. Identifying the locations of productive aquifers to support future public water supplies is also very important so that zoning measures can be adopted to protect water quality.

The DFD considers the Water Protection District south of Hoosac Road and Stillwater Road, east of Interstate 91 as the recharge area for the Stillwater well and springs. The purpose of the Watershed Protection District (WPD) is to promote the health, safety, and general welfare of the community by ensuring an adequate quality and quantity of drinking water for the residents, institutions, and businesses. The WPD acts as an overlay district requiring uses to adhere to standards often more strict than the underlying zoning. Land uses that involve the use and/or storage of potential groundwater contaminants are either prohibited or allowed only under special permit.

Once the recharge areas for the districts water supplies are known, the Town of Deerfield should consider amending their zoning bylaws to regulate land uses in those areas that typically involve hazardous materials as well as non-point source pollution. The land conserved around each spring and wellhead should reflect the relationship between land use, groundwater, recharge areas, and aquifer integrity.

Developing a Pro-active Land Protection Program

Permanently protecting land in Deerfield has many benefits including the protection of scenic, agricultural, recreational, and natural resource values. Land can be permanently protected from development using a variety of methods from ownership by local, State, Federal, and private conservation agencies and organizations, to the holding of conservation restrictions on land by these same entities. Landowners that count on the financial return that conversion to residential, commercial, or industrial uses provides, can be compensated for the fair market value of either the value of the land in full or the value of the development rights of the property. Municipal land protection programs in combination with the efforts of local land trusts and State agencies have successfully conserved valuable land resources across the Commonwealth. Protecting land will further reduce future pressures on public drinking water supplies.

The permanent protection of land can be one of Deerfield's main tools for the long-term sustainability of its ground water resources. One result of open space protection is the reduction in the number of acres that can be developed. Another is the protection of the aquifers' recharge areas. Both will help to protect the integrity of the aquifers supporting public water supply wells as well as private wells.

A related benefit of open space and farmland protection is a reduction in the future cost of providing community services including water, sewer, schools, etc. In 1991 the American Farmland Trust conducted studies that found that protection of farmland and open space is an effective strategy for balancing a community's tax base. The American Farmland Trust (AFT) studies found that the median ratio of dollars generated by farmland and open space to services required was \$1:\$0.29 resulting in a positive fiscal impact to the town. In contrast, the median ratio for residential development was found to be \$1.00:\$1.16, indicating that residential development costs more in terms of town services that it generates in tax revenues. The towns studied by the American Farmland Trust included Deerfield. Table 2-4 shows the cost of community service ratios (in \$) for two towns in Franklin County.

Table 2-4: Cost Of Community Service Ratios (In \$)*

	Residential	Commercial/ Industrial	Farm/Open Land
Deerfield	1:1.16	1:0.38	1:0.29
Gill	1:1.15	1:0.41	1:0.29

* American Farmland Trust, 1991

Recommendations

- The Select Board and Planning Board should work with the Deerfield Fire District and the Massachusetts Highway Department to establish a no-salt zone along Route 5/10 that coincides with the recharge area for the Deerfield Fire District's Wapping Well. According to the Deerfield Fire District, the Wapping Well is contaminated with road salt and is not used for any purpose. The Massachusetts Highway Department (MHD) uses road salt during the winter seasons as part of their program to make the roads safe for travelers in ice and snow conditions. It may be possible for the Town Boards to discuss with MHD the use of road salt alternatives. These alternatives could be confined to the aquifer recharge area. If the road salt alternatives are used the Wapping Well will be able to produce clean drinking water in the future. In that case the Deerfield Fire District could use this well during water supply emergencies.
- The Select Board should coordinate with the Guilford Rail System to make sure that railroad tracks are being properly maintained to reduce the risk of hazardous waste spills alongside the Deerfield River. The Deerfield Fire District's (DFD) Stillwater Well, their only active well, utilizes an aquifer that is located beneath the bed of the Deerfield River. Water from the river can be pulled into the aquifer by the force of the well pump. The DFD is correct to be concerned about the potential contamination of this aquifer by accidental hazardous waste spills from derailed train cars. The Guilford Rail System owns and maintains freight train travel routes on tracks that run alongside of the Deerfield River from the Hoosac Tunnel in Florida, Massachusetts to the Stillwater Bridge in Deerfield. The DFD and the Select Board should initiate discussions with the Guilford Rail Systems with respect to adequate maintenance and safety inspections of those tracks that are in use upstream of the aquifer.
- The Planning Board should work with the South Deerfield Water Supply District (SDWSD) to establish a watershed protection overlay district to protect the Roaring Brook Reservoirs. A watershed protection overlay district can be a useful tool for the protection of both ground and surface water supplies. The SDWSD owns approximately one hundred and twenty-five acres in the southwestern corner of the Town. An overlay district could provide additional limited protection to the aquifer by regulating land uses in the recharge area for the reservoir, which is equivalent to its own subwatershed. The overlay district could be designed with the needs of the SDWSD in mind. The district would be included in the Town's zoning bylaws only after being approved at Town Meeting.

- The Select Board and Planning Board should work with both water districts to determine appropriate water consumption limits for businesses. These limits could be incorporated into the Special Permit process and considered when decisions are made with respect to tax incentives. Both water districts have a limited supply of water. One manufacturer is responsible for a majority of the current drinking water consumption in the SDWSD. If any new industries arrived without concern paid to its water needs, it is possible that the SDWSD could fail to be able to provide an adequate supply when peak demand occurred during drought periods. For this reason, both districts support the development of incentives that would encourage efficient use of drinking water in Town by both existing and incoming businesses.
- The Select and Planning Boards should work with the Deerfield Fire District and the South Deerfield Water Supply District to establish a water line connection between the two districts for emergencies only. Both Town Boards should initiate discussions with the leadership of the two districts concerning the potential benefits for an emergency drinking water supply connection between the two districts.
- The Planning Board and the Deerfield Fire District should explore the feasibility of creating a boundary to future water district expansion to help control residential growth. The Deerfield Fire District provides drinking water to primarily residential properties, the educational institutions, and farmers. The District has no official boundary. A water district can be as large as the farthest reaches of its customers. The argument for establishing boundaries to water main expansion rests on two main factors. One is that the Deerfield Fire District has a limited water supply and the other is that water line expansion could raise farmland values and help spur on development at a faster rate than expected.

Waste Disposal

This section presents information about the main issues for solid and hazardous waste disposal in Deerfield.

Goals:

- To manage solid waste using an integrated management system that includes waste reduction, recycling, composting, and appropriate disposal techniques.
- To collect and dispose of hazardous waste in an environmentally sound manner.

Objectives:

- Establish priorities for the handling of solid waste. The first priority is to reduce the amount of waste as much as possible. The second priority is to recycle or compost waste that cannot

be avoided. The third priority is to treat waste that cannot be recycled or composted. Finally, wastes must be landfilled that cannot be recycled, composted, burned, or treated in some other manner.

- Decrease the volume of municipal solid waste from incinerator and landfill facilities by maximizing participation in recycling and composting programs through public education or by providing incentives to recycle like establishing disposal fees.
- Allocate adequate storage for the collection and interim storage of materials for recycling.
- Continue and expand regular hazardous waste collection.
- Require commercial and industrial businesses that use, store, generate, or transport hazardous materials or wastes to prepare and maintain an emergency response plan that identifies potential environmental and health risks and recommends ways to reduce those risks. Plans should be provided to local officials responsible for emergency response coordination.

Solid Waste

Many landfills have been closed throughout New England in the last 10 years. There are several reasons for landfill closure, including lack of space, environmental concerns, and the will of local community groups. However, the major reason is Subtitle D of the Federal Resource Conservation and Recovery Act, which mandates the closure of unlined landfills.

Since 1989, the Massachusetts Department of Environmental Protection has conducted environmental assessments of operating town landfills, which is the first step in closure. After landfill operations cease, capping of the site requires three to four months when the weather is most conducive to earthmoving functions, usually July through October. The procurement of funding to cap landfills presents a challenge to towns as costs average \$45,000 to \$100,000 per acre for capping. In addition, ground water testing and monitoring must be maintained for up to thirty years at neighboring sites. The various components involved in landfill closure are:

- Excavation and removal of refuse
- Impervious cover layer
- Drainage layer, loaming, and seeding
- Site Preparation
- Gas vents
- Rip-rap

The closure of local unlined, potentially polluting landfills has generated a need for regionally integrated waste management systems. In 1990 Deerfield joined other Franklin County towns to form the Franklin County Solid Waste Management District (FCSWMD) and introduced mandatory recycling at the town landfill. The Deerfield landfill was closed in 1997. Up until August of 1998 non-recyclable solid waste had been sent to the Bernardston landfill.

Deerfield is not alone in having to close and cap its landfill. Between 1994 and 1999, the landfills of eleven (11) towns in Franklin County were scheduled for closure and capping. Bernardston's landfill was scheduled to close in July of 1999. Because there are no solid waste disposal sites in the region, the FCSWMD has coordinated contracts with landfills outside the region.

The Franklin County Solid Waste Management District (FCSWMD) was formed a decade ago as a waste planning and contracting consortium of twenty-one Franklin County towns. It is working to locate a long-term disposal site outside the region, as no Franklin County town has expressed an interest in siting a landfill within its boundaries. Regional plans for transfer of non-recyclables using larger compactors or transfer trailers to carry more tonnage will mean cost containment for towns in the FCSWMD.

Deerfield has sought out its own contracts separate from the FCSWMD except for its sludge disposal. Deerfield sends its solid waste to Northampton at a rate of sixty-five dollars per ton. Equally important, the town is implementing composting and recycling programs.

The average residential recycling rate last year for towns in the Franklin County Solid Waste Management District was forty-five percent (45%), well above the State's average of thirty-four percent (34%). The 1998 recycling rate for Deerfield was twenty percent (20%) (FCSWMD; 1998). However, Deerfield's recycling rate in fiscal year 1999 is over fifty-three percent (53%) (Ameen, FCSWMD, personal communication; 1999). This is largely due to the adoption of variable rate disposal fees and extensive recycling services. Adoption of variable rate disposal fees, or "pay by the bag," is useful to provide waste generators with direct economic incentives to conserve resources. Deerfield currently charges residents twenty-five dollars (\$25) per household plus people pay a one dollar a bag fee for garbage pick-up.

Deerfield provides its residents disposal of recyclable bulky items, white goods (appliances like dishwashers) not including refrigerators, and tires. The expansion of markets for these waste materials continues to make these programs viable alternatives to landfilling. Commercial recycling and disposal will continue to be driven by cost. As waste disposal costs escalate, more recycling will be done. A new regional recycling contract with the Springfield Materials Recycling Facility (MRF) has been negotiated to provide a realistic payment schedule for collectibles through the year 2005.

Composting is a safe, efficient and relatively inexpensive way to convert food and yard wastes into a usable product. Town and home composting programs, combined with public education, have expanded participation. In our region's smaller towns, yard waste has never been a significant part of the waste stream but the larger towns maintain yard waste piles. Deerfield provides for disposal of leaves and chips at a compost pile near their transfer station. On-site food composting for schools, hospitals, institutions, and large businesses has been successfully initiated in other parts of the country and could significantly reduce Deerfield's waste stream. It is slowly being incorporated into some local institutional waste management programs. Composting may be an important way that Deerfield's educational institutions could contribute to reducing food and yard waste.

The cost of trash disposal has risen ten dollars a ton since July 1, 1999 because hauling and tipping fees rose to compensate for the waste being transported a greater distance. The anticipated increases in both hauling and disposal fees, provide an incentive to further reduce waste generation.

Hazardous Waste

While source reduction of solid waste remains a high priority, Deerfield must also address the use and disposal of hazardous materials. Appropriate hazardous waste management is critical to ensure the protection of the environment and of public health. If hazardous wastes are improperly disposed of at landfills, down drains and through the incineration process, even though they are in small quantities, they will contaminate air, land and potentially drinking water supplies. Cost-effective management of hazardous wastes begins with education aimed at minimizing use. Environmentally safe disposal methods in use include paint swaps, paint collection, and collection of pesticides, solvents and other hazardous wastes. Since 1992, the FCSWMD has sponsored an annual collection of household hazardous waste. The collected toxic substances can be safely burned using specialized incinerators. In 1998, the FCSWMD developed four regional “super depot” sites in Bernardston, Colrain, Conway, and Orange, for permanent, year-round collection of special wastes (also called universal wastes) that require restricted collection and handling. These include fluorescent bulbs, oil-based paint, antifreeze, waste oil, oil filters, and rechargeable and button batteries. While the household hazardous waste collection program gathered fourteen (14) tons of toxic materials in 1997, many more tons are still uncollected and may potentially pollute our ground water and atmosphere.

Recommendations

- The Select Board in conjunction with the Highway Superintendent should continue to require solid waste generators to pay for the full cost of disposal. Deerfield currently charges residents twenty-five dollars (\$25) per household plus a one dollar a bag fee for garbage pick-up. Increasing the price per bag would further persuade generators to reuse and recycle more.
- The Select Board and the FCSWMD representatives should provide residents and educational institutions opportunities to learn about and adopt on-site composting. On-site composting and increased recycling are programs that have been developed by the FCSWMD to help municipalities reduce the amount of garbage that must be trucked to the landfill. As available landfill space continues to decrease, tipping fees will become more expensive. Recycling and composting programs can do much to reduce the amount of garbage being transported out of Town. Food waste is just one example of an institutional waste that can be separated from the refuse stream by the generator. The compost could then be used by the generator as landscaping material.

- The Planning Board, Board of Health, the Deerfield Fire District, and the South Deerfield Water Supply District should work together to develop a voluntary hazardous waste registration for households and businesses in areas near, or within, their aquifer recharge areas. A voluntary registration of these materials by a resident or business owner would provide the Town knowledge of any material use that could negatively impact the local aquifer. Registration would also provide an opportunity for the Boards to provide members of the community with educational material that would demonstrate how normal every day, but hazardous materials, if misused or disposed of carelessly, could result in the degradation of drinking water aquifers in Town.

Wastewater Treatment

The expansion of sewage treatment plants and lines were identified as one of the most important planning issues by respondents to the community survey. Discussions to expand the capacity of the plants and the collection system have been prompted by the failure of private septic systems throughout Deerfield, but mainly in higher density residential areas where lots are typically less than a half an acre in size. The failure of these systems is largely due to high groundwater tables in particular soils. Given the new Title 5 Regulations, the cost of replacing an existing system, if it is even possible, is costly ranging from ten thousand to twenty thousand dollars (\$10,000 to \$20,000).

The issue of wastewater treatment expansion is a difficult one since areas with a high frequency of septic system failures are spread throughout Deerfield. In addition, the South Deerfield Wastewater Treatment Facility is near capacity, some of which is caused by an inflow and infiltration problem. This will be discussed further in this section. Infrastructure improvements, which may include expanding the capacity of the South Deerfield Wastewater Treatment, are needed before any sewer lines are extended.

The impact of any expansion of the collection system on those parcels newly traversed by sewer lines is a prime concern and will likely contribute to development pressures on farmland. In fact Weston and Sampson Engineers (WSE), in their Wastewater Strategic Plan identified the loss of farmland and open space as a potential result of the expansion. The purpose of this section of the chapter, Community Facilities and Services, is to integrate the findings of the Weston and Sampson Strategic Plan with the information presented in the Farmland, Open Space, and Natural Resources chapter. It will include an assessment of the two wastewater treatment plants including the conditions that warrant action prior to sewer line expansion. The proposed strategic plan prepared by WSE and the Deerfield Sewer Subcommittee is then used to outline potential impacts to farmland and open space.

The Master Plan Goals and Objectives were derived from the results of the community survey and reviewed by the Deerfield Master Planning Committee. They provide a framework for the preparation of this section.

Goals:

- To maintain and renovate the sewer system so that it provides adequate service to those areas within Deerfield that are constrained from using any other method of treating wastewater, and in a manner which the districts and residents can afford.
- To plan the expansion of any wastewater treatment to be consistent with the Master Plan so that access to the sewer system minimizes the loss of farmland, open space, wildlife habitat, and scenic viewsheds to development.
- To provide environmentally sound wastewater treatment.

Objectives:

- Establish sewer extension limits consistent with the Master Plan.
- Consider neighborhood treatment systems rather than sewer extensions for existing development in Deerfield and new clustered housing developments.
- Plan for the construction or expansion of sewer infrastructure that reinforces the traditional character and village development patterns of the region.
- Support proposals to upgrade and improve existing wastewater treatment facilities and sewer lines.
- Encourage the adoption of practices that help to reduce storm water runoff such as directing rain gutters to dry wells or alternative means of disposal.

Existing Conditions

Table 2-5 summarizes the current conditions as measured by flow rates for the two wastewater treatment plants in Deerfield. The South Deerfield plant is receiving wastewater at a rate only two percent (2%) below its design capacity. Wastewater treatment plants are required by the Department of Environmental Protection to initiate plans for expansion when the rate at which wastewater comes into the system, called the influent loading rate, reaches eighty percent (80%) of the facility's design capacity for ninety (90) days. The Old Deerfield plant is currently operating at forty-six percent (46%) of its design capacity.

Table: 2-5: Wastewater Treatment Facilities in Deerfield

Facility Name and Location	Facility Type	Number Persons Served	Design Capacity (MGD)	Average Monthly Flow	% of Design Capacity Remaining	Sludge Treatment or Disposal	Effluent Disposal Location
Deerfield (South)	EA	5,600	0.85	0.834	2	Incineration	Connecticut River
Deerfield (Old)	EA	2,000	0.25	0.116	54	Incineration	Deerfield River

Source: Massachusetts Department of Environmental Protection

Note: EA = Extended Aeration. MGD = Millions of Gallons per Day.

There are several design criteria that influence greatly the capacity of the wastewater facility. These design criteria help to identify potential solutions to the problems experienced by the treatment plants and require resolution before new sewer lines can be connected to areas with failing septic systems. The design criteria relate to both the quantity and quality of wastewater that flows into the collection system from the sewer lines and the quality of the wastewater that is discharged into the Connecticut and Deerfield Rivers after it is treated.

Table 2-6: Deerfield Wastewater Treatment Plan Design Criteria and National Pollution Discharge Elimination System (NPDES) Permit Discharge Limitations

Wastewater Treatment Facility	Design Average Daily Flow (Hydraulic Loading)	Design Peak Hourly Flow Rate	Design BOD Loading	Design TSS Loading	Discharge BOD Limit (Monthly Average)	Discharge TSS Limit (Monthly Average)
South Deerfield	0.85 MGD	3.2 MGD	3,000 lbs./day	1,370 lbs./day	30 mg/l	30 mg/l
Old Deerfield	0.25 MGD	NA	400 lbs./day	300 lbs./day	30 mg/l	30 mg/l

Source: Weston and Sampson Engineers Wastewater Strategic Plan, 1999.

Note: MGD = Millions of gallons per day. BOD = Biological Oxygen Demand. TSS = Total Suspended Solids.

Hydraulic loading is the term used to measure the quantity of water flowing into the two plants. WSE analyzed flow monitoring records for 1997 and 1998 for both plants. The average daily flow entering the South Deerfield WWTP exceeded the permitted capacity during nine (9) separate months in 1997 and 1998. The monthly average daily flow ranged from 0.492 million gallons per day (MGD) to 1.308 MGD. WSE recommended that the South Deerfield plant take action to remain in compliance with their existing National Pollution Discharge Elimination System (NPDES) permit. According to WSE staff, the Peak Hourly Flow Rate of 3.2 million gallons per day (MGD) listed in the table above is a surge factor. The plant can handle a surge of wastewater that would be equal to 3.2 MG divided by twenty-four hours or, one hundred and thirty-three thousand three hundred and three (133,333) gallons per hour. Compare this to the average daily flow permitted by DEP of 0.85 MGD or, thirty-five thousand four hundred and seventeen (35,417) gallons per hour. The same flow monitoring records were analyzed for the Old Deerfield plant. Their average daily flow ranged from 0.052 MGD to 0.205 MGD, which did not exceed their permitted capacity of 0.25 MGD.

The SDWWTP's Chief Operator suggests that these figures can be misleading. Given certain conditions, the SDWWTP can handle 2.5 MGD for an entire day without an effluent discharge violation. They have had one violation last spring and none for the previous three years. Hydraulic flow violations happen frequently but are usually caused by Infiltration and Inflow problems particularly during storm events, which are discussed in more detail below.

Biological oxygen demand (BOD) and total suspended solids (TSS) are two design criteria that describe wastewater, both the quality of the water coming into the system, and the water being discharged to the rivers. Biological oxygen demand (BOD) is a measure of the amount of oxygen consumed by the wastewater in a given period, typically five (5) days. Total suspended solids (TSS) measures the number of particles in the water. The United States Environmental Protection Agency and the Massachusetts Department of Environmental Protection regulate the levels of these parameters found in the water discharged from wastewater treatment plants. Each plant has a NPDES permit that quantifies the allowable levels of BOD and TSS in the discharged wastewater. The influent to the Old Deerfield plant does not normally exceed design criteria for BOD or TSS. However, according to WSE, the wastewater entering the SDWWTP (influent) often exceeds design capacity for BOD and TSS loading though the discharge remains within the permit criteria.

Industrial wastewater from one or more users is thought to be the potential source of high nutrient content to the wastewater influent at the SDWWTP. In particular, the influent to the SDWWTP from Cains can impact the treatment capability of the plant. Although the inflow is already pretreated by Cains' on-site wastewater treatment facility, it contains lactic acid and vinegar that contribute to the development of filamentous bacteria in the SDWWTP's clarifier.

The wastewater inflow arrives at the SDWWTP carrying waste solids and enters settling tanks. Bacteria in the settling tanks break down the solids into sludge. It takes roughly twenty-four hours for this first phase to be completed. Then the wastewater flows into a circular clarifier where the sludge settles. Normally, as the sludge settles the clear water flows over the top of the clarifier, gets disinfected, and is then discharged into the river. Filamentous bacteria retard the sludge from settling out in the clarifier. The bacteria can be treated with chlorine gas, but this takes between one to two weeks to complete. If, during this time, a storm event sends a surge of water into the collection system, it is unlikely that the plant will be able to adequately treat the wastewater before discharging it.

Even though Cains has reduced its hydraulic loading by twenty-five to thirty percent (25% -30%) in the past year, there is concern that problems will continue if the company expands production. Based on WSE's analysis, and the information presented by SDWWTP staff, the South Deerfield Plant is in need of expansion due to the fact that normal influent flows exceed design criteria for both hydraulic loading and nutrient loading of BOD and TSS in the wastewater.

One reason that the South Deerfield Wastewater Treatment Plant is experiencing average daily hydraulic flows that are in excess of design criteria is that water is entering the sewer system from areas other than the initial points of generation. This problem is referred to as Infiltration and Inflow. Infiltration represents groundwater entering the collection system via breaks within the piping, open joint pipe, or cracks within manholes. Infiltration can be estimated based on the

minimum flow that enters the plant during the time of day when wastewater generation is at a minimum typically between 1:00 am and 6:00 am. Inflow represents the water that enters the system through direct connections such as catch basins, roof gutter leaders, and leaking manhole covers. Inflow is estimated by subtracting the peak dry weather flows from the peak wet weather flows.

WSE reviewed many studies of Infiltration and Inflow experienced by the South Deerfield plant including the most recent one in 1987. The sewer sections identified in the 1987 study that were contributing the greatest percentages of infiltration flow are listed below. WSE's analysis of the 1987 study showed that approximately 0.5 MGD of the peak infiltration entered the collection system through the pipe sections listed. Because the 1987 study was accomplished in June, when groundwater levels are typically much lower than in March and April, the sections identified may not have been the ones with the greatest infiltration contributions. For that reason WSE suggests that a new Infiltration and Inflow study be done during a period of high groundwater.

Table 2-7: South Deerfield Sewer Sections with Excessive Infiltration

Sewer Section	Length in Feet
Sugarloaf Street and Sugarloaf Road South of Gromacki	1,100
Sugarloaf Street Between Mountain Road and King Phillip Avenue	1,280
Sugarloaf Street and Thayer Street east of Porter Street	1,670
Thayer Street between Porter Street and cross-country interceptor	800
North Main Street between Conway Street and Graves Street	400

Source: Weston and Sampson Engineers, 1999.

According to SDWWTP staff, the Town of Deerfield has fixed a number of the sewer sections listed above so that a building moratorium set in 1991 could be lifted. The building moratorium was initiated by DEP in 1991 due to the SDWWTP exceeding its design capacity by more than eighty percent (80%) for more than ninety days. Since 1991, there have been a number of projects accomplished towards treating the infiltration and inflow problems within the South Deerfield area. They are tabulated below.

Table 2-8: Actions taken to Reduce Infiltration and Inflow of the SDWWTP 1991-1999

Time Period	Treatment	Section of Sewer	# Gallons of Infiltration Reduced/Result	Cost/Cost Estimate
April-June 1991	Manhole Inspections	All of South Deerfield	NA	NA
	Television Inspection of Sewers (Request for Proposals)	6,500', 21" cross-country connections + 5,700', 8" on Sugarloaf and Thayer Streets	NA	NA
	Raising manhole frames and covers	NA	NA	NA
July-Sept. 1991	Television Inspection of Sewers	6,500', 21" cross-country connections + 5,700', 8" on Sugarloaf and Thayer Streets	Sugarloaf Street found to have the most problems	
	Raising manhole frames and covers	NA	NA	NA

Table 2-8: Actions taken to Reduce Infiltration and Inflow of the SDWWTP 1991-1999 (cont.)

	Sewer repair	Short section of Sugarloaf Street	NA	NA
	Sewer Rehabilitation Plan	Sugarloaf Street with the Insituform pipe lining process	Construction Spring 1992	NA
June 25, 1992	Replaced 40' 8" section of pipe	Sugarloaf Street	5,800 gpd	NA
June 16, 1992	Replaced 30' section of pipe	Graves Street	NA	NA
July 9-10, 1992	Raised and repaired 15 manhole covers	N. Main Street	NA	NA
July 1992	Repaired leaky manhole cover	Eastern Avenue	NA	NA
June 30, 1993	Repaired break	8" Captain Lathrop Drive sewer using sleeve	NA	NA
July 7, 1993	Replaced collapsed 8" sewer	N. Main/ Pleasant Street	6,000 - 9,000 gpd	NA
1994	TV Inspections	Sections of sewers on Graves, Easter Ave., and Captain Lathrop Drive	NA	NA
	Rectangular clarifiers refurbished	NA	NA	NA
1995-1996	Disconnect five of the six Municipal Office Building roof leaders from the sewer collection system	NA	NA	NA
1999	Warrant Articles for 1999 Town Meeting:			
	Sewer System Evaluation Study for SDWWTP	NA	NA	\$250,000
	Facilities Plan for SDWWTP *	NA	NA	\$250,000
	Install improved aeration system at SDWWTP	NA	NA	\$375,000
	Plan retrofit of Graves Street Sewer	NA	NA	NA
	Monitor and work with Cains	NA	NA	NA

Source: Yearly reports by the SDWWTP staff to DEP personnel.

Note: NA = Not Available.

* The Old Deerfield Waste Water Treatment Plant will also be included in the Facilities Plan.

WSE reviewed the South Deerfield treatment plant's 1997 and 1998 inflow records and determined that the peak inflow and infiltration levels still exceeded the design capacity of the plant. That means that current Infiltration and Inflow problems produce hydraulic loading that is still excessive even with the results of the actions listed above (prior to 1999). SDWWTP staff

believe that this is due to the fact that the sections of sewer pipe left to repair contribute the most infiltration and are the more expensive projects.

Correction of Infiltration and Inflow problems should be addressed where feasible. Often the costs associated with repairing problem sections is prohibitive in comparison to processing the additional water the infiltration represents. WSE suggested that the Town of Deerfield conduct a Sewer System Evaluation Survey (SSES) to determine which pipe sections should be repaired, giving priority to the South Deerfield plant. Typically, according to WSE, one can expect only a forty percent (40%) reduction in the infiltration flow from repairs given cost constraints. It is very important for both wastewater treatment plants to work with the Town of Deerfield and State agencies to identify and repair existing Infiltration and Inflow problems.

WSE assessed Infiltration and Inflow for the Old Deerfield Wastewater Treatment Plant as well. They determined that 0.14 MGD of peak infiltration could be due to the pipe sections described in the table below.

Table 2-9: Old Deerfield Sewer Sections with Excessive Infiltration

Sewer Section	Length in Feet
Old Deerfield Road (MH 412 to 409)	1,600
Old Deerfield Road (MH 420 to 418)	600
Cross-Country (MH 409 to 421)	1,920
Pine Nook Road (MH 428 to 424)	880
Old Deerfield Road (MH 418 to 412)	1,200
Pine Nook Road (MH 440 to 435)	1,080
Pine Nook Road (MH 432 to 428)	3,802

Source: Weston and Sampson Engineers, 1999.

Proposed Sewer Extension Plan

The proposed sewer expansion plan prepared by WSE and the Deerfield Sewer Subcommittee includes reducing Infiltration and Inflow and extending sanitary sewer to some of the problem areas that are within 1/2 mile of the existing sewer system. It also includes upgrading the treatment system to address BOD and TSS loading, shared systems for problem areas that are not within 1/2 mile of the sewer system, and conventional or alternative on-site systems.

The determination of which areas should be connected to the sewer system was based on a set list of ranking criteria developed by WSE. The entire town was broken up into five zones and then each of the criteria was ranked for each zone. The highest-ranking criteria were whether:

- Development was possible and encouraged;
- The zone was expected to involve expansion of commercial and industrial development;
- Residents formally petitioned for sewers;
- A significant portion of the zone is within one quarter of a mile of a feasible connection or sewer is within the zone;
- Greater than twenty percent (20%) of the septic systems are expected to fail Title 5 inspections;

- There are thirty-five (35) buildable lots that are 1/2 acre in size or less;
- There are greater than 20 households with historic septic system problems;
- The zone is comprised of significant dense residential development;
- The zone is characterized by groundwater conditions that limit construction of septic systems;
- The zone contains a significant number of households with both private wells and septic systems, and;
- The zone has a significant number of homeowners that pump their septic system at least once per year.

According to the strategic plan, areas proposed for sewer system extensions included portions of Whately Road, South Mill River Road, Conway Road and all the land between, Mill Village Road near Evans lane, Hillside Road, Hillcrest Road, Beaver Road, Route 5/10 from North Hillside to Depot Road, and Steam Mill Road (*see Agricultural Lands and Proposed Strategic Plan for Sewer System Expansion Map in Chapter 1*). The WSE Strategic Plan proposes that shared systems would be good for areas outside the 1/2 mile sewer extension limit when a significant number of residents have problem septic systems. Title 5 allows for the option of constructing shared systems, which involves two or more homes utilizing one common septic tank and/or soil absorption system. This is an option where suitable soil and groundwater conditions exist in close proximity to both available land, and a high concentration of households that cannot repair their failed systems in a cost-effective manner. Title 5 allows shared systems that can collect up to ten thousand (10,000) gallons per day. Title 5 requires a system with a design criterion of one hundred and ten (110) gallons per bedroom per day. Therefore shared systems can be used for up to forty-five (45) two-bedroom units, thirty (30) three-bedroom units, or twenty-two (22) four-bedroom units. Shared systems may be appropriate include Jones Cross Road, Sherman and Meadow Wood Drives, and Stage Road.

A third component of the WSE Strategic Plan is the use of innovative and alternative on-site septic systems. These are technologies allowed by Title 5 that can reduce the distance separating the system from the groundwater required with conventional systems. They can also be used to reduce the amount of naturally occurring soil required above bedrock. These innovative systems require maintenance and upkeep and are only appropriate in areas where shared systems or sewer lines are not possible.

Potential Impact of the 1/2 Mile Sewer Expansion on Farmland and Open Space

Although there are significant numbers of farmland parcels protected in Deerfield, their location provides one view on the potential impact of the sewer line expansion. Most of the farmland parcels protected are along River Road and in a valley that lies between Interstate 91 and Route 5/10, north of North Main Street and south of Old Deerfield. Unfortunately, there is little protected land in the proposed areas for sewer line expansion along 5/10, Whately Road, South Mill River Road, and Conway Road.

The potential impact of expanding the sewer lines could well be the conversion of this land into residential subdivisions. Loss of woodland would mean the potential for decreased water quality

in Bloody Brook, which runs through the area. Loss of farmland would mean loss of rural character and the economic base farming operations provide. In terms of farmland and open space protection, the extension of sewer lines will likely increase the cost of purchasing development rights, since lots will be easier to develop because uncertainties related to Title 5 and soil conditions are avoided.

In the previous chapter, Farmland, Open Space, and Natural Resources, the impact of the proposed sewer extensions is analyzed. The potential for losses in farmland acreage and a diminishment in the quality of the environment are considered to be primary impacts. The table below is from the farmland section of the chapter and is reprinted here for convenience. Only those areas that would receive an extended sewer line (in bold) are considered in light of the potential impacts to farmland and other natural resources. This is based on the assumption that shared systems and on-site systems would not cause abutting land to become more vulnerable to development. Except for Beaver Drive, extension of sewer lines to all the other problem areas would create opportunities for the development of farmland for residential and industrial development.

Table 1-7: Septic Problem Areas by the Types of Treatments they are to Receive Under the Weston and Sampson Engineers Strategic Wastewater Plan

Problem Area	Extended Sewer Line	Shared Septic System	Alternative/Conventional On-Site System
Whitney Road/South Mill River Road	X		
Beaver Drive	X		
Captain Lathrop/Hillside Road	X		
Mill Village Road.	X		
Greenfield Road/Steam Mill Road	X		
Boynton Road		X	
Stage Road		X	
Jones Cross Road		X	
River Rd./Hillside Road			X
River Road			X
Keets Road/Greenfield Road			X
West Deerfield Lower Road			X
West Deerfield Upper Road			X
Conway Rd./Lee Road			X
Chapman/Hawks Road			X

Source: Weston and Sampson Engineers, Inc. Wastewater Strategic Plan; 1999.

Recommendations

- The Select Board and the Planning Board should explore the application of shared conventional or alternative systems in situations where the cost of sewer line expansion, the heightened threat of residential development, and the reduction in local farming operation profitability far outweigh any benefits. Sewer line expansion could have negative impacts on other resources that the Town values including farmland, open space, and low property taxes. The Select and Planning Boards should consider these costs and determine which areas, if any, could receive an extension of a sewer line at a cost that would be less than the price of a

shared system. Then these areas should be assessed for the resulting costs of the residential development that will occur as abutting lands become equipped with sewer. Remember that for every dollar new residential development brings into the Town as tax revenues, one dollar and sixteen cents goes out of the Town coffers to pay for municipal services demanded by that land use.

- The Planning Board and Select Board should develop and execute incentives for incoming or expanding businesses and industries to produce less wastewater. In the same way that the Town should work to encourage businesses to use less water, producing less wastewater is also important. Recently the Town voted to upgrade the capacity of the South Deerfield Wastewater Treatment Plant (SDWWTP) to handle total suspended solids. However, the new aerator system will only allow the SDWWTP to be able to deal with more solids. It does not directly increase the plant's allowable, or design average daily hydraulic flow, which is the amount of inflow allowed under the plant's National Pollution Discharge Elimination System (NPDES) Permit. Therefore it is very important to develop incentives for new or expanding businesses to either reduce their outflow or make up the difference by reducing the amount of sewer flow arriving at the plant from Infiltration and Inflow.
- The Planning and Select Boards should work together to explore the feasibility of creating a boundary to future sewer-line expansion to help control residential growth. Sewer lines are the precursors to new residential development. Unless the Town would like to have large lot residential development wherever it can be built, Town members should consider another alternative. One other method is to determine where the Town would like to have most of its future residential development and place sewer expansion there. This will not deny people access to selling of their land for development, but it will help Deerfield retain its ability to provide the municipal services in an efficient manner.

Recreational Resources

In the community survey, respondents identified the five most desirable recreational resources that they would like in Deerfield. They were in order of importance: 1) trails and paths for hiking, skiing, and biking; 2) access to rivers; 3) parks and playgrounds; 4) indoor area (fitness center, or gym), and; 5) recreational fields. Overall the most popular types of recreational programming (not including youth sports) supported by the survey respondents were, in order of importance: 1) concerts; 2) community fairs; 3) holiday events; 4) arts festivals, and; 5) nature outings and summer recreation programs.

Recreational resources are an important consideration in any Master Plan. Often the sense of community spirit relates to experiences of neighbors interacting in their leisure time. The experience of community can be enhanced through activities, events, resources, and programming that seeks to bring people together again and again throughout the year.

A diverse menu of community facilities and services including recreational activities is useful to attract firms and industries to locate in Deerfield. Trade magazines that cater to manufacturing firms often contain advertisements highlighting the characteristics of a community that many businesses find desirable. Good schools, open space, transportation access, sewer and water infrastructure, and recreational opportunities are mentioned. Diverse recreational opportunities serve the community in many ways.

The following section of the Community Facilities and Services chapter of the Master Plan will include goals and objectives, based on the community survey, inventories of Deerfield's recreational facilities and programs, and recreational issues.

Goal:

- To provide additional recreational programs and facilities for Deerfield residents based on the results of the community survey.

Objectives:

- Develop new, and expand existing, multiple-user recreational trails connecting Deerfield's open space, natural, historic and cultural resources.
- Identify and develop new opportunities to access the Deerfield and Connecticut Rivers.
- Provide for new recreational facilities in Deerfield including parks, playgrounds, roadside rest areas, and a fitness center.
- Publicize family oriented programs and facilities in place for use by residents.
- Address safety, maintenance, and operations issues for all recreational sites.
- Develop and implement an open space program so that residents and landowners may donate land for the community's enjoyment and long-term stewardship.

Recreational Facilities

Currently, there is a lack of town-owned recreational sport fields, playgrounds, and other areas to adequately support the needs of Deerfield residents. Many of the youth programs not associated with the Frontier Regional High School utilize a mix of private, State, and local fields for their activities on a case by case basis. It is important that Deerfield residents continue to nurture the relationships they have with State and private agencies and organizations so that access to these recreational land resources may be maintained. Table 2-10 identifies the facilities, common activities, ownership, size, extent of resources, and issues and opportunities associated with each area or facility.

Table 2-10: Recreational Resources and Facilities in Deerfield

Map #	Name of Area or Facility	Main Recreational Value or Use	Owner of Land/Manager	Size of Area	Extent of Resources	Issues/ Opportunities
1	Tri-Town Beach	Swimming Lessons	Towns of Deerfield and Whately	15 acres	Lake with paid lifeguards and swimming instructors	Potential site for development of sports fields on fifteen acre field abutting lake
2	Police Station Ballfields/ Proposed Town Field	Used for soccer, baseball and softball programs	Between the Police Station/Tilton Library and Senior Center	2.5 acres	Open lawn back of town hall. No other facilities	Potential to link community buildings with elementary school, to be a multi-use recreation area, and to serve as a site for events
3	Old Deerfield Grammar School	Used for baseball	Town of Deerfield owns field	1.5 acres	Baseball field	Small little league field with small backstop located in the heart of Historic Deerfield
4	Sugarloaf Mountain Field	Little league	Massachusetts Department of Environmental Management	1 - 2 acres	Parking area for 20+ cars, covered team benches, chain link fence and back stop, refreshment stand, picnic tables, and stands	Use is by DEM permission only
5	Channing L. Bete Fields	Used for soccer	Channing L. Bete	5 - 7 acres	Two soccer fields	Owner may develop it
6	Eaglebrook	Uppvall Field for girl's softball	Eaglebrook School	2-3 acres	Softball Fields	
7	New Deerfield Elementary School	Basketball, fitness, and general play	School District	12 acres	One multi-use playing field, two basketball courts, a tot lot, a playground, and an obstacle course	
8	New Regional High School Fields and Tennis Courts	Pop-Warner (Football for young people) Summer Programs	Regional School District	12 (approx.) acres	Large playing field, a running track, basketball courts, and tennis courts	

Table 2-10: Recreational Resources and Facilities in Deerfield (cont.)

9	Deerfield Academy fields	Home games for high school	Deerfield Academy	30-50 acres	4 -10 soccer fields, 1 deluxe football field with announcer's tower, stands and field posts, 1 other football field, and a number of tennis courts	
10	Mt. Sugarloaf State Reservation	Hiking, picnicking	Massachusetts Department of Environmental Management (DEM)	537 acres	Auto road winds to top, scenic views of Pioneer Valley, and a Pavilion	Handicap accessible
11	Pocumtuck Ridge Nature Preserve	Hiking, bird watching, horseback riding, and cross country skiing	Pocumtuck Stewards of the Land	121 acres	Nature trails	Kiosk needed to orient and welcome visitors
12	Third Island	Picnicking and boating destination	Silvio Conte Wilderness Refuge	3 acres	An island on the Ct. River	Conte's ownership may lead to enhanced recreational opportunities
13	Town Memorial Forest	Tree Farm	Town of Deerfield	20 acres	Trail runs along border	This area could be a demonstration forest
14	Nature Sanctuary	Hiking and nature watching	Town of Deerfield	34 acres	Accessible only through private yards	A trail easement through this land could connect this forest with Pocumtuck Nature Preserve

Source: Deerfield Recreation Committee members; 1999, and the 1999 Open Space Plan Update.

Recreational Programs

As a result of the April 1998 Deerfield Town Meeting, the Board of Selectman appointed a Recreation Committee to explore ways in which facilities and land may be used to create more recreational opportunities for Deerfield residents. In April of 1999 by Town Meeting appropriation, approval was made for the creation of a Parks and Recreation Department within the Town. Currently Mr. Joel Cole serves as the Town's first Recreation Coordinator whose part time position is year-round. The Recreation Department is now organizing many of the programs that used to be developed and supervised by volunteers. Table 2-11 lists the recreational programs, the groups they serve, and the numbers of people they serve.

Table 2-11: Recreational Programs in the Town of Deerfield.

Program	Group Served	Number of People Served
Soccer	Coed Youth	150-180
Basketball	4 th Grade and Up	120
Girls Softball	4-Town District	
Baseball	Youth	200
3-Week Summer Recreation Program	Coed Youth	46 in 1999

Source: Deerfield Recreation Committee members; 1999.

Recreation Issues

Trails and Paths

According to Deerfield Recreation Committee members, previous efforts to establish bike paths in Deerfield met resistance among landowners concerned about providing public access near private property. The successful development of the multi-use trail that runs from Amherst to Northampton may provide the positive example needed to encourage support for a similar trail in Deerfield. Bike paths could also be established throughout the town alongside roads where traffic volumes are low. Streetscape improvements including sidewalks that support pedestrian traffic may satisfy residents' needs for a more pedestrian oriented downtown in South Deerfield.

Other types of trails that are typically located within or around open space were also favored within the community survey. The 1999 Open Space Plan Update recommended the development of trails along the Pocumtuck Range that connected various protected parcels under private, town, and State ownership.

Access to Rivers

Respondent to the community survey clearly felt that access to the Deerfield and Connecticut Rivers was something they sorely lacked. The Deerfield Recreation Committee has helped the town acquire one acre of land abutting the Deerfield River near Old Historic Deerfield that allows access as a canoe or kayak put-in. Although used currently, the site has not received much publicity and therefore not many people seem to know about it. Access to the Connecticut River on the other hand is very difficult since many of the owners are farmers along River Road. The University of Massachusetts owns three hundred and fifty-eight (358) acres alongside the Connecticut River. Their application for a conservation restriction under the Agriculture Preservation Restriction (APR) Program may not support access to the river.

Need for More Recreational Multi-Use Fields

The acquisition of recreational fields wholly owned by the town of Deerfield is a top priority among Deerfield Recreation Committee members. Currently, recreational programs are typically run on fields not owned by the town. For instance Channing L. Bete has graciously allowed the town to utilize a field for youth sports. If the field were ever to be developed by the publishing company, finding a new area would be difficult. One solution may be to continue developing relationships with the private schools that already provide limited use to their facilities. Another may be to combine the interests and energies of all land protection entities within the town to seek new open space. Town-wide open space programs, which are consistently active are more successful at receiving land as donations to the resource.

All-age Programming

Another priority for the Recreation Committee is to develop a more well-rounded menu of recreational programming. Most if not all the programs currently offered are for youth. Other activities that do involve adults are on an ad-hoc basis, like pick-up basketball games at the Elementary School or at Deerfield Academy. These activities could be expanded to provide opportunities for adults and senior citizens in addition to what is offered at the Senior Center. As all other recreational programs seem to have started out as volunteer driven activities, perhaps that may be the process by which new programming proven to be useful is included within the responsibilities of the Recreation Coordinator.

Community Fairs, Concerts, and Holiday Events

Also noted in the community survey was the desire for community centered events. Having a town common large enough for people to gather is vital. Plans for developing the area in between the town offices, police station, Tilton Library and the Senior Center could provide resident the space they need to put on a variety of events from farmer's markets to crafts fairs to sporting events.

Recommendations

- Deerfield's Recreation Committee should work with the Stewards of the Land, Deerfield Land Trust, and landowners along the Pocumtuck Range for the purpose of building and maintaining passive recreation trails for all ages. Hiking trails that connect permanently protected open space along the Pocumtuck Range would be one way to encourage the use and appreciation of open space. The Recreation Committee should work with other organizations that seek to protect conservation land and are invested in an active and ever expanding open space program. Inviting people to learn about, enjoy, and become stewards of the Town's natural areas is an excellent way to build a constituency for open space.
- The Recreation Committee should seek recreational easements from landowners with access to the Connecticut and the Deerfield Rivers and work with State agencies to make sure State access points are well developed. The Recreation Committee has several opportunities to work with both public and private landowners to secure rights to access the river by way of this river-side property. The Department of Environmental Management and the Town of Deerfield have property that abuts the Deerfield River, one near Stillwater Bridge and the other west of the South Meadows. Other private landowners including farmers could provide access to both the Connecticut and Deerfield Rivers and the Town should be ready to support these projects financially if necessary.
- The Recreation Committee should develop a protocol for managing the Town's relationship with the institutions that provide residents access to their recreational fields. Since many fields used now by area youth leagues are "lent" by private educational organizations or State agencies, it would be advantageous for the Recreation Committee to establish a protocol for how fields are scheduled, used, and maintained. The Recreation Committee should also establish a method for resolving conflict between the leagues and the field owners.

CHAPTER

3

HOUSING

Housing was identified by the community survey as an important topic to be addressed. There is significant concern about the level of residential growth and its impact on the natural resource base, particularly farmland. Approximately 70% of the survey respondents would like to curb residential growth. In terms of new housing, most of the survey respondents would prefer the development of single family homes on 1/2 to 2 acre lots. However, the need to maintain a diverse housing stock, which provides affordable alternatives for Deerfield residents, is also important. Fortunately, Deerfield currently has a fairly diverse set of housing options from apartments and condominiums to single family homes and overall is doing well in maintaining affordable options for its residents. However, this situation may change since the recent trend in new home construction in Deerfield is principally single family homes on large lots.

The most important housing issues identified by survey respondents and Master Plan committee members are control of residential development, compliance with the State's Title 5 septic system requirements and the need to meet State mandates for low and moderate income housing. This section includes an assessment of current housing stock and housing issues which need to be addressed in the near future.

Housing is considered "affordable" when households spend no more than thirty percent (30%) of their gross income on housing costs. The sectors of the population, which are often in greatest need of affordable housing are elders living on fixed incomes and young families buying their first home. Overall, sixty-eight percent (68%) of the survey respondents support the building of elderly housing and fifty-one percent (51%) endorse programs that support first-time home buyers. However, the majority of community survey respondents do not support the development of low and moderate income family housing. Forty-three percent (43%) oppose it and thirty-three percent (33%) support it.

Since 1982, Massachusetts has directed that every town should offer ten percent (10%) of its housing stock for low and moderate income households. The number of units which count towards a municipality's ten percent (10%) goal established by the State for low and moderate income housing only includes units that receive subsidies from State or Federal housing assistance programs and does not include other affordable housing units based on the "30% of gross income" criteria. Communities which do not meet the 10% criteria of the State, may receive proposals from developers which may override local zoning with respect to factors such as density under the Chapter 40B Comprehensive Permit process. Communities are well advised to take a pro-active approach to meeting this goal in order to maintain control over the type of development suitable for their town.

While community survey respondents want to control residential growth, population projections indicate the Town will continue to expand and housing for residents will be needed. In particular, housing for the elderly is needed given population forecasts according to age groups. This chapter contains information on population growth forecasts and projects the number of housing units which are expected to be needed over the next two decades. The best location(s) to direct new residential development will be addressed in the Land Use and Zoning section.

The following goals and objectives for housing are based on the community survey results and input from the Master Planning Committee.

Goals:

- To encourage a mix of housing densities, ownership patterns, prices, and building types to serve diverse households consistent with the character of the community.
- To provide financial assistance to homeowners for State mandates with respect to Title 5 and remediation of lead paint hazards.
- To provide decent, safe, affordable housing for rental or purchase that meets the needs of Deerfield residents.

Objectives:

- Preserve existing affordable housing stock and work with legislators to have the State expand its definition of “affordable” in meeting the 10% goal.
- Support a mix of residential and commercial development in South Deerfield center similar to current types.
- Support State-sponsored programs that provide financial assistance for homeowners to comply with Title 5 septic system and lead paint compliance mandates by the State.
- Work with the Franklin County Housing and Redevelopment Authority and non-profit agencies to help homeowners obtain access to financial assistance for Self-Help building funds, septic upgrades, and home improvement financing.
- Pursue public grants and other sources of funding to enhance the financial feasibility of affordable housing development, both rental and owner occupied, for elders and young families.
- Support grants for rehabilitation of vacant or underutilized buildings for residential use.

Assessment of Current Conditions

Housing in Deerfield has traditionally consisted of compact single and two-family housing in the Old Deerfield and South Deerfield village centers and single family homes on frontage lots in the rural areas. In the 1980s, three developments of two-family units, called Mill Village, were built on farmland to add to the Deerfield housing base. By 1990, two-family and multi-family units accounted for 459 dwellings or 22% of the housing stock. In addition, a number of dwelling units were created in the Tannery behind Hotel Warren which was converted to multi-family housing in 1993. The June 1998 zoning bylaw amendments now only allow the conversion of structures to multi-family housing via a special permit process and only in the CVRD and the Small Business District. Housing data is provided below.

According to the United States Census Bureau, Deerfield had a total of one thousand seven hundred and six (1,706) housing units in 1980. By 1990, this number had grown by 377 units to two thousand eighty-three (2,083) housing units (*see Table 3-1*). Of the total occupied housing units in Deerfield, one thousand three hundred ninety-six (1,396), or seventy percent (67%) were owner occupied. An additional five hundred ninety-nine (599) or twenty-nine (29%), were occupied rental units. Of the eighty-eight (88) vacant units, thirteen (13) were for sale, and thirty-one (31) were for rent. The remaining forty-four (44) units were vacant for other reasons. The eighty-eight (88) vacant units represent a low vacancy rate of 4.2% reflecting the desirability of living in Deerfield.

Table 3-1: Housing Units in Deerfield - 1990

	1990	Percent of Total	
Owner Occupied	1,396	67.0%	.9%
Renter Occupied	599	28.8%	4.9%
Vacant Units	88	4.2%	
Total Units	2,083	100.0%	4.2%

Source: US Census, 1990

According to the 1990 Census data, Deerfield has a favorable mix of housing types for a rural community. Approximately thirty percent (30%) of the housing stock was available for rent. In addition, over twenty-two percent (22%) of the town's housing structures were two-family housing or greater (*see Table 3-2*). However, according to building permit information compiled from data supplied by the U.S. Census Bureau and the Deerfield Building Inspector's Office (*see Table 3-3*), only single family units have been constructed between 1991 and 1998, indicating a movement away from the diversity exhibited in the housing stock in 1990.

Table 3-2: Types of Housing Structures in Deerfield - 1990

	Units	% of Total
Single Unit	1,529	73.4%
2-4 Units	359	17.2%
5 or More Units	100	4.8%
Other	95	4.6%
Total	2,083	100.0%

Source: US Census Bureau, 1990

Table 3-3: Deerfield Residential Building Permits

	Single Family	Multi Family
1990*	4	2
1991*	6	0
1992*	13	0
1993*	7	0
1994*	16	0
1995**	11	0
1996**	12	0
1997**	10	0
1998**	8	0
Total	87	2

*Source: US Census Bureau, 1994

**Source: Building Inspector's Office, Town of Deerfield, 1999

Based on Census data from 1990, almost 42% of the town's residential units were built in the 1970s and 1980s, (see Table 3-4) reflecting the rapid expansion of the town's population during that period. However, over 33% of the town's housing units were constructed prior to 1939, when the use of lead paint was prevalent. In fact between 1960-1975, 20% of homes were still using lead-based paints. The presence of lead paint poses a problem for families with small children because the safe removal of lead is an expensive process.

Table 3-4: Age of Housing Structures in Deerfield

	# of Units	% of Total
1989-March 1990	53	2.5
1980-1988	406	19.5
1970-1979	410	19.7
1960-1969	205	9.8
1950-1959	134	6.4
1940-1949	179	8.6
1939 or earlier	696	33.4
Total	2,083	100.0

Source: US Census Bureau, 1990

According to the community survey, 70% of town respondents want to limit residential development. When asked to rank the top five planning issues, "population growth" was tied for third place by survey respondents. Table 3-5 provides historic population figures and projected growth trends between 1970 and 2010. Although the growth rate has slowed from 17.3% between 1970 and 1980, to 11.1% between 1980 and 1990, the population has still increased by five hundred residents in the past ten years. The Massachusetts Institute of Social and Economic Research (MISER) data projections indicate that another 412 persons will be added to the census rolls in Deerfield between 1990 and 2000. These same projections expect another 289 residents by the year 2010. While the growth rate is slowing, the town continues to expand and will need to plan for housing its residents in future years. The projected growth is not surprising given the town's attractive location to regional employment centers. Interstate 91 and Route 5/10 links Deerfield to Greenfield in the north, and to Northampton and Springfield in the south. Route 116 provides easy access to Amherst.

Table 3-5: Historic Population Figures & Projections for Deerfield (1980-2010)

Year	# of Persons	% Change
1970	3,850	
1980*	4,517	17.3
1990*	5,018	11.1
2000**	5,430	8.2
2010**	5,719	5.3

*Source: US Census Bureau, 1990

**Source: Projection data from the Massachusetts Institute of Social and Economic Research (M.I.S.E.R.)

To translate population growth into the need for housing, an average household size per housing unit can be used. Using the most recent figures for housing units, 2,083 in 1990, and comparing, this to the population size of 5,018 people, an average household size can be calculated of 2.4 individuals (population/housing units). Using the MISER population projection and the average household size, an increase of 412 residents would translate into a need for 172 additional housing units by the year 2000. However, building permit information through 1998 shows that only 87 single family and 2 multi-family permits have been issued indicating a total addition to the housing stock of approximately 108 units. Assuming approximately 10 units are added each year in 1999 and 2000 the total additional units added would be 128 versus the 172 predicted. Accordingly, either the MISER population estimates are high or the average household size in Deerfield has increased significantly. Since there is always uncertainty with forecasts, it is best to assume a range in the household size of 2.4 to 3.2. With another 289 residents projected by 2010, an additional 90 to 120 housing units would be needed between 2000 and 2010. How much acreage these housing units will need is examined in the Land Use and Zoning Chapter.

It is important to understand which portion of the population is growing in order to plan for housing needs. The data in Table 3-6 registers a moderate 4% growth in the 0-19 age group, a 9% drop in the 20-44 young worker group, a substantial 18% increase in the older 45-64 worker group, and a small 3% increase for retiring and elderly residents. In particular, the increase in the older worker group (45-64) age category indicates that more elderly housing will be needed over the next twenty years. The town could provide housing for retiring elders who desire to remain in town, but need smaller, more affordable homes. Taking a proactive approach to developing elderly housing, which is compatible with the town's character could allow the town to increase the number of units counting towards the 10% goal of low and moderate income housing required by the State. Also of note is the decline in the 20-44 "young worker" group category. This trend is consistent with State population trends.

Table 3-6: Number of People in Deerfield & Massachusetts by Age Group (1990 and 1995)

Age Group	Deerfield	Deerfield	Massachusetts	Massachusetts
	1990*	1995**	1990*	1995**
0-19 Years	1,200	1,250	1,582,382	1,586,312
20-44 Years	1,598	1,448	2,527,402	2,526,368
45-64 Years	1,520	1,798	1,105,714	1,233,156
65+ Years	700	721	802,853	826,058
Total	5,018	5,217	6,018,351	6,171,894

*Source: U.S. Census Bureau, 1990

**Source: Massachusetts Institute of Social and Economic Research (M.I.S.E.R.)

Affordability

Housing is considered "affordable" when households spend no more than thirty percent (30%) of their gross income on housing costs. Households spending more than this amount on housing are considered "cost burdened." For renters, housing costs include rent and utilities (heat, hot water, trash disposal, and electricity). For homeowners, the housing costs include principal, interest, property taxes, and property insurance.

According to an analysis of the 1990 Census of Population and Housing conducted by the Housing Assistance Council, Massachusetts has one of the highest percentages of cost burdened rural residents in the country. In 1990, the State had the third highest rural median monthly rent at five hundred eighty-eight dollars (\$588). The rural median monthly owner cost was one thousand one hundred forty dollars (\$1,140) and was the fourth highest in the country. The total percentage of cost-burdened rural households in the State was 28%.

Deerfield's 1990 Median Household Income (MHI) is listed as \$38,942 (*see Table 3-7*). Based on this data, a median income household could afford a house costing \$110,000, assuming an 8.5% fixed interest rate mortgage. This "affordable housing cost" has been obtained from a worksheet used by the Franklin County Regional Housing and Redevelopment Authority. The assumptions used for this calculation are that monthly payments include principal, interest, taxes, and insurance based on a 10% down payment; a 30 year term; fire and hazard insurance equal to 5/12% of the purchase price; a tax rate equal to 15 dollars per thousand of purchase price; private mortgage insurance (PMI) equal to .00031250 of a point of mortgage value; no homeowners fee; and a minimum income based on allowing 30% of gross income towards monthly cost.

Table 3-7: Deerfield Income and Housing Data

Median Household Income (MHI)	\$ 38,942
95% MHI	\$ 36,995
80% MHI**	\$ 31,154
Median House Value	\$138,600
Median Gross Monthly Rent	\$ 456

Source: U.S. Census data 1990

Notes: Owner occupied units occupied by households with income of no more than 95% of the MHI for the town are eligible for assistance under affordable housing programs.

Rental units occupied by households with income no greater than 80% of the MHI for the town are eligible for assistance under the affordable housing programs.

Median House Value is the Census respondent's estimate of how much the property would sell for, including the lot. The 1990 Median Gross Monthly Rent for Deerfield seems low compared to current rents. Upton-Massamont Realty noted a rent range from \$450 to \$850 for apartments in Deerfield and \$800 to \$1,200 for houses. Reviewing the advertisements for rental properties in the Greenfield Recorder for the month of August 1999 revealed no vacancies for any rental units in town.

The 1990 median value of a house was \$138,600 in Deerfield according to the U.S. Census. This indicates a gap of \$28,600 between the median value of a Deerfield home and the amount that a median income household can afford to pay for housing. However, Banker & Tradesman figures

state that the 1990 median sales price for a home was \$120,000, showing a gap of only \$10,000 between median housing costs and the ability to pay.

While the median value of owner occupied housing units increased dramatically between 1980 and 1990, from \$47,800 in 1980 to \$138,600 in 1990, prices have declined somewhat according to more recent information provided by Banker and Tradesman. Table 3-8 presents information on housing sales between 1990 and 1996. Because the economy for the country was in a recession during the early 1990s, median sale prices fluctuated significantly during this period but were under \$125,000. The housing market in the region has regained momentum in the last several years with a prosperous economy and low interest rates. The Upton-Massamont Realty Agency noted that 1999 single family homes typically sold from \$150,000 to \$200,000. Older condos without garages sold from \$70,000 to \$75,000 and newer condos with garages sold from \$100,000 to \$130,000. Condos offer more affordable housing and typically represent from 20% to 25% of available units on the market.

Table 3-8: Home Sales in Deerfield

Year	Number	% Change	Median Sale Price	% Change
1990	53	-32.1	\$120,000	-3.2
1991	81	52.8	\$95,000	-20.8
1992	58	-28.4	\$124,000	31.1
1993	80	37.9	\$95,000	-23.7
1994	93	16.3	\$107,750	13.4
1995	55	-40.9	\$115,000	6.7
1996	80	45.5	\$107,000	-7.0

Source: Banker and Tradesman

Note: Home Sales & Home Prices include data for all transactions between \$25,000 and \$1,000,000. Condominium sales and prices are included.

The Median Sale Price of homes of \$107,000 in 1996 compares favorably to the cost which an average household in Deerfield can afford to pay for a home of \$110,000. Deerfield is currently doing well in maintaining affordable options for its residents and this reflects the diversity of the current housing stock which includes condominiums, two-family and single family homes. However, this situation may change if new construction is solely limited to single family homes on large lots. This has been the recent trend in new home construction in Deerfield. According to the Franklin-Hampshire County Association of Realtors there were six (6) land sales during the first nine (9) months of 1999 in Deerfield and the average price was \$52,733. The average price for land sales provides a rough estimation of the current price of a building lot. The land cost in addition to the cost of a new single family home will begin to drive up the median price of a home. Continuing to provide alternatives such as housing on smaller lots in appropriate locations will help to maintain affordability for Deerfield residents.

For rental properties in 1990, the median income household in Deerfield could afford to spend \$973 for monthly rent and utilities. This compares favorably with the median gross monthly rent of \$456 identified by the U.S. Census. However, the gross monthly rent figures for the town seem low compared to current rents. In 1999, Upton-Massamont Realty listed one-bedroom rents in a range from \$450 to \$600 per month. Two-bedroom apartments typically rent from

\$600 to \$850 per month and single family home rentals range from \$800 to \$1,200 per month. These rental rates are still in line with what median income households in Deerfield can afford.

Massachusetts Executive Order 215 of 1982 directs that every town should offer 10% of its housing stock for low and moderate income households. This State mandate allows a developer, who will guarantee long term low and moderate income housing, to obtain a comprehensive permit through a town's Zoning Board of Appeals. A town cannot deny the permit if its low and moderate income housing stock is below the 10% standard, but can require reasonable changes. The twenty-four units in Deerfield, on record with the Department of Housing and Community Development (DHCD), which count towards the 10% standard are listed in Table 3-9. The numbers are small because the State defines low and moderate income housing, for the purpose of determining whether a community has met the 10% standard, as housing developed with a State or Federal subsidy, in which at least 25% of the units are reserved for households with incomes not exceeding 80% of the median. The rent or price of the housing must also be restricted to "affordable levels" for a specified period of time (generally at least 15 years). These 24 units represent only 1.15% of the Town's housing stock. Deerfield currently needs over 180 units to comply with the State directive.

Deerfield does not have any public housing, that is, rental housing owned by a public housing authority and funded through the government, so those conventional State and Federal programs are not being utilized. Rental assistance programs indicate that only one State supported voucher program recipient and only one Federal Section 8 recipient were in Deerfield in 1994. However, because these programs allow the subsidy to travel with an individual who finds an apartment in the private sector, these numbers can fluctuate. The remainder of the subsidized housing units are in Elm Circle.

Table 3-9: Residential Units Receiving State or Federal Housing Assistance in Deerfield

Subsidized Housing Units*	% Subsidized	Public Housing Units**		Rental Assistance***	
		Conventional State	Conventional Federal	State(MRVP)	Federal(Section 8)
24	1.15	0	0	1	1

* Subsidized Housing Units: the number of housing units which count toward the municipality's 10% standard for low and moderate income housing. It includes both subsidized affordable units and market rate units in certain eligible subsidized developments, but does not reflect the presence of tenant based subsidies or other affordable rental apartments.

** Source: DHCD 1993

*** Source: DHCD 1994

Note: Chapter 774 of the Acts of 1969 (also known as Chapter 40B of the Massachusetts General Laws or the Anti-snob Zoning Act) is a process established by the Legislature to help address the State's housing needs through locally granted permits. This law enables the local Zoning Board of Appeals to grant a single permit to an eligible developer proposing State or Federally subsidized low or moderate income housing.

The town should consider working with the Franklin County Regional Housing and Redevelopment Authority (HRA) to devise ways for State recognition of affordable units that do not utilize assistance from State or Federal programs. Deerfield can also choose to take a proactive stance to identify its housing needs and pursue its development. Additional housing

for elderly residents of the community is clearly indicated by population forecasts and will be needed in the next two decades. Affordable housing for Deerfield's aging population, designed in scale and style with the traditional town architecture, would qualify towards the 10% mandate required by Executive Order 215. As an example, the Shelburne Housing Authority worked with the HRA to develop Highland Village, a highly successful housing complex for the elderly, disabled, and handicapped. The complex of 46 units is nestled on 4.35 acres at the edge of Shelburne Falls village and gives preference to Shelburne residents when tenants are selected.

Summary of Housing Issues

Remediation of Lead Paint

One third of the houses in Deerfield were constructed prior to 1939, when lead paint was widely used. Removal of this paint is often expensive and many property owners do not have adequate funding to undertake removal or encapsulation. Currently, only about one lead paint determination per year is requested through the Board of Health. A large number of rental apartments remain untreated and new families with young children often experience difficulty finding an apartment without lead paint.

Title 5 (State Law Governing On-Site Septic Systems)

Revised Title 5 regulations were instituted in the spring of 1995. Compliance with Title 5 regulations is an important issue for many of the rural households in Deerfield that have on-site septic systems. Failure of septic systems has been a significant problem in certain areas of Deerfield. Homeowners living in areas of seasonal high groundwater are finding that the repair of a failed system can be a significant expense. Many repairs require mounded or alternative systems in order to meet the requirements of Title 5 for separation to groundwater

The repair cost for mounded systems typically range from \$10,000 to \$25,000. The Department of Environmental Protection's (DEP) Homeowner Septic Loan Program, instituted in 1996, utilizes funds from FHA Title I loan program and from the Open Space Bond Bill. The FHA program creates a private bank-funded capitalization of septic system loans available for all income earners. The criterion for a loan is based on the credit history of the borrower, and allows a maximum debt-to-income ratio of 45%. This program encourages bank lending since loans will be backed by a 90% Federal guarantee, and are salable to secondary market portfolio players. Low and moderate income (LMI) homeowner receive below market interest rates.

In the past, the Department of Environmental Protection has offered loan programs to towns in Franklin County, which provide loans at below market interest rates for residential homeowners needing to repair or install Title 5 systems. Deerfield may want to consider applying for these programs once the sewer study is completed. Homeowners in areas which will not be served by

either sewer extensions or neighborhood package treatment plants may need financial assistance to install Title 5 systems.

Executive Order 215 (State Directive for Low and Moderate Income Housing)

Since 1982, the Massachusetts Executive Order 215 has directed that every town should offer 10% of its housing stock for low and moderate income households. Towns that initiate a proactive stance regarding this policy have the opportunity to develop a scale and style of construction that fits their traditional town character. Deerfield currently needs over 180 units to comply with the State directive.

Elders and Young Families

A diverse housing stock with a wide range of costs is a necessary component of the social and economic health of Deerfield. Young families and the elderly population often need assistance to continue to reside in the town where they were raised. These are often the demographic groups with lower or fixed incomes, as they make their way up in the world or wind down after a fruitful life. The ability to pay for housing is thus lower for these groups. The high cost of land and development makes it difficult for the private housing market to bear the full burden of providing an adequate number of affordable rental and home ownership opportunities. General demographic trends across the country suggest that elders, single persons and new couples are all seeking housing with less space and fewer maintenance responsibilities than the single family home. There is a need for a wider variety of housing types beyond the traditional single family house.

Recommendations

- Consider working with the Franklin County Regional Housing and Redevelopment Authority to establish an elderly housing complex which will give priority to Deerfield residents and which will contribute to meeting the State's 10% goal for low and moderate income.
- Promote the use of Conservation Subdivision Design in rural areas to provide lower cost single family housing given the smaller lot sizes associated with this type of development.
- Encourage infill of residential dwellings in the Central Village Residential District and mixed residential and commercial uses in the C-I District.
- Consider changes to the Zoning Bylaws which will help to maintain a diverse and affordable housing stock.

Work with Deerfield's legislative delegation to request that the State expand its narrow definition of housing stock which meets the State's 10% goal.

CHAPTER

4

HISTORIC & SCENIC RESOURCES

"Just at evening we drove over to Deerfield, a distance of three miles, through the most luxuriant and beautiful country, that we had any where seen in our whole journey. This country is the fine alluvial region, intersected by the Deerfield River, and probably formed by it, as the alluvial countries on rivers generally appear to be. Even now, in the latter part of October the grass is most vividly green, thickly matted, and rich as the shag of velvet. The remains of the crops of corn, evinced also great productiveness, and seemed almost to realize the fables of the golden ages. We were comfortably lodged in a good inn, just in time to visit, before dark, a very interesting antiquity in this town." Benjamin Silliman - Remarks Made on a Short Trip Between Hartford and Quebec, in the Autumn of 1819

The "luxuriant and beautiful" country that Benjamin Silliman described in 1819 is still found today in Deerfield, Massachusetts. Rich meadowland, with more than twenty feet of topsoil along the banks of the Deerfield River, yields productive harvests for Town farmers. According to the Massachusetts' Department of Food and Agriculture (Executive Office of Environmental Affairs), soils throughout the central portion of Deerfield are among the "most fertile agricultural soils in the country." More than one thousand acres of tillable land, with exquisite rural views to the north, west and south, ring the mile-long village whose late 17th century plan remains nearly intact.

The "very interesting antiquity" that Silliman traveled to see is Old Deerfield Village itself, now 330 years old. Historic Deerfield, Inc. and the Pocumtuk Valley Memorial Association keep alive the rich legacy of artifacts, architecture and the agricultural way of life that is uniquely Deerfield's. The National Trust for Historic Preservation has called this village "the gem of New England" and "a unique national treasure." Each year hundreds of thousands of travelers, tourists and students from all over the world visit this old place to see one of America's best preserved historic sites and to discover New England as they hoped to find it.

In addition to Old Deerfield Village, the historic and scenic environment of South Deerfield's North Main Street and center village complex must be carefully maintained. With remnants of its 19th century common and several old mercantile and agricultural buildings reused and revitalized within the commercial center, this village can turn to its architectural and agricultural past for its economic future.

The first historic marker ever erected in this country was placed in the 1720's on what is now North Main Street, commemorating the Bloody Brook Attack of 1695. A 'modern' Greek Revival monument was built in the 1830's drawing tourists from throughout the Northeast well before overland transportation was convenient. Thomas Edison's film company opened its famous 1910 movie "Ononko's Vow"—a modern rendition of the 1704 Deerfield Massacre - showing this impressive historic monument. And, the stately, well manicured houses along

North Main Street tell the story of prosperous 19th century merchants and farmers who were attracted to the rich soil of the middle Connecticut River Valley that is still tilled in 'backyards' at the foot of Sugarloaf Mountain.

It is the combination of historic preservation and the preservation of the scenic landscape that makes the entire Town of Deerfield so unique. From the Connecticut River to the east, to the abundant orchards, farms, and rolling hills of West Deerfield; from the internationally renowned village of Old Deerfield on the banks of the Deerfield River to the carefully maintained residential neighborhoods of South Deerfield, this Town has much to lose in ignoring the unusual combination of historic and scenic resources which it has.

With over 85% of the respondents to Deerfield's Community Survey expressing concern that the historic buildings and landscapes of this Town be preserved and the agricultural way of life be supported, this chapter in the Town's Master Plan takes on enormous importance. This chapter inventories the various historic and scenic resources of Deerfield and their historical context. First the goals and objectives focusing on the conservation of historic and scenic resources are presented. A brief history of Deerfield is then given to provide the context to the inventory of historical structures and landscapes, and scenic roads. Deerfield is rich with precious examples of period architecture and settlement and farming patterns from as early as 1669. Finally the most important historic resource issues are listed, followed by recommendations developed by the Historic and Scenic Resources Subcommittee.

Overall eighty-five percent (85%) of the respondents to Deerfield's Community Survey felt it was either important, or very important, to preserve historic buildings and landscapes. Often in Deerfield, the most scenic landscapes are maintained by ongoing agricultural activities of Deerfield farmers. This demonstrates well the interdependence of historical structures on agriculture, scenic viewsheds, and local farmers and farming. Based on the community survey completed in 1999, the Master Planning Committee prepared Goals and Objectives for a Master Plan.

Goal:

- **To identify and protect historic resources including buildings, sites, and landscapes.**

Objectives:

- Review existing Massachusetts Historical Commission forms and identify needed actions to create a more complete and accurate inventory of all historic buildings, sites and landscapes.
- Consider implementing voluntary design guidelines for commercial uses to support the protection of the historic character along Route 5/10, in Historic Deerfield, and in the existing Central Village in S. Deerfield
- Identify and pursue federal and State grants in support of historic resource protection.

- Identify and protect historic and scenic landscapes, especially agricultural landscapes.
- Explore the feasibility of adopting special bylaws that help protect agricultural lands and scenic resources.

Historical Perspective

The Contact Period of initial European settlement is considered by the Massachusetts Historical Commission (MHC) to be between the years 1500 and 1620. Historians consider the Deerfield area as being the central location of the native indigenous people, the Pocumtucks. Although there have been no native-period sites confirmed by trained archaeologists (Claire Carlson, archaeologist and researcher, personal communication; December 1999), the Deerfield area is considered as having excellent potential for surviving period sites. Archaeological sites are thought to be present in the meadows north of Fuller Swamp and on Pine Hill.

During the Plantation Period (1620-1675), Pocumtuck (as Deerfield was known then) continued to have a large native population until the village's destruction by the Mohawks c.1663. From this date on, Deerfield lacked a sizable permanent native population. By the end of the period, Deerfield consisted of only one hundred and twenty five (125) permanent European residents and a garrison of twenty-five to thirty (25-30) soldiers. Most of the Town's settlers were from Dedham, Hatfield, and Medfield.

Deerfield was the earliest community settled in Franklin County. Aside from Northfield it was the northernmost English settlement situated in the Connecticut River Valley in Massachusetts. This location relative to the region's other settlements to the south was probably an important factor in inhibiting its development into a political and commercial center on par with Northampton and Springfield. Colonial settlement was confined to Main Street in Old Deerfield Village. Period homes were built along the whole length of the present street in the village of Deerfield. Garrison houses were constructed on the north and south ends of the street in response to increased Anglo-Indian tensions. After the outbreak of King Phillip's War in 1675, the settlement was abandoned.

During the Colonial Period (1675-1775) Deerfield's growth as an agricultural and commercial center continued to be hampered throughout the late 17th and first half of the 18th centuries by the settlement's exposure to French and Indian attacks. Even with this threat Deerfield was still one of the most well developed of the English settlements situated on the northern frontier of the Connecticut River Valley.

The primary highway during this period was the north-south running road from Bloody Brook through Wapping to Deerfield Street. There was a Pine Island fordway across the Deerfield River to Cheapside. Later during the reestablishment of Deerfield after King Philip's War in 1675, radial roads were created from pre-existing trails. These improved trails left the town

center to the Connecticut River crossings including Greenfield Road, North Hillside Road to Swampfield (Sunderland) via the ferry at Mt. Sugarloaf (Route 116 bridge), and River Road to Rice's Ferry Road. Improvements to regional routes to the western highlands included Mathews Road (1754) to Huntstown (Ashfield) along the Mill River gorge and Old Albany Road (1762) from Wisdom (West Deerfield) to the Mohawk Trail.

The European population of Deerfield during the Colonial Period experienced steady growth despite violent events that reduced its numbers considerably. After the King Phillips War of 1675, the population of Deerfield ranged from two hundred and fifty (250) to two hundred and sixty-eight (268) permanent residents not including a garrison of fifteen (15) to twenty (20) soldiers. Although there were no permanent Native American settlements in Deerfield during this period, a region stretching from Deerfield to Northfield served as the primary location of hostile Narragansetts, Nipmucs, and Pocumtucks between 1675 and 1676. An English military force displaced them from this area in the spring of 1676. Pine Hill was a valued lookout post for natives engaged in battling the European settlers and colonial militia.

Beginning in 1677, Colonial resettlement concentrated on Main Street in Old Deerfield Village. By the 1690's resettlement had picked up and substantial infill had occurred especially on Meetinghouse Hill. The Town's first meetinghouse was erected in 1684 near the intersection of Main Street and Albany Street. This general area was also the site of Deerfield's first schoolhouse which was built in 1698. A wooden stockade was built around the meetinghouse in 1690 when residents heard of the French and Indian attack on Schenectady, New York. Prior to 1704, settlements occurred in the areas around Wapping, the Bars, and north into Greenfield. The 1704 French and Indian attack on the Town decimated its colonial population. Forty-seven (47) of its inhabitants were killed while one hundred and twelve (112) were carried off to Canada. In addition, the attack on the settlement destroyed seventeen (17) of the community's forty-one (41) dwellings as well as a number of outbuildings and a large number of livestock, crops, and personal belongings.

Settlement after 1704 continued to slowly spread south and north of Old Deerfield Village. Deerfield's grazing lands were expanded in 1712 when present-day Conway and Shelburne were granted to the Town. In addition, several fortifications were built in Old Deerfield Village and Wapping in the 1740's and 1750's. By the 1740's the lower portion of the Connecticut River floodplain, near North and South Sugarloaf Mountain, was being utilized for wheat and rye production.

Deerfield experienced substantial growth in the second half of the 18th century. By 1765, the Town had seven hundred and thirty-seven (737) residents. By 1767, settlement was substantial enough in the Bloody Brook area that a schoolhouse was built for local residents. By 1776 the population had increased to eight hundred and thirty-six (836) occupants. Agriculture remained the economic mainstay of Deerfield residents in the Colonial Period. In 1694, tobacco production was first documented.

Comparatively, Deerfield saw modest industrial development during this period. The Town's first mill (a sawmill) was built in 1689 on the Mill River and a grist mill was also located on the Mill River slightly east of the Deerfield/Conway line in 1693. Joseph Stebbins and Zadock

Hawks both ran tanneries adjacent to Bloody Brook from 1745 to 1794. Deerfield was an important regional supply depot for English military forces active during the French and Indian Wars of the 1740's and the 1750's.

Old Deerfield Village is probably the premier district in the Connecticut River Valley for 18th century architecture. Although there are some examples of other 18th century buildings on Mill Village Road at the Bars, in South Deerfield and on River Road, most of the outstanding Colonial period houses dating from the early 18th century to the 1770's are along Main Street in Old Deerfield Village. Among the earliest houses surviving are the Allen House (1720's), the Abercrombie House (1712) and the Wells Thorn House (1717), all three being center chimney plans. By the mid 18th century double interior chimney and center hall plans were common in Old Deerfield Village.

One architectural feature that sets Old Deerfield Village homes apart from others in the region is the high quality of detail on many of the houses, of which the most renowned feature is the Connecticut Valley entrance surround. The entrance is typified by a pediment supported on carved pilasters and crowns a double leaved door. Among the houses exhibiting Connecticut Valley Georgian details are the Sheldon Hawks (1743), Dr. Williams (1748), John Williams (1754), Saxton (1760), and Manse (1770) homes.

The institutional structures from that period include the Town's third meetinghouse and a number of schools. The meetinghouse was constructed in 1696, withstood the 1704 siege of the Town, but was replaced in 1728.

During the Federal Period (1775 - 1830) Deerfield's population grew in leaps and bounds such that by 1830, Deerfield had a population of two thousand and three (2,003) and was the most populous town in Franklin County. Improvement to the north-south highway corridor from Greenfield to Northampton included a bridge at Cheapside, replacing the old fordway at Pine Hill, and the north-south Greenfield Road to Main Street in South Deerfield. The Stillwater fordway was replaced by a bridge in 1790 and the Sunderland ferry was replaced by a toll bridge in 1812.

Civic focus remained at Old Deerfield Village with the establishment of Deerfield Academy in 1797 and the rebuilding of the meeting house in 1728. However, South Deerfield became an economic hub with the advent of local manufacturing and the development of its own MeetingHouse in 1821. Yet, agriculture still dominated the economy. Surplus agricultural products including butter, tobacco, and beef cattle were shipped down river from Cheapside to Hartford, Boston, and the West Indies. Beef cattle were Deerfield's major farm product during this period. Deerfield was also ranked second only to Hadley in the Valley in terms of broom corn production value. Lastly, in the latter half of this period Deerfield was home to the production of pocket books lined with goat and sheep skins.

Notable houses of the Federal period include the David Dickinson house (1783), the double pile plan, end chimney brick Wright House (1824), and the Benjamin Ray House (1825). Federal houses can be observed in the town center, on Route 5/10, Route 116 at Mill Village, at South Deerfield, and on River Road.

Institutional buildings of the period included the formation of the Baptist Society of Deerfield and Shelburne in 1787 (Meetinghouse 1794-1806) and the organizations of the Second Congregational Society in South Deerfield in 1818. In 1824, the 1729 meetinghouse of the First Parish was replaced by the present brick building. Other institutional construction during that period included the founding of Deerfield Academy in 1797.

The Early Industrial Period (1830-1870) in Deerfield saw continued growth in infrastructure, population, and economy. The expansion of the north-south transportation corridor included the Connecticut River Railroad in 1874 and the monumental stone arch bridge intact at Depot Road (1847) as well as the iron truss bridge that spans the Deerfield River to Cheapside (Greenfield). At the end of the period, as at the beginning, Deerfield was still the largest town in the Franklin County with three thousand six hundred and thirty-two persons (3,632). In 1855, Deerfield had a foreign-born population of just over seventeen percent (17.1%). Much of this immigration probably settled in the area near Russell Cutlery, now in Greenfield.

Agriculture remained a predominant economic force in the community as Deerfield farmers produced large quantities of beef cattle, butter, Indian corn, hay, and other products. By 1865, Deerfield led Franklin County in the number of acres under cultivation for tobacco (484 acres), which displaced much of the broom corn acreage. Primary civic activities remained in Old Deerfield Village as tobacco production became common in the meadows.

South Deerfield continued to develop as a local industrial center along the Main Street axis with regional railroad connections and formation of a depot district along Elm Street in 1847. Industries north of the Deerfield River, an area which in 1896 became part of Greenfield, manufactured cutlery, corn brooms and pocket books. Corn broom production peaked in 1832, pocket books in 1855. Over seventy-nine percent (79%) of all the State's production of pocket books took place in South Deerfield. Other manufacturers during that period included a maker of lead pipe at Mill Village, small tanneries, woodenware shops, palm leafed hats, and boot and shoe shops. By 1865 there were also six makers of wooden or paper boxes.

Although some residential development occurred in Old Deerfield Village during this period, by 1870, the focus of the building activity had shifted to South Deerfield. The River Road area experienced its greatest growth period between 1840 and 1870. Housing of a modest design occurred in South Deerfield. The sidehall plan predominated most of the Greek Revival and Italianate houses and cottages.

The Early Industrial Period was one of considerable institutional expansion, especially at South Deerfield. In 1848, the Second Congregational Society of South Deerfield was founded and a meetinghouse (extant; remodeled in 1865) was built. In 1832 the Shelburne and Deerfield Baptist Society separated and the local contingent became the Deerfield Baptist Society. In 1859, the Town's first high school was established within the structure of the Deerfield Academy and in 1860 a second high school was founded at Bloody Brook. Finally, most of the commercial buildings standing in Town are in South Deerfield, but there are less than six frame or brick structures remaining which were built during this period.

The Late Industrial Period (1870-1915) saw improvements to the north-south transportation corridor between Greenfield and New Haven including expansion of railroad (1881) lines that ran through South Deerfield paralleling the Connecticut River around Old Deerfield Village to East Deerfield. An interurban trolley also ran between Hatfield and Greenfield in 1902. Development of the East Deerfield railroad yard included rebuilding the Deerfield River Bridge (c.1910) and the Connecticut River Bridge to Montague.

Between 1870 and 1900, Deerfield lost over forty-five percent (45%) of its population, which was caused by Greenfield's annexation of Cheapside in 1896. Even though the yearly population increases were significant up until 1915, the population at the closing of the period was twenty-four percent (24%) below the 1870 figure. The percentage of foreign born residents was still over seventeen percent (17%), and forty-five percent (45%) of these persons were Polish.

Even though South Deerfield remained the economic and commercial center with the expansion of the suburban district east to Mt. Sugarloaf, Deerfield remained predominantly an agricultural community. By 1880, the Town's production of hay, butter, tobacco, potatoes, and Indian corn were greater than any other town in Franklin County. The Town's tobacco production ranked third in the Valley after Hadley and Hatfield. In 1885, the top four Franklin County towns in beef production were Greenfield, Deerfield, Conway, and Shelburne. In that era, Deerfield led the State in pork production. In 1890 a pickle factory opened in South Deerfield and by 1905, Deerfield was also a top onion producer.

The area of greatest residential growth continued to center in South Deerfield where modest cottages and single and multi-family homes developed off Main and Sugarloaf Streets. A small number of workers' housing was built during the 1880s and the 1890s near the rail yards of East Deerfield. Most of the houses around South Deerfield are one-and-a-half or two-story framed Queen Anne and Colonial Revival structures with sidehall plans and most have been built after 1885. Of special note are several well-detailed Craftsman bungalows of the early 20th century. Many of these bungalows incorporate stucco or shingled finishes and use materials such as cobblestones or concrete as decoration. At Old Deerfield Village near the southern end of Main Street are examples of large and well-detailed Queen Anne, Colonial Revival, and Shingle Style houses. Workers' houses at East Deerfield are primarily Stick-Style or Queen Anne sidehall cottages.

The majority of extant institutional buildings date from the late industrial period. Most of these structures are in South Deerfield, although Deerfield Academy added on to its complex after 1890, thus many notable buildings were constructed in Old Deerfield Village during that time period. Institutional buildings at South Deerfield include three churches, a school and the former Town offices. The churches included a Colonial Revival (c.1915), an onion-domed structure (c.1920), both on Sugarloaf Street, and a Gothic Revival structure (c.1930) on Thayer Street. The school is a two-and-a-half-story brick, hip roofed structure located on Conway Road. Buildings at Deerfield Academy are brick neo-classical structures built in the 1930's and later.

Most of the Town's commercial buildings are located at South Deerfield including the three-story mansard roofed Warren Hotel (c.1880) and several well-detailed brick or frame two and three story commercial blocks in the Queen Anne and colonial Revival styles. These generally include

store front spaces with residential space (apartments) above. Industrial buildings of the era include a number of brick or frame one- or two-story railroad freight houses and warehouses at South Deerfield and at East Deerfield as well as a grain elevator at East Deerfield.

The Early Modern Period (1915-1940) saw the shift in Deerfield from an agricultural based community into one that provided much of its employment in the schools in Deerfield. This period also saw changes in transportation, population, settlement, and the economy. In 1924 the trolley line between Greenfield and South Deerfield was abandoned as improvements to local highways were made for the benefit of local automobile traffic. The primary north-south highway was designated as U.S. Route 5/10 through South Deerfield. A secondary east-west connector from Sunderland to Conway was designated as Route 116. After the flood of 1936, the current art deco bridges spanning the Deerfield and Connecticut Rivers were constructed.

It was during the Early Modern Period that the local economy became more dependent on its educational institutions than on farming or manufacturing. Deerfield still produced tobacco and cucumbers. The Arms manufacturing Company still produced pocketbooks in South Deerfield. Three pickle factories were also located in Deerfield, but the real economic base for Deerfield were in its schools, Deerfield Academy, the Bement School, and Eaglebrook School.

Little construction happened in this period. Of the residential construction that did occur, most took place in South Deerfield where a number of small cottages were built as infill housing on side streets, on River Road, and on Route 5/10. At least two institutional buildings were constructed during this period including a Georgian Revival Library (c.1915) on Main Street and the two-story brick Georgian Revival school (c.1925). Notable commercial structures are automobile-related and include a gas station with light house emblem and a stucco Tudor Revival roadhouse of the 1920s both on Route 5/10.

Inventory of Historic and Scenic Resources

The following inventories for historic structures, landscapes and scenic roads were constructed using information from the Massachusetts Historical Commission (MHC), the Deerfield Historical Commission, the 1992 Franklin County Rural Historic Landscape Preservation Plan, and field surveys conducted by FRCOG Planning Staff.

The inventory of historic structures and sites were developed from two sources, the MHC and the Deerfield Historical Commission. The MHC has a Statewide Inventory of Historic and Archaeological Resources of the Commonwealth. Structures are included in this inventory when a local Historical Commission submits a completed inventory form for the structure to the MHC. The individual forms representing Deerfield's historic structures and sites were filled out by different individuals and organizations. Most of the structures located outside of Old Deerfield Village were identified only with the input of the Deerfield Historical Commission. All of the structures and sites were then tabulated based on their location within general areas of the Town. The general areas represent the Old Deerfield National Historical Landmark Area, South

Deerfield Village, River Road, the Bars & Wapping, and Mill River Valley. The tables of historic structures and sites included in this section contain the results of this inventory work.

It is important to note that the Massachusetts Historical Commission files do not contain many of the significant historical structures and sites that currently exist in South Deerfield and other areas. Almost all of the structures and sites outside of Old Deerfield Village that are presented below are from inventory forms held by members of the Deerfield Historical Commission yet not included in the MHC file in Boston. Efforts should be made towards updating the files held by the Massachusetts Historical Commission. An accurate and complete inventory is one of the first steps to preserving the remaining historic resources in Deerfield.

The status of historical landscapes and scenic roads in Franklin County, is reported in the 1992 Franklin County Rural Historic Landscape Preservation Plan created by the Franklin County Commission (now FRCOG). In the Fall of 1999, FRCOG Planning staff conducted several field surveys to determine if development or other changes, may have compromised the quality of the landscapes selected for preservation in the 1992 plan.

The 1992 Franklin County Rural Historic Landscape Preservation Plan Report describes the status of historic landscapes in the region, the historic context that was used in its determination, and the methodology used in rural historic landscape reconnaissance. It distinguishes between the types of landscapes assessed (*agricultural, community development, recreational, conservation, industrial, transportation, scientific, religious, and engineering*), identifies in general terms the locations of rural historic landscapes in each town, and provides examples of direct and indirect preservation strategies.

This methodology for identifying significant historical landscapes was based on the National Park Service criteria including area of significance, period of significance, and historical integrity. The National Park Service classifies landscapes into four different categories: landscapes that reflect major patterns of a region's history (e.g. agricultural landscapes), landscapes that are associated with historically significant individuals (e.g. institutional grounds and buildings), landscapes that are important due to their design or physical characteristics (e.g. an 18th century Colonial Period Connecticut Valley rural farm), and landscapes that yield or have the potential of yielding significant information on pre-history or history (e.g. a native American encampment site).

The significance of a rural historic landscape is that aspect of historical development that contributes to one of the above criterion where the "use, occupation, physical character or association, influenced the development or identity of its community or region" (U. S. Department of the Interior, 1990). The period of significance is the time span in which a property or area has attained its significance related to the National Park Service Criteria. The historic integrity and soundness of a landscape provides a sense of time and place and reflects significant aspects of use, design, association and information.

The purpose of the 1999 field survey was to ascertain the current integrity of the rural historic landscapes identified in the 1992 Franklin County Rural Historic Landscape Preservation Plan. Planning Department staff utilized the same methodology used to assess the historical landscapes

in 1992. The structure and site locations are estimated based on available information. The separate historic landscapes identified in the 1992 Franklin County Rural Historic Landscape Preservation Plan were often identified as multiple properties along a particular road. FRCOG Planning Staff have identified the approximate locations of these landscapes on the Historic Resources Map.

Old Deerfield National Historic Landmark Area

The Old Deerfield National Historic Landmark (NHL) area encompasses all the land in Deerfield between Route 5/10 and the Deerfield River from Wells Cross Road north to the Town's border with Greenfield. It contains the Old Deerfield Village center and surrounding agricultural landscapes including portions of the Upper and Lower Meadows (*see Historic Resources Map*). The following tables list the various historic structures and sites within the NHL area, which have been compiled from the Massachusetts Historical Commission (MHC) inventory and forms held by the Deerfield Historical Commission. All of the tables below include the historic name of the feature, the date of origin, its style, and its street location. The tables also include a form number, assigned by the MHC. The form numbers were recorded from the individual MHC historical inventories.

Table 4-1: Significant Historic Structures and Sites Within the Old Deerfield National Historic Landmark Area

Historic Name	Year	Style	Street Name	MHC Inventory Number
Frary House	1740's	Colonial	Main Street	13
Samuel Childs House	1690's	Georgian	Main Street	1
Deerfield Village Old Burying Ground	1702		Albany Road	801
Allen House	1725	Colonial	Main Street	20
Rev. John & Maj. Elijah Williams House	1707	Georgian	Albany Road	81
John Nims House	1710	Georgian	Main Street	12
Joseph Severance House	1710	Federal	Main Street	19
Eleazer Hawks & Elijah Russell House	1712	Federal	Main Street	58
Ebenezer Wells - Thorn House	1717	Colonial, Georgian	Old Main Street	11
Timothy Childs House	1730	Georgian	Main Street	53
Rev. Jonathan Ashley House	1733	Georgian	Main Street	31
John Arms House	1741	Georgian	Main Street	4
John Sheldon - Hawks House	1743	Georgian	Main Street	32
Dr. Thomas Williams House	1748	Colonial Revival	Main Street	41
Capt. Thomas Dickinson House	1754	Federal	Main Street	40
Dwight House	1725	Georgian	Main Street	54
Field House	1797	No style	Main Street	17
Bloody Brook Tavern	1758	No style	Main Street	38
Hall Tavern	1760	Georgian	Main Street	14
Little Brown House - David Saxton Jr.	1761	Colonial	Albany Road	79
John Partridge Bull & Ephraim Williams House	1761	Federal	Main Street	47

David Saxton House	1761	Georgian	Main Street	48
House from Conway	1765	Colonial	Main Street	21
Joseph Barnard House - Manse	1770	Georgian	Main Street	93
Eldad Bardwell House	1771	No style	Main Street	23
Joseph Stebbins House	1774	Georgian, Colonial Revival	Main Street	42
Jonathan Hoit House	1775	Georgian	Main Street	9
Justin Hitchcock House	1779	Federal	Albany Road	80
David Dickinson House	1783	Federal	Main Street	35
John Williams Jr. House	1792	Federal	Main Street	50
Francis Munn House	1797	Federal, Colonial Revival	Taylor Road	60
Asa Stebbins House	1799	Federal	Main Street	16
Memorial Hall	1798	Federal	Memorial St	64
Higginson - Childs House	1801	Federal	Main Street	55
Augustus Lyman House	1803	Federal	Main Street	51
David Hoyt House	1803	Federal	Main Street	56
Zenas Hawks House	1805	Federal	Main Street	18
Joseph Stebbins Jr. House	1811	Federal	State Road	86
Ebenezer Hinsdale & Ebenezer Williams House	1816	Federal	Main Street	24
John Wilson Printing House and Bookbindery	1816	Colonial	Main Street	57
Wright House	1824	Federal	Main Street	25
Brick Church	1824	Federal	Main Street	46
Ralph Arms House	1825	Federal	Main Street	2
William Russell House	1825	Federal	Main Street	49
Benjamin Ray House	1835	Greek Revival	Main Street	52
Joshua G. Pratt House	1838	No style	Main Street	44
White Church	1838	Greek Revival	Memorial St	61
Wapping School House	1839	No style	Main Street	26
Edwin Ware House	1842	Greek Revival	Main Street	10
Deerfield Old Town Hall	1846	Greek Revival	Memorial Street	63
Rev. John Farwell Moors House	1848	Gothic Revival	Old Main Street	39
Congregational Church Parsonage	1849	Italianate	Albany Road	84
Wright - Stebbins House	1849	Italianate	Main Street	28
Elisha Wells House	1857	Italianate	Main Street	6
Arthur W. Hoyt House	1858	Italianate	Albany Road East	82
John Stebbins House	1858	Italianate	Main Street	36
Elbert Amidon House	1867	Italianate	Main Street	30
Deerfield Academy - Ashley Dormitory	1869	Greek Revival, Italianate	Albany Road East	83
Richard Catlin Arms House	1872	Italianate	Main Street	3
John Catlin House	1872	Victorian Eclectic	Main Street	7
Virgil M. Howard Barn	1872	Victorian Eclectic	Main Street	92
Dollhouse Gift and Tea Shop	1880	Colonial Revival	Memorial Street	68
Not Available	1880	Craftsman	Wells Street	76
Deerfield Inn	1884	No style known	Main Street	43
George M. Wells House	1885	No style	Main Street	5
Deerfield Old Town Office Building	1895	Panel Brick	Memorial Street	62
Mason - Brown Shop	1895	No style	Main Street	15

William Abercrombie House	1896	Colonial Revival	Taylor Road	59
Broughton's	1900	Colonial Revival	Pond Road	85
Shepard House	1900	Victorian Eclectic	Memorial Street	70
PVMA Curator's House	1908	Colonial Revival	Memorial Street	65
Robert Childs House	1912	No style	Memorial Street	69
Wallace C. Adams House	1913	Craftsman / Bungalow	Main Street	27
Richard Lewis House	1915	Colonial Revival	Main Street	8
U. S. Post Office - Deerfield Village Branch	1920	Colonial Revival	Main Street	45
Babineau House	1920	Colonial Revival	Memorial Street	71
Deerfield Grammar School	1920	Colonial Revival	Memorial Street	78
Benjamin Z. Stebbins House	1923	Colonial Revival	Main Street	29
Harry M. Brown House	1924	Colonial Revival, Four-square	Main Street	91
Julian Gibbs House	1925	Colonial Revival	Memorial Street	67
Henry Wells House	1926	No style	Wells Street	75
Deerfield Old Indian House Replica	1929	Colonial Revival	Main Street	37
Frederick Mills House	1930	Colonial Revival	Main Street	33
No Name Given	1930	Colonial Revival	Wells Street	77
James Waterhouse House	1932	Colonial Revival, Cape	Main Street	34
Ray Keyes House	1932	Bungalow, Craftsman	Wells Street	72
Mills House	1935	Bungalow, Craftsman	Wells Street	73
Van Petersilge House	1935	Colonial Revival, Cape	Wells Street	74
Frank Thorn House	1937	Cape, Colonial Revival	Memorial Street	66
Residence	n.d.	2 1/2 Story Rural Farm	Mill Village Road	5-9
Katherine Fuller Arms - Present Owner	n.d.	2 1/2 Story Rural Farm	Mill Village Road	5-10
Carlos Allen - Present Owner	n.d.	2 1/2 Story Rural Farm	Greenfield Road	5-11

Source: Compiled from Massachusetts Historical Commission and Deerfield Historical Commission Inventory forms. n.d. = No date available.

South Deerfield Village

Most of the significant historic structures in South Deerfield Village are residences and institutional buildings on North Main Street and Sugarloaf Street. These structures were not included in the Massachusetts Historical Commission files in Boston and the dates of origin can only be estimated. The 1871 Beers Atlas shows many residences and their owners as of 1871. From this map the common names of the structures were identified. The most descriptive name for each structure may have been established prior to 1871. The recommendations should include a more detailed cross referencing of the data included on the forms held by the Deerfield and Massachusetts Historical Commissions.

Table 4-2: Significant Historic Structures and Sites Within South Deerfield Village

Historic Name	Year	Style	Street Name	MHC Inventory Number
Decker - Consolidated Cigar Company Tobacco Barn	1850	No style	Sugarloaf Street	88
Common Grave	1675	Common grave	South Main Street	901
Town Hall	n.d.	2 story Greek Revival	North Main Street	14
Col. Wright House	pre 1871	1-1/2 story Greek Revival	177 North Main Street	15
American Legion & VFW	pre 1871	2-1/2 story Victorian Gothic	219-29 North Main Street	16
Congregational Church of South Deerfield	pre 1871	2 story Greek Revival church	North Main Street	17
Tilton Library	n.d.	2 story Georgian	245 North Main Street	19
St. James Church	n.d.	Greek Revival Church	253 North Main Street	21
St. James Rectory	n.d.	2 story Rural Farm	255 North Main Street	22
Residence	n.d.	2 story Gambrel	265 North Main Street	24
C. Arms House	pre 1871	2 story Rural Farm	273-9 North Main Street	25
J. C. Arms House	pre 1871	1-1/2 story Rural Farm	283 North Main Street	26
W. D. Bates House	pre 1871	2 story Rural Farm	295 North Main Street	27
South Deerfield School	n.d.	2 story School	Conway Street	28
B. F. Bridges Jr. House	pre 1871	2 story Victorian	Railroad Street	29
A. Bumstead House	pre 1871	2-1/2 story Rural Farm	North Main Street	30
D. B. Arms House	pre 1871	1-1/2 story Victorian	North Main Street	50
Dental office	n.d.	2-1/2 story Greek Revival	2-4 North Main Street	13
Residence	n.d.	2-1/2 story Georgian	330 North Main Street	31
G. Smith House	pre 1871	2-1/2 story Greek Revival	340 North Main Street	32
F. C. Anderson House	pre 1871	2-1/2 story Greek Revival	360 North Main Street	33
Mrs. A. Mann House	pre 1871	1-1/2 story Rural Farm	398 North Main Street	35
S. D. Billings House	pre 1871	2 story Rural Farm	Hillside Road	34
F. Bartlett House	pre 1871	1-1/2 story Cross plan w/ Victorian trim	410 North Main Street	36
E. Clark House	pre 1871	1-1/2 story Rural Farm w/ Greek Revival features	430 North Main Street	37
Mrs. Barnard House	pre 1871	2 story Rural Farm	North Main Street	38
A. Baldwin House	pre 1871	2-1/2 story Rural Farm	444 North Main Street	39
A. Billings House	pre 1871	2-1/2 story Rural Farm	452 North Main Street	40
A. Cooley House	pre 1871	2 story Greek Revival	445 North Main Street	41
S. Dunlap House	pre 1871	2-1/2 story Greek Revival	441 North Main Street	42
W. H. Billings House	pre 1871	1-1/2 story Greek Revival	347 North Main Street	45
Residence	n.d.	2 story Greek Revival	251 North Main Street	20
Residence	n.d.	2 story Gambrel	263 North Main Street	23
Residence	n.d.	2 story Italianate	123 Sugarloaf Street	111
Residence	n.d.	2 story Rural Farm	157 Sugarloaf Street	110
Chick's Luncheonette	n.d.	3 story Victorian commercial/residence	28 Elm Street	103
Holy Ghost Ukrainian Catholic Church	n.d.	Federal Style church	Sugarloaf Street	112
H. Poland House	pre 1871	1-1/2 story Rural Farm	409 North Main Street	43
A. Hawks House	pre 1871	2 story Rural Farm	365 North Main Street	44

Dana-Jewett House	n.d.	2-1/2 story Victorian	339 North Main Street	46
L.A. Cooley House	pre 1871	1-1/2 story modern Victorian	329-31 North Main Street	47
Residence	n.d.	2-1/2 story Rural Farm	313-315 North Main Street	48
Frontier Regional School	n.d.	3 story School house w/ Romanesque features	North Main Street	49
A.W. Bates House	pre 1871	1-1/2 story Rural farm	303 North Main Street	51
Storefront/residential	n.d.	2 story Commercial/residential	60 Elm Street	101
Storefront/residential	n.d.	2 story brick Commercial	Elm Street	102
Commercial	n.d.	1 story Commercial	20 Sugarloaf Street	104
South Deerfield Fire Dept.	n.d.	2 story Commercial	24 Sugarloaf Street	105
Residence	n.d.	1-1/2 story Gothic Revival	Sugarloaf Street	106
St. Stanislaus Bishop & Martyr R.C. Church	n.d.	2 story Georgian church	Sugarloaf Street	107
Residence	n.d.	2-1/2 story Victorian w/ Greek Revival features	126 Sugarloaf Street	108
Residence	n.d.	2-1/2 story Greek Revival	130-132 Sugarloaf Street	109
Residence	n.d.	1-1/2 story Greek Revival	109 Sugarloaf Street	113
Residence	n.d.	1-1/2 story Greek Revival	87 Sugarloaf Street	114
Residence	1913	1-1/2 story Victorian	79 Sugarloaf Street	115
Hearse House	pre 1871	1-1/2 story Commercial	61-63 Sugarloaf Street	116
Fisher's Garage	n.d.	1 story Commercial	59 Sugarloaf Street	117
Gromacki Real Estate	n.d.	2 story Commercial	45 Sugarloaf Street	118
Frontier Pharmacy	n.d.	2 story Commercial	Sugarloaf Street	119
Vic's Barber Shop & Stanley's Bakery	n.d.	2 story Commercial/residential	Elm Street	120
Commercial	n.d.	2 story Commercial/residential	39&49 Elm Street	121
Hotel Warren	n.d.	3 story Victorian	Elm Street	122
Residence	n.d.	1-1/2 story Chalet style	97 Elm Street	123
S. & G. Mill	pre 1871	2-1/2 story Rural farm	99-101 Elm Street	124
Residence	n.d.	1-1/2 story Victorian Gothic	92 Main Street	125
Residence	n.d.	2-1/2 story Greek Revival	54-6 Main Street	126
Residence	n.d.	1-1/2 story Greek Revival	46 Main Street	127
Residence	n.d.	2-1/2 story Greek Revival	40 Main Street	128
Residence	n.d.	2 story Federal	36 Main Street	129
Col. D. Bryant Homestead	n.d.	2 story Federal	10 Main Street	130
Mrs. Hawks House	pre 1871	1-1/2 story Rural farm	15 Main Street	131
Residence	n.d.	1 story Rural farm	19 Main Street	132
Thayer Street Market	n.d.	2-1/2 story Commercial	55 Thayer Street	133
Residence	n.d.	2 story Rural farm	Thayer Street	134
Holy Name of Jesus Church	n.d.	Gothic Revival	Thayer Street	135
Funeral home	n.d.	2 story Greek Revival	Thayer Street	136
Residence	n.d.	2 story Rural farm	42 Thayer Street	137
Residence	n.d.	2 story Rural farm	Thayer Street	138
H. C. Graves House	pre 1871	2 story Rural farm	72 Graves Street	139
S. Palmer House	pre 1871	1-1/2 story Rural farm	298 North Main Street	1
Residence	pre 1871	2-1/2 story Victorian	294 North Main Street	2

Residence	n.d.	1-1/2 story Federal style	290 North Main Street	3
E. Taft House	pre 1871	2 story Rural farm	286 North Main Street	4
Residence	n.d.	1-1/2 story Greek Revival	270 North Main Street	5
E. S. Ruddock House	pre 1871	2 story Greek Revival	260 North Main Street	6
H. Hale House	pre 1871	2-1/2 story Greek Revival	236 North Main Street	7
Residence	n.d.	2-1/2 story Victorian	234 North Main Street	8
Masonic Temple	n.d.	Romanesque Revival	230 North Main Street	9
Bloody Brook Monument	1838	Monument	North Main Street	902
E. Himes House	pre 1871	2 story Victorian	220 North Main Street	10
A. Ware House	pre 1871	2-1/2 story Greek Revival	206-8 North Main Street	11
Mrs. Smith House	pre 1871	1-1/2 story Greek Revival	198 North Main Street	12
Mt. Sugarloaf Reservation	early industrial	Overgrown woods, road to summit	Mt. Sugarloaf Reservation	004
C.C.C. Road	1930s	Paved road to summit	Mt. Sugarloaf Reservation	
C.C.C. Camp and Dance Hall	1930s	Cellar hole and ruins	Mt. Sugarloaf Reservation	001

Source: Compiled from Massachusetts Historical Commission Inventory forms held by the Deerfield Historical Commission. n.d. = No date available.

The Bars and Wapping

South of the Old Deerfield National Historic Landmark Area's southern boundary, which is Well's Cross Road, lies the Bars and Wapping. The Bars is an area of land along Mill Village Road north of Lee Road to Wells Cross Road. Wapping is located east of the Bars across Route 5/10. The significant historic structures in this area are predominantly residences of many styles from Lean-to and Gambrel to Colonial and Greek Revival.

Table 4-3: Significant Historic Structures and Sites Within the Bars and Wapping

Historic Name	Year	Style	Street Name	MHC Inventory Number
Childs, Timothy House	1720	Colonial	The Bars	90
Munn, Francis House	1798	Colonial	The Bars	89
Consolidated Cigar Company Tobacco Farm	1915	Not researched	Lower Road	87
Harris Homestead	1807	2 story Federal	Mill Village Road	1
The Cottage	1850	1-1/2 story Rural farm	Mill Village Road	2
Old Tack Studio	1720	2 story Lean-to Colonial style	Mill Village Road	3
Fuller House	1798	2 story Gambrel	Mill Village Road	4
Residence	n.d.	2-1/2 story Rural farm	Mill Village Road	5
Residence	n.d.	2-1/2 story Rural farm	Mill Village Road	6
Residence	n.d.	1-1/2 story Rural farm w/ Lean-to rear addition	Greenfield Road	12
Residence	n.d.	2-1/2 story Rural farm	Greenfield Road	13
Residence	n.d.	2-1/2 story Lean-to	Greenfield Road	14
Residence	n.d.	2-1/2 story Federal	Greenfield Road	15
Residence	n.d.	2-1/2 story Rural farm	Greenfield Road	16
Residence	n.d.	2-1/2 story Federal	Greenfield Road	17
Residence/Farm	n.d.	2-1/2 story Rural farm	Greenfield Road	18

Residence	n.d.	2-1/2 story Rural farm	Greenfield Road	19
James D. Garvey House	n.d.	2 story Victorian	Greenfield Road	20
Residence	n.d.	2-1/2 story Greek Revival	Greenfield Road	21
Residence	n.d.	1-1/2 story Rural farm	Greenfield Road	22
Meadow Brook Farm	n.d.		Mill Village Road	904

Source: Compiled from Massachusetts Historical Commission and Deerfield Historical Commission Inventory forms. n.d. = No date available.

River Road

The River Road area includes portions of East Deerfield, Pine Nook Road, and the Sadoski Farm structures. The historic structures are imbedded in rich agricultural landscapes partially protected through the APR program, State agency ownership and the farmland of the University of Massachusetts. Most of the inventory forms for these structures are in need of further research regarding architectural style and date of origin.

Table 4-4: Significant Historic Structures off River Road in Deerfield

Historic Name	Year	Style	Street Name	MHC Inventory Number
Pine Nook Cemetery	1811		River Road	800
Gunn - Sadoski House	1818	Federal	River Road	94
Gunn - Sadoski Farm Livestock - Hay Barn	1818	No style	River Road	95
Gunn - Sadoski Farm Hayfield	1818		River Road	900
Gunn - Sadoski Farm Wood Lot	1818		River Road	901
Whitcomb Ferry Road	1830		River Road	902
Gunn - Sadoski Farm Equipment Barn	1900	No style	River Road	96
A. Stebbins House	pre 1871	2-1/2 story Rural farm	River Road	4
M. S. Ward House	pre 1871	2-1/2 story Rural farm	River Road	5
Abercrombie House	pre 1871	2 story Federal	197 Deerfield Road	1
C. Smith House	pre 1871	1-1/2 story Greek Revival bungalow	198 McClelland Farm Road	2
Residence	n.d.	2-1/2 story Victorian	204 McClelland Farm Road	3
Residence	n.d.	1-1/2 story Rural farm	208 McClelland Farm Road	4
Residence	n.d.	2 story Rural farm	McClelland Farm Road	5
Hill Top Farm	n.d.	2 story Rural farm	247 Pine Nook Road	6

Source: Compiled from Massachusetts Historical Commission and Deerfield Historical Commission Inventory forms. n.d. = No date available.

Mill River Valley

The Mill River Valley encompasses an area south of Route 116, east of Whately Woods, and west of Interstate 91. All of the historic structures are located off of Conway and South Mill River Roads. This area encompasses portions of Mill River and Bloody Brook and contains active farmland. Rural farmhouses and Greek Revival style residences are common.

Table 4-5: Significant Historic Structures and Sites in Mill River Valley

Historic Name	Year	Style	Street Name	MHC Inventory Number
C. Phelps House (possibly)	pre 1871	2 story Greek Revival	Conway Road	3
S. Harding House (possibly)	pre 1871	2-1/2 story Rural farm	South Mill River Road	11
Residence	n.d.	2-1/2 story rural farm	South Mill River Road	12
D. Jewett House	pre 1871	2 story Rural farm	Conway Road	1
C. S. May House	pre 1871	2-1/2 story Federal	Conway Road	2
C. Lee House (possibly)	pre 1871	2-1/2 story Rural farm	Conway Road	4
Mill River School	1844	1 story Schoolhouse	Conway Road	5
Residence	n.d.	1-1/2 story Greek Revival	Conway Road	7
Residence	n.d.	1-1/2 story Rural farm w/ Greek Revival features	Conway Road	8
C. Clapp House	pre 1871	2 story Rural farm	South Mill River Road	9
C. Clapp House	pre 1871	1-1/2 story Greek Revival	South Mill River Road	10
Residence	n.d.	2-1/2 story Greek Revival	Conway Road	6

Source: Compiled from Massachusetts Historical Commission and Deerfield Historical Commission Inventory forms. n.d. = No date available.

Other Areas in Deerfield

Throughout Deerfield there are small concentrations of significant historic structures. They include an area south of Route 116 around Hager and Sunderland Cross Roads, Hillside Road, and Jones Road in West Deerfield. Because each concentration may include from one to four single structure(s) it is important to acknowledge the possibility that there may be other structures scattered throughout the Town of Deerfield that have not yet been documented.

Table 4-6: Other Significant Historic Structures and Sites in Deerfield

Historic Name	Year	Style	Street Name	MHC Inventory Number
Residence	n.d.	2 story Greek Revival	Sunderland Cross Road	6
Residence	n.d.	2-1/2 story Greek Revival	Sunderland Cross Road	7
Residence	n.d.	2-1/2 story Rural farm w/ Greek Revival features	Sunderland Cross Road	8
Residence	n.d.	1-1/2 story Rural farm	Hager Cross Road	9
The Gables	n.d.	2 story Federal Revival	Rte. 5 & 10	1
I. Gilbert House	pre 1871	1-1/2 story Rural farm	31 Hillside Road	2
W. Warner House	pre 1871	1-1/2 story Greek Revival	Hillside Road	3
Residence	n.d.	2 story Lean-to	Jones Road	1

Source: Compiled from Massachusetts and Deerfield Historical Commission Inventory forms. n.d. = date unknown

Burial Grounds

Burial grounds are very important resources rich in historic monuments, art, genealogical data, and Town history. Cemeteries should be identified, cared for, and protected.

Table 4-7: Significant Historic Burial Grounds in Deerfield

Historic Name	Year	Style	Street Name	MHC Inventory Number
Common Grave	1675	Common grave	South Main Street	901
Pine Nook Cemetery	1811		River Road	800
Deerfield Village Old Burying Ground	1702		Albany Road	801
Hawk Cemetery	n.d.		On Shelburne Town Line	
North Cemetery	n.d.		Old Albany Road	
West Deerfield Cemetery	n.d.		Upper Road	
Savages Cemetery	n.d.		Lower Road	
Mill River Cemetery	n.d.		Stillwater Road/Lee Road	
Sugarloaf Street Cemetery	n.d.		Sugarloaf Street, Town Center	
Brookside Cemetery	n.d.		South Main Street	
Polish Roman Catholic Cemetery	n.d.		Boron Avenue	
Polish National Catholic Cemetery	n.d.		Boron Avenue	
Ward Cemetery	n.d.		River Road	
East Deerfield Cemetery	n.d.		River Road	
Laurel Hill Cemetery	n.d.		Pine Nook Road	

Source: Massachusetts Historical Commission and Deerfield Historic Commission files. R. Baker and H. Eaton Jr., Highway Department, personal communication; December 1999. n.d. = No date available.

Historic Bridges

Bridges in Deerfield are important links to the past. Railroad bridges are especially visible reminders of the role transportation and technology has played in the development of Deerfield and surrounding communities. When maintained and highlighted, bridges can reflect a community's pride in its own historic foundations.

Table 4-8: Significant Historic Bridges Within Deerfield

Historic Name	Year	Style	Street Name	MHC Inventory Number
Cheapside Railroad Bridge	1912	Unknown	River Road	905
B & M Railroad Bridge over Connecticut River	1918	Unknown	Connecticut River	907
Cheapside Bridge	1931	Unknown	Rt. 5/10	906
Sunderland Bridge	1937	Unknown	Rt. 116	909
Sprouts Crossing Bridge	1946	Unknown	Main Street	908

Source: Compiled from Massachusetts Historical Commission Inventory forms.

Historically Significant Agricultural Landscapes

Another category of historic resources is landscapes. A listing of agricultural landscapes is provided below in Table 4-9 and is followed by a brief description. The approximate locations of these landscapes are identified on the Historic Resources Map. These landscapes are tied to the agricultural history and remain largely intact, but are most at risk from Approval Not Required (ANR) development.

Table 4-9: Historically Significant Agricultural Landscapes in Deerfield

Name of Significant Landscape
Multiple Properties Along:
River Road
Pine Nook Road
Keith Cross Road
Mill Village Road
Route 116 (West Deerfield)
Deerfield River (East Bank)
"Pine Nook Area," River Road, and Pine Nook Cemetery Road
The "Bars," Mill Village Road
W. Smith, c.1871, Keith Cross Road
J. Hawks, c.1871, Hawks Road
W.D. Allen, c.1871, Keith Cross Road

Source: Franklin County Rural Landscape Preservation Plan Report; 1992.
Field survey by FRCOG Planning Department staff, 10/99.

Multiple Properties along River Road

River Road south of Keiths Cross Road provides views of the historical use of the western floodplains of the Connecticut River. As the first European settlers cultivated these fields they built their large farm homesteads far apart from each other. Each farmstead is surrounded by level fertile fields with eastern edges that follow the river. Old apple orchards and far off views of the fields of Montague and Sunderland are common as you travel south towards Cemetery Road. A short stretch of this road's landscape is interrupted by a stretch of ANR development before reaching the UMASS farmland parcels.

North of Keiths Cross Road, River Road offers visual access to large active and fallow fields, pastures, and old fruit tree orchards. From Keiths Cross Road, fields are on the right for the first three tenths of a mile. Then ANR development on the slopes to the west and woodlands to the east reduce the agricultural significance of the landscape. The majority of this portion of River Road is characterized by active fields in back of mostly modern structures on ANR lots. North of the intersection with McClelland Farm Road, River Road is characterized by agricultural landscapes up until the electric power lines cross the road.

Pine Nook Road

Off Route 5/10, one must cautiously travel under a one lane railroad bridge underpass then begin the climb past Eaglebrook School and Campus and the Ridge Road entrance. Pine Nook Road allows access to the ridge line of the Pocumtuck Range by way of a paved road with the twists

and turns of a mountain pass. The departure from the darkness of the forest combined with the immediate and expansive views of hayfields, hedgerows, stone walls, a farmhouse, barns, and the Pocumtuck Range is breathtaking. Once past Keith Cross Road, fields continue to run to the southwest. As one departs Pine Nook Road onto River Road the distant agricultural landscape is magnificent.

Keith Cross Road

A short road connecting Pine Nook Road to River Road, Keiths Cross Road abuts a few parcels that have been cultivated for centuries. Keith's Cross Road also provides viewsheds that encompass some of the most historic natural landscapes in all of Deerfield and surrounding towns.

Mill Village Road

The field survey conducted in October of 1999, updated the 1992 Franklin County Rural Historic Landscape Preservation Plan, which had stated plainly that multiple properties along Mill Village Road could be characterized as significant agricultural landscapes. FRCOG Planning Department Staff found that due to residential development, portions of Mill Village Road should be removed from consideration. Specifically this includes the east and west sides of Mill Village Road from Route 5/10 to Clark Cross Road, and the eastern side of the Mill Village Road from its intersection with Stillwater Road north three tenths of a mile. The rest of the properties along this road are significant with agricultural fields and meadows used for the past three hundred years. In some areas along this road, a visitor can see little but active fields and riparian forests and drying barns for tobacco. Mill Village Road terminates to the north in Old Deerfield Village.

Route 116 (West Deerfield)

Route 116 west of its intersection with Stillwater Road contains multiple properties, fields and small farmsteads including residences established as far back as 1777. In between Lee Road and Stillwater Road is the Mill River School house from the late nineteenth century. East of Stillwater Road only the southwest side of Route 116 contains significant agricultural landscapes. The north side contains multiple residences with driveways along Route 116. The farmland in this area, which is bordered by South Mill River Road and Whately Road appears to have been under cultivation consistently for many centuries.

Deerfield River (East Bank)

Most likely, the 1992 Report was describing the agricultural landscape represented by the Bars and the Upper Meadows, north of the Old Deerfield Village and also part of the National Historic Landmark area. Here, in the Upper Meadows, east and south of the meandering Deerfield River, expansive views of the rich fertile fields are limited only by the northern lobe of the Pocumtuck Range, Pine Hill, or Arthur's Seat.

Pine Nook Area, River Road, Pine Nook Cemetery, and Sadoski Farm, River Road

Outside of Old Deerfield, this is probably the most breathtaking historic agricultural landscapes in all of Deerfield. It is difficult to separate the components of this landscape because the landscape's integrity is dependent on those abutting it. For example, off Pine Nook Road travelling south towards River Road, one can view a farmstead, lush green pasture, far off

hedgerows and the ridgeline of the Pocumtuck Range to the west. Agricultural fields and woodland straddle Pine Nook Road until its intersection with River Road. A slow right onto River Road is soon followed by a panoramic view of a large farmland homestead with barns and outbuildings, the Connecticut River, and the plains and farmland surrounding the western flanks of Mt. Toby in Montague and Sunderland.

The Bars and Mill Village Road

The Bars represent a portion of Mill Village Road between Boynton Road East and Childs Cross Road. In the Bars, and the Lower Meadows, the land is utilized by dairy and vegetable farmers. Historic agricultural landscapes begin north after Lee Road because modern residential development along the southern segment of Mill Village Road has affected roadside views permanently. North of the Bars along Mill Village Road, there are extensive cultivated fields, hedgerows, floodplain forests, and barns.

Hawks Road

Hawks Road provides access to historical agricultural landscapes. It is a very rural and rough road with old pastures and fields abutting it. Closed for mud and winter seasons, the road is a favorite walking route.

Other Historically Significant Landscapes

Other historically significant landscapes located throughout Deerfield are listed in Table 4-10 and are followed by a brief description.

Table 4-10: Other Historically Significant Landscapes in Deerfield

Name of Significant Landscape	Type of Landscape
Deerfield Center - "Old Deerfield Village" and surrounding agricultural properties along Route 5/10, Main Street, the Existing Old Deerfield National Historic Landmark Area	Community Development/Agriculture
Mount Sugarloaf State Reservation, Sugarloaf Mountain Road	Recreation/Conservation
Pocumtuck Ridge, View from "the Rock"	Recreation/Conservation
Whately Glen Road	Transportation/Recreation

Source: Franklin County Rural Landscape Preservation Plan Report; 1992.
Field survey by FRCOG Planning Department staff, 10/99.

Old Deerfield Village

The 1992 Franklin County Rural Historic Landscape Preservation Plan Report identified the Old Deerfield National Historic Landmark area, "Old Deerfield Village" and surrounding environs as significant both for its *Community Development* and *Agricultural* landscapes. The Old Deerfield National Historic Landmark area contains Pine Hill and the North Meadows as well as portions of Wapping and South Meadows. The historic relationship between the original European settlement and the surrounding agricultural fields is well documented. Much of the landscape's land use patterns north of the Bars and south of Pine Hill have been retained through continuous active farming and the efforts of the private landowners in Old Deerfield Village, namely Deerfield Academy, Historic Deerfield, Inc., the Bement School and the Pocumtuck Valley Memorial Association. The Deerfield Land Trust has also been active in working to preserve the

agricultural land within the Landmark area and surrounding portions of Town. The continuous threat to the landscape is residential development. Over eighty percent (80%) of the farmland within the Old Deerfield National Historic Landmark area is not permanently protected. The National Historic Landmark status of the agricultural fields provides no protection from conversion to residential uses (Grace Friary, Historic Deerfield, Inc., personal communication; 1999). Furthermore, very little of the farmland within the North Meadows area of the Old Deerfield National Historic Landmark area is in the Chapter 61A Program. Farmland enrolled in the Chapter 61A Program provides limited protection from development since it provides a short-term opportunity for the Town to have the right of first refusal to purchase the farmland if it comes up for sale. Even this temporary form of land protection is not present for these parcels.

Mount Sugarloaf State Reservation, Sugarloaf Mountain Road

The Mount Sugarloaf State Reservation is considered to be a significant historic *Recreational* and *Conservation* landscape. Because the property is owned by the Commonwealth of Massachusetts, it is considered to be permanently protected. Other than modifications to the pavilion structure, the visitor amenities and the access road itself, which may be done to safeguard both the experience and the safety of all visitors, this landscape is relatively free from threats to its historic integrity. On the other hand, the view from the pavilion itself is greatly affected by changing land use patterns in the landscapes below.

Pocumtuck Range

The Pocumtuck Range stretches from the floodplain forests on the southern bank of the Deerfield River south across Woolman Hill and the ridgeline to North and South Sugarloaf Mountains. This is also considered to be a significant historic *Recreational* and *Conservation* landscape. It may be difficult to quantify the value that the mostly undeveloped range provides Deerfield and surrounding communities. Historic Deerfield Inc., has been successful in retarding the development of transmission towers atop the Pocumtuck Range because of the importance of this ridgeline to the historic integrity of the Old Deerfield National Historic Landmark area. The future threat of development is also difficult to assess. Although there are significant parcels of permanently protected land along the ridge line, enough of the landscape remains unprotected that one could imagine new residential development on both the lower western and eastern slopes of the Range.

Whately Glen Road

Whately Glen Road is considered in the 1992 Preservation Plan Report to be a significant *Transportation* and *Recreational* historic landscape. Whately Glen Road is located in the south western corner of Deerfield. It is mostly a dirt road that provides access to the South Deerfield Water Supply District's (SDWSD) new water filtration plant. Northwest of the plant, which is in Whately, the road bypasses upland forests and agricultural land. All the land in Deerfield southwest of the road is either owned outright by the SDWSD or is in the Chapter 61 program.

Scenic Roads in Deerfield

In many parts of Deerfield, historic landscapes blend with scenic viewsheds. Scenic roads, which access these special places overlap both. It is for this reason that we list the scenic roads

here. Portions of River Road and Pine Nook Road are locally designated scenic roads pursuant to Chapter 40, Section 15C of the Massachusetts General Laws. Members of the Master Planning Committee recommend that the other roads listed in the table below should receive the same protection. Local scenic road designation provides limited protection to historic and scenic resources along local byways. Once designated, the Planning Board must give written approval before any repair, maintenance, construction, or paving of the road is allowed if that activity would involve the cutting or removal of trees, or the tearing down or destruction of stone walls in the public Right of Way.

Scenic roads provide access to historic landscapes. The Historic and Scenic Resources Map identifies scenic roads that contain the most important historic and scenic resources. In a few cases, the location of an historic landscape that does not include a structure, is identified by the road which accesses it.

Table 4-11: Scenic Roads in Deerfield

Status	Name of Road	Portions of Road Considered as Scenic
Locally Designated	Pine Nook Road*	Entire Road
Locally Designated	River Road*	Between the intersections of Hillside Road and McClelland Farm Road
Proposed	Mill Village Road	North of intersection with Lee Road
Proposed	Keith Cross Road	Entire Road
Proposed	Whatley Glen Road	Entire Road in Deerfield
Proposed	Old Albany Road	Entire Road
Proposed	Hawks Road	Entire Road

Source: Field Survey by FRCOG Planning Staff, 1999.

* Designated as Local Scenic Roads

Historic Issues

Incomplete Inventories

The historic inventories are from Massachusetts Historical Commission forms of existing historic resources. Most of the structures that occur outside of the National Historic Landmark Area are from forms submitted to FRCOG Planning Department staff by Deerfield Historical Commission members. The majority of these locally submitted forms are not included in the MHC files. First, these additional forms should be submitted to MHC in Boston. Then, it is very important that the total inventory of all significant historic structures and sites within Deerfield be completed. The existing forms also lack information on locations. As part of any future effort to expand or establish new historic districts, additional work by an historic preservation expert will be needed to expand the inclusiveness of the inventory and completeness of the forms.

Deerfield Historical Commission

Although the historic resources within the Old Deerfield National Historic Landmark area are under the careful watch of private organizations like Historic Deerfield, Inc., all other structures, sites, and landscapes require the stewardship of the Deerfield Historic Commission. Historic resources across Deerfield require dutiful preservation efforts including the first step of documentation. Without this effort, the historic buildings left in South Deerfield and other areas may be lost to new development or neglect.

Deterioration of Historic Structures

Without due attention, neglect and deterioration may threaten significant structures. Demolition by neglect of farm buildings is one of the most pervasive threats to historic rural resources. If structures deteriorate too far, restoration becomes cost prohibitive, resulting in the eventual loss of the structures. In order to preserve historic resources it is necessary that a preservation and protection plan be devised before structures deteriorate too far. Additionally, tools like a Demolition Delay Bylaw or Farm Structure Reuse Bylaw may offer communities the opportunity to find alternative uses for unused historic properties.

Loss of Historic Elements

Historic details on many houses may be potentially lost, such as door and window moldings, porch supports, eaves brackets, etc. In some cases they are replaced by cheaper or mass-produced versions that lack the character of the original. Similarly, alterations to windows such as the insertion of stock bay windows can occur. This change in the details and patterns of facades can be very detrimental. The use of vinyl siding and the use of vinyl replacement windows with fake muntins are a double threat to the appearance of the historic properties. An education program for property owners to illustrate the negative impacts to historic clapboard buildings caused by siding and replacement windows would be valuable.

Incentives and Financing for Historic Resource Preservation

Preservation and restoration of historic structures can often be a prohibitively expensive prospect for landowners. A twenty percent (20%) Investment Tax Credit is currently available for rehabilitation of commercial properties on the National Register of Historic Places. At present, there is no parallel program that helps to allay the cost for restoration of residential properties. Such legislation does have support both at Federal and State levels. It is hoped that a tax credit program for residential structures will be passed in the next few years. Private funding initiatives may offer another avenue for financing restoration. Some of the successful strategies that have been used in other parts of the country are revolving funds, facade easement donations held by land trusts, and loans by local banking institutions interested in the long term economic effects of historic preservation.

Integration of Land Conservation and Historic Preservation

Deerfield contains cultural resources that include historical structures, sites, and landscapes. Traditionally, land conservation and historic preservation, which typically focuses on structures, have been treated as separate issues. The close link between these two resources calls for an integrated strategy. For example, Sunderland's Historical Commission is integrating the town's recent cultural resource inventory with information on farms in the APR program. They are including barns and other outbuildings in their historic structure inventory. Deerfield should consider a similar integrated approach to land conservation and historic preservation.

Through the Master Planning process, the value of each and every resource of the community is apparent. Preserving and enhancing Deerfield's natural, agricultural, and historic resources requires an integration of interdependent factors and also opportunities. For example, the long-term integrity of the significant historic landscapes along River Road depend on the viability of farming, on land preservation efforts, and on maintaining the structural and design qualities of the historic buildings and sites. Clearly, residential development pressure is the number one threat to the integrity of the historical agricultural landscapes throughout Deerfield.

Accessibility

Most historic buildings were not built to be wheelchair accessible. It is important to carefully design the access to historic buildings as required by the American with Disabilities Act. This may include moving the ramps to a side entrance, and reducing ramp widths, as appropriate.

Recommendations

Town-wide Historic Structure and Site Inventory

The Town of Deerfield like many communities across Massachusetts has seen significant growth in the past ten years. With the potential for sewer expansion on the horizon, Deerfield may face increasing development pressures. This chapter of the Master Plan provides the Town of Deerfield with an assessment of many of its historic and scenic resources: structures, sites, landscapes, and roads. Historic structures and elements are lost every year through neglect, remodeling, or demolition. The people who care most about preserving the character and integrity of Deerfield's historical foundations must band together and share their stewardship ethic for historic preservation with others. One of the most important aspects of any historic preservation effort is in education.

A complete and detailed inventory of every road, every structure, barn and roadway that has any historic significance (older than 50 years) is a project that could involve many Deerfield residents. It is therefore recommended that the Town of Deerfield work with the Deerfield

Historical Commission, the Pocumtuck Valley Memorial Association, and Historic Deerfield, Inc. to secure a grant to fund the identification of all structures and sites in Deerfield which would be supported by an historic preservation professional. This professional would be served well by having an organized group of volunteers assisting him/her in combing the Town for its treasures. These resources must be each identified on a complete inventory form and submitted together to the Boston office of the Massachusetts Historical Commission. Once this is accomplished and the exact locations of the Town's resources are known, other recommendations can be enacted with a greater chance of success.

Demolition Delay Bylaw

Consider establishing a demolition delay bylaw to provide community-wide protection to historic structures by providing an alternative to demolition when it is in the public interest to preserve particular buildings.

Typically, an application for a demolition permit for an historic property triggers the operation of a demolition delay procedure. The local building inspector is usually responsible for notifying the local historical commission that a property owner applied for a demolition permit. The local historical commission determines whether the historic property is significant and should be preserved rather than demolished. The demolition delay bylaw enables the historical commission to delay granting of the demolition permit for a set period of time, usually up to six months, while viable alternatives are explored and negotiated.

Demolition delays can benefit both the property owner and the Town. The owner may be unaware of the historical significance of their property. They may also be unfamiliar with federal rehabilitation tax incentives or with the economic benefits that can come from preserving historic properties through development projects. Options may include adaptive re-uses for the building, locating buyers willing to rehabilitate, preserve or adapt the property, or as a last resort, moving the building to a new location. The delay bylaw also provides municipalities time to consider the impact of proposed demolitions at the early stages of a projects development. The delay period can also provide a leverage tool when demolition seems inevitable. In exchange for design review, local historical commissions could agree to release the delay period.

Protection of Historic Landscapes

The goal of identifying the historic landscapes and scenic roads of Deerfield is to implement preservation strategies with willing landowners. Preservation strategies for landscapes and scenic roads include acquisition of land in fee simple by a public or private preservation or conservation organization like the Deerfield Land Trust, or acquisition of a scenic easement by same. Other mechanisms include tools such as siting and design guidelines, right-of-first-refusal agreements, site plan review, transfer of development rights, and cluster/open space zoning. Using historic landscape patterns to shape and guide new development helps to protect historic rural landscapes. Site planning and design based on historical or contextual elements can help

new development fit in with the rural historic landscape when permanent protection is not impossible.

Local Scenic Road Designation

M.G.L. Chapter 40, Section 15C, authorizes towns to pass local bylaws designating certain town roads as scenic. Each community determines on its own which roads should be designated as scenic. Planning Boards, Conservation Commissions and Historical Commissions typically play an active role in recommending which roads should be included in the local bylaw. Once designated, the Planning Board must give written approval before any repair, maintenance, construction, or paving of the road is allowed if that activity would involve the cutting or removal of trees, or the tearing down or destruction of stone walls in the public Right of Way.

Voluntary Design Guidelines Overlay District Bylaw for Route 5/10, South Deerfield Village Center, and Old Deerfield National Historic Landmark Area

Consider adopting a Voluntary Design Guidelines Overlay District Bylaw would assist Deerfield in preserving the South Deerfield Village Center as well as the rural character and scenic views along Route 5/10. The bylaw provides incentives for developers to use voluntary guidelines, such as reductions in setbacks and parking, in order to create new development that fits better with the historic and rural character of the Town. The purpose of this bylaw would be to promote the use of voluntary design guidelines for new development or redevelopment in the South Deerfield Village Center and along Route 5/10. The use of the design guidelines is at the landowner's option but incentives can be provided to encourage their use. These guidelines can include standards for access, parking lot design, pedestrian access, landscaping, lighting, building materials, window treatment, roof pitch, and building height.

TRANSPORTATION RESOURCES

Transportation resources are the highways, roads, railroad tracks, bus routes, bike paths, and sidewalks that exist within a town. Their importance is often overlooked until there is a problem, an accident, or traffic jam. Transportation resources impact people's daily lives as well as the ways their community grows. When these resources are neglected or modified without consideration of these impacts, the results can be negative, from lost opportunities for pedestrian traffic to serious safety issues. Deerfield's transportation resources are a valuable commodity deserving assessment and enhancement.

The road infrastructure of Deerfield is comprised of one interstate highway (I-91), two state highways (Rte. 5/10 and Rte. 116), and a network of roads serving South Deerfield, Old Deerfield and outlying rural areas. Due to its rural nature, cars and trucks are the primary modes of transportation for people and goods. According to the 1990 Census, ninety-five percent (95%) of Deerfield households owned at least one vehicle. In addition, sixty-six percent (66%) of Deerfield's working population are employed outside of the Town. This places great importance on the road networks for commuting, particularly since Deerfield is not well served by public transportation.

The two main north-south routes are Interstate 91 and Route 5/10, which run through the center valley of Deerfield, passing through Old Deerfield and some of the finest farmland in the country. Also in the vicinity of South Deerfield, Route 116 intersects both roads. Route 116 represents the main access road for commuters from Conway and towns west, and from Deerfield to Route 91 and points east. Route 116 south to the Sunderland bridge represents one of the principal locations people can cross the Connecticut River between Northampton and to Montague. The Community Survey revealed that road improvements and maintenance were a top priority. Roads were the top ranking category for needed capital expenditures.

The roadway infrastructure is not only important to local residents, but also supports economic development in Deerfield, local business and tourism. One of the reasons Deerfield has so many large employers, including manufacturing and transportation firms, is because of the Town's convenient access to the highway network. Yankee Candle is reportedly the second most popular attraction in the State second to only the Freedom Trail in Boston (*Massachusetts Office of Travel & Tourism*). There is an opportunity to draw out-of-town dollars to businesses along Route 5/10 and in South Deerfield Village with improvements made to these two travel areas. Adding pedestrian routes and bikeways between Old Deerfield and South Deerfield Village would also aid in linking these downtown areas for pedestrian purposes.

Deerfield has other transportation infrastructure that includes an active rail line and a limited public transit service. The East Deerfield freight yard owned by the Guilford Rail System (GRS) is one of the largest rail yards in New England. Technically it can hold up to nine hundred cars per day. It is primarily used as a classification yard for freight trains coming in from the east and west, as well as the north-south main lines. There are also several tracks available for public unloading. The

following businesses all depend on the East Deerfield rail yard: Huntsman Packaging, Barker Steel, Huntsman Plastics, Crop Production Services, All States Asphalt, and New England Wild Bird Food (Indus-Rail Co.; 1999).

There are two fixed bus route services that serve Deerfield residents and students of its schools, the Franklin Regional Transit Authority (FRTA) and the Pioneer Valley Transit Authority (PVTA). There are two scheduled trips every weekday between Greenfield and South Deerfield for the FRTA and three times on Saturday. The PVTA, through UMASS Transit, provides bus service to Sunderland and South Deerfield. The South Deerfield route travels to and from the University of Massachusetts six times per day during the school year, five times per day during vacations.

The need for alternative transportation options is reflected in the 1990 Census commuter data, which showed that only one percent (1%) of Deerfield's workers used public transportation. The vast majority of residents drove alone. However, in 1990, thirty-four percent (34%) of Deerfield's workers were employed in Town and twelve percent (12%) walked to work or worked at home. The fact that so many Deerfield residents stay within Town for the majority of their day suggests a need for transportation options other than the automobile. Although the presence of bicycle and pedestrian infrastructure is sparse in Deerfield, Community Survey respondents and Town officials are in favor of developing more extensive facilities for both.

The Transportation Resources chapter of the Master Plan will inventory most of the resources outlined above. These resource values are reflected in the following Transportation goals and objectives. The goals and objectives were prepared based on the results of the Community Survey.

Goals:

- **To improve the condition of the road system.**
- **To improve the pedestrian infrastructure.**
- **To improve traffic patterns at key locations.**
- **To expand transportation choices for Deerfield residents.**

Objectives:

- Pursue additional funding sources for road improvement projects including Public Works Economic Development (PWED) grants.
- Provide or improve sidewalks in the South Deerfield village center.
- Explore the feasibility of providing walking trails throughout Deerfield.
- Explore the feasibility of establishing bike paths in Deerfield.

- Address parking and circulation issues in the South Deerfield village center.
- Identify intersection improvement and congestion mitigation measures for main roads.
- Expand local bus service through Deerfield to Greenfield and Amherst.
- Explore the effectiveness of the local speed limits and work to adjust as necessary.

To address these Goals and Objectives the following work items are included in the Master Plan:

- a) An assessment of the potential for improving the pedestrian network in South Deerfield and for adding bicycle and pedestrian trails;
- b) A discussion of comprehensive pavement management and an analysis of its benefits to Deerfield. Comprehensive pavement management assesses all maintained paved roadways as to their overall condition and estimates the funding needed to improve the condition of the road system;
- c) Collection of traffic counts for main roads;
- d) Collection and analysis of accident data;
- e) An assessment of traffic volumes to road capacity known as Level of Service (LOS) along important roads;
- f) A discussion of the Deerfield rail system and East Deerfield Railyard; and
- g) A discussion of the condition of Deerfield's bridges.

In addition, an analysis of key intersections in Deerfield will be completed by the Franklin Regional Council of Governments in the coming year as part of a Route 5/10 and Route 116 Circulation Study. The Transportation Map at the end of this Chapter illustrates many of work items listed above.

Bicycle and Pedestrian Transportation Infrastructure Assessment

This section provides a brief overview of the infrastructure for the most common types of non-motorized transportation—bicycling and walking and the public transportation that supports them, mainly buses. Primarily, infrastructure in and around the South Deerfield village center was assessed. The following areas or ideas were explored:

- a) Establishing the Deerfield Bikeway, a southern spur to connect downtown Greenfield, Cheapside, and Historic Deerfield;
- b) Establishing a Bikeway connection between Historic Deerfield and South Deerfield Center;
- c) Increase public transportation opportunities (i.e. buses and carpooling); and
- d) Creating a pedestrian-friendly downtown in South Deerfield.

Bikeways

Twenty-five to thirty years ago, a group of Franklin County citizens designed a bicycle route. The original plan involved a loop through Montague, Gill, and Greenfield. The Loop also included a southern spur that traveled through Cheapside, passed over the bridge, and then ran down Route 5/10 to Historic Deerfield. At that time, Deerfield Town officials and police were in agreement with the Bikeway group. Then due to a variety of circumstances including limited funding, the project stalled.

After passage of the Intermodal Surface Transportation Efficiency Act (ISTEA), the Franklin County Commission Planning Office adopted responsibility for the bikeway and its implementation. In 1993, the Franklin County Commission Planning Department approached the same towns for a reconfirmation of their interest in the Bikeway. Due to the increased traffic on Route 5/10, especially with the expansion of Yankee Candle (YCI), Deerfield Town official's felt that a Route 5/10 Bikeway spur from Cheapside would be too dangerous. In 1996, the Town of Deerfield reiterated their concern that shared bicycle facilities were not acceptable. A shared facility would include a bike lane in the road shoulder.

Deerfield was more interested in an off-road trail system. The opportunity to use an old railroad corridor parallel to Route 5/10 as an off-road bike path may have been lost since the railroad abandoned the land back to abutters and companies such as YCI and Savages Market have already expanded onto the old railroad bed. Many legal entities own the land in the corridor now.

Now however, there is some interest amongst Town officials to host a southern spur of the Franklin County Bikeway. Like the original plan, Historic Deerfield would be connected by way of a bike path to Greenfield via the Cheapside Bridge over the Deerfield River. The difference with this preliminary plan is that the bikeway would bypass Route 5/10 in Deerfield all together. Instead of following the shoulder of Route 5/10 south to Brougham's Pond Road, an off-road bikeway would be built to pass westerly along the southern bank of the Deerfield River to ultimately connect with Pogues Hill Road. The resulting bike path would enter the Old Deerfield National Historic Landmark Area immediately after crossing the bridge and then travel through the North Meadows, some of the most productive farmland in the region. A short loop would direct cyclists through Old Deerfield without connecting to Route 5/10 then send them back along Pogues Hole Road.

Other preliminary plans suggested by Deerfield Planning Board members connect this Old Deerfield loop with a path alongside Mill Village Road. The intent of this path is to cross over Route 5/10 either onto North Main Street or North Hillside Road to connect Old Deerfield to South Deerfield. The nature of the Route 5/10 crossing is an important safety consideration that may not be resolved without a signal light or stop sign.

Deerfield officials have also expressed interest in a bikeway that focuses attention on River Road. Portions of River Road have been designated by the Town of Deerfield as a Scenic Road. There are many significant historic agricultural landscapes on River Road, especially near the Pine Nook Road area. There would then be the potential for this bike path to connect to two potential "off-road" mountain bike paths namely, McClelland Farm Road and Rice's Ferry Road. McClelland Farm Road intersects River Road in two places in East Deerfield, north of the East Deerfield Railyard. The mostly dirt road provides access to woodlands, nurseries, and the riparian forest of the western bank of the Connecticut River. Rice's Ferry Road is an old road, which connects River

Road to Pine Nook Road. The development of any of these bikeways would provide opportunities for cyclists to explore some of Deerfield's more scenic landscapes.

The future role of the bicycle as an alternative form of transportation may not be apparent to Deerfield residents, especially as their main travel routes are becoming more congested with use. Traffic calming, as discussed below, may help to provide safe conditions for bicyclists in South Deerfield, but along Rte. 5/10, Rte. 116, and the other main roads the long term solution may be the "off-road" system as is found on Martha's Vineyard. It would be beneficial for the Select Board or the Deerfield Recreation Committee to consider the methods of successful "off-road" bike paths throughout the State of Massachusetts.

Bikeway Connection from Historic Deerfield to South Deerfield Center

Alternatives were examined to determine the best route for bicyclists to travel from a proposed bicycle path loop (along Pogues Hole Road, Albany Road and Main Street) in Historic Deerfield to South Deerfield. All possible on-road routes, and several potential off road connections, were examined to determine a safe and feasible route to cross Route 5/10 to South Deerfield Village Center. The examination was focused on potential routes that would be best suited for a novice bicyclist.

Potential off-road options were investigated first, since these are often the safest and most desirable type of bicycle facility. There appeared to be no readily available routes that would connect the two village areas via publicly owned land. As a note, however, there is an old rail-bed that runs the length of Route 5/10 on the eastern side of the road. It is believed that the land, when abandoned, was returned to the abutters. There are some stretches where the former railroad bed is visible. It would be worth investigating the potential of developing an off-road bicycle path along the former rail-bed connecting Depot Road at Historic Deerfield and North Main Street to South Deerfield Center. This could allow an easier crossing of Route 5/10 at Depot Road, which is not as wide or congested at this location as it is further south near Elm Street. However, the implementation of this option could be complicated by the former rail-bed having been reverted back to a large number of abutting property owners.

In light of the fact that there were no obvious off-road routes, all possible existing roads on either side of Route 5/10 were examined. Crossing Route 5/10 poses the biggest challenge to determining a safe route from Historic Deerfield to South Deerfield center. The option of crossing Route 5/10 at its intersection with Memorial and Depot Roads did not provide a good route since Depot Road is very steep, narrow and winding. This route would travel to South Deerfield via Pine Nook Road, and would provide a relatively long and circuitous route with hilly terrain.

Clark Cross Road across Route 5/10 to North Hillside Road is not a safe location for a bicycle crossing because these two roads are offset from one another. This route would require that the bicyclists travel along Route 5/10 for a short distance and then cross the road. In addition, this intersection does not have a traffic signal.

The on-road route of Main Street in Old Deerfield Village south to Mill Village Road, then across Route 5/10 at the intersection of Mill Village Road to North Main Street provided the best route. However, a number of intersection improvements would be required. The following

recommendations would need to be implemented to ensure that the crossing at Route 5/10 is safe. A pedestrian activated traffic light is recommended at the intersection of Route 5/10 and North Main Street. There is currently no traffic signal at this intersection and a signal that could be activated by bicyclists would allow them to stop the traffic on Route 5/10 and cross the street. The cost of design and installation of a traffic light with a pedestrian activated traffic signal is estimated between \$100,000 and \$150,000. Also, intersection reconstruction work is needed on North Main Street at its intersection with Route 5/10. The existing curb located on the southwest side of North Main Street at the intersection would pose a hazard to bicyclist. A widening of the road at this location would allow a shoulder for potential bicyclists. Once through the intersection and over the existing railroad bridge on North Main Street, adequate shoulder exists to support bicycle travel into South Deerfield center along this road.

The intersection of Elm Street and Route 5/10 has a traffic light with a pedestrian activated signal. However, use of this crossing would require that the bicyclists travel on Route 5/10 for some distance from the intersection of Elm Street and Route 5/10 to the intersection of Route 5/10 and Mill Village Road. It has been the position of the Deerfield Select Board for several years not to support bicycle travel on Route 5/10 due to the high speed and volume of vehicles on this road.

Pedestrian Facilities

The FRCOG Planning Department will be implementing a traffic-calming study for South Deerfield, which will look at options to the four-way stop in the center of Town. The objectives of traffic calming are to manage speed and better integrate vehicular and pedestrian traffic.

There are plans for a Park and Ride Lot between Elm and Conway Streets off North Main Street. Because the University of Massachusetts at Amherst recently raised their parking fees, Town officials are concerned that there might be an increase in the numbers of people who park their cars in South Deerfield for the day. The Park and Ride Lot will attempt to offset expected demand for parking by bus riders. The Lot is expected to hold seventy to one hundred cars and can be a multi-use parking lot as well. A multi-use parking lot will also begin to make South Deerfield more accessible to the out-of-town visitor.

In addition to a large parking lot, efforts to redesign the downtown village area for pedestrians with walkways, benches, tree plantings, appealing street lamps, and green spaces would help to enhance the pedestrian experience.

Any effort to rethink zoning, streetscape improvements, and pedestrian and bicycle facilities should include an infill study. Infill studies examine current zoning, parcel occupation, and building vacancy to determine where future building construction can occur. Future development of South Deerfield could have negative impacts on historical, housing, economic, and transportation resources if not well planned. Historical resources like architectural styles, institutional buildings, and monuments require stewardship. Housing for the elderly is needed according to demographic trends (*see Chapter 3 - Housing*). Having elder housing close to downtown and convenient pedestrian and public transportation facilities would encourage small businesses. The enhancement of pedestrian facilities is an important part of any redevelopment plan for South Deerfield Village Center.

Finally, FRCOG staff will be accomplishing a regional pedestrian assessment within a year's time. This will identify areas in the region that lack pedestrian facilities. The purpose of this assessment is so that future projects can be reviewed for their contribution to needed pedestrian facilities.

Pavement Management Analysis

A Pavement Management System (PMS) as defined by the American Public Works Association (APWA) is “a systematic method for routinely collecting, storing, and retrieving the kind of decision-making information needed (about pavement) to make maximum use of limited maintenance and construction dollars.” Historically, road maintenance funds were channeled to those roads that were perceived by local highway superintendents to be in the worst condition. Various studies have indicated that a pavement maintained in a perpetual “good” to “excellent” condition, requires one-fourth to one-fifth the investment of a pavement that is poorly maintained and rehabilitated only after it reaches a “poor” or “failed” condition. A PMS is designed to provide quantitative information to support repair and budget decisions to maintain roads in a perpetual “good” to “excellent” condition.

Figure 5-1 gives a graphical depiction of the general life cycle of an asphalt pavement. Under normal conditions with consistent weather and traffic patterns, a pavement will deteriorate by forty percent (40%) in the first seventy-five percent (75%) of its life. During the next twelve percent (12%) of its life the pavement will deteriorate by a further forty percent (40%). With proper timing of preventative maintenance measures during the first seventy-five percent (75%) of a pavement's life, many years can be added to the functionality of the road at a lower overall cost.

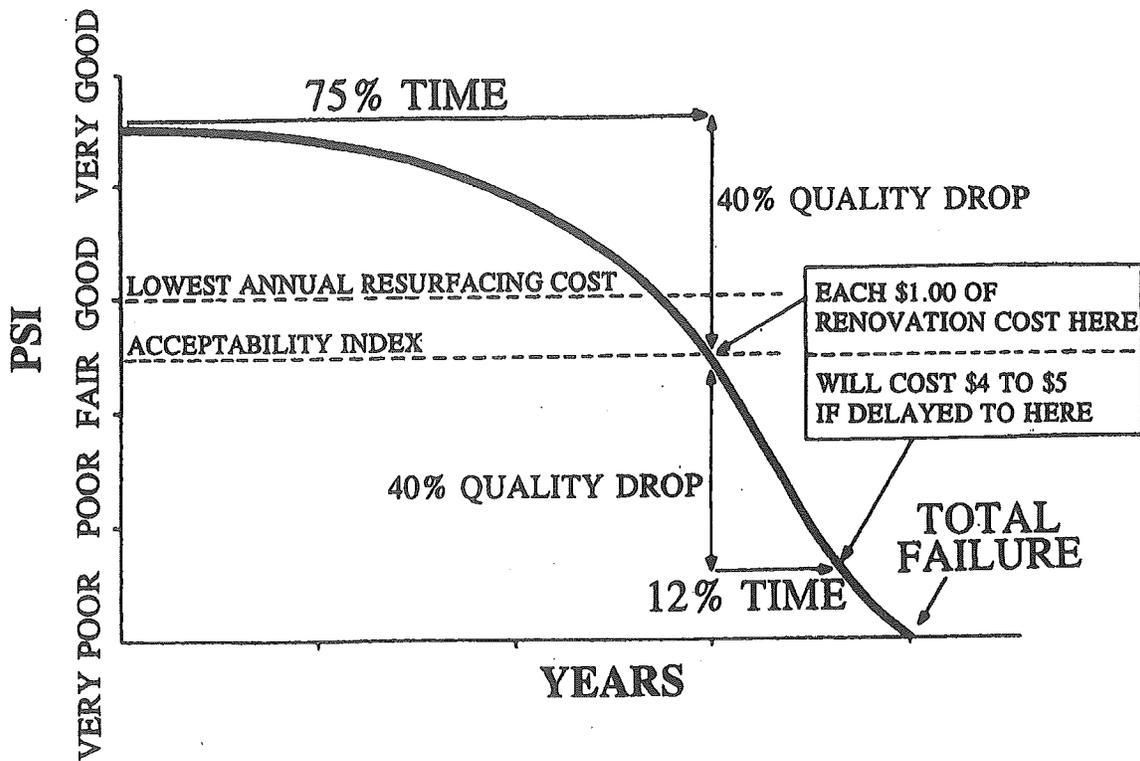
With limited availability of transportation funding, it is more important than ever to make cost-effective decisions. A formalized PMS improves on the existing practices that most highway departments already employ by enhancing professional judgement through guidelines and a standardized approach. It also provides highway departments and Town officials with information that can be used to request additional funding either from Town Meeting or State and Federal sources. A PMS is generally based around a piece of computer software that has been developed from years of research into pavement behavior and the effects of timed repair strategies. A PMS can help determine the most appropriate time to make the repairs, the most cost-effective method, and the annual cost of maintaining the roadway at the desirable condition level.

The FRCOG Planning Department has been involved in pavement management activities since the early 1990's. In 1997, the FRCOG completed a three-year pavement management contract with the Massachusetts Highway Department (MassHighway) encompassing the survey and analysis of nearly five hundred miles of Federal-Aid and State Transportation Program (STP) funded roads in the twenty-six Franklin County communities. Unfortunately, this contract was not renewed due to a lack of available funds at the State level.

The FRCOG Planning Department is committed to continuing the Pavement Management program and has made funding available to assist towns interested in conducting a pavement management analysis of their paved road network. This funding allows the FRCOG to collect pavement distress data on roads classified as Major Collector and above such as Routes 5/10, Route 116, and others. Town personnel can be trained to collect the data on their local roads or can contract with the

FRCOG to collect the data, being charged per center lane mile of roadway surveyed. Analysis of the collected data and the production of a personalized report are also covered by the funding.

Figure 5-1. Life Cycle of Asphalt Pavement



ROADWAY DETERIORATION vs TIME

Source: 1996 Pavement Management Program Technical Report, Mass Highway Department

The following provides a brief explanation of the processes involved in pavement management. The methodology used for data collection and analysis was designed to maximize the effectiveness of the Road Manager software. The survey technique involves the identification of nine different distress categories present on the pavement surface. The average severity and extent of the present distresses along a road section (no more than 1 mile in length) are input into the software. Based on this input, a pavement condition index (PCI) is calculated. The PCI is based upon a scale between 100 (best) and 0 (worst). A pavement with no distresses noted will have a PCI equal to 100 and as the number, severity, and extent of distresses increase the lower the PCI becomes. Based on the PCI and a number of other factors a general repair strategy is assigned to the surveyed roadway section. A cost is associated with each repair type and based on the area the repair would be applied to, a total cost is calculated. The final step is the calculation of a "Benefit Value" which reflects the cost effectiveness of conducting repairs on one road section over another. Higher priority (better cost effectiveness) is given to sections requiring routine and preventative maintenance techniques over sections requiring reconstruction. This reflects the principles of pavement management discussed earlier and shown in Figure 1. The type of repair is not the only factor in this calculation. The average daily traffic (ADT) volume is also considered. This means that a high volume section

requiring reconstruction would receive a higher benefit value than a low volume road requiring routine maintenance.

As part of the pavement management contract with MassHighway, the FRCOG collected pavement distress data on approximately fifteen (15) miles or twenty-five percent (25%) of Town maintained paved roads and twelve (12) miles or sixty percent (60%) of MassHighway maintained paved roads. This data was collected during the summer of 1995 and would have been collected again in 1998 if the program had been refunded. Due to the constant changes in pavement structure, either due to maintenance activities or deterioration, re-surveying and analysis is recommended every two to three years. This data is now over four years old and, in that time, pavement conditions have changed considerably. Therefore, this data is only being used to show the types of information a pavement management program can provide.

Table 5-1: Summary of Pavement Conditions for 1995 Surveyed Town Maintained Roads

PAVEMENT CONDITION (PCI Range)	Number of Miles	Percentage of Total Mileage
Excellent (≥ 95)	0.13	1%
Good ($85 \leq \text{PCI} < 94$)	9.85	64%
Fair ($65 \leq \text{PCI} < 84$)	5.19	34%
Poor (< 65)	0.13	1%

Source: 1995 Road Inventory File

Total Mileage = 15.30

The summary in Table 5-1 provides a review of the conditions of the surveyed road network in Deerfield. The majority of the surveyed roads had PCI index numbers in the 'Good' range. Table 5-2 describes the backlog of repair projects needed and the estimated total cost to bring the surveyed segments of the network up to an excellent condition.

Table 5-2: Summary of Required Repairs for 1995 Surveyed Town Maintained Paved Roads

REPAIR TYPE	Number of Miles	Percentage of Total Mileage	Estimated Cost of Repairs
5. No Immediate Action	4.82	32%	\$0
4. Routine Maintenance	4.91	32%	\$191,469
3. Preventative Maintenance	2.45	16%	\$254,578
2. Rehabilitation	2.99	20%	\$377,111
1. Reconstruction	0.13	1%	\$68,600

Source: 1995 Road Inventory File

Total Mileage = 15.30

Backlog of Repair = \$891,758

Summary of Deerfield Road Mileage

Town Maintained Paved Roads = 59.94 miles (2.34 miles eligible for Federal Aid¹)

Town Maintained Gravel Roads = 20.15 miles

MHD District 2 Maintained Paved Roads = 19.87 miles

Table 5-3 lists the top ten prioritized sections based on the cost benefit of doing the repairs. This list provides a good example of the principles behind pavement management. The first four prioritized sections are all on North Main Street with each assigned the same average daily traffic (ADT) volume. It can be seen that the sections assigned routine maintenance have received a higher priority than the section requiring preventative maintenance, which has been assigned a higher priority than the section requiring reconstruction. This is consistent with the principles of pavement management where it is more cost effective to regularly conduct routine and preventative maintenance measures than allow a pavement to deteriorate to a condition requiring reconstruction.

¹ Federal Aid is available for Reconstruction projects only, through the Transportation Improvement Program (TIP)

Table 5-3: 1995 Surveyed Top 10 Prioritized Town Maintained Road Sections

Street Name	Section ID	Section From:	Section To:	Length (ft)	PCI	Repair Type	Estimated Cost	PMS Rank	Estimated ADT	Survey Date
North Main Street*	4500	Route 5/10	#27 North Main Street	1162	90	4	\$11,620	1	4500	7/27/95
North Main Street*	4800	End of Rail Bridge	Kelleher Drive	4224	90	4	\$44,587	2	4500	7/27/95
North Main Street*	4900	Kelleher Drive	Sugarloaf Street	2534	84	3	\$76,020	3	4500	7/27/95
North Main Street*	4600	#27 North Main Street	End of Rail Bridge	686	53	1	\$68,600	4	4500	7/27/95
West Deerfield Upper Road	9430	#270 West Deerfield Upper	Greenfield Town Line	4224	85	4	\$28,160	5	1160	7/27/95
West Deerfield Upper Road	9410	#198 West Deerfield Upper	(2 nd) Jones Road	5808	89	4	\$38,720	6	1160	7/27/95
West Deerfield Upper Road	9400	Stillwater Road	#198 West Deerfield Upper Road	3168	90	4	\$21,120	7	1160	7/27/95
Stillwater Road	1100		West Deerfield Upper Road	158	85	4	\$878	8	860	7/27/95
Stillwater Road	1200	I-91 Bridge		1690	89	4	\$9,389	9	860	7/27/95
Stillwater Road	1300	Change in Surface	I-91 Bridge	1320	88	4	\$7,333	9	860	7/27/95

Street Name - Street Name. * Indicates the road section is eligible to receive Federal Aid or Non-Federal Aid for Reconstruction only.

Section From - Start point of the individual section.

Section To - End point of the individual section.

Length (ft) - The length of the section, measured in feet.

Pavement Condition Index (PCI) 95 - 100 indicates the pavement is in **excellent** condition; 85 - 94 indicates the pavement is in **good** condition; 65 - 84 indicates the pavement is in **fair** condition; and 0 - 64 indicates the pavement is in **poor** condition.

Repair Type -1. Reconstruction; (\$30 sq/yd); 2. Rehabilitation; (\$10 sq/yd); 3. Preventative Maintenance; (\$7.50 sq/yd); 4. Routine Maintenance; (\$2.50 sq/yd); and 5. No Immediate Maintenance. (\$0 sq/yd)

Pavement Management System (PMS) Ranking - A ranking of all the sections requiring repair, based on a cost/benefit produced by the Road Manager software through the Benefit Value. The section with the highest Benefit Value has received a PMS Ranking of 1. Sections with equal Benefit Values have received the same ranking.

Estimated Average Daily Traffic (ADT) - Average Daily Traffic travelling on each section of road. Generally, traffic count data was available on the higher volume roads. Where data was not available, estimates were made based on the functionality of the road and the number of houses or businesses they served.

Survey Date - Date on which the pavement distress data was collected.

The average daily traffic (ADT) volume on North Main Street is the reason why the reconstruction project receives a higher priority than the routine maintenance measures on West Deerfield Upper Road and Stillwater Road.

It should be noted that the prioritized list of measures produced by the Road Manager (the software program) is not a dictation of the order in which repairs should be completed. The results of the analysis should be integrated into existing procedures used to maintain the road network. It should be emphasized that the data displayed in this report is only for explanatory purposes and does not reflect the current conditions of the listed roads.

Although, much of the data recorded in this section can not be used for assessing the current conditions of Deerfield roadways, it may be used to draw focus to those roads with considerable priority. In particular, four different segments of North Main Street were in need of routine and preventative maintenance back in 1995. This should be a roadway to monitor depending on the kind of repairs North Main Street has received since then. After the traffic light was installed at the intersection of Route 116 and Sugarloaf Street this past year, traffic moving through the center of Town is expected to rise. Therefore, North Main Street's ADT would likely rise. A pavement management system would be able to assist the Town in determining how, when, and where it should focus its road maintenance and repair funds.

Traffic Counts

FRCOG Transportation staff conducted traffic counts along high traffic locations in Deerfield in 1999 and in previous years. This information was used to determine the Average Annual Daily Traffic (AADT). Traffic counts from previous years were studied, where available, and the Average Annual Growth Rate (AGR) was calculated for these locations. The results of this study are tabulated in Table 5-4 below. The bolded street/routes identify significant changes in the average annual growth rates.

Table 5-4: Deerfield Traffic Count Data

Street/Route	Location	Past Year Count		Most Current Count		Average AGR
		Year	AADT	Year	AADT	
Conway Street	Between Route 5/10 and North St.	1998	1060	1999	930	-6.33%
Elm Street	Just East of North St.	1998	5610	1999	5810	3.57%
Hillside Road	½ Mile West of River Rd.	-	-	1999	730	-
Industrial Drive West	50 ft South of Route 116	-	-	1999	1200	-
Lee Road	Between Gully & Mill Village Rds.			1993	1200	
Memorial Street	West of Route 5/10	-	-	1996	1700	-
North Hillside Road	² / ₁₀ Mile East of Route 5/10	-	-	1999	660	-
North Main Street	Between Route 5/10 & Rail Bridge	1998	2490	1999	2730	9.46%
North Main Street	North of Pleasant St.	-	-	1999	5020	-
North Main Street	South of Pleasant St.			1999	4760	
Pine Nook Road	East of Route 5/10	-	-	1996	1300	-
Pleasant Street	West of North Main St.	-	-	1999	1230	-
River Road	⁶ / ₁₀ Mile East of Route 5/10	1997	1060	1999	1080	0.94%
River Road	200ft South of Junkyard Entrance	-	-	1997	1090	-
River Road	½ Mile North of Route 116			1999	1270	

River Road South	Whately Town Line	1998	1740	1999	1770	1.72%
Route 5/10	At Keets Rd.	-	-	1999	9600	-
Route 5/10	South of Memorial St.	-	-	1996	7500	-
Route 5/10	North of Memorial St.	-	-	1996	7600	-
Route 5/10	4.0km North of Whately Town Line	1994	7635	1998	7697	0.20%
Route 5/10	½ Mile North of Route 116 (N)	-	-	1999	8200	-
Route 5/10	Between Elm St. & Route 116 (N)	-	-	1997	14200	-
Route 5/10	Between Route 116 (S) & Elm St.	-	-	1997	12300	-
Route 116	Sunderland Town Line	1997	14190	1999	15980	6.12%
Route 116	East of Sugarloaf St.	-	-	1995	16000	-
Route 116	West of Sugarloaf St.	1997	11060	1999	10950	-0.50%
Route 116	Between Rte. 5/10 & I-91NB On-Ramp	-	-	1997	9100	-
Route 116	2/10 Mile West of I-91 Exit 25	-	-	1999	4950	-
Route 116	Conway Town Line	1993	3100	1996	4300	11.52%
Stillwater Road	East of I-91 Bridge	1997	850	1998	830	-2.35%
Sugarloaf Street	North of Route 116	1997	5310	1999	5820	4.69%
Sugarloaf Street Extension	Whately Town Line	1998	870	1999	930	6.90%
West Deerfield Upper Road	Between Lee & River Roads	1997	910	1998	870	-4.40%
Whately Road	East of South Mill River Rd.	1993	420	1995	410	-1.20%
Whately Road	West of South Mill River Rd.	-	-	1997	510	-

AADT – Average Annual Daily Traffic. AGR – Annual Growth Rate.

The Traffic Count data listed in Table 5-4 shows the relative change in the volume of traffic between the years listed. Traffic counts were recorded by FRCOG using standard procedures. The Average Annual Daily count takes the average number of vehicles counted during at least two successive twenty-four hour periods, then seasonally adjusts the figure based on MassHighway specifications for each month. For example if a count on Rt. 5/10 took place in October, during fall foliage season, the figure would be decreased to represent an average day in that year, based on MassHighway's factor for the fall months. The Average Annual Growth Rate is the rate of change in traffic counts per year. For instance, there were two traffic counts established on Sugarloaf Street, north of Rt. 116, in 1997 (5310) and 1999 (5820). The difference between these two traffic counts represents an annual change of nearly five percent (4.69%), or just over nine percent (9.38%) for the two years.

Average Annual Growth Rate figures can be used to demonstrate the results of known traffic upgrades or new development or, to try to decipher upcoming trends or problems. The "hotspots" listed below are based on preliminary analysis of one week's worth of data.

Conway Street, Between Route 5/10 and North St., -6.33%

The differences between the 1998 and the 1999 traffic counts are different by about sixty vehicles out of nine hundred. In this case, the 1998 count was higher. Conway Street off of Route 5/10 provides access by way of North Street to Pleasant Street and the two public schools in Town. The weekday average figures for the traffic counts show roughly equal volumes throughout the day except for afternoon peaks in 1998 between four and six p.m. This was probably caused by a school event in 1998 that required more pickups from school than normal.

Elm Street, Just East of North St., 3.57%

North Main Street, Between Route 5/10 & Rail Bridge, 9.46%

Sugarloaf Street, North of Route 116, 4.69%

All three of these counts were taken to monitor traffic volumes before and after the traffic signal was installed at the intersection of Sugarloaf Street and Rt. 116. The growth in traffic volumes are possibly explained by an increase in the number of people who choose to cut through the center of South Deerfield instead of using Routes 116 and 5/10. Prior to the addition of the traffic signal many commuters that needed to travel across the Sunderland Bridge were probably avoiding Sugarloaf Street because invariably the left turn onto Rt. 116 (southbound) resulted in a long delay in a multi-vehicle queue. However, now with the traffic light, there is much less of a delay from Sugarloaf Street. Commuters on Rt. 116 now must face a potential delay where, prior to the traffic light's construction, travel used to be relatively free flowing. In addition, traffic volumes recorded on Route 116 north (west) of Sugarloaf Street declined by an average of 0.50% after the signal's installation

Route 116, Sunderland Town Line, 6.12%

This increase in traffic volume may be explained by commuters favoring the Sunderland bridge over the Coolidge Bridge (between Northampton and Hadley), which has been experiencing increasing traffic congestion.

Route 116, Conway Town Line, 11.52%

This is a significant increase in the north and southbound traffic on Rt. 116 on the Conway town line and may be explained simply by Conway's population growth rate during the same time period. According to the Massachusetts Institute of Social and Economic Research's (MISER) mid-year estimates, Conway's population grew by nearly ten percent between 1993 and 1996. Other towns that have commuters traveling on Rt. 116 west and north of Conway, include Hawley, Ashfield, and Buckland.

Sugarloaf Street Extension, Whately Town Line, 6.90%

The marked increase in traffic flow on Sugarloaf Street Extension, which forms a crossroads with Sugarloaf Street and Route 116, may be the result of more people choosing to exit Rt. 116 by way of this road than further east, on South River Road. Commuters traveling north on Rt. 116 and wanting to travel towards Whately on South River Road, may be more inclined to go to the traffic light and take the Extension due to the protected left turn lane. The intersection of South River Road and Route 116 can be dangerous due to long queues of traffic and the speeds with which vehicles are traveling.

Not surprising, most of the roadways that measured an increase in traffic volumes may be utilized as major travel corridors by commuters out of, and into Deerfield. The trends have shifted, and more and more people seem to be using the center of Town as the fastest way to get to and from work. The Sugarloaf Street/Route 116 traffic light and the Coolidge Bridge reconstruction project will result in making the South Deerfield village center more congested. Deerfield must address the short and long-term issues that come with being a regional employment center and a nexus of major travel routes in the region.

Congestion in the village center may be addressed by making it less attractive to the hurried commuter through the use of traffic calming techniques. Traffic calming is a set of engineering solutions utilized in towns and cities throughout the country. By combining traffic calming with

pedestrian and bicycle facilities, South Deerfield may be able to maintain and enhance its small town atmosphere inviting more tourist traffic and at the same time discourage people from using the downtown area as an on ramp for Rt. 116 and points north.

Accident Analysis

During the summer of 1999 the FRCOG Planning Department undertook a study to identify locations where accidents were occurring in unusually high numbers with the intention of investigating potential corrective measures for these locations or evaluating the effectiveness of measures recently implemented. Traffic accidents are often unpredictable, unavoidable events. However, sometimes conditions exist that increase the chances for accidents to occur and these are often correctable. The vast majority of traffic accidents are the result of driver error, but often driver error is magnified by poor roadway or intersection design, or by inadequate traffic control measures. Although traffic accidents are random events, when crashes occur in high numbers at a particular location, there is probably a common reason for the accidents related to the design and/or signage of the road.

All accidents recorded by local or state police are forwarded to the Massachusetts Registry of Motor Vehicles, which logs each accident in a database. The FRCOG obtained access to the database for the three most recent years available, 1995 through 1997. The data was sorted by town and then by location. Records that described accidents that took place along road segments but did not adequately describe each event's exact location were discarded. The remaining records were sorted by individual intersection.

After grouping the accident records by individual intersection, the severity of the accidents were calculated using the Equivalent Property Damage Only (EPDO) rating system. This is a nationally accepted rating system, which assigns points to each accident based on its severity. There are three severity levels of accidents; property damage only, injury, and fatality. The EPDO ranking system assigns one (1) point to property damage only accidents, five (5) points to injury accidents, and ten (10) points to fatality accidents. Only one point category is assigned to a given accident. For example, an accident that involved three cars, resulting in all three vehicles receiving property damage and injuries to two occupants, would be classified as an injury accident and receive an EPDO rating of five (5). The EDPO rating were totaled for each intersection.

In previous accident studies conducted by the FRCOG, the EPDO rating system was the only measure used to rank the high accident intersections. However, using this measure alone does not accurately reflect the most hazardous intersections. A major factor in the number of accidents is the traffic volume traversing a location. As the traffic volume increases, there is a greater probability that an accident will occur. To better reflect this probability in ranking the most hazardous intersections, accident rates were calculated based on EPDO by Million Entering Vehicles (MEV). This method is described in the MassHighway, Highway Design Manual (1997 edition). The equation used in the MEV calculation is:

$$MEV_{(EPDO)} = \frac{1,000,000 \times EPDO}{365 \times T \times AADT}$$

Where: EPDO = Equivalent Property Damage Only Total Points
T = Time Frame of Analysis, years
AADT = Average Annual Daily Traffic Entering Intersection

Using the results of this calculation the intersections were ranked. Four intersections in Deerfield are listed in the top thirty (30) intersections for Franklin County. These intersections are:

- a) Conway Road. (Route 116)/Route 5/10;
- b) River Road (north)/Route 116;
- c) Route 116/Sugarloaf Street; and
- d) Elm Street/Route 5/10.

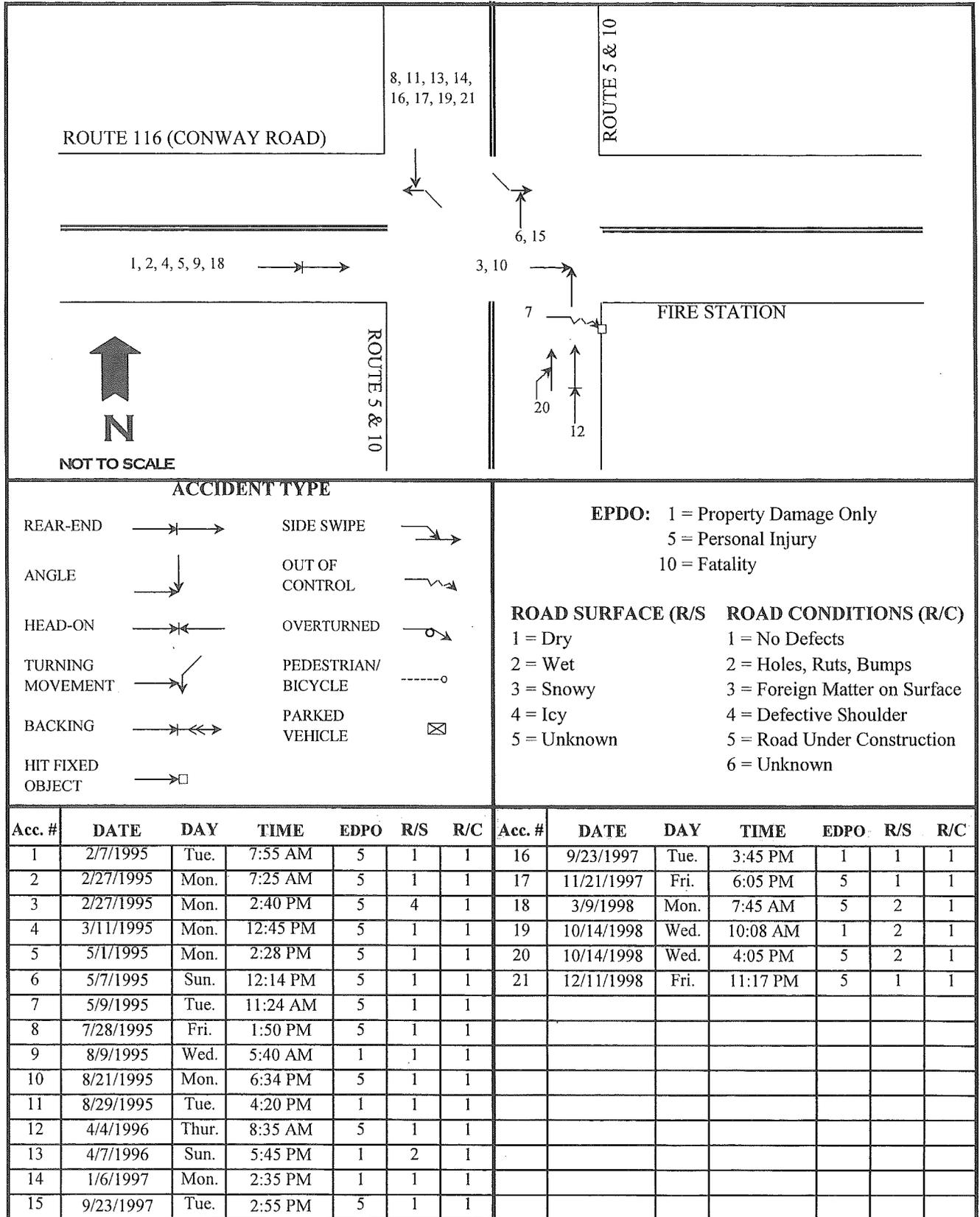
For each of the four intersections listed above the individual accident reports from 1995 through 1998 were reviewed at the Deerfield Police Department. From this review of the accident reports, collision diagrams were developed showing the accident type (rear-end, angle, head-on, etc.), date, time, and road conditions at the time of the accident.

Conway Road (Route 116)/Route 5/10 intersection

This intersection is listed as the twelfth most hazardous intersection in Franklin County based on MEV_{EPDO} rating for the years 1995 through 1997. Figure 5-2 shows the collision diagram for the years 1995 through 1998. A total of twenty-one (21) accidents had been recorded by the Deerfield Police Department during these four years resulting in an EPDO total of eighty-one (81). Over half (52% or eleven accidents) of the recorded accidents occurred in 1995, with all but two of these accidents resulting in an injury accident. Seven of these eleven accidents occurred before the intersection was reconstructed and a traffic signal was installed. Since the installation of the traffic signal, fourteen accidents have occurred. Four accidents occurred in the remainder of 1995, two accidents occurred in 1996 and four each in 1997 and 1998. Eight of these fourteen accidents were similar in nature in that they all involved a vehicle making a left turn from Route 5/10 north to Conway Road (Route 116) hitting or being hit by a vehicle going straight on Route 5/10 south. The majority of those left turning drivers received a citation either for failing to grant the right of way or making an improper turn.

The left turn movement for northbound Route 5/10 traffic receives a protected left turn (left turn arrow displayed and Route 5/10 southbound traffic receives red light) based on demand detected by sensors placed in the road. When this phase of the signals ends, the left arrow goes out but a solid green light remains displayed. At this time both the Route 5/10 southbound and northbound traffic receive a green light. Under this signal phase, Route 5/10 northbound, left turning vehicles must now grant the right of way to southbound traffic on Route 5/10. Further investigation into the signal timing needs to be done to assess whether the amount of time between the green arrow ending and the start of the full green for southbound traffic on Route 5/10 is too short. Increasing the time between these phases may reduce the number of conflicts between the two movements. From observations of this intersection, vehicles making the left turn often continue making the turn after the arrow signal goes out (in effect running a stop sign), which brings them into conflict with the Route 5/10 southbound traffic. This intersection will be analyzed further as part of the Route 5/10/116 Circulation Study being conducted by the FRCOG.

Figure 5-2: Collision Diagram 1995-1998, Conway Road (Route 116)/Route 5/10



Accidents 1-7 occurred when intersection was under stop control; and Accidents 8-21 occurred when intersection was under signal control.

River Road (north)/Route 116

This intersection is listed as the fifteenth most hazardous intersection in Franklin County based on MEV_{EPDO} rating for the years 1995 through 1997. Figure 5-3 shows the collision diagram for the years 1995 through 1998. Nineteen accidents had been recorded by the Deerfield Police Department during these four years, which resulted in an EPDO total of forty-three (43).

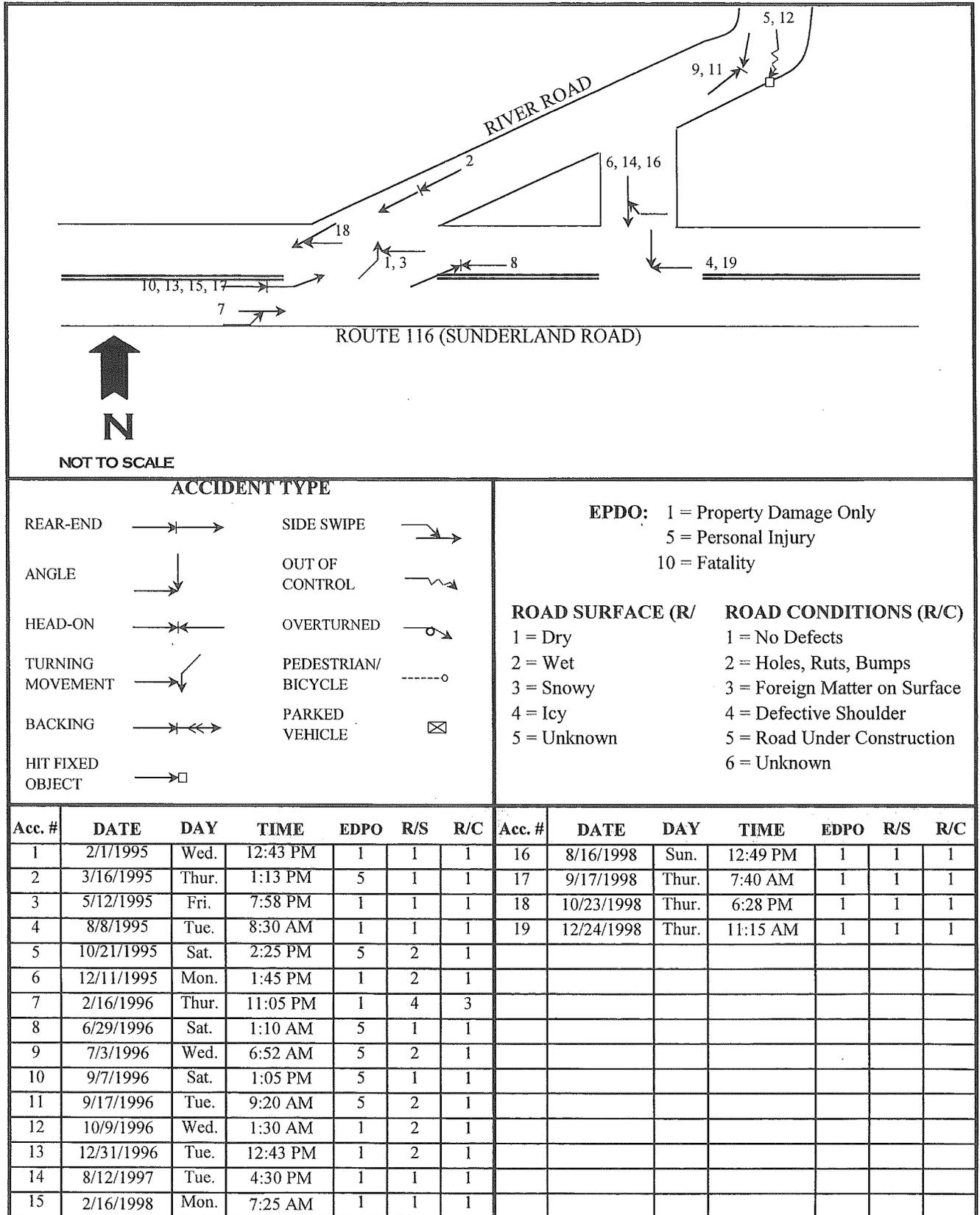
Four of the nineteen accidents occurred at the sharp bend just before the intersection. Two of the four involved single vehicles losing control at the corner in wet conditions striking the crash barrier on the northbound side of the road. The other two accidents were similar in nature in that they involved a vehicle heading south in wet conditions, but in these cases they struck vehicles in the northbound direction instead of the guardrail. All four of these accidents occurred in 1995 and 1996. No similar accidents have been recorded since then, which *may* coincide with the reconstruction of the road.

Seven of the nineteen accidents involved vehicles making a left turn from the southbound lane of Route 116 onto River Road (northbound). Four of these collisions resulted in rear-end type accidents with the following vehicles hitting the back of the turning vehicle. Based on the descriptions these accidents were the result of drivers following too close behind the left turning vehicle and being unable to take action in time. Two other accidents involved the left turning vehicle turning in front of oncoming vehicles.

As traffic volumes increase on Route 116 during the Coolidge Bridge reconstruction project, the potential for these types of accidents may increase since left turning vehicles will likely have to wait longer for gaps in the opposing traffic, placing them in a vulnerable location. These left turning drivers will be more likely to try and make turns in smaller gaps. It is unlikely that current left turn volumes would warrant the installation of a dedicated left turn lane at this location, but this accident pattern should continue to be monitored, especially throughout the period of the Coolidge Bridge reconstruction project. This intersection will receive further assessment as part of the Route 5/10 and Route 116 Circulation Study where the possibility of adding a dedicated left turn will be evaluated.

Three of the accidents involved collisions between right turning traffic from Route 116 northbound onto River Road and left turning vehicles from River Road. The first accident involved a vehicle with a snowplow making the left turn striking a vehicle waiting at the stop line. The second involved a tractor-trailer whose trailer struck a vehicle turning left onto River Road as the truck exited River Road. The third involved a vehicle with a boat trailer, which struck a vehicle waiting at the stop line as it made a right turn from the northbound lane of Route 116. These three accidents indicate that the turning radius for larger vehicles making turns into and out of River Road may not be sufficient to allow the movements to be made within the marked lanes. Due to the presently low traffic volumes on River Road, conflicts between these movements will be rare. This issue may need closer attention if traffic volumes on River Road increase.

Figure 5-3: Collision Diagram 1995-1998, River Road (north)/Route 116



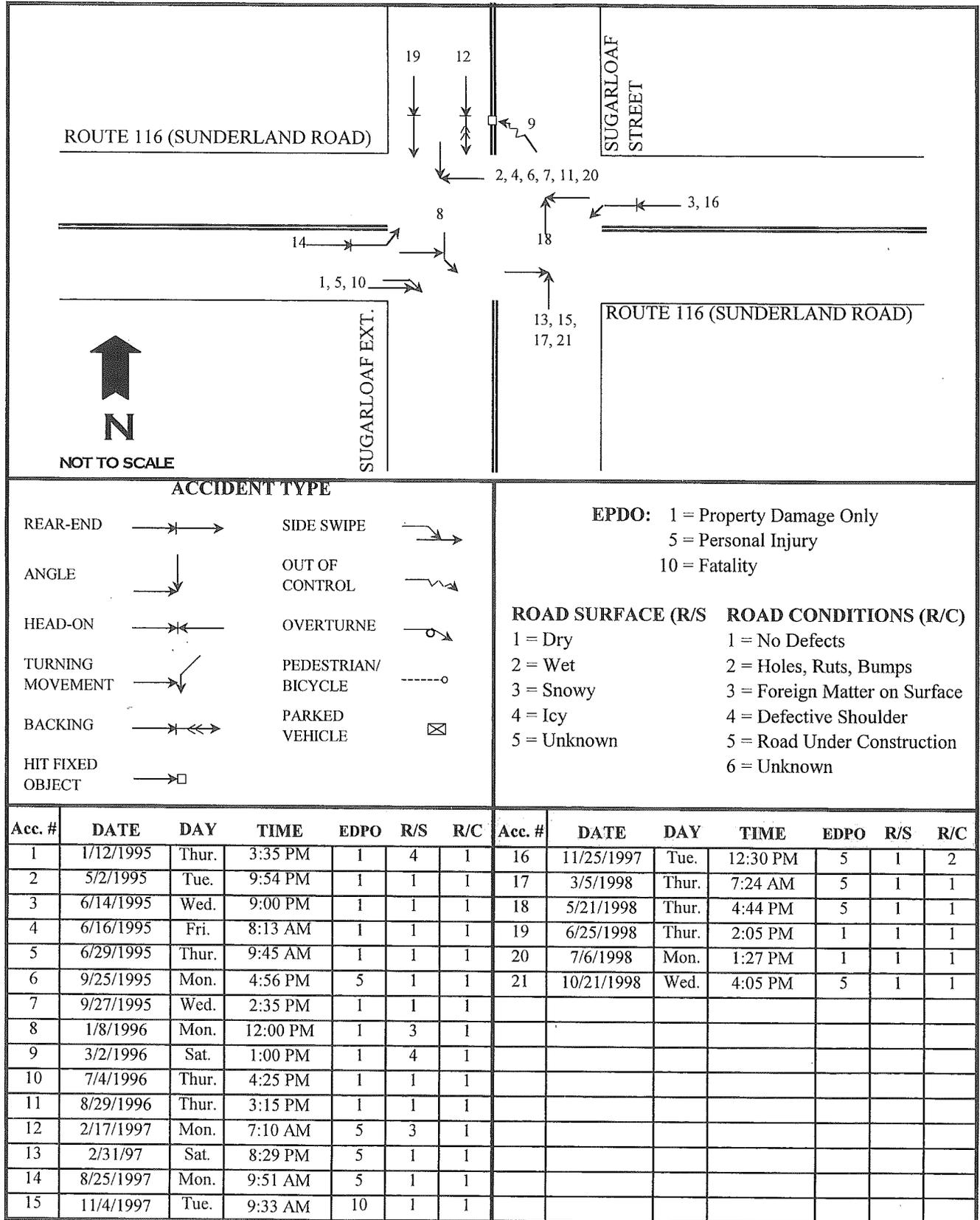
Route 116/Sugarloaf Street

This intersection is listed as the eighteenth most hazardous intersection in Franklin County based on MEV_{EPDO} rating for the years 1995 through 1997. Figure 5-4 shows the collision diagram for the years 1995 through 1998. A total of twenty-one (21) accidents were recorded by the Deerfield Police Department during these four years resulting in an EPDO of sixty-seven (67).

Twelve of these accidents involved vehicles crossing or turning onto, and colliding with vehicles on, Route 116. Five of this type of accident involved vehicles from Sugarloaf Street Extension, all of which occurred in 1997 and 1998 (2 and 3 respectively). One of these accidents resulted in a fatality and the other four involved at least one injury. The other seven accidents involved vehicles from Sugarloaf Street. Six of these accidents happened in 1995 and 1996 (4 and 2 respectively), with the remaining accident occurring in 1998. Only one of these seven accidents resulted in injury, with the other six resulting in property damage only. No reason is immediately apparent why accidents involving vehicles from Sugarloaf Street mainly occurred in 1995 and 1996 and those involving vehicles from Sugarloaf Street Extension did not occur before 1997.

This intersection was reconstructed during the summer of 1999 and a traffic signal installed. This should alleviate the conflicts that produced the majority of the accidents recorded at this intersection.

Figure 5-4: Collision Diagram 1995-1998, Route 116/Sugarloaf Street



Elm Street/Route 5/10

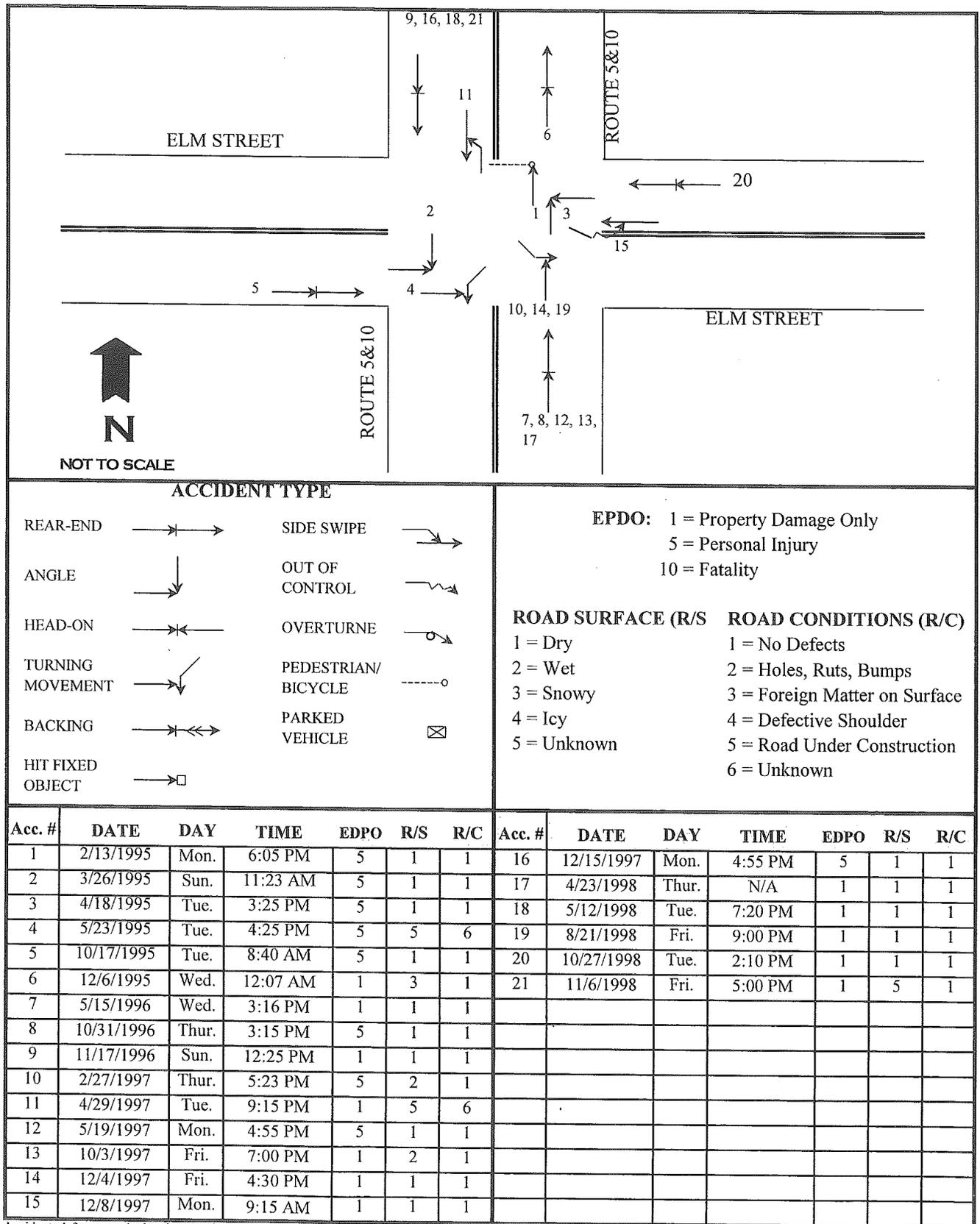
This intersection is listed as the twenty-first most hazardous intersection in Franklin County based on MEV_{EPDO} rating for the years 1995 through 1997. Figure 5-5 shows the collision diagram for the years 1995 through 1998. A total of twenty-one (21) accidents had been recorded by the Deerfield Police Department during these four years resulting in an EPDO total of fifty-seven (57).

The first three accidents occurred when this intersection had stop signs. Then the intersection was reconstructed during the spring of 1995 and a traffic signal was installed. Two thirds of the accidents that occurred after the traffic signal installation happened in 1997 and 1998. General increases in traffic volumes could be a factor in this increase. Yankee Candle, located off this intersection, has seen considerable growth in the last two to three years, but impacts from this growth cannot be directly attributed to this source. Over half of the accidents occurred during what would be termed off-peak periods of the year.

Over half (11 of 18) of the accidents, occurring after the traffic signal installation, involved a rear-end type accident at the stop line of each of the four approaches. All but two of this type of accident occurred on Route 5/10, four on the southbound arm and five on the northbound arm. Causes of this type of accident need further investigation. Contributing factors are likely driver inattention (increasing numbers of tourists unfamiliar with signals) combined with higher speeds and traffic volumes on this section of roadway (speed limit is 45 mph) combined with either too short or too long of a yellow light time as the signal changes from green to red. If the yellow light time is too short, vehicles will be forced to stop quickly, increasing the potential for following vehicles to not react as quickly. If the yellow light time is too long, following vehicles may have the expectation that the vehicle in front of them will continue through the intersection on the yellow light, when in fact it does not. FRCOG will be analyzing this intersection in the coming months as part of the circulation study.

Three accidents involved vehicles travelling southbound on Route 5/10, making a left turn onto Elm Street, and colliding with a vehicle heading north on Route 5/10. In two of these cases the driver making the left turn was cited for failing to grant the right of way. In the third case no citation was issued to either driver as each insisted they had the right of way. Although it is not specified in the accident reports, it is likely that the drivers making the left turns continued to make the turns after the green signal arrow ended. The left turn movement for the southbound Route 5/10 traffic receives a protected left turn (left turn arrow displayed and Route 5/10 northbound traffic receives a red light) based on demand detected by sensors placed in the pavement. When this phase of the signals ends the left arrow goes out but a solid green light remains displayed. At this time both the Route 5/10 northbound and southbound traffic receives a green light but, the southbound and left turning vehicles must now grant the right of way to the northbound traffic on Route 5/10. As traffic volumes increase specifically for this left turn movement, all vehicles may not be accommodated during the time allotted for the protected turn. Some of these vehicles may continue to make the turn after the end of the green arrow (in effect running a yield sign), coming into conflict with traffic heading north on Route 5/10. This type of accident should be monitored in the coming years, with possible signal timing changes being required to accommodate changes in traffic patterns.

Figure 5-5: Collision Diagram 1995-1998, Route 116/Sugarloaf Street



Accidents 1-3 occurred when intersection was under stop control; Accidents 4-21 occurred when intersection was under signal control; and Accident 16, Driver under the influence of alcohol.

Roadway Level of Service (LOS) Analysis

The Highway Capacity Manual provides a methodology for calculating the LOS for rural two lane roadways, which has been applied to segments of Route 5/10 and Route 116 within the Town. "Level of Service is a qualitative measure describing operational conditions within a traffic stream, generally described in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience and safety."² For two lane roads, LOS is a function of traffic volume to capacity, with the capacity of a roadway being calculated based on geometric and environmental conditions, such as lane and shoulder widths, terrain, percentage of "no passing zones," make-up of the traffic stream, and its directional split. LOS is calculated for peak flow traffic conditions and is used to identify sections of road, which are at or nearing capacity based on traffic volume, and/or experience congested conditions due to geometric parameters of the road's layout. The varying LOS levels are assigned letters A through F, which have the following generalized definitions:

- LOS A - signifies a road section where motorists are able to drive at their desired speeds (approaching an average of 60 mph in ideal conditions); delays incurred by slow-moving vehicles occur less than thirty percent (30%) of the time; demand for passing is well below capacity; and almost no platoons of three or more vehicles are observed.
- LOS B - signifies a road section where delays incurred by slow-moving vehicles occur up to forty-five percent (45%) of the time; average speeds in ideal conditions exceed 55 mph; demand for passing required to maintain desired speed approximately equals the passing capacity; and the number of platoons forming in the traffic stream increases significantly.
- LOS C - signifies a road section where delays occur sixty percent (60%) of the time; average speeds under ideal conditions exceed 52 mph; demand for passing is in excess of passing capacity; and platoons are prevalent, commonly chaining together and although the traffic flow is stable, it is becoming susceptible to congestion due to turning and slow-moving vehicles.
- LOS D - signifies a road section where the two opposing traffic streams essentially begin to operate separately as passing becomes extremely difficult; average speeds under ideal conditions approach 50 mph even though platoon sizes reach between five and ten vehicles; motorists incur delays up to seventy-five (75%) of the time; and turning or slow-moving vehicles cause major shock waves in the traffic stream.
- LOS E - signifies a road section where speeds under ideal conditions drop below 50 mph and are much lower under less than ideal conditions where passing becomes virtually impossible; delays are incurred greater than seventy-five percent (75%) of the time and "platooning" becomes intense as slower vehicles or other interruptions are encountered.
- LOS F - signifies a road section where traffic demand has exceeded capacity resulting in heavily congested flow.

In general, it is desirable to maintain traffic conditions at a LOS C or better.

Table 5-5 gives the results of the LOS analysis conducted using the Highway Capacity Software. It should be noted that these LOS conditions reflect the peak traffic conditions, i.e. reflecting the largest one-hour recorded traffic volume on the roadway. It should also be noted that the LOS calculations do not take into account the pavement conditions of each of the road sections. This information is also illustrated on the Transportation Map.

² Highway Capacity Manual 1994, Transportation Research Board

Table 5-5: Rural Two Lane Roadway Level of Service (LOS) Analysis Results

Route/Road	From	To	Volume/Capacity Ratio	LOS
Route 5/10	Greenfield Town Line	Old Deerfield Road	0.50	D
Route 5/10	Old Deerfield Road	North Main Street	0.44	D
Route 5/10	North Main Street	Route 116 (North)	0.37	D
Route 116 (North)	Route 5/10	I-91 Bridge	0.39	D
Route 116 (North)	I-91 Bridge	Conway Town Line	0.29	C
Route 116 (South)	Whately Town Line	Sugarloaf Street	0.50	D
Route 116 (South)	Sugarloaf Street	Sunderland Town Line	0.62	E

Due to the closeness of the traffic signals along the stretch of Route 5/10 between Route 116 north and south this method of LOS analysis cannot be conducted. The LOS of this section will primarily be dictated by the service provided by these three traffic signals. The required information to conduct such an analysis is not available at this time.

The results of the analysis indicate that Route 5/10 from the Greenfield Town Line to the intersection with Route 116 (North) is operating at LOS D during the peak observed hour. At this LOS, travel speeds may still be relatively high, probably around the speed limit, but drivers will not be able to maintain their desired speeds because of the limited number of passing opportunities. Passing opportunities are limited due to the volume of opposing traffic causing platoons of between five and ten vehicles.

Route 116 (North) past the I-91 on-ramp to the Conway Town Line is operating at a LOS C during the peak observed hour. This section of roadway sees the lowest volumes of all the routes analyzed and therefore the best LOS level.

Route 116 (South) from the Whately Town Line to the Sunderland Town Line sees the highest traffic volumes of the routes analyzed. From the Whately Town Line to Sugarloaf Street LOS conditions are similar to those described for Route 5/10, namely LOS D. From Sugarloaf Street to the Sunderland Town Line, Route 116 is operating at a LOS E during the peak observed hour. This section of roadway experiences heavy traffic volumes during the peak period. Traffic may still flow relatively smoothly, but long platoons of vehicles will develop. Turning and slow vehicles will have a detrimental effect on the traffic flow, causing vehicle speeds to slow dramatically.

The LOS analysis may demonstrate a need for increased precautions at key locations around Deerfield. Route 5/10 and Rte. 116 are currently rated "D" and "E," respectively. Even though it is important to know that the volume figures were recorded during the peak usage periods, they are likely to increase.

The development of portions of the Technology Park by Yankee Candle, the Coolidge Bridge reconstruction, and normal population growth will raise volume levels. Yankee Candle plans on constructing its main distribution center and an office building complex on land located opposite Channing L. Bete. Although the current subdivision plan already calls for two curb cuts for the entire Park, the Select Board and Planning Board should work to minimize the total number of curb cuts along Route 5/10 and Route 116. Every curb cut represents additional congestion caused by slowing, stopping, and turning traffic onto and off the main highways. The nature of the development will also determine the types and timing of potential traffic congestion. Yankee Candle's distribution center will probably produce truck traffic throughout the day while the office

complex will likely result in an increase in the number of commuters using Route 5/10 during the peak usage periods. The Coolidge Bridge reconstruction project will probably increase traffic volumes throughout the day but especially during the morning and afternoon commute. Finally, normal population growth in Deerfield and surrounding towns will likely result in additional traffic volume increases over time. Development and the periodic rehabilitation of other vital resources within the regional transportation network will cause traffic volumes on Rte. 5/10, Route 116, and on other major roads and collectors to increase. As volumes go up, the level of service will fall unless capacity can be improved.

The capacity of a road may be increased with expansion. This brings up a key issue for Old Deerfield and for all Deerfield residents. How can the town of Deerfield work cooperatively with MassHighway to ensure that any future reconstruction and expansion of Route 5/10 is done to protect farmland, natural resource, open space, historic, and scenic values.

Another way of reducing future traffic volume without increasing the capacity of the road system is to encourage land uses which minimize traffic generation along the main highway corridors. For instance, some land uses generate greater volumes of traffic. A supermarket is an example of a high traffic generator. A small to medium sized light manufacturing firm may be a light traffic generator. Open space like farmland is a very low traffic generator. By protecting farmland along Route 5/10 and by limiting development to low traffic generators, Deerfield and MassHighway would hopefully avoid expansion.

Travel-Time Run Results

Travel-time runs are generally conducted to determine the efficiency and ability of a route to carry traffic, to identify problem locations along a route, and to provide input to evaluate trends over time. The travel time runs conducted in Deerfield were conducted using the "Average-car technique." This requires a vehicle to be driven at the average speed of vehicles in the traffic stream. Timing stations, which are generally intersections or points where speeds are likely to change, are identified along the route. The time to travel between each timing station and delays incurred at the timing stations are noted during each travel time run on the route. The routes are driven alternately in each direction during the study period.

Two travel time routes have been surveyed. The two routes are:

1. Route 5/10/Route 116: Starts at Ripka's Farm Stand on Route 5/10 and continues on Route 5/10 to Route 116 (South), where it heads south on Route 116 ending at the intersection with River Road South.
2. Route 5/10/South Deerfield/116: Starts at Ripka's Farm Stand on Route 5/10, turns onto North Main Street and continues to the center of Town, where it picks up Sugarloaf Street to Route 116. The route ends at the intersection of Route 116 and River Road South.

In 1997, the two routes were first identified and the travel time runs were conducted as the installation of the traffic signal at the intersection of Route 116 and Sugarloaf Street was being designed. Following the installation of this signal more traffic may be attracted to use Sugarloaf Street to get to and from I-91 (north) and Route 5/10 to Greenfield due to the reduced delays from

Sugarloaf Street. Travel time runs for these routes were re-conducted in 1999 before construction of the lights began and will be done again in 2000. The 1997 travel time runs were conducted during the two hour period of 3:00 p.m. and 5:00 p.m. Traffic counts conducted after this indicated that the peak period for traffic volumes was between 4:00 p.m. and 6:00 p.m. Therefore the 1999 runs were conducted during this time period. Each route was driven in each direction between eight and nine times.

Table 5-6 provides a summary of the results from 1997 and 1999. Figures showing the speed and the delay information along the routes as well as tables from each individual run are also located in the Appendix.

Table 5-6: Comparison of 1997 and 1999 Travel Time Runs

Route	Direction	Average Time (minutes)		Average Speed (mph)	
		1997	1999	1997	1999
Route 5/10/116	Northbound	5.48	5.12	39	42
	Southbound	5.47	5.64	39	38
Route 5/10 South Deerfield/116	Northbound	5.55	5.10	33	36
	Southbound	6.20	7.27	30	27

This summary shows that for both routes the average travel time in 1999 for the northbound direction was shorter and for the southbound direction it was longer. This is most likely due to varying traffic patterns given the slightly different times the runs were conducted. The results show that in both 1997 and 1999, the travel times in the northbound direction for both routes are within a few seconds of each other, 5.48 and 5.55 minutes in 1997 and 5.12 and 5.10 minutes in 1999. The second route through South Deerfield is a ½ mile shorter making it a more attractive route for northbound traffic. In the southbound direction the travel time was between ¾ and 1½ minutes longer through South Deerfield. The majority of this time was due to delays incurred at the intersection of Sugarloaf Street and Route 116, which at the time of the runs did not have a traffic signal. This difference is likely to narrow following the installation of the light as delays will be reduced on Sugarloaf Street and increased on Route 116.

Railroad Resources

Deerfield's railroad resources are included in a separate discussion section for two reasons. First, the relationship between environmental quality of the Deerfield River and the safety of the east-west GRS rail line has been addressed in other chapters. Secondly, in Chapter 6, Economic Development land nearby the East Deerfield Railyard is mentioned as a potential location for economic development and increased rail activity in support of Deerfield's industries.

The GRS east-west line is considered a major line with six to ten trains per day carrying six hundred to one thousand cars. It also carries hazardous materials. The Guilford Rail System maintains the rail line that follows the Deerfield River from the Hoosac Tunnel to Greenfield with a crew out of Shelburne Falls. In addition, the Federal Railroad Administration inspects each major line every year. Accidents can result from human carelessness and from failures in the track's geometry. The

Deerfield Select Board may want to discuss with GRS its maintenance regime on this stretch of track.

The East Deerfield Railyard is currently one of GRS' main classification rail yards in New England especially since their yard in Mechanicsville closed recently. The only other yard like it is located in Maine. A classification yard acts like a post office, splitting up lengths of containers, and rerouting containers into new train lengths based on their final destination. The most feasible additional role for the East Deerfield Railyard in the future is as a transloading facility. A transloading facility would allow companies to move material from train containers to trucks. It would require additional storage space and equipment at East Deerfield but it could be done. It could still be used as a classification yard. For prospective rail dependent businesses, it would be difficult to locate near the yard. North and east of the yard is wetland, and the commercially zoned land to the south is uphill. These businesses would typically want to transport material from the container directly to the plant floor, not into a truck for five minutes of transport uphill. Therefore, the East Deerfield Railyard may be a future transloading facility as well as an important classification yard. One result of a new transloading yard would be increased traffic in and out of the rail yard, on Route 5/10, and in Greenfield. A feasibility study exploring the entire rail yard and alternatives for its redevelopment would be worthwhile for the Town of Deerfield to pursue.

Bridges

Bridges are ranked by the American Association of State and Highway Transportation Officials (AASHTO) on a scale from one to a hundred. It is a complex rating system that considers structure, number of cars (traffic volume), and whether it is a national defense bridge. If the rating is less than fifty, the bridge is eligible for replacement; fifty to seventy-five or eighty and the bridge is eligible for reconstruction; and ratings greater than seventy-five or eighty means the bridge is ineligible for funds. The deficiency rating in the last column is based on the AASHTO ratings. Functionally obsolete means that a bridge is structurally sound but of an old design that is inadequate for current traffic volumes or lane widths. Structurally deficient means that the bridge needs repairs of some kind. Finally if a bridge is ineligible for funds, it means that it is in good condition.

Table 5-7: Deerfield's Bridge Statistics, Dec. 1999

AASHTO Rating	Road/ Location	Bridge Crosses	Owner	Functional Class	Year Built	Year Rebuilt	Deficiency
50	Main Street	B&M R.R.	State	Rural Major Collector	1903	1946	Functionally Obsolete
55	I 91 Northbound	Deerfield River and Stillwater Road	State	Interstate	1963		Functionally Obsolete
56	I 91 Southbound	Deerfield River and Stillwater Road	State	Interstate	1963		Functionally Obsolete
57	McClelland Farm Road	B&M R.R.	State	Local Road	1909		Structurally Deficient
58	West Deerfield Upper Road	Deerfield River	Town	Rural Minor Collector	1950		

79	I 91 Southbound	West Deerfield Lower Road	State	Interstate	1964		Functionally Obsolete
80	Whately Road	Bloody Brook	Town	Rural Minor Collector	1950		
80	Rte. 116, Conway Road	Mill River	State	Rural Major Collector	1917	1933	
81	Whately Road	Bloody Brook	Town	Rural Major Collector	1965		
81	Rte. 116, Conway Road	I 91	State	Rural Major Collector	1965		
83	Lee Road	I 91	State	Local Road	1963		
85	Rte. 116	Connecticut River	State	Rural Minor Arterial	1937		
94	Rte.5/10	Deerfield River	State	Rural Major Collector	1932		
96	I 91 North and Southbound	Bloody Brook	State	Interstate	1965		

Based on the information provided in Table 5-7, the first five to eight bridges listed are eligible for reconstruction. Only one, the bridge over West Deerfield Upper Road, is owned by the Town.

Recommendations

- Conduct a traffic flow study of the South Deerfield Village center roads including Conway Street, and the four-way intersection of Elm, Sugarloaf, and the Main Streets and determine the best ways for managing the increasing traffic.
- Encourage land uses, which minimize traffic generation and support open space protection efforts.
- Request that the Recreation Committee work with the Franklin Regional Council of Governments to explore and designate an appropriate bicycle route that connects Old Deerfield with the South Deerfield village center including a safe crossing of Route 5/10.
- Amend the Zoning Bylaws to encourage shared curb cuts and low traffic generating land uses along Route 5/10 to minimize congestion caused by vehicles slowing and turning off and onto the highway:
- Ensure that all new commercial and industrial development along Route 5/10 addresses the impacts of their construction on the drainage patterns of abutting lands.
- Support the improvement of pedestrian facilities and public transit options in the South Deerfield village center.
- Support the Town of Deerfield's application for Public Works and Economic Development grant funding to pay for the raising of the railroad bridge off of River Road in East Deerfield. The raised bridge would allow truck traffic to enter the rail yard near the Greenfield Town line. This

would eliminate the truck traffic currently using the section of River Road north of the intersection with Route 116, which is predominantly of residential and agricultural use.

- Initiate communication with Guilford Rail Systems to discuss the Town of Deerfield's concerns regarding the safety of the railroad tracks that run alongside the Deerfield River to ensure that adequate inspection, maintenance, and repair procedures are being followed.

CHAPTER

6

ECONOMIC DEVELOPMENT

Historically, the dominant industries in Deerfield's economy have been agriculture, manufacturing, and education. The fertile floodplain soils of the Deerfield and Connecticut Rivers and their tributaries helped to fuel early economic growth by providing both soil nutrients and water power. In the 1700's, Deerfield's number one industry was agriculture. In the 1800's, the Town continued to prosper as the region's hub for farming products. South Deerfield and Cheapside, then a part of Deerfield, developed into early industrial centers. In the middle part of the twentieth century, from 1915 to 1940, private educational institutions were Deerfield's main employers. Now at the end of this century, Deerfield has a diverse economy providing residents with numerous employment opportunities, goods and services, and consistently moderate property taxes. In addition, Deerfield is a regional employment center primarily for people in Franklin and Hampshire Counties.

Economic development concerns were included in the 1999 Community Survey. Overall, fifty-eight percent (58%) of the survey respondents supported both commercial and industrial development in Deerfield, while twenty three percent (23%) opposed it. The types of industries and businesses favored and opposed were also included in the survey. Respondents that favored commercial and industrial development in Deerfield supported agricultural businesses, professional offices, and light industry that emphasized non-manufacturing industries as described in Table 6-1.

Table 6-1: Types of Businesses Supported by Survey Respondents Favoring Commercial and Industrial Development in Deerfield

Type of Business or Industry	Percent in Favor	Percent Opposed	Percent Unsure
Farming: dairy, truck, nurseries, aquaculture	90 %	3 %	7 %
Business/professional offices	83 %	8 %	9 %
Light industry that emphasizes non-manufacturing industries	76 %	13 %	11 %
Retail establishments	67 %	19 %	15 %
Tourist and Recreation Attraction/Services	64 %	21 %	16 %
Small/moderate sized manufacturers	61 %	19 %	20 %

Source: 1999 Open Space Plan Update Survey Analysis.

Community survey respondents expressed their desires and concerns about future economic development. Clearly, from the table above, the types of businesses and industries most favored by respondents were farming and business and professional offices. Other development favored by residents were light industries that did not emphasize manufacturing. Survey respondents also expressed their concerns about

negative impacts commercial and economic development may cause along Route 5/10. The top three concerns were traffic issues (congestion and public safety), loss of scenic character, and loss of farmland.

This chapter presents information on Deerfield's economy and main economic development issues, and recommendations for addressing these issues. As in the previous chapters, the Master Planning Committee developed the economic development objectives below using the community survey results as a guide.

Goal:

- To support and promote commercial and industrial development that will maintain existing jobs and provide new employment opportunities, which are compatible with Deerfield's environment and historic character, and which have minimal impacts upon existing agricultural land.

Objectives:

- Encourage the development of local businesses which can be integrated into the community without adverse environmental impacts including agricultural operations (farming, specialty food products, nurseries), forestry, home based businesses, restaurants, artisans, and professional offices.
- Review land available for new commercial and industrial development and determine if zoning districts are compatible with the protection of farmland and environmental resources.
- Encourage a mix of businesses within the South Deerfield Village district, which provide services and products for both residents and tourists.
- Support retailers that sell local produce and products.

Demographics & Labor Force Statistics

Demographics

Understanding Deerfield's economic well being must include assessing certain characteristics of the population, approached within the context of the larger region, in this case, Franklin County. Statistics that describe Deerfield residents are important to

economists for two reasons. Statistics that describe Deerfield's population and its trends can help Town officials manage fiscal resources. The second reason population figures are important is that they can describe trends in the local and regional labor force. Economic development implies an expansion of production, employment, and annual payroll. However, for a business or industry to expand or want to locate in Deerfield, it usually means that additional people will need to be hired. Having those additional available workers in Deerfield and the region is an important consideration for a prospective business or an existing enterprise interested in expanding.

Deerfield is a regional employment center providing jobs for Deerfield residents and especially for residents of other towns in Franklin County. In 1990, according to the U.S. Census, nine hundred and seventy-one (971) or thirty-four percent (34%) of the total number of Deerfield residents that worked in that year did so in Town. The rest worked in almost equal amounts in Franklin and Hampshire counties.

According to the 1990 Census of Population & Housing, Journey to Work figures, Deerfield's employers provided jobs for three thousand, three hundred and fifty-four (3,354) workers. As was stated above, nine hundred and seventy-one (971) of those workers were Deerfield residents or twenty-nine percent (29%) of Deerfield's total employment. Another thirty-two percent (32%) came from other towns in Franklin County namely, Greenfield, Montague, Whately, Conway and Sunderland. Thirteen percent (13%) came from Hampshire County towns including Northampton, Hatfield, Amherst, and Easthampton.

Demographics are used here for two main purposes. First they describe the population size and characteristics including growth, which helps to forecast the need for municipal services. They also describe the labor force of the Town and the region. According to the Massachusetts Institute of Social and Economic Research's (M.I.S.E.R.), 1997 mid-year estimates, there were five thousand, four hundred and fifty-four (5,454) residents in Deerfield. How has the number of Deerfield residents changed in the past twenty years, and how is it projected to increase, and at what rate compared to the region? The answers to these questions are important because they help forecast increasing residential development and the taxes needed to support new growth. If the number of residents in Deerfield is increasing, there will be a greater demand for municipal and district services including road maintenance, police, fire, water and sewer, and especially schools.

Many factors that affect the economic development of Deerfield are intertwined. One relationship that involves residential development, land use, and property taxes, illustrates the impetus for pursuing economic development. Commercial and industrial property is often very valuable and the property taxes generated every year help pay for a large portion of the goods and services for which the Town of Deerfield is responsible. In fact for every dollar that's raised by commercial and industrial property taxes, only thirty-eight cents are spent on services relating to that property (American Farmlands Trust; 1991). Residential development, on the other hand, costs one dollar and sixteen cents in services for every dollar raised in property taxes. The ties between residential and economic

development are real. However, planning economic development to counteract the negative fiscal impact of residential development should not overlook the benefits of farming and open space protection. Similar to industrial and commercial development, only twenty-nine cents are spent on services for every dollar of revenue generated from taxes paid on farmland. Accordingly, farmland can play an important role in both balancing the tax base and in protecting natural resources.

In November of 1999, M.I.S.E.R. released their population estimates of Massachusetts Cities, Towns, and Counties. These included population figures through July 1, 1997. Based on their estimates Deerfield's population increased by almost nine percent (8.7%) between 1990 and 1997. That is equal to four hundred and thirty-six (436) new residents in seven years. During the same time frame the County's population grew by just under two percent (1.9%) and the State's by three and a half percent (3.5%). Deerfield has the fourth highest population of all towns in Franklin County and is among the fastest growing communities in the region.

According to M.I.S.E.R. estimates (*see Table 6-2 below*), Deerfield will see a fourteen percent (14%) increase in population between 1990 and 2010, which is well beyond both the County and the State's population growth rate. Franklin County's population growth rate is projected to decline from the previous two decades but is still significant considering the numbers of new residents involved.

Table 6-2: Population Growth and Projections 1970-2010

	Population Growth, 1970-1990 (# of People)	Percent Growth, 1970-1990	Population Growth Projections, 1990-2010 (# of People)	Percent Change, 1990-2010
Massachusetts	329,150	+5.8%	704,179	+11.70%
Franklin County	10,882	+18.4%	8,098	+11.60%
Deerfield	501	+11.1%	701	+14.00%

Sources: 1970-1990 data from the U.S. Census Bureau Decennial Census of Population & Housing; Population Growth Projections from the Massachusetts Institute of Social and Economic Research (M.I.S.E.R.), August 1999.

It is important to be able to differentiate the age groups of residents whose numbers have been either increasing or decreasing. The rise and fall in the number of people in different age groups (called cohorts) over time can affect demand for different municipal services including schools and housing. It can also impact the number of people in the labor pool available to local businesses. Finally, predicting the rise and fall of particular age groups allows Town officials to forecast needs with respect to elder housing services.

According to the Table 6-3, the numbers of Massachusetts residents in the younger and older cohorts have been increasing between 1990 and 1995 while the population changes of other age groups during the same period are experiencing slow growth or are declining. There were more young people (0-19 years old), fewer young to middle aged adults (20-44

years old), and more middle to elder aged residents (45-65+ cohort) between 1990 and 1995. Franklin County, as a whole, had a very similar track record except for its elder numbers, which decreased. Deerfield appears to follow these trends. Its population in the young person (0-19 years) and the elder aged (65+ years) cohorts increased by roughly three percent (3%) and four percent (4%), respectively. Although the growth rate in the younger cohort is less than the State's, it is still over three times the County average. An increase in the young person (0-19 years) cohort may suggest increases in educational costs.

Table 6-3: Number of People by Age Cohort Between 1990 and 1995 in Massachusetts, Franklin County, and in Deerfield

Age Cohort	Massachusetts		% Change	Franklin County		% Change	Deerfield		% Change
	1990	1995		1990	1995		1990	1995	
0-19 years	1,475,100	1,586,312	+7.5%	19,015	19,177	+0.8%	1,216	1,250	+2.8%
20-44 years	2,533,456	2,526,368	-0.3%	28,556	26,719	-6.4%	2,017	1,932	-4.2%
45-64 years	1,115,150	1,233,156	+10.6%	12,348	14,901	+20.7%	1,045	1,314	+25.7%
65+ years	819,284	826,058	+0.8%	10,173	10,095	-0.8%	691	721	+4.3%

Source: Massachusetts Institute of Social and Economic Research (M.I.S.E.R.) Population Estimates, November 1999.

The data in Table 6-3 above also describes two other trends. There are a larger number of elders in Deerfield and the growth rate of this cohort is increasing, while in the County the number of elders are decreasing. This could mean a greater demand in the future for elder housing in Deerfield. Another trend relates more specifically to the labor force. Deerfield's work force is getting older. As compared to the County, there are a larger number of Deerfield residents in the middle-aged cohort (45-64 years). It is important to understand characteristics of the local and regional labor markets. If there are more people in Deerfield and the region that are able to work, local and incoming businesses are more likely to be able to hire local and regional workers as they expand.

Table 6-4: Mean Household Income, Per Capita Income, and Percentage Below Poverty Level in 1990 for Deerfield Compared to Franklin County and the State

	Median Household Income	Per Capita Income	Percentage Below Poverty Level*
Deerfield	\$36,004	\$17,526	2.6%
Franklin County	\$30,350	\$14,508	9.6%
Massachusetts	\$36,950	\$17,230	8.9%

Source: U.S. Census Bureau, 1990 Census of Population & Housing.

* Persons living below poverty level for whom the poverty status has been determined.

There are other population characteristics that help to describe the local and regional labor force. The figures in Table 6-4 above, illustrate the relative prosperity of households in Deerfield as compared to the County and the State. Deerfield households earn more income than the County average and slightly less than the State average. Per capita income is equal to the total income earned by all of Deerfield's residents divided by the

total number of men, women, and children in Deerfield. The fact that Deerfield has a high per capita income may be accounted for by the many good paying jobs provided by major employers.

Labor Force

Another factor that describes the local and regional labor force is its educational attainment. From a business owner’s perspective it demonstrates the ability of a community to provide labor and expertise to an existing or incoming venture. It could be one of the many factors in the decision of a company to stay in, or relocate to, Deerfield. The percentage of residents that have a high school diploma, or a Bachelor's degree or higher is greater in Deerfield than in Franklin County, and in the State. This demonstrates that Deerfield has a highly educated work force.

Table 6-5: Educational Attainment for Adults as Compared to the State in 1990

Highest Level of Educational Attainment for Adults		
	High School Diploma or Higher	Bachelors Degree or Higher
Deerfield	88.4%	32.2%
Franklin County	82.4%	24.2%
Massachusetts	80.0%	27.2%

Source: U.S. Census Bureau, 1990 Census of Population & Housing.

To a prospective business owner considering locating in Deerfield, knowing that there is a relatively prosperous, well educated labor force in the Town and region would be helpful. It would be important to understand the current and historic availability of that labor force to new employment opportunities. Table 6-6 shows that the number of Deerfield residents who are employed increased by six and a half percent (6.5%) between 1992 and 1998. The table also shows that the unemployment rate for Deerfield residents declined from six percent (6.3%) to just under three percent (2.9%) during the same period. In Franklin County during the same time period, employment jumped by nearly eight percent (7.8%) while the unemployment rate in 1998 was just under four percent (3.9%). The key figure here is the difference in the unemployment figures. The County figure is slightly greater than the State unemployment rate of just over three percent (3.3%), which means that the County has a greater portion of their labor force available for employment than in the State. Overall, the unemployment rates are low indicating that additional workers may need to move into or travel to the region to support the labor force requirements of expanding businesses.

Table 6-6: Labor Force Employment and Unemployment Rate in Deerfield 1992-1997

	1992	1993	1994	1995	1996	1997	1998	1992-1998 Change	% Change
Number of People in the Labor Force and Employed	2,759	2,809	2,908	2,815	2,816	2,861	2,939	+180	+6.5%
Unemployment Rate	6.3%	5.1%	5.0%	4.2%	3.0%	3.3%	2.9%	-3.4	N/A

Source: Massachusetts Division of Employment and Training; March 1999, Local Area Unemployment Statistics.

Are there enough workers with the necessary skills in the regional labor pool to satisfy the needs of Deerfield businesses interested in expanding? The size of the immediately available labor pool may be estimated by adding together the total number of unemployed persons in Franklin and Hampshire Counties. In 1990 thirty-two percent (32%) of Deerfield's total employment came from other towns in Franklin County and thirteen percent (13%) came from Hampshire County towns. Another twenty-six percent (26%) arrived to work in Deerfield having left other counties and states. Assuming that the majority of Deerfield's employees aren't traveling from further away than Hampden County, the gross available labor pool would be over fifteen thousand workers.

Table 6-7: Gross Labor Force Statistics by County in 1998

Geography	Labor Force	Employed Persons	Unemployed Persons	Unemployment Rate
Franklin County	37,545	35,907	1,638	4.4%
Hampshire County	80,367	77,617	2,750	3.4%
Hampden County	212,051	201,206	10,845	5.1%
Total Regional Labor Pool	329,963	314,730	15,233	4.8%

Source: Massachusetts Division of Employment and Training, 2000, Local Area Unemployment Statistics.

The labor force statistics above illustrate the labor pool within the three counties. However, it is difficult to determine which of these available workers have the skills Deerfield employers require. In 1997, FRCOG mailed an employer survey to Franklin County businesses. Overall, of the seventy-seven respondents, almost one third reported that they had plans to expand within twelve months and another third said they would bring on new employees in two to five years. Half of the respondents reported difficulty in finding skilled employees. The type of skills these businesses were looking for varied, though health professionals, machinists, and machine operators were most in demand.

Deerfield's businesses are fortuitous to be located in a region that has access to five colleges and three vocational/technical schools. The five colleges provide potential employees in the high technology fields including engineering and health sciences. The vocational and technical schools represent an opportunity for the business community to ensure an ample supply of skilled employees to fill vital positions. A close relationship between the business community and higher education in the region could help alleviate the shortage of skilled workers that are in demand.

Employment Sectors & the Local Economy

The local economy represents the relationship between existing industries and businesses, their customers, the municipal services provided, labor, capital, and natural resources at the local, regional, national, and global scales. Judging the well-being of Deerfield's economy can be based on different perspectives. Some may base their judgement on the residential property tax, which at its fiscal year 2000 level (\$15.00) was ranked ninth lowest in the County. Others may view the number of businesses and industries that are located in Deerfield as a good measure of the economy. Some may see the ever present demand for prime single family housing as a sign that Deerfield is growing. Finally some people may look further into the future with concern wondering how the delicate balance between economic growth and their small town quality of living can be sustained.

Economic development planning in the Deerfield Master Plan should follow the community's objectives. Briefly these are:

- a) Encourage the development of local businesses which can be integrated into the community without adverse environmental impacts including agricultural operations, forestry, home based businesses, restaurants, artisans, and professional offices;
- b) Review land available for new commercial and industrial development and determine if zoning districts are compatible with the protection of farmland and environmental resources;
- c) Encourage a mix of businesses within the South Deerfield village district, which provide services and products for both residents and tourists; and
- d) Support retailers that sell local produce and products.

Encouraging local business development is an important objective. How should the Town prioritize their efforts? There are at least four factors that should be considered. First, which of the industrial sectors or, types of businesses are growing faster in Deerfield than compared to the County and the State. Secondly, it is important to know how employment is spread throughout the economy, in big businesses or small. Third, it is important to determine the quality of the jobs provided by these employers. Are most of the jobs provided part time or full time? Finally, it would be helpful to know local businesses' requirements for expansion.

Employment Sectors

Economists use a classification system to compare the performances of similar types of economic activities in different geographical locations. The North American Industry Classification System (N.A.I.C.S), published by the Executive Office of the President's Office of Management and Budget in 1997, organized all economic activities into general categories. The NAICS classified all economic activities into twenty sectors. The seven most commonly analyzed industry sectors are listed in the tables which follow. In Table 6-8, the numbers of people employed in each of the seven industries are given for the

years 1990 and 1996. TCPU stands for Transportation, Communication, and Public Utilities. FIRE stands for Finance, Insurance and Real Estate.

The employment statistics presented below are from two sources. The County and State figures are from the Bureau of the Census, County Business Patterns (CBP). The employment statistics describing Deerfield's employment figures are from a different source, the Commonwealth of Massachusetts, Division of Employment and Training (DET). County Business Patterns does not include the government sector, nor is it within the services sector. DET does include the government sector. Therefore a government sector comparison cannot be conducted between the Town and the County. Tables are presented containing both numbers of employees and percentages of total employment. Both are included so that the reader may at once see each sector's actual employment figures and then be able to compare these to other sectors within the same locale. The percentages are also included so that the relative importance of a particular industry sector to that locale can be seen. Lastly, both the percentages and the employment numbers are used in analysis to determine the sector's relative share of the economy and the important trends over time.

If we look at Table 6-8 and focus exclusively on the employment numbers it is quite clear that the services sector was the dominant employer category in Franklin County and the State in 1996. In this sector, health services accounted for the majority of employers. Although the manufacturing sector has declined in the County and in the State over the past twenty years, it still represents the second greatest group of employers. The plastics industry is considered to be a major segment of this sector in the County. The third most important sector is retail trade, which comprised twenty-four percent (24%) of the total employment in the County. The dominant segments of the retail trade sector were eating and drinking establishments and food stores (FRCOG Regional Policy Plan; 1998).

Table 6-8: Employment by Industry Sector for the County and the State, 1990 and 1996

Industry Sectors	1990 Franklin County	1996 Franklin County	1990 Massachusetts	1996 Massachusetts
Agriculture	*140	128	11,881	11,747
Construction	884	612	108,187	91,989
Manufacturing	5,587	5,540	536,369	461,610
T.C.P.U.	1,006	805	131,374	132,712
Trade	5,367	5,022	720,257	693,005
F.I.R.E.	1,258	1,013	246,920	234,972
Services	6,555	7,453	1,009,359	1,151,071

Source: County Business Patterns 1990 and 1996, Bureau of the Census.

*This is an approximation determined from the total employment figures for Franklin County in 1990.

T.C.P.U.: Transportation, Communication, and Public Utilities; Trade: Wholesale and Retail Trade.

F.I.R.E: Finance, Insurance and Real Estate.

In Table 6-9, the numbers of employees in each industry are described as a percentage of total employment. These simply show the percentage of the total employment that occurs within that sector. Comparing all industries within the County would result in the determination that, as in the State, manufacturing, trade, and services are the industries that employ the most people. If the percentage of total employment produced by an industry in the County is larger than in the State it signifies that the County has a greater share of employees in an industry than does the State. For example, in 1996 manufacturing employed almost twenty-seven percent (26.9%) of all the people employed in Franklin County. In that same year the State manufacturing firms employed just under seventeen percent (16.62%) of the State's total employment. Clearly, manufacturing in Franklin County is a much stronger industry, employing more people than would be expected by looking at the State's average for all counties.

By comparing the percentages of total employment between the County and the State for each industry, it is possible to estimate which industries are more competitive in the County. When an industry has that kind of employment, economists suggest that the industry is likely producing more than the average sector in the State and therefore is probably exporting products and services into other regions. When industries are exporting, they are bringing in money from outside the region which has a positive impact on the local economy. Comparing the percentages of total employment for all sectors in Franklin County to the State's shows that agriculture and manufacturing are higher.

Table 6-9: Employment by Industry Sector for Franklin County and State of Massachusetts as a Percentage of Total Employment, 1990 and 1996

Industry	1990 Franklin County	1996 Franklin County	1990 Massachusetts	1996 Massachusetts
Agriculture	0.67%	0.62%	0.43%	0.42%
Construction	4.25%	2.98%	3.91%	3.31%
Manufacturing	26.87%	26.93%	19.40%	16.62%
T.C.P.U.	4.84%	3.91%	4.75%	4.78%
Trade	25.81%	24.41%	26.06%	24.95%
F.I.R.E	6.05%	4.92%	8.93%	8.46%
Services	31.52%	36.23%	36.51%	41.45%

Source: County Business Patterns 1990 and 1996, Bureau of the Census.

T.C.P.U.: Transportation, Communication, and Public Utilities.

Trade: Wholesale and Retail Trade; F.I.R.E: Finance, Insurance and Real Estate.

Measuring the changes in employment in each sector over time can describe strengths and weaknesses in the economy of the County as compared to the State. Given that Deerfield is part of the County and that so much of its employees come from these communities, it is important to understand how the County employment figures are changing.

First of all, between 1990 and 1996 agriculture employment declined at a greater rate in the County than the State (-8.6%). The construction, T.C.P.U. (which includes Transportation, Communications, and Public Utilities), trade, and F.I.R.E. (representing

Finance, Insurance, and Real Estate) sectors, all experienced greater relative reductions in employment in the County than the State. In contrast, the manufacturing sector lost less than one percent of its employment in the County, but nearly fourteen percent (13.9%) in the State. And, in both the County and the State, the services sector saw increases in employment at roughly equivalent rates of growth.

Table 6-10: Employment by Industry Sector for Deerfield as a Percentage of Total Private Sector Employment; 1990 & 1996

Industry	1990 Deerfield Employed	1990 Percentage of Total	1996 Deerfield Employed	1996 Percentage of Total
Agriculture	56	2.1%	86	2.6%
Construction	112	4.1%	99	3.1%
Manufacturing	1,129	41.6%	1,356	41.6%
T.C.P.U.	171	6.3%	238	7.3%
Trade	217	8.0%	385	11.8%
F.I.R.E.	42	1.5%	47	1.4%
Services	789	29.0%	813	24.9%
Government	201	7.4%	239	7.3%
Totals	2,717	100.0%	3,263	100.0%

Source: Commonwealth of Massachusetts, Division of Employment and Training ES-202 data.

There are significant differences between the relative importance of particular industries to the economy of Deerfield as compared to Franklin County (*see Table 6-10 above*). If the percentage of total employment for an industry is greater in Deerfield than in the County, that industry is more competitive. Any industry that is already a strong component of the local economy should get the attention and support of the Town to maintain its competitive edge. Using this form of analysis for 1996, agriculture, T.C.P.U. (includes Transportation, Communications, and Public Utilities), manufacturing, and construction are the industries in Deerfield that are doing very well, producing more employment than what would be expected looking at the employment in the rest of the County for these industries.

Another form of analysis looks at the rate of change in employment in these industries between 1990 and 1996 and compares these changes in the Town to those in the County. In the County, the only industry that has been growing in numbers of employees is the service industry. In Deerfield, between 1990 and 1996 the following industries (from greatest to least) grew at a faster rate based on the number of employees, than for the same industry in the County: trade, agriculture, TCPU, manufacturing, and FIRE.

Some industries require a level of service that is only provided by having businesses of the same industry aggregated. Whether the industry is agriculture, publishing, or plastics, businesses can benefit from economies of scale. Commonly required raw materials, services, labor, fuels, banking, infrastructure, etc. can be less expensive and more convenient if the supply is available for a larger market. It is even better if these raw

materials and other needs can be met locally within the region. The importance of retaining existing businesses and encouraging expansion by providing needed services and infrastructure is an important issue for Deerfield.

Deerfield's agricultural industry is a good example of an exporting business that is dependent on land and raw materials and that benefits from an aggregate of other farming enterprises. Some dairy farms in Deerfield depend on three hundred or more acres of land. Some of that acreage is land rented from other farmers. The manure produced by their dairy herd can be taken off their hands by local organic farmers. In these ways, sustaining the industry of farming in Deerfield may require keeping all the farms going. A loss of one farm may have a disproportionate effect on the success of all the other farming businesses in Town.

The Town of Deerfield should encourage those types of businesses that are successful and growing. In Deerfield's multi-faceted economy, there are some industry sectors that are exhibiting growth in employment beyond the average for that sector in Franklin County. Wholesale and retail trade, agriculture, TCPU (Transportation, Communication, and Public Utilities), manufacturing, and FIRE (Finance, Insurance, and Real Estate) are all types of growing businesses in Deerfield. Providing these industries appropriately zoned land, adequate water and sewer infrastructure, and the encouragement to expand locally would be a wise use of Deerfield's economic development resources.

Major Employers

The second factor that should be considered is the distribution of employment. How is employment spread throughout Deerfield, in big businesses or small. Deerfield's diverse economy includes businesses of different industry sectors and sizes. The major employers (employers with at least fifty employees) in Deerfield that are important in terms of number of employees are listed in Table 6-11.

It is important to understand which sectors and businesses provide employment within a community. In 1999 Deerfield had fifteen employers with at least fifty employees each. In 1998, according to the Massachusetts Division of Employment and Training, there were three thousand, five hundred and seventy-eight (3,578) people employed in Deerfield by one hundred and fifty -eight (158) employers (employers with a set minimum of employees), including the government sector. Assuming that this total employment figure hasn't changed since 1998, a large proportion of the total employment in Deerfield (80%) is currently provided by fifteen employers. In addition, this group represents a large share of the commercial and industrial property that provides tax revenues. Overall, the business community is responsible for providing twenty-seven percent (27%) of the tax base (John Paciorek, personal communication; 1999). Although history has shown Deerfield to have a dynamic economy where businesses have tended to take advantage of vacancies in commercial facilities, the industrial park is now full. It is difficult to forecast

the impact of a loss in one or more of these businesses if they should need to expand and there was not properly zoned land and infrastructure available.

Table 6-11: Number of Employees and Percent Full Time by Major Employer in Deerfield in December 1999

Major Employers in Deerfield by Type of Industry	Number of Employees	Percent Full Time
Manufacturing		
Greenfield Industries Diston	305	92%
Yankee Candle Incorporated	406	79%
Channing L. Bete	315	89%
Hardigg Industries, Inc.	260	100%
Huntsman Packaging Corp	169	100%
Cains Foods	100	100%
MilliTech	<u>227</u>	94%
	1,782	
Transportation, Communication and Public Utilities		
N&B Express	110	91%
Private Educational Institutions/Organizations		
Deerfield Academy	350	89%
Historic Deerfield	150	40%
Eaglebrook School	135	84%
Bement School	<u>71</u>	83%
	706	
Government/Public Education		
Frontier Regional High School	125	NA
Deerfield Elementary School	80	NA
Town of Deerfield	<u>49</u>	NA
	254	

Sources: List of Major Employers from the 1997 Franklin Region Council of Governments Major Employer Survey. 1999 Employment figures including the percentage full time workers, where available, were from personal communications with the Human Resource Departments, or in the case of the Town of Deerfield, the Town Clerk during the month of December 1999.

The third factor that should be considered in determining where the Town should prioritize their support of economic development is the quality of the employment provided by each sector. In Table 6-11, it appears that the manufacturing sector represents a large portion of the total full time employment provided by Deerfield's major employers. Full time positions are more likely to include benefits like health insurance and retirement benefits. The Town of Deerfield should encourage the creation of full time jobs with benefits over part time positions.

The fourth factor that should be considered concerns which existing businesses are likely to expand in production and employment. The 1997 Franklin Regional Council of Governments Major Employers Survey identified several employers in Deerfield that had plans to expand in the near future. Channing L. Bete, Hardigg Industries, and Historic Deerfield all planned on expanding in the next one to three years. Already Hardigg Industries has received approval for expanding at their existing location. Yankee Candle

is also expanding and will use up a portion of the remaining land zoned for industrial uses. The result is that there is little remaining land in areas zoned for industrial development with adequate water, sewer and transportation infrastructure and Deerfield would be well advised to start planning for the next industrial park.

Deerfield's economic development strategies should not stop at the support of the major employers and specifically the needs of the manufacturing sector. Although satisfying the land and infrastructure needs of expanding major employers should be a high priority for Deerfield, supporting other elements in the economy is also important. Two other elements that should be considered are small businesses and the expansion of economic activity in the South Deerfield Village Center.

Deerfield's diverse economy is comprised of major employers and small businesses of under twenty employees. Small businesses are typically responsible for over eighty percent of growth in employment. In Deerfield, they are typically begun by residents of the community or the region. Businesses that are locally owned are more likely to remain within the region. Ensuring there is adequate space and infrastructure is important. Deerfield should explore ways to support small business through incubators or other means.

Any local industry or business that provides employment within Deerfield is contributing to the local economy. Businesses located in Deerfield inject money into the local economy in two ways. They provide support for municipal services through payment of property taxes which has a positive fiscal impact. They also inject money into the economy through the salaries and wages they pay their employees. This money helps support service and retail businesses in Deerfield. Even if the employees are not Deerfield residents, they may spend their money there for lunches, clothes, coffee, etc. They may also have accounts in Deerfield bank branches. If the employees actually live in town, they may also pay property taxes.

The redevelopment of the center of South Deerfield Village through streetscapes improvement, pedestrian friendly walkways, new parking, tree planting, and limited expansion of both residential and commercial properties could attract the employees of the one hundred and fifty-eight businesses in Deerfield and thereby support small retail and commercial establishments there. Improving the downtown area would provide a place where people who work in Deerfield but live elsewhere can spend a portion of their money on goods and services instead of in Amherst, Northampton, or Greenfield. Each time that a dollar is spent in Deerfield it supports a variety of local businesses for services or for products like food, clothing, or appliances, etc. Economists call the value added to each dollar as it cycles through the local economy, the multiplier effect. The more times a dollar is used locally, the more its value is multiplied. An infill study that would identify businesses which are lacking, such as a small grocery store, would be advisable.

More than likely, Deerfield, like other New England communities, will be best served by taking care of the industries and commercial enterprises that are already there.

Determining expansion needs of both the small businesses and the major employers and securing land and developing infrastructure ahead of time is advisable.

Local Economy

Overall, Deerfield's economy is dynamic yet growing well over time. Table 6-12 below, provides the total annual payroll and average annual wage per year for Deerfield from 1990 to 1998. The establishments listed were provided by the Commonwealth of Massachusetts Division of Employment and Training (DET). The establishments included in these yearly must meet a certain minimum number of employees, therefore these figures are not inclusive of all employers. According to Table 6-12, from 1993 to 1995 employment saw a dramatic rise which was then followed by a large drop in 1996. This drop in employment in 1996 was most probably caused by the reduction in Yankee Candle Inc. employment in Deerfield when it moved its manufacturing operations to Whately. Since 1996, employment seems to have stabilized. In 1998, according to the DET statistics, Deerfield contained one hundred and fifty-eight (158) businesses or industrial establishments with a certain minimum number of employees. In the same year, the area's annual average wage paid to employees, \$29,732, was the highest it has been since 1994.

Table 6-12: Employment and Wages in Deerfield 1990-1998

Year	Total Annual Payroll	Avg. Annual Wage	Number of Establishments	Total Number of Employees
1990	\$66,444,362	\$24,455	163	2,717
1991	\$69,494,836	\$25,540	156	2,721
1992	\$71,652,285	\$26,411	150	2,713
1993	\$76,812,696	\$26,876	147	2,858
1994	\$113,738,400	\$31,385	149	3,624
1995	\$114,620,989	\$28,641	154	4,002
1996	\$93,712,671	\$28,720	160	3,262
1997	\$100,358,134	\$29,233	155	3,433
1998	\$106,382,440	\$29,732	158	3,578

Source: Commonwealth of Massachusetts, Division of Employment and Training, ES-202 data.

Another measure of the stability of the economy is the commercial vacancy rate. Vacancy rates are the relationship between the amount of vacant space and the total space in the market. The rates in Table 6-13 have been calculated on an average annual basis, based on random surveys conducted during the course of the year. In general, there has been a positive absorption of all classifications of space in the region over the past year except in Greenfield and Turners Falls. Many of the town centers are changing from a retail and manufacturing orientation to service and office markets. According to Table 6-13, Deerfield has a moderate commercial vacancy rate compared to those of Amherst, Sunderland, Northfield, and Shelburne Falls which are all at five percent (5%).

Table 6-13: Commercial Vacancy Rates for Major Employment Centers

Town	1995	1996	1997	1998	1999*
Deerfield	12%	8%	6%	6%	8%
Shelburne Falls	12%	5%	5%	8%	5%
Sunderland	12%	7%	7%	6%	5%
Northfield	6%	6%	6%	5%	5%
Amherst	5%	5%	5%	5%	5%
Greenfield	12%	9%	9%	13%	11%
Turners Falls	14%	8%	19%	17%	20%

Source: K. Levich Associates, Real Estate Appraiser; Greater Franklin OEDP, April 1999.* Year to date figures.

In summary, Deerfield's successful sectors of employment include manufacturing, trade, agriculture, transportation, finance, and real estate. These sectors are growing at rates faster than the County or the State. Over eighty percent of the employment is provided by fifteen major employers, a large portion of which are in the manufacturing sector. Also, a large percentage of the manufacturing businesses provide mostly full time employment. Small businesses are also important to Deerfield's future because they typically are locally owned, stay within the region when they expand, and represent much of the nation's job growth. Creating a thriving and diverse economy should include supporting the expansion needs of large and small sized businesses. This may translate into land and infrastructure for large employers and incubator space, business plan development, and networking support for small businesses.

Economic Development Issues

Any plan that would guide the development of Deerfield's economy must take into account several issues that require attention: property tax rates, agriculture, commercial and industrial building sites, South Deerfield downtown revitalization, and community facilities.

Property Tax Rates

It has been shown through studies done by the American Farmland Trust (AFT) and others that based on the amount of municipal services used by the different types of land uses (residential, commercial, industrial, or privately owned open space), residential uses cost towns the most money. The more houses that are built in Deerfield, the higher the tax rate will likely go. Residential uses require a variety of town services, particularly schools, the most expensive item in most municipal budgets. In contrast, the AFT found that commercial and industrial land uses, on average, have a positive fiscal impact by generating more tax revenues than the cost of services consumed. Privately owned open space also provides a positive fiscal impact for the Town given that minimal services are needed.

The property tax issue according to Town officials is the need to keep tax rates low. Given that residential development is likely to continue even with ongoing efforts in land protection and zoning, there is a perceived need to balance residential growth with industrial and commercial growth. It is important to understand the impacts of trying to maintain the balance between different land uses to maintain consistently low property tax rates and this is examined in the Land Use and Zoning Chapter.

Agriculture

Farming in Deerfield clearly encompasses aspects of the quality of life that the area provides for its residents. Open spaces, pastoral views, access to fresh produce and the retention and continued maintenance of some of the area's most significant historic structures and landscapes are some of the things people associate with farming but often take for granted.

The future of farming in Deerfield is not guaranteed. Buying locally grown produce is one step in the right direction. Providing business development help to farms of all sizes is another. Deerfield should identify ways to support the profitability of farming operations. This can be done by either reducing their overhead costs such as lowering their excise and property taxes or by increasing their revenues. For example Deerfield residents can impact the vegetable farmer's bottom line by increasing the demand for locally grown produce.

The future of agriculture in Deerfield was discussed in the first chapter of this Master Plan, Farmland, Open Space, & Natural Resources. The threats to farmland include the pressures upon farmers to sell their land for both residential and commercial/industrial development. The truth is, some farmland may need to be developed for future development of both types. The questions of location and quantity of land required depends on many factors. However, the future development of an industrial park should try to minimize farmland losses.

Availability of Commercial and Industrial Sites

Commercial and industrial site availability is a critical issue for Deerfield. For existing businesses to be able to expand, or for new businesses to relocate to Deerfield, there must be vacant land appropriately zoned with adequate water, sewer and transportation infrastructure. According to Select Board Member, John Paciorek, the Route 116 Industrial Park has no vacancies. Although the development of an industrial park, is only one aspect of Deerfield's economic development plans, it is vital to create opportunities for business attraction and expansion. The planned expansion of Yankee Candle will use up a good portion of the remaining land zoned for industrial development. One area which should be examined for future growth is the land currently zoned C-II adjacent to the Deerfield Railyard. An assessment of the development potential of this land in terms of

the cost of providing adequate water, sewer and transportation infrastructure should be undertaken.

South Deerfield Village Center Redevelopment

A revitalized downtown that caters to pedestrian traffic would also provide services to local residents and the employees of over one hundred businesses in Deerfield. By taking advantage of Deerfield's status as a regional employment center, the redevelopment of the South Deerfield Village Center would enhance the Town's economic vitality. Local voluntary design guidelines and streetscape amenities could produce an area that all visitors enjoy and protect the area's remaining significant historical architecture.

Community Facilities

New commercial and industrial development may be constrained by current limits to the drinking water supply and waste water treatment capacities. The South Deerfield Water Supply District is seeking a permit from the Massachusetts Department of Environmental Protection to withdraw additional water from the Roaring Brook Reservoirs, their sole source of drinking water. Even if granted the permit, their supply will not be unlimited. In the same way, the Town of Deerfield has recently invested in a new aerator system for the South Deerfield Wastewater Treatment Facility. Although this will increase the plant's capacity to handle suspended solids, it will not increase total flow capacity. Therefore, businesses that are high water users pose a potential problem to both systems.

The Town should consider methods of providing water and sewer infrastructure required by new businesses in a manner that neither jeopardizes current capacity nor unduly burdens the prospective employer. New and expanding businesses should ideally be low water users, even processing facilities for agricultural products. In the case of the Technology Park on Route 5/10, Yankee Candle will be allotted thirty thousand gallons of inflow per day into the South Deerfield Waste Water Treatment Plant. They in turn would also be required to pay for the reduction of an equivalent amount of infiltration and inflow in sewer line sections in South Deerfield. Drinking water needs should also be accounted for. In cities like Brockton and Stoughton, Massachusetts, where drinking water supplies are at emergency levels, creative programs have been established to allow for development without increasing water demand. In this case, Stoughton requires any new business's water needs to be created out of reduction in institutional water use through purchased water conservation technologies.

Recommendations

- To support the future expansion needs of existing businesses in Deerfield, assist the Deerfield Economic and Industrial Corporation (DEDIC) in conducting an engineering study of the C-II Commercial District adjacent to the East Deerfield Railyard to determine the potential for establishing a new industrial park for office space and light industry. Factors to be considered would include the cost of extending sewer and water infrastructure from Old Deerfield or possibly Greenfield, truck access, benefits of rail access which currently exists, and environmental constraints (floodplain, critical habitat areas, wetlands, etc.). If this area is determined not to be economically feasible the Town should conduct a study to find another area in the southern part of Deerfield to support future commercial and industrial development.
- Conduct a parcel level analysis of the infill potential in the South Deerfield Village for new commercial establishments and in the Planned Industrial Park for the expansion of existing businesses in terms of square footage. The analysis would look at the potential for placing new buildings on vacant lots and the possibility of additions to existing businesses given current lot configurations and zoning requirements.
- Conduct an analysis of the existing mix of businesses in South Deerfield Village and identify those which are needed to provide Deerfield residents and employees more convenient access to local goods and services. For example, a small grocery store (e.g. Keystone Market – Shelburne Falls) or health food store (e.g. Greenfield Market – Greenfield) could serve residents and the large number of employees working in Deerfield. Also consider the addition of businesses which could serve both residents and tourists which currently visit Yankee Candle and other tourist destination points along the Route 5/10 corridor.
- Apply to the Transportation Equity Act for the 21st Century (formerly ISTEA) Enhancement Program to obtain funding to hire an engineering/landscape architecture firm to survey and prepare streetscape design and engineering plans, specifications, and estimates for the South Deerfield Village Center. The design should utilize the preliminary work plans prepared by the Conway School of Landscape Design in 1997. It should address traffic circulation, shared parking for downtown businesses and pedestrian amenities including walkways, street tree planting, benches, lighting, and signage. The streetscape design should also address the linkage of the Town Center to the Route 5/10 corridor and establish a clear "gateway" to the South Deerfield Village Center. This would provide a visual mechanism for attracting some additional visitors to the South Deerfield Village Center to support businesses there. At present many visitors to Deerfield only go to nearby destination points such as Yankee Candle. Consider changing the zoning along the "gateway" area to C-I Small Business.

- Prepare voluntary design guidelines to be incorporated into the Town's Zoning Bylaws which provide density bonuses or parking reductions in exchange for following the design guidelines.
- Support agricultural businesses in Deerfield through the creation of a "buy local" campaign, establishing a seasonal farmers' market in the South Deerfield Village Center, or creating a brochure on Deerfield farmstands and products for distribution through Historic Deerfield and Yankee Candle.

CHAPTER

7

LAND USE AND ZONING

Growth and development in a community can often reflect its history and values. From the first years after Deerfield was permanently settled by Europeans, Old Deerfield's Main Street reflected the values of a close knit, security-conscious community. As mills took advantage of water power in the Mill River and later in Cheapside along the Green River, activities broadened to include industries like broom and pocketbook manufacturing. Different areas throughout Deerfield began developing with their own Post Offices and cemeteries. Trails that began as Native American travel ways between encampments and hunting grounds were adopted by colonists and later improved to their present paved state. South Deerfield became a center for industry and dense suburban living. Farmers spread throughout the Town situated along floodplains of the Connecticut and Deerfield Rivers to take advantage of the prime soils there.

The private schools of Deerfield beginning with the Deerfield Academy in the late 18th Century and continuing with Eaglebrook and the Bement School later in the 20th Century played an important role in the growth of Deerfield by employing teachers and administrators. The private educational institutions were one of the most important employer groups in Town for many years. In addition, the founding of Historic Deerfield, Inc. and the initiation of the private institutional ownership of much of the surrounding landscape was due in part to parents of students taking an interest in the future of the historic structures on Old Deerfield's Main Street.

As industries expanded and new companies came to Deerfield, the population grew and people built new homes along existing roads throughout Town. Roads that normally only saw farm machinery traffic, were now being traversed by automobiles. During the 1980's, fourteen residential subdivisions were developed in the South Deerfield area. In the past ten years new residential development consisted of only one subdivision. The primary form of development in the past decade has been individual houses scattered across Deerfield on lots with frontage on local roads.

The Land Use and Zoning Chapter of the Master Plan inventories the current patterns and trends in land use in Deerfield. The effects of these patterns on Deerfield's natural and cultural resources are reviewed. The costs of community services for residential and industrial development and farmland in Deerfield are analyzed. This is followed by an assessment of the potential for future development based on current land use patterns and zoning, known as a build-out analysis. A build-out analysis estimates the maximum amount of development, which could be realized in the future based on current zoning and available undeveloped land. It can also be used to estimate the number of new homes, miles of new roads needed, gallons of additional drinking water supply required, and the number of tons of municipal waste generated.

Following this is a preliminary analysis of the impacts of this build-out scenario on watersheds and aquifers, on traffic congestion, and on the farming industry.

The following land use goals were prepared by the Deerfield Master Planning Committee based on the results of the Community Survey. In many ways, the Land Use and Zoning chapter represents a synthesis of the work presented in previous chapters. For this reason, the objectives that are listed below reflect the work of the Master Planning Committee on each resource areas.

Goals:

- To protect the rural and historic character of Deerfield.
- To sustain the Town's natural resources and open space through appropriate zoning measures.
- To encourage light industry to locate in appropriate areas in Town.
- To design future development so that traffic patterns remain light near residential areas and that public safety concerns remain a priority.

Objectives:

- Maximize the protection and sustainability of farmland, open space, and natural resources.
- Mitigate the impacts of development's demands on drinking water supplies and sewer system capacity.
- Minimize the negative impacts of traffic congestion due to development along Routes 5/10 and 116.
- Improve the availability of housing for the elderly in South Deerfield.
- Protect all significant historic structures and landscapes throughout Town.
- Support small business development, particularly farm-related businesses, and ensure that space and infrastructure is available for expansion of the major employers in Deerfield.

Land Use and Land Use Change

Deerfield's growth and the changes in specific land uses over time can be seen both graphically in the 1997 Land Use and Land Use Change (1971 - 1997) map and in tabular form. The 1971, 1985, and 1997 MacConnell land use data layers have been produced by the Department of

Forestry and Wildlife at the University of Massachusetts at Amherst based on aerial photographs taken in those years.

Table 7-1 below lists the area, in numbers of acres, of selected natural resources and agricultural land uses in Deerfield. Note the large extent of both farm and forestland. In 1997, forestland accounted for fifty-eight percent (58%) of the total land area of the Town of Deerfield. Agricultural land, consisting of cropland, pasture, and orchards or nurseries comprised twenty-four percent (24%) of the land area. According to the United States Fish and Wildlife Service's National Wetlands Inventory (NWI), Deerfield contained one thousand five hundred and eighty-six (1,586) acres of wetlands or eight percent (8%) of the total land area.

Although the landscapes are mostly permanent, being based on glacial and geomorphic processes, their uses are not. For example, the floodplains of Deerfield have historically been prized for their prime soils and thus farming has been a dominant activity there. However, as residential development consumes more and more farmland, the use of those prime soils changes.

Table 7-1: Natural Resources and Agricultural Land Acreage in Deerfield in 1997

	Acres	Percentage of Total Area
Forest	12,340	58%
Cropland	4,463	21%
Non-Forested Wetlands*	1,012	5%
Surface Water	593	3%
Forested Wetlands*	574	3%
Pasture	345	2%
Orchard, Nursery, etc.	197	1%
Other (Developed Land Uses)	1,864	7%
Total Land Area in Deerfield	21,388	100%

Source: 1997 Massachusetts GIS Land Use Coverage except for wetlands data.

* These figures were determined from calculations using National Wetlands Inventory data.

In Table 7-2, a comparison of the types of land uses, and their acreages in Deerfield between 1971 and 1997 demonstrates which natural resources are most susceptible to development pressures. Cropland and forestland have been the primary resources converted to other uses, particularly to residential development. As residential development of one quarter acre or larger has increased, both cropland and forestland acreages have decreased (*see 1997 Land Use Map*).

Table 7-2: Changes in the Land Area of Different Land Uses Between 1971 and 1997

	Land Use Acreages in 1971	Land Use Acreages in 1985	Land Use Acreages in 1997	Change in Acreage Between 1971 and 1997
Forestland	12,898	12,574	12,340	-558
Cropland	4,927	4,704	4,463	-464
Pasture	357	361	345	-12
Orchard, Nursery, etc.	146	171	197	51
Surface Water	593	593	593	0
Open Land	418	403	423	5
Non-Forested Wetland	114	114	113	-1
Residential > 1/2 acre	507	609	845	338
Residential 1/4 - 1/2 acre	519	723	765	246
Transportation	457	464	461	4
Mining (Gravel, etc.)	107	160	212	105
Open Land - Urban	122	158	185	63
Industrial	30	89	149	119
Participation Rec.	128	142	144	16
Commercial	45	86	106	61
Waste Disposal	14	18	33	19
Spectator Recreation	6	6	0	-6
Residential-Multi	0	14	14	14
Residential <1/4 acre	0	0	0	0
Total Area	21,388	21,388	21,388	

Source: MacConnell 1997 Massachusetts GIS Land Use Coverage

The land use tradeoffs between 1971 and 1997 were primarily a loss of forest and farmland and a gain in residential and industrial development. Larger lot residential growth has resulted in the loss of five hundred and eighty-four (584) acres of farmland or forestland. The loss in natural resources may go beyond simply the loss in acreage. As farm and forest land acres are converted to residential and commercial uses the landscape becomes fragmented.

Fragmentation of the landscape can negatively impact the quality of wildlife habitat, watershed protection, recreation opportunities, farm viability, forest management opportunities, and ultimately the municipal services budget. Many rural towns in western Massachusetts have much of their landscape covered in forest vegetation. Unlike more urbanized towns, this forestland is not intersected by roads or residential development. As development spreads across the landscape wildlife habitat may become segmented so that animals that require large amounts of interior forest habitat are forced to search for it in still more remote areas. Fragmenting large blocks of contiguous forestland also jeopardizes the water quality and quantity in many first and second order streams, which are the most extensive and sensitive components of a watershed's stream network. The value of recreational opportunities associated with hiking, snowmobiling, and mountain biking often depends on whether there exists a network of fields and forests that are somewhat removed from residential areas.

Dairy farmers use approximately sixty percent (60%) of the cropland in Deerfield. The more fragmented farmland becomes, the more expensive it becomes to farm, based on additional time and fuel costs. In the same way fragmentation of the landscape affects the viability of forest

management operations. When a large forest block is fragmented by a subdivision, the resulting parcels associated with single family homes are often too small to manage individually for forestry purposes. Finally, the most inefficient method of providing municipal services such as police, fire, sewer, water, waste disposal, and plowing is associated with a fragmented landscape where residential development is spread sparsely across field and forest.

Many Deerfield residents value both the working farms and the scenic values they provide. Overall, eighty-nine percent (89%) of the community survey respondents felt that each of the following natural resources were either important or very important to maintain or preserve: working farms; wildlife habitat and stream corridors; and scenic views. Also, when asked for the most important concerns relating to future growth along the Route 5/10 corridor, two of the top three choices were loss of farmland and loss of scenic character. In a related question, the five most preferred types of new recreational facilities desired for the future was in order of importance (first to last): "Trails and paths (hiking, ski, bike), access to rivers, parks and playgrounds, indoor areas (fitness center, gym), and recreational fields." In summary, the community survey respondents expressed their appreciation for agricultural landscapes, open space, natural resources, and the scenic views they help to create.

Deerfield residents also need to be aware of the indirect value of open farmland. Generous farmers in Deerfield provide a phenomenal amount of (unpaid for) recreational benefit to snowmobilers, hikers, walkers, joggers, hunters, X-C skiers, ice skaters, people walking dogs, etc. If farmland continues to be lost, residents will lose these benefits.

Existing Patterns of Development

In this section, Existing Patterns of Development, the types of development and their spatial relationship to the landscape are identified. The following text is meant to accompany the 1997 Land Use and Land Use Change (1971-1997) map, which can be found at the end of this chapter.

According to the Community Survey the change in the pattern of open space, farmland, and residential, commercial, and industrial development that has occurred in Deerfield between 1971 and 1997 has not maintained the Town's rural character, which was a most attractive characteristic to residents. Of all the Community Survey respondents, seventy-three percent (73%) moved to Deerfield within the past thirty years and when asked which items have improved, stayed the same, or worsened, the worst ratings were given first to "rural character", then to "taxes."

Prior to the twentieth century, the people of Deerfield lived in a set of village centers and in farmhouses surrounded by large cultivated fields and logged-over forestland. Between the turn of the century and 1971, dense development in the South Deerfield village center took place. Since that time, the beginning of sprawl is starting to materialize in the form of approval-not-required (ANR) development along existing roads.

The changes in land use over the past twenty-six years can best be understood by reviewing the pattern of development in 1971. In the South Deerfield Village Center, almost every road had the current density of residential development. The South Deerfield Village Center at the intersections of Elm, Sugarloaf, South and North Main Streets had a commercial area and the Cains plant was located where it is today, in between Thayer, Sugarloaf, and South Main Streets. South of Elm Street and along the railroad tracks there was a small industrial area and another one existed behind homes on South Main Street. There was also a small industrial area off of North Main Street where Hardigg Industries is now located. In the central portion of Deerfield there were scattered residential and commercial uses along Route 5/10 above its intersection with North Main Street. Equally, there were homes spread out on the main roads in the Pocumtuck Ridge area, on Upper Road, and in the Bars neighborhood.

The changes between 1971 and 1997 can be described as three main patterns: subdivision, commercial/industrial expansion, and approval-not-required development. Between 1971 and 1990, fourteen subdivisions were established in Deerfield. Since then, only two definitive subdivision plans were accepted by the Planning Board, Crestview and the Technology Park (Route 5/10 across from Channing L. Bete). The location of the residential subdivisions signify one important trend. They are all located in the southern half of Deerfield. There are also three areas that have seen the most subdivisions and represent current and future sites that may be available for further concentrated residential development: Mill River area, Hillside, and South Deerfield Village Center.

During the same time period, the existing commercial and industrial development grew to include a planned industrial park, the Yankee Candle complex, Channing L. Bete, Huntsman Packaging, etc. In those twenty-six years commercial development converted sixty-one (61) additional acres. By 1997, industrial uses covered another one hundred and nineteen (119) more acres than in 1971. This development primarily occurred in South Deerfield along Routes 5/10 and 116. More recently, the proposed Yankee Candle distribution center will be constructed on a portion of the land opposite Channing L. Bete along Route 5/10. The proposal will develop a parcel approximately eighty acres in size.

Approval not required (ANR) residential development is the third main pattern of development that has contributed to sprawl. According to the Massachusetts Subdivision Control Law, M.G.L. Chapter 41, Sections 81-K through 81-GG land can be legally subdivided and recorded without approval of the Planning Board (thus its name, "Approval Not Required"), if it meets the following conditions:

- The lots shown on the plan must front on a way which the Town clerk certifies is maintained and used as a public way, or a way shown on a plan approved and endorsed in accordance with the subdivision control law, or a way in existence when the subdivision control law became effective in the city or town in which the land lies, having in the opinion of the Planning Board sufficient width, suitable grades and adequate construction to provide for vehicular traffic in relation to the proposed use;
- The lots meet the minimum frontage requirements according to the Town's zoning by-law; and

- Vital access to such lots exists to protect public safety and welfare.

Prior to receiving a building permit, the lots must also meet the requirements of a Town's zoning bylaws including acreage. Approval Not Required development can lead to sprawl along the Towns' roads. Such sprawling development leads to the negative impacts of fragmentation of wildlife habitat, farmland, forestland, and scenic resources. It also may require new infrastructure, lengthen service routes for school buses, police, fire, and emergency service vehicles, create more air pollution from automobiles, and increase road maintenance costs including snow plowing.

Effects of Development on Working Agricultural Landscapes, Rural Character, and Natural Resources

Deerfield is experiencing significant growth in residential, commercial, and industrial development. Most of this growth is happening outside of the South Deerfield village center resulting in the loss of farmland, rural character, and natural resources. The recent news concerning the development of industrially zoned land along Route 5/10 is one example. The proposed project will provide one of Deerfield's major employers with land and infrastructure for its expansion, however, there may be unintended consequences to the development. Plans to extend sewer to this parcel will increase the likelihood that homes on Mill Village Road will be connected to the public sewer system. If that were to happen, the development value of many of the adjoining farmland parcels would increase. This would increase the cost of purchasing the development rights of farmland through the Agricultural Preservation Restriction (APR) Program. These farmland parcels would most likely be the first ones to be developed for residential uses.

There has been an emphasis placed on conserving farmland in this Master Plan. The emphasis originated in the Community Survey results and was then translated into the Master Plan Goals and Objectives by the Master Planning Committee. The conservation of the working agricultural landscape is critical given competing demands on this resource from other types of land use. Farmland is typically one of the easiest resources to develop given its flat topography and often well drained soils.

Small shifts in current land use patterns are always occurring. Every acre of land removed from open space for development, whether it be commercial, industrial, or residential, produces impacts that are sometimes difficult to track. It is important to acknowledge that with the benefits that development brings also come costs to our working landscapes, especially for farmland. We know from the Farmland section of the Master Plan that the farms which seem to be succeeding are either small and medium sized retail farms or very large dairy and wholesale farms with over five hundred acres of land in use. If there are roughly four thousand four hundred acres of cropland in Deerfield, the land may support less than nine big farms. If the cropland becomes fragmented through residential development, the economic viability of a farm operation will likely be impaired.

According to a local vegetable farmer, H.V. Marsh, Deerfield residents should be aware that over sixty percent (60%), almost twenty-seven hundred (2700) acres, of Deerfield farmland is associated with the dairy industry, either directly producing milk or in growing feed for other dairies. While not all of this land is prime, river bottom land, much of it is buildable. This means that the fate of the dairy farmers is critical to the fate of farmland in Deerfield. It must be recognized that their economic viability in the long run is very tenuous and depends on the Northeast Dairy Compact, which in turn is controlled by national politics. The Northeast Dairy Compact won a reprieve in the Fall of 1999, but just barely. This means that in the future, dairy farming feed crops may need to be replaced with vegetables for example and that all types of farming production will need the support of local consumers. Strategies that may reduce the costs or increase the revenues associated with farming would assist in keeping this farmland in cultivation and help to ensure a successful transition to different crops. These could include eliminating excise taxes on farm animals and machinery, encouraging farmers to apply for Tax Increment Financing if available, and supporting links between farm stands, restaurants, and tourist hot spots like Yankee Candle.

The preservation of the rural character of Deerfield is also an important goal of the Master Plan. Although there are many tools and techniques for minimizing the visual impact of structures on the landscape, even a limited amount of development can still greatly affect the scenic quality of our landscapes. Consider River Road and Mill Village Road. These are two roads that access incredible scenery and significant historic landscapes. Residential development along each road has impacted the scenic character.

Deerfield is a regional employment center bisected by I-91, Routes 5/10, and 116. Although the level of traffic volume in Deerfield is affected by regional population and economic growth, congestion is directly related to land use in the vicinity of the major roadways. For example the development of a distribution center and office park may result in relatively high traffic generation as compared to a manufacturing firm. If there are numerous curb cuts, or entrances to the businesses, a greater number of vehicles slowing on Route 5/10 to enter and exit would result in heightened congestion. Ongoing residential development that scatters homes throughout town, continues to create conditions that hinder the adoption of alternative transportation systems. Traffic congestion is not a characteristic residents equate with rural character.

Natural resources have also been included in the preceding chapters and have been shown to be of finite quantity and quality. Drinking water is located within reservoirs. Some like the Roaring Brook Reservoir system, the main water supply for the South Deerfield Water Supply District, are above ground and others are below ground aquifers. Both types of reservoirs depend on healthy watersheds to maintain adequate supplies of clean water. The Deerfield Fire District's Stillwater Well taps into the Stillwater Aquifer that is located below the Deerfield River. The quality of this aquifer is dependent on people not introducing hazardous materials into the groundwater. Wastewater from septic systems, pesticides, and road salt, are just three examples of pollutants that have been known to affect aquifer water quality.

Current permitted water withdrawal volumes in the South Deerfield Water Supply District (SDWSD) are less than the amount needed to support existing development. Although the

SDWSD may receive permission from the Department of Environmental Protection to withdraw water at current usage rates, the supply is not without limits, and the search for new ground water sources, in and outside of the district, needs to continue. Future well sites within Deerfield may need to be developed outside of the SDWSD's territory and the best areas are those that are less intensively developed.

Water quality and wildlife and fisheries habitats are greatly affected by current land use patterns and practices. Current land use patterns include dense residential population in South Deerfield Village and the transportation corridors of I-91, Route 5/10, and Route 116. Traffic and development are concentrated in the valley and in the southern portion of Town. The result is that large portions of forestland along Pocumtuck Ridge, in the Old World part of West Deerfield, and in Whately Woods remain undeveloped. These large forested patches abut other forested areas in Conway and Shelburne. Large forest patches have significant habitat value and also provide protection for first order tributaries, which is important to preserving the water quality of Deerfield's large rivers. Certain practices associated with particular land uses can negatively impact the quality of the rivers and riparian habitats. For example, residential development and some farming practices in the valley can contribute to poor, river water quality. Agricultural chemicals, residential herbicide and fertilizer use, and wastewater from faulty septic systems are probably responsible in part for the significant lack of invertebrates in the main stem of Bloody Brook. These organic and inorganic pollutants can leach through the groundwater into small streams that cut through fields and run near residential developments. Many of these pollutants could be retained by a buffer strip of woody vegetation bordering both sides of a stream.

In summary the land use change which has occurred over the past thirty years is impacting the rural character and natural resource base. Subdivisions, commercial and industrial development, and approval not required residential development are the three main types of development in Deerfield. The early signs of sprawl are becoming evident, as ANR development continues to occur along town roads. The impacts of sprawl include reducing active farmland, changing the character of the community from rural to suburban, and eroding the quality of the natural resources upon which the residents depend, especially the quality of the water in Deerfield's streams, rivers, and aquifers.

Sustainable Development and the Cost of Community Services

The Deerfield Master Plan is in part a search for a model of development that retains the Town's rural character, active farmland, and its economic vitality. The formulation of Land Use and Zoning recommendations requires an understanding of the capacity of Deerfield's critical systems and the various models that may promote a balance of land uses and a stable tax rate. A critical system, for the purpose of this Master Plan, is defined as a set of interconnected resources that sustains Deerfield's residents. An impaired critical system would lead to a significant reduction in the prosperity, health, and quality of life for Deerfield's residents.

One critical system that has been examined in previous chapters is the quality and quantity of public water supplies (above and below ground). Undeveloped forest and farmland managed with best management practices protect drinking water supplies and levels of water within aquifers, rivers, and streams. These in turn support wildlife and fisheries. In Deerfield as in other communities, the maximum limit to the amount of water that can be consumed without endangering that system's ability to produce the same amount of water the next day, is called the safe yield. Logically, Deerfield would protect as much of the landscape in current and future aquifer recharge areas from development. Too much development would result in increased runoff, more non-point source pollution entering streams, rivers, and the ground water. Forests, orchards, pastures, and properly managed cultivated cropland in Deerfield naturally help the landscape filter, retain, and then release water into streams allowing for ample supplies of water for wildlife, fisheries, and for human consumption.

Beyond sustaining critical systems like watersheds, designing a model that balances the growth of land uses in Deerfield should also promote a stable tax rate. In designing the model it is important to understand the measurable values of different land uses. For instance, permanently protected open space (e.g. farmland/forest), residential, and commercial /industrial development each have a different fiscal impact depending on the relationship of property tax revenues generated to municipal services consumed. There is a process by which the fiscal value of these three different land uses are compared within a town to determine whether a use has a positive or negative fiscal impact. This process is called a Cost of Community Services (COCS) analysis.

In 1991 the American Farmland Trust conducted a Cost of Community Services analysis for several towns in the region including Deerfield. The results of that study showed that protection of farmland and open space is an effective strategy for promoting a stable tax base. The American Farmland Trust (AFT) studies found that for every dollar generated by farmland and open space, the municipal services required by that land cost only twenty-nine cents (\$0.29) resulting in a positive fiscal impact to the Town. Similarly, for every dollar generated by commercial and industrial uses, only thirty-eight cents (\$0.38) were spent by Deerfield on municipal services. In contrast, the AFT study found that for every dollar generated by residential development, the municipal services required by that land use cost one dollar and sixteen cents (\$1.16). On average, residential development costs more in terms of municipal services that it generates in tax revenues.

In 1995, the Southern New England Forest Consortium (SNEFC) commissioned a study of eleven southern New England towns that confirmed the findings of the earlier AFT study. The purpose of the SNEFC study was to evaluate the fiscal contribution of developed land versus that of open space using the methodology developed by the American Farmland Trust. This study was based on allocating one year's worth of income and expenses to different land use sectors to show the impact of these land uses on the local economy. The results of the study concluded that for eleven southern New England towns, the conversion of open space for residential development is not advisable on a financial basis alone. For every dollar of tax revenue raised from the residential sector, these towns spent an average of one dollar and fourteen cents (\$1.14) on residential services, which is a negative fiscal impact. The commercial and industrial development sectors on average cost the towns only forty-three (\$0.43) cents on services for each dollar of tax revenues received generating a positive fiscal impact. The study points out that the

figures for commercial and industrial development do not take into account secondary costs such as the potential for increased residential development, increased traffic and noise pollution, the loss of open space to filter water and air, or the need to provide recreation opportunities. Farm and forestland and open space in comparison costs on average forty-two (\$0.42) cents in municipal services. That left fifty-eight (\$0.58) cents to pay for municipal services for the residential sector. The study also found that there is a correlation between a town's population characteristics and the cost of community services. Towns that have larger and growing populations experience greater losses on their residential development. The study concluded that a "well balanced" land use plan would, in the long run, develop a stable tax base.

The challenge for Deerfield and other communities is to define what "well balanced" looks like in their community. A "well-balanced" land use plan that supports a stable tax base would also need to respect the capacity of the natural resource base. It would allow for the expansion of commercial and industrial development in a way that aggregated uses, created room for business expansion, protected farmland and historic resources, minimized water consumption and sewage production, and protected the integrity of the aquifer.

To illustrate the fiscal impact of different types of land uses, the following example is provided. It uses the cost of community services ratios developed by the American Farmland Trust in 1991. That is for every dollar raised in tax revenues from open space, commercial/industrial development, and residential development it will cost the Town twenty-nine cents (\$0.29), thirty-eight cents (\$0.38) and one dollar and sixteen cents (\$1.16) to provide municipal services for those uses. The primary reason that residential development has a negative fiscal impact is the cost associated with schools.

Using the FY (fiscal year) 2000 Assessment/Classification Report and acreage figures for different land uses provided by the Deerfield Board of Assessors, the following example illustrates the importance of maintaining the industrial /commercial tax base and having a strong open space protection program. It is important to remember the figures are averages and each development situation will be unique, but the figures provide a benchmark for the Town to identify an appropriate growth management strategy.

Assume a ten (10) acre subdivision of single family homes is developed. According to the assessor's records, the average value per acre for single family homes is:

$$\begin{array}{rcl}
 \$193,567,200 & / & 2,889 = \$67,001.45 \text{ (Average Value Per Acre of Single Family Homes} \\
 \text{(Total Residential} & \text{(Total Number} & \text{including land and buildings)} \\
 \text{Assessed Value} & \text{of Acres)} & \\
 \text{Type 101)} & &
 \end{array}$$

The estimated tax revenues generated by a ten acre subdivision of single family homes is shown in the calculation below. First, multiply the average value per acre for single family homes (*see above*) by the total number of acres in the subdivision. Then divide the total value for the whole ten acres by one thousand dollars and multiply the result by the property tax rate. The tax revenue will equal:

$$((\$67,001.45) \times 10 \text{ acres} / \$1,000) \times \$15 \text{ (Property Tax Rate)} = \$10,050.22$$

According to the American Farmlands Trust (AFT) Cost of Community Services analysis in Deerfield in 1991, the cost of municipal services for residential development was one dollar and sixteen cents (\$1.16) for every dollar raised in tax revenues. Therefore, using this ratio, the expenses of the municipal services needed for this ten acre subdivision would be equal to:

$$\$10,050.22 \text{ (Tax Revenue)} \times 1.16 = \$11,658.26 \text{ (Expense of Municipal Services)}$$

This results in a loss since revenues are less than expenses:

Tax Revenue	=	\$10,050.22
Expense of Municipal Services	=	\$11,658.26
Negative Fiscal Impact	=	(\$1,608.04)

Using the same information from the Deerfield Board of Assessors for industrial development and the American Farmlands Trust 1991 COCS analysis, a ten acre industrial subdivision would have a positive fiscal impact. First, the average value per acre for industrial uses is calculated below:

$$\frac{\$35,684,319 \text{ (Total Industrial Assessed Value)}}{495 \text{ (Total Number of Acres)}} = \$72,089.53 \text{ (Average Value Per Acre of Industrial Property including land and buildings)}$$

The estimated tax revenues would equal the average value per acre times ten (10) acres. This number is divided by one thousand and multiplied by the property tax rate to calculate the total tax revenue generated by ten acres of industrial property.

$$((\$72,089.53 \times 10 \text{ acres}) / \$1,000) \times \$15 \text{ (Property Tax Rate)} = \$10,813.43$$

The expenses incurred by Deerfield in providing the municipal services required by this ten acre industrial subdivision is calculated using the AFT ratio of 0.38, which means that for every dollar generated by industrial development, it is assumed that the direct expenses will not exceed thirty-eight cents. Therefore the expense of municipal services is just over four thousand dollars. If you then compare the revenue (\$10,813.43) and the expenses (\$4,109.10), it is clear that there is a positive fiscal impact estimated at over six thousand dollars (\$6,704.33) as shown below.

$$\$10,813.43 \text{ (Tax Revenue)} \times 0.38 = \$4,109.10 \text{ (Expense of Municipal Services)}$$

Tax Revenue	=	\$10,813.43
Expense of Municipal Services	=	\$4,109.10
Positive Fiscal Impact	=	\$6,704.33

In other words, for every ten acre residential subdivision, which costs the Town about sixteen hundred dollars a year, you would need between two and three acres of new industrial development to offset the loss incurred.

In determining the fiscal impact of ten acres of permanently protected farmland under the Agricultural Preservation Restriction (APR) program it is assumed that farmland under the APR program is valued by the Assessors at the same rate as farmland in the Chapter 61A Land Classification and Taxation Program. The average value per acre for APR farmland is around one thousand dollars (\$1,006.22) as shown below.

$$\begin{array}{rcl} \$2,161,352 & / & 2,148 = \$1,006.22 \text{ (Average Value Per Acre of APR/61A Land)} \\ \text{(Total APR/61A} & & \\ \text{Land Assessed Value)} & \text{(Total Number} & \\ & \text{of Acres)} & \end{array}$$

The estimated tax revenues, generated from ten acres of farmland in the APR program or in 61A, is calculated by taking the average value per acre, multiplying that value by the number of acres in the parcel (ten acres), dividing by one thousand dollars (\$1,000) and multiplying that amount by the property tax rate as shown below.

$$((\$1,006.22 \times 10 \text{ acres}) / \$1,000) \times \$15 \text{ (Property Tax Rate)} = \$150.93$$

Deerfield receives one hundred and fifty dollars and ninety-three cents (\$150.93) in tax revenues from a ten acre parcel of farmland in the APR or Chapter 61A programs. To determine the cost in municipal services that this ten acre farmland parcel would require, the same calculation is used as before except that the American Farmland Trust's ratio for open space/farmland is \$0.29. This means that for every dollar in tax revenues raised by open space land uses, only twenty-nine cents in municipal services are required. Therefore the cost of municipal services for ten acres of farmland in Deerfield is less than forty-four dollars (\$43.77).

$$\$150.93 \text{ (Tax Revenue)} \times 0.29 = \$43.77 \text{ (Expense of Municipal Services)}$$

The ten acre parcel of farmland produces a positive fiscal impact of over one hundred dollars.

Tax Revenue	=	\$150.93
Expense of Municipal Services	=	\$43.77
Positive Fiscal Impact	=	\$107.16

Both industrial development and open space protection has a role in balancing the negative fiscal impact of residential development. The best approach to maintaining a stable property tax rate is to ensure that residential development is balanced by both open space protection and industrial/commercial development. Protecting open space will reduce negative fiscal impacts over the short and long term.

use that on average costs Deerfield money every year. Industrial development has a significant positive fiscal impact but may produce some secondary effects whose cost have not been included. Protected open space has a small positive impact but more importantly prevents the negative fiscal impact of residential development.

The approximate cost to the Town to protect the ten (10) acres of land under the Agriculture Preservation Restriction (APR) Program would be five thousand dollars (\$5,000) or five hundred dollars (\$500) per acre. This amount would be spent by the Town in a little over three years if residential development were to occur.

Accordingly, investment in open space protection will greatly benefit the Town over the long term. Providing for industrial development expansion and proactive farmland and open space protection is the best choice for producing a stable tax rate. Encouraging industrial development alone will only make residential development less painful by maintaining the tax rates at a moderate level. However, with limited land available for commercial and industrial uses, this cannot be the only strategy. In addition, industrial and commercial development will not retain the rural character, or help to reduce the potential for traffic congestion. As industrial development expands, indirect development pressures from service industries, people seeking to live closer to their jobs, and increased traffic congestion is inevitable. Only through pursuing with equal effort, both the expansion of industrial/commercial development and the protection of farmland and open space, will Deerfield be able to maintain a stable tax rate and sustain the natural and agricultural resources that contribute to it's rural character.

Permanent protection of a significant portion of the landscape will also help to protect the long term health of current and future drinking water sources from increases in non-point source pollution that occurs in urbanizing watersheds. As Deerfield grows, no matter how slowly, the integrity of its aquifers must be protected for current and future use. Equally, the protection of federally endangered species habitats in the Mill River watershed should not be overlooked.

Deerfield should view open space protection as an integral part of a balanced land use plan that maintains a stable tax rate. Equally important is the ability to support new commercial and industrial development to offset the negative fiscal impacts of residential development. A balanced land use plan for Deerfield would work to direct growth in the best possible ways. It would seek to balance commercial/industrial development with residential land uses within a matrix of permanently protected farmland, forestland, and open space. Ideally, the commercial and industrial development would be located in areas where sewer and water infrastructure expansion would not put adjoining farms under development pressure. Future residential uses would be encouraged to locate around existing villages, instead of spread out in the middle of prime farmland or as ANR development along existing roads.

This is the first glimpse in the Master Plan of a future land use plan for Deerfield, which allows for prudent commercial and industrial expansion and residential land uses within a mostly protected forest and farmland filled landscape. The following section goes back to where we started in this chapter, with the current zoning and existing patterns, and assesses conditions in a possible future, one where the changes in land use follow the current zoning until all land is utilized. This analysis also assumes that no additional land is protected, and no additional land is

zoned commercial/industrial. The build-out analysis illustrates the current trend, where commercial and industrial development will occur to offset the fiscal losses created by the incoming residential development until each consumes as much land as allowed by zoning.

Build-out Analysis

The following build-out analysis methodology was developed by the Metropolitan Area Planning Council (MAPC) and adapted by MassGIS and the Executive Office of Environmental Affairs (EOEA) Statewide build-out analysis program. This build-out analysis program examines the potential for redevelopment of commercial, industrial, and residential areas based on the current zoning if all potentially developable land were built on to the maximum extent allowed by current zoning bylaws. Housing units and commercial and industrial square footage estimated to occur at build-out are used to calculate the total additional community facilities required from drinking water and municipal waste disposal to school enrollment figures.

The build-out analysis does not predict how fast or slow growth will occur, only what the end result will be. The time frame for build-out to be reached is probably many decades, but now is the time to implement a better model if the result of current zoning is not what the Town desires.

Table 7-3: Town of Deerfield Zoning Districts and Statistics in 1997

Zoning District	Acreage in District	Percent of Town
Residential/Agriculture Zone	17,962 acres	83.98%
Central Village Residential	692 acres	3.24%
Small Business	74 acres	0.35%
Commercial	1,215 acres	5.68%
Industrial	354 acres	1.66%
Planned Industrial	82 acres	0.39%
Watershed Protection Overlay District	517 acres	2.42%
No Zone-Water	492 acres	2.30%
Total	21,388 acres	100.00%

Table 7-3 describes acreages and the percentage of the total land in Deerfield that is found within each zoning district. Almost eighty-four percent (84%) of Deerfield's total land area is in the residential district with the largest minimum lot size. It is also important to note that the Watershed Protection Overlay District is an important district because its restrictions to development and associated uses are greater than the underlying residential/agriculture district.

The patterns of future development, as depicted in the results of Deerfield's build-out, depends on the requirements of each zoning district. Table 7-4 describes the assumptions for all of the different residential districts including their minimum lot size, frontage requirement, the road right-of-way width in a subdivision, the number of dwelling units allowed per lot, the maximum lot coverage by impervious surfaces allowed, and the calculated build factor. The assumptions for the commercial and industrial zoning districts are in Table 7-5 and include required parking, front setback, the maximum percentage of impervious surfaces allowed, and the height of the building.

Table 7-4: Town of Deerfield Assumptions used in Residential Build-out Calculations

Zoning District	Minimum Lot Size (in square feet)	Frontage Requirement (in feet)	Right of Way (in feet)	Build Factor	Dwelling Units/ Minimum Lot	Maximum Lot Coverage by Impervious Surfaces
Residential-Agriculture	60,000	200	50	0.620	1	50%
Central Village Residential - 1 Family	12,000	100	40	3.090	1	75%
Central Village Residential - 2 Family	15,000	100	40	2.470	2	75%
Water Protection Overlay District	80,000	200	50	0.460	1	50%

Source: Deerfield Zoning Bylaws, 1995 and EOEI Build-out Methodology.

Table 7-5: Town of Deerfield Assumptions used in Commercial/Industrial Build-out Calculations

Zoning District	Minimum Lot Size (in square feet)	Frontage Required (in feet)	Build Factor	Maximum Lot Coverage by Impervious Surfaces	Required Parking (400 sq.ft./Space)	Front Setback (in feet)	% of Lot for Roads/ Drainage	Height Assumed
Small Business	15,000	125	0.375	80%	1 Space/250 sq. ft	30	10%	2-Story
Commercial	30,000	200	0.375	60%	1 Space/250 sq. ft	50	10%	2-Story
Industrial	80,000	200	0.250	60%	1 Space/500 sq. ft	40	10%	1-Story
Planned Industrial	80,000	200	0.250	70%	1 Space/500 sq. ft	50	10%	1-Story

Source: Deerfield Zoning Bylaws, 1995 and EOEI Build-out Methodology.

The “Build Factor” is used to determine the number of units that can fit on every acre of developable land within any of the zoning districts. In the case of the Residential/Agriculture district, the build factor is determined by subtracting from a standard subdivision, the amount of land required for roads, utilities, and drainage, then dividing that remaining acreage by the minimum lot size. The build-out assumes both subdivisions and approval-not-required (ANR) development would occur over all potentially developable land. For example, a ten-acre parcel in Deerfield in the Rural Agricultural District can be subdivided with lots having a minimum size of sixty thousand (60,000) square feet. Roughly fifteen percent of the total acreage is assumed to be for the road, utilities, and drainage. So, ten acres minus fifteen percent equals eight and a half (8.5) acres. The build factor is then calculated as seen below:

$$\begin{aligned}
 \text{Build Factor} &= \frac{8.5 \text{ acres} \times 43,560 \text{ sq. ft. (\# of sq. ft in one acre)}}{60,000 \text{ square feet/lot}} \\
 &= 6.171 \\
 &6.171/10 \text{ acres (\# acres in parcel)} = 0.62 \text{ (the Build Factor)}
 \end{aligned}$$

Potentially developable land is that which does not have environmental constraints like steep slopes and that which is not already permanently protected such as state forest, farmland under the APR program, or land owned by a conservation land trust. The study estimated the gross

acreage of industrial, commercial, and residential development, which could be potentially developed under present zoning.

The build-out analysis in Deerfield illustrates an unbalanced land use plan where the land that can be developed in the residential/agriculture zoning district is, and the impacts of this design on the natural systems and on the community's facilities and infrastructure are staggering. In 1998, the total amount of drinking water used per day by customers of both public water supply districts was over eight hundred and eighty-four thousand (884,909) gallons, which is in excess of their current combined registered withdrawal volumes of seven hundred and fifty thousand (750,000) gallons per day. At build-out there will be an estimated demand for an additional two million, two hundred and seventy-two thousand (2,272,094) gallons per day for new residential, commercial, and industrial development. This additional water demand would require new ground water sources in both districts. The cost for establishing each new ground water source typically ranges from five hundred thousand (\$500,000) to two million (\$2,000,000) dollars. Excessive drinking water withdrawals in the future could also greatly impact water levels of wetlands and streams. Table 7-6 and 7-7 present the results of the potential build-out for residential and commercial/industrial development using the build factors and multipliers.

Table 7-6: Summary of Residential Land Uses Build-out Analysis Results

Zoning District	Amount of Land that can be Potentially Developed (Acres)*	# of Lots	# of Units	Additional Residents at Build-out ***	Additional School Children at Build-out ****	Additional Water Use (in Gallons per Day) at Build-out **	Additional Non-Recycled Solid Waste (tons/year) at Build-out *****	Additional New Road (miles) at Build-out
Residential/Agriculture	10,996	6,818	6,818	16,362	2,782	1,227,154	5,969	129
Watershed Protection Overlay District	405	186	186	447	76	33,517	163	4
Central Village Residential District - 1 Family	193	597	597	1,433	244	107,475	523	6
Central Village Residential District - 2 Family	22	53	159	382	65	28,637	139	1
Totals	11,616	7,654	7,760	18,624	3,167	1,396,783	6,794	139

*All mapped wetland areas removed from Potentially Developable Acreage.

** The assumed figure, 75 gallons per day/person, is from the Department of Housing and Community Development's Growth Impact Handbook.

***The figure 2.4 people/unit is from the 1990 Census; Population/Housing Units.

**** MISER; Percentage of School Children/Population in 1997.

***** The figure 0.3648 tons/person/year for non-recycled solid waste is the State-wide Average.

Table 7-7: Summary of Commercial/Industrial Land Uses Build-out Analysis Results

Zoning District	Potentially Developable Land (acres)*	Additional Commercial/Industrial square Footage (square feet) At Build-out	Additional Commercial/Industrial Water Usage in Gallons per Day at Build-out**
Small Business (C-I) District	5.70	93,110	6,983
Commercial (C-II) District	571.90	9,341,987	700,649
Industrial (C-III) District	197.40	2,149,686	161,226
Planned Industrial District	7.90	86,031	6,452
Totals	782.90	11,670,813	875,311

*All mapped wetland areas removed from Potentially Developable Acreage.

** the assumed figure of 75 gallons per day/1000 square feet is from the Department of Housing & Community Development's Growth Impact Handbook

At maximum build-out Deerfield will have lost its rural character. Consider that three years ago, according to the 1997 MassGIS Land Use coverage for Deerfield, roughly eleven percent (11%) of the Town's total land area was developed. According to the Massachusetts Institute for Social and Economic Research (MISER), the population in 1997 was five thousand, four hundred and fifty-four (5,454) people. The current population density is equal to one hundred and seventy (170) people per square mile. After the build-out, the population density will be equal to seven hundred and forty-eight (748) people per square mile. Imagine Deerfield with that many people and without the presence of nearly as much undeveloped open space. Currently, roughly sixty-five percent (65%) of the total landscape is undeveloped. While this may only happen far into the future, implementing a strategy to permanently protect forest and farmland needs to start now.

The results of the build-out forecast a future state for the Town of Deerfield where traffic congestion exists on the roadways. Land use is dominated by residential development, not forests and farmland. At build-out there will be an estimated seven thousand, seven hundred and sixty (7,760) more homes than there are today. There will be over eighteen thousand more people and over three thousand more school-aged children. There were less than nine hundred school-aged children in 1997.

The potential future for the Town of Deerfield as depicted by the build-out raises serious questions about whether the Town will be taxing the capacity of its aquifers. The build-out figures in Tables 7-7 and 7-8 show that residential water use will require an additional estimated one million and four hundred thousand (1.4 million) gallons per day and the additional commercial and industrial demand will be nearly nine hundred thousand (900,000) gallons per day. The total future demand for drinking water at build-out is over three million gallons per day and will clearly exceed the current capacity for both public water supply districts combined (*see Chapter 2 Community Facilities and Services*). In addition to overtaxing the aquifers, extensive residential development will increase the cost of community services due to the presence of three times as many school children, managing an additional seven thousand tons of municipal waste, and maintaining another one hundred and forty-six miles of town roads.

One interesting fact is that this maximum build-out scenario forecasts that roughly thirty percent of the entire Town will not be developed. That thirty percent is the same amount that is there today and includes land that is permanently protected or considered undevelopable because of the River Protection Act, wetlands, or excessive slopes, etc. The rest of the available land, based on this build-out analysis, would be developed and the impacts, although only estimated above, would clearly transform Deerfield into a suburban community with very likely higher tax rates and diminishing environmental quality. The rural character and agricultural landscapes would be largely gone.

Potential Impacts of Future Patterns of Development

The potential impacts of the future pattern of development upon the environmental quality, public drinking water supplies, traffic congestion, and the farming industry are important to estimate. A well-balanced land use plan protects critical systems and provides the basis for a stable tax rate.

The Impact of Future Development on Environmental Quality

The quality of Deerfield's aquatic resources and the health of upland and lowland plant, wildlife, and fisheries habitats and populations is dependent on, or directly related to, the integrity of its watersheds. Specifically, the manner in which water naturally permeates the soil, enters into the ground water to then recharge streams, rivers or aquifers, affects the water's quality and its availability for consumption.

The relationship between land use, watershed integrity, and wildlife and fisheries habitat is well recognized by the Commonwealth of Massachusetts. The Watershed Initiative, funded by the Commonwealth of Massachusetts Executive Office of Environmental Affairs, has implemented watershed planning by teams throughout the State.

The first two chapters of the Master Plan established that land uses can impact the health and integrity of both groundwater and surface water supplies, which are recharged by precipitation that has infiltrated through soil into the groundwater. Therefore to protect the long term integrity of the public water supplies in Deerfield, residents and Town Officials should seek ways to protect their watersheds. The basic concepts of watershed protection include:

- a) Each sub-watershed contains a network of small stream channels that are known as headwater streams, which represent a majority of the drainage network and are exceptionally vulnerable to development within the watershed;
- b) Recent scientific research has shown that the amount of impervious cover in a sub-watershed can be used to project the current and future quality of many headwater streams; and
- c) The relationship between impervious cover and sub-watershed quality can be predicted by a simple model that projects the current and future quality of streams and other water resources at the sub-watershed level.

To forecast the amount of impervious surface, the State Department of Environmental Protection uses a technique developed in part by the Center for Watershed Protection (CWP) in Elliot, Maryland. According to CWP, stream research generally indicates that good stream quality exists when there is less than ten percent (10%) of impervious cover in the sub-watershed. A second threshold appears to exist around twenty-five to thirty percent (25%-30%) the impervious cover, where most indicators of stream quality shift to a poor condition including diminished aquatic diversity, water quality, and wildlife habitat values.

The EOE has developed a Geographic Information Systems (GIS) analysis tool that allows users to determine the amount of impervious cover in any sub-watershed in the Commonwealth. The percentage of impervious cover is equal to the overall portion of the landscape within a sub-watershed that is comprised of surfaces that keep water from entering the soil at the point at which rain impacts the land. For example, when rain drops impact cement and asphalt and the water travels on these surfaces, that movement of water is called storm water runoff. The more runoff, which occurs in a sub-watershed, the more above ground pollutants, like road salt, oils, and phosphates, will find their way into streams via storm drains.

The amount of land that is covered by surfaces that are impervious to water is an important indicator. As a community grows new housing, roads, and parking lots increase. Open space diminishes, thus reducing the amount of surface area that would allow rainwater to enter into the groundwater naturally. Communities with a high percentage of impervious surfaces find that heavy rainstorms produce quickly rising streams, more flooding, erosion, siltation, and extensive non-point source pollution problems. This in turn changes the structure of the streambeds, increasing channeling and reducing fisheries and wildlife biodiversity.

According to CWP, aquifers can be negatively impacted by impervious cover in terms of both the quantity and quality of groundwater. Impervious cover decreases infiltration rates and allows more stormwater to be diverted as runoff. This in turn reduces the amount of ground water available to recharge aquifers. Identifying future public water supply areas and protecting their recharge areas from excessive amounts of impervious surfaces is an important consideration for a well balanced land use plan.

Portions of the Town of Deerfield are within three main watersheds and sub-basins: the Connecticut River basin, the Mill River sub-basin (of the Connecticut River), and the Deerfield River basin and contain ten separate sub-watersheds. It is important to determine the percentage of impervious cover that exists in each sub-watershed. The percentage of impervious cover is a rough estimate based on the relationship between that area's different land uses and the expected percentages of impervious cover found to be associated with each use. For example forestland is estimated to have a very low percentage of impervious surfaces and dense urban residential areas with all the roofs, parking lots, and roadways would be estimated to have a high percentage of impervious cover.

Impervious cover analysis can provide a look at the general health and integrity of the streams, wetlands, and aquifers within the sub-watersheds in Deerfield today and at build-out. It is important for Deerfield to be able to determine the percentages of impervious surfaces in each of

its sub-watersheds as a tool in land use planning. Development projects, which are to be located in sub-watersheds, which are already compromised by known levels of impervious surfaces, may require additional conditions to ensure that the quality of the sub-watershed's streams, groundwater, and aquifer are not diminished further.

Although impervious surface analysis is best applied at the sub-watershed level, percentages are presented here for the entire surface area of the Town of Deerfield. The land use acreages and the percentage of impervious surfaces are estimated and compared between the year 1997 and the time of maximum build-out. The resulting figures show that in 1997, of the entire surface area in Deerfield, four percent (4%) is made up of impervious surfaces. At build-out, the percentage climbs to fifteen percent (15%). At some point in the future, were Deerfield to grow as illustrated in the build-out analysis, the percentages of impervious surfaces would exceed ten percent (10%) resulting in a reduction in the quality and quantity of water in the majority of the watersheds' streams, groundwater supplies, and aquifers.

Table 7-8: Estimated Percentage of Impervious Surface in Town of Deerfield in 1997

	Land Use Acreages in 1997	Department of Environmental Protection (DEP) Impervious Multiplier	Impervious Acres based on DEP Model	
Forestland	12,340	0.01	123	
Agriculture	5,005	0.01	51	
Wetland/Water	706	0.01	7	
Waste Disposal	245	0.01	3	
Open Land	0	0.01	0	
Recreation	144	0.02	3	
Transportation	461	0.75	346	
Residential > 1/2 acre	845	0.10	85	
Residential 1/4 - 1/2 acre	765	0.13	100	
Residential <1/4 acre	0	0.57	0	
Residential-Multi	14	0.80	11	
Industrial	149	0.75	112	
Commercial	106	0.90	95	
Total Area	21,388		936	4 %

Source: MacConnell 1997 Massachusetts GIS Land Use Cover

Table 7-9: Estimated Percentage of Impervious Surface in Town of Deerfield at Maximum Build-out

Land Use Category	Estimated Land Use Acreages at Build-out	Department of Environmental Protection (DEP) Impervious Multiplier	Impervious Acres	
Forestland	4,240	0.01	42	
Agriculture	1400	0.01	14	
Wetland/Water	706	0.01	7	
Waste Disposal	0	0.01	0	
Open Land	0	0.01	0	
Recreation	144	0.02	3	
Transportation	1,346	0.75	1,010	
Residential > 1/2 acre	11,623	0.10	1,162	
Residential 1/4 - 1/2 acre	958	0.13	125	
Residential <1/4 acre	0	0.57	0	
Residential-Multi	35	0.80	28	
Industrial	252	0.75	189	
Commercial	684	0.90	616	
Total Area	21,388		3,196	15%

Source: MacConnell 1997 Massachusetts GIS Land Use Coverage and EOEA Build-out Analysis.

The subject of impervious surfaces becomes more relevant with the definition of the aquifer recharge area boundaries. Once the recharge areas are known for both current and potential future public water supplies, the relationship between land use, the percentage of impervious surfaces within the recharge area, and the quantity and quality of drinking water within the aquifers will become important to quantify. Even before that time though, it is important for Deerfield to acknowledge that the potential results of the build-out analysis provide enough evidence to warrant choosing a model that works to protect significant amounts of farm and forestland for the purpose of conserving the integrity of their public water supplies.

The Impact of Future Development on Traffic Congestion

The Town of Deerfield is a regional employment center that contains one interstate and two north south roadways (Routes 5/10 and 116) that provide access to much larger population centers and other towns. Regional population growth will therefore have an impact on Deerfield's roadways. However, even if that were not the case and future development in Deerfield were allowed to follow the plan presented by the build-out, the rise in traffic congestion would still be significant. Current traffic congestion levels are high enough to warrant being chosen by residents as one of the top five planning issues in Deerfield's community survey. Imagine the population of Deerfield doubling or tripling and then consider the resulting traffic flows on Routes 5/10 and 116. As these main roads become congested, commuters are apt to discover other routes as they are doing even now. The build-out analysis

estimated that there would be one hundred and forty six (146) miles of new roads that would be constructed through the development of subdivisions.

The existing Level of Service (See Chapter Five, Transportation Resources) ratings for Deerfield's major roads already indicate significant traffic congestion during peak travel hours. The Level of Service (LOS) is a qualitative measure of traffic volume to capacity, with the capacity of a roadway being calculated based on geometric and environmental conditions. LOS is calculated for peak flow traffic conditions and is used to identify sections of road, which are at or nearing capacity based on traffic volume or experience congested conditions due to geometric parameters of the road's layout. The varying LOS levels are assigned letters A (no congestion) through F (gridlock). A desirable LOS is "C" or better. In Deerfield, Route 5/10 is already classified as having an LOS of "D" and Route 116, between Sugarloaf Street and the Sunderland Bridge, is ranked as "E." Unless Deerfield's land use plan pro-actively supports public transit and conserves a significant amount of its farmland and open space, traffic congestion on all major and minor routes and collectors will continue to degrade the Town's rural character.

The Impact of Future Development on the Farmland and Open Space

The potential build-out analysis assumes that after 1997 there would not be any additional open space preserved. Therefore fourteen hundred (1,400) acres of farmland would survive the maximum build-out. Roughly three hundred acres of this total is land owned by the University of Massachusetts. Assuming that the trends in farm size presented in the Farmland section of Chapter One are still relevant, there would be enough land for two large scale farms and several small retail farms. This also assumes that there is enough of an agricultural industry in the region for farming to be economically feasible. By the time most of the farmland has been converted to residential uses in the area, the businesses that support local farmers may have closed shop for lack of clientele.

What will be the nature of farming in Deerfield when most of the large farms are gone? The farms that are on permanently protected land may become inactive for lack of equipment, supplies, and services. One farmer noted recently that horse and riding stables are big in some areas of the state. In a suburban neighborhood riding stables may actually be more popular. Otherwise farmland may succeed back to forestland.

With respect to open space in general, approximately six thousand and eight hundred (6,800) homes are forecasted by the build-out analysis to be constructed in the Rural/Agriculture zoning district and this would consume close to 11,000 acres of land. Deerfield's total acreage is twenty-one thousand, three hundred and eighty-eight (21,388) acres. While the time frame for the build-out is uncertain, population forecasts (*see Housing Chapter*) indicate the need for 90 – 120 new homes by the year 2010. This would consume 124 to 166 acres in the Residential/Agriculture District.

Recommendations

The following recommendations require changes to Deerfield's existing zoning bylaws. The current land use plan in effect today is the support of commercial and industrial development as the main stabilizer to property tax rates impacted by increased residential development. Although support of major employers and small businesses is an important component of a balanced land use plan, reflected in the following zoning recommendations, the proactive permanent protection of farmland and open space is an equally important recommendation and one that can only be indirectly supported by zoning. Farmland and open space preservation must therefore depend on the targeting of federal, state, municipal, and private funding to purchase development rights from willing landowners.

The following zoning and non-zoning recommendations do provide support for a balanced land use plan. The non-zoning recommendation is the establishment of a town-sponsored open space protection program. Zoning recommendations include, the establishment of a watershed protection district in the basin, which empties into the South Deerfield Water Supply District's Roaring Brook Reservoir, to help reduce future non-point source pollution. An Agriculture Protection Overlay District could help to target land preservation efforts, control residential development, and provide farming operations with business support. Possibly rezoning the land adjacent to and including the East Deerfield Railyard from C-II Commercial to C-III Industrial would support major employers with land located outside of the prime farmland areas. The expansion of the C-I Small Business district in South Deerfield to include both sides of Elm Street to its intersection with Route 5/10 would attract infrastructure improvements and financial support to small businesses located in the village center. Finally, voluntary design guidelines would seek to encourage that rural character and traditional architecture are retained and reflected in new development.

There are also two long term recommendations that are included, which require technical information currently unavailable. The first is the recommendation that an aquifer protection overlay district be identified that would protect the recharge areas of future ground water sources for South Deerfield. The second long term recommendation concerns the determination of sending and receiving zones for the implementation of a transfer of development rights bylaw.

Short Term Recommendations

Open Space Protection Program

The Town of Deerfield should develop and implement a strong and consistent program of open space protection. Purchasing development rights from willing landowners is one of the more efficient ways of protecting the most land with limited funding. The Town can influence the amount of farmland protected through the Agricultural Preservation Restriction (APR) Program by contributing five percent (5%) of the cost of the development rights for each acre that is protected. The Town can also work closely with conservation land trusts in the area, like the Deerfield Land Trust, to purchase the development rights from willing forest landowners.

A proactive Open Space Protection Program would seek to purchase the development rights from willing landowners, and could receive donations of land, in areas that protect working farmland, river corridors, recreational sites, wildlife habitat, and historically significant scenic landscapes. Protecting land and these natural, cultural, and historical resources will help to ensure that the areas of Deerfield that residents value, will be there for future generations. Protected open space can direct residential growth to desirable areas, conserve aquifers and drinking water supplies, and ensure that Deerfield retains its rural character well into the future.

Watershed Protection Overlay District

The South Deerfield Water Supply District recommends that the Town of Deerfield establish a Watershed Protection Overlay District similar in concept to the overlay district protecting the Deerfield Fire District's Stillwater springs and well. The purpose of the existing Watershed Protection Overlay District is "to promote the health, safety, and general welfare of the community by ensuring an adequate quality and quantity of drinking water for residents, institutions, and businesses; to preserve existing and potential sources of drinking water supplies; to conserve the natural resources of the Town; and to prevent temporary and permanent contamination of the environment."

The Roaring Brook Reservoirs are located in Conway and Whately and serve as the surface water supplies for the South Deerfield Water Supply District (SDWSD). Roaring Brook is a tributary of the Mill River, which along with Bloody Brook drains a significant portion of the Mill River watershed. The Mill River watershed is considered a sub-basin of the Connecticut River basin. The Roaring Brook sub-watershed is separated from another sub-watershed by the edge or boundary of its "bowl." All watersheds are defined as the area of land that drains to create stream flow at a particular point. The boundaries of the sub-watershed for the Roaring Brook reservoirs and thus the overlay district, represent the edge at which rain water would travel to the reservoirs as opposed to the next stream to the northeast or southwest.

The proposed overlay district would be located in the southwestern corner of the Town, with its eastern boundary beyond Whately Glen Road. The SDWSD currently owns roughly one third of the sub-watershed. The history of land use in this area appears to be mostly farming with no residential development existing within the proposed district. The watershed protection overlay district prohibits land uses, which utilize or generate hazardous materials to protect public water supplies. Single family homes would be allowed but would require a minimum lot size a bit larger than the underlying Residential/Agriculture zoning district. In addition, the watershed protection overlay districts could be identified as potential sending zones if and when, a Transfer of Development Rights bylaw is established in the Town of Deerfield.

Agricultural Protection Overlay Districts

The overall purpose of an Agricultural Protection Overlay District in Deerfield would be to shape the pattern of residential development so that as much farmland as possible could remain accessible to farmers. Controlling residential development would help keep farm operations viable. It would also protect other benefits like the pastoral scenery and rural character that are easily diminished with the poor placement of large and small modern homes.

The location of such an overlay district should encompass those areas that are both highly valuable from a soils standpoint and at the same time are under threat of conversion to residential development. Important areas to protect may also represent vast viewsheds unparalleled in the region, or significant historic landscapes that are part of the Old Deerfield National Historic Landmark area. These areas could represent large contiguous blocks of farmland that, from an economic standpoint would warrant preservation efforts to support the agricultural operations in Town. Finally, some of the lands in the overlay district may represent areas of farmland that are associated with a stream, that if urbanized further, would probably result in the destruction of the habitat of federally endangered wildlife species within the watershed.

The proposed Agricultural Protection Overlay Districts would cover the entire Old Deerfield National Historic Landmark area, south to the Technology Park (along Route 5/10) and then southwest to the Mill River valley, but well east of the Mill River residential area. A separate overlay district is proposed for the farmland along River Road, from the southern edge of the C-II Commercial district near the East Deerfield Railyard south to Route 116.

The requirements of the Agricultural Protection Overlay Districts would depend on the associated use regulations adopted in the zoning bylaws. For example, residential development could be controlled by requiring the submittal of a conservation development plan, also known as a cluster plan, for any subdivision. The overlay district might also include language that requires the use of neighborhood septic systems to prevent development pressures that sewer line expansion would bring. It might also include the official recognition that farm-related businesses within the district would be able to apply for Tax Increment Financing if they choose to invest in farm-related structures or commercial retailing that focuses on selling locally produced value-added agricultural products.

Rezoning the land around the East Deerfield Railyard from C-II Commercial to C-III Industrial

Currently in the northeastern portion of East Deerfield there is land that is zoned as a C-II Commercial district. This type of commercial district allows offices, banks, retail sales, hotels or motels, printing and publishing shops, bakeries, and deli shops. The area is currently dominated by a trap rock quarry in the western portion of the district and by the East Deerfield Railyard and a nursery growing ornamental trees and shrubs in the northern section. The East Deerfield Railyard, as explained in the Transportation Resources chapter of the Master Plan, is considered one of the largest classification yards in New England. Determining whether the zoning of this land should be changed from C-II to C-III depends on the results of an engineering study proposed jointly by the Deerfield Economic and Industrial Corporation and the Master Planning Committee. The purpose of the engineering study will be to determine the feasibility of establishing a new industrial park including the cost of providing sewer and water infrastructure and roadway access.

The purpose for rezoning the land from C-II to C-III involves factors uncovered in the Master Planning process. In the Economic Development Chapter of the Master Plan, it was discovered that Deerfield is a regional employment center and eighty percent (80%) of the current employment in Deerfield is located amongst fifteen major employers. Deerfield's economic

development efforts should be focused on providing opportunities for its major employers to expand their operations within Deerfield. To be able to expand, major employers require properly zoned land, water and sewer infrastructure, and access to major highways. Some of these employers may be able to expand where they are, like Hardigg Industries. Others, like Yankee Candle, require more land and infrastructure on a separate parcel. As shown by the Build-out analysis there is little land available in the Planned Industrial Zone and a good portion of the land available in the existing C-III district along the Route 5/10 corridor will be used up by the Yankee Candle expansion.

Manufacturing industries in Deerfield employ mostly full time employees, so each job created provides more overall value to the employee and thus the larger community. In addition, manufacturing industries typically generate much less traffic than commercial businesses like office space. As shown in the Cost of Community Services analysis, industrial uses have a positive fiscal impact. The land currently zoned C-II Commercial near the East Deerfield Railyard is considered to be a better alternative to rezoning and developing prime farmland soils in other areas of Town if the engineering study results are favorable.

Expand C-I Small Business District in South Deerfield west to include the Intersection of Elm Street and Route 5/10

The existing pattern of development in the western portion of the South Deerfield Village Center, specifically between the Town common and the intersection of Elm Street and Route 5/10, is of large scale commercial and industrial businesses separated by open urban land. This pattern of development creates a visual barrier between passing motorists along the Route 5/10 corridor and the South Deerfield Village Center. There would likely be more growth opportunities for South Deerfield small businesses if the downtown area were connected to the flow of people traveling along Route 5/10 just several hundred feet away.

This change in the zoning districts would seek to connect South Deerfield with the dominant regional travel way, yet conserve the majority of the land area currently dedicated to commercial and industrial development. The proposed new C-I, small business district would extend west from the railroad tracks along Elm Street to Route 5/10. The northern and southern boundaries of the C-I Small Business district would then extend two hundred and fifty (250) feet back on either side of Elm Street (*see Potential Zoning Districts Map*). This area now contains five of the seven lots with frontage along Elm Street on the north side and small portions of five other lots including the larger lot used by Yankee Candle. On the southern side of Elm Street, the district would include one of the five lots with frontage on Elm Street.

Voluntary Design Guidelines

The land and buildings along Route 5/10 and within portions of South Deerfield's village center have gone through significant changes over the past fifty years. In some cases, Deerfield has seen its rural character lessened. A town's rural character will begin to fade with increased traffic congestion and the development of architecture and signage that takes away from the town's unique characteristics often anchored in the historical and architectural styles and patterns of buildings and village layout.

Voluntary design guidelines are one way to encourage the preservation of these historical and architectural styles and patterns. With proper planning, the Town of Deerfield could identify which styles and development patterns they would like to encourage for building heights, roof lines, window treatments, signage, landscaping, and parking. Deerfield could then offer incentives to developers by providing reductions in the requirements of parking spaces or increases in the maximum lot coverage in exchange for following aspects of the guidelines to help make their structures consistent with the local character.

Long Term Recommendations

Establish a Transfer of Development Rights Bylaw

A transfer of development rights bylaw allows property owners in one area of Deerfield (sending zone) to transfer development rights to a property owner in a different area (receiving zone) of Town. For example, a property owner with land in either a Watershed Protection District or an Agricultural Protection Overlay District (sending zones) might sell their development rights to a landowner in a village center or industrial zone in order to permanently protect their farmland while realizing value for the development rights. The landowner in the receiving zone might purchase these development rights in order to increase the square footage of industrial development or decrease the lot size requirements for residential homes beyond what is currently permitted under existing zoning.

Transfer of development rights facilitates the protection of prime agricultural land and open space by allowing development to be concentrated in designated areas of Town. Landowners that own land in areas that are designated as sending zones will be able to sell their development rights. However, this requires receiving areas in Deerfield that residents agree should receive development at a higher density than is currently allowed by zoning. These receiving zones would probably be areas of Town that are already developed, have water and sewer infrastructure, and could accommodate more development if a higher density were allowed. Because many people are concerned about increasing density in their neighborhoods, the passing of a transfer of development rights bylaw will require additional discussion and study.

Establishment of Aquifer Protection Overlay Districts

Delineate Zone II Water Recharge Areas for all existing and future public drinking water supplies and expand the Aquifer Protection Overlay District to encompass these areas and prevent contamination from hazardous materials.

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APPENDIX I

The Deerfield Master Plan:

Survey Analysis

Prepared by:

Laurie Connors
UMASS Graduate Assistant

Return Rate

Surveys distributed: 2324
Percentage returned by deadline: 30.34%
Total percentage returned: 32.79%

Day	Return Rate	Marked Surveys
Business day 6	3	
Business day 7	0	
Business day 8	2	
Business day 9	380	1
Business day 10	61	1
Business day 11	0	
Business day 12	46	
Business day 13	0	
Business day 14	144	6
Business day 15	0	
Business day 16	0	
Business day 17	3	
Business day 18	0	
Business day 19	66	
Total Returned by Deadline:	705	8
Total Returned Thereafter:	762	

WHY DO YOU LIVE HERE?

Deerfield Questionnaire:

Question 1

How long have you lived in Deerfield?

Age:	# of Responses	Percentage of Total	Age:	# of Responses	Percentage of Total
0 - 5 years	126	19%	46 - 50 years	24	4%
6 - 10 years	95	14%	51 - 55 years	7	1%
11 - 15 years	90	13%	56 - 60 years	14	2%
16 - 20 years	57	8%	61 - 65 years	12	2%
21 - 25 years	72	11%	66 - 70 years	15	2%
26 - 30 years	55	8%	71 - 75 years	10	1%
31 - 35 years	39	6%	76 - 80 years	5	0.73%
36 - 40 years	35	5%	81 - 85 years	2	0.29%
41 - 45 years	23	3%			

Total responses: 681

WHY DO YOU LIVE HERE?

Deerfield Questionnaire: Question 3

During the time you have resided in Deerfield do you feel that each of the following has improved, stayed the same, or worsened? Please circle an item for each number.

	Much Better	Better	Same	Worse	Much Worse	Total Responses
	1	2	3	4	5	
Access to major highways	99 or 14%	112 or 16%	452 or 66%	21 or 3%	5 or .73%	689
Affordable housing	2 or 1%	16 or 6%	125 or 49%	69 or 27%	42 or 17%	254
Air/water quality	5 or 2%	17 or 7%	127 or 50%	73 or 29%	30 or 12%	252
Historic character	9 or 4%	56 or 24%	153 or 64%	14 or 6%	6 or 3%	238
Job opportunities	10 or 4%	86 or 38%	109 or 48%	17 or 7%	7 or 3%	229
Proximity to family/friends	11 or 5%	25 or 10%	189 or 79%	4 or 2%	11 or 5%	240
Public services	8 or 3%	59 or 25%	147 or 63%	15 or 6%	6 or 3%	235
Quality of school systems	22 or 9%	81 or 35%	87 or 37%	33 or 14%	12 or 5%	235
Recreation opportunities	5 or 2%	41 or 17%	151 or 62%	26 or 11%	19 or 8%	242
Rural character	5 or 2%	17 or 7%	96 or 37%	101 or 39%	42 or 16%	261
Safety from crime & vandalism	9 or 4%	32 or 13%	138 or 57%	48 or 20%	15 or 6%	242
Scenic views	6 or 3%	10 or 4%	155 or 66%	52 or 22%	11 or 5%	234
Taxes	1 or .37%	6 or 2%	117 or 43%	83 or 31%	63 or 23%	270
Walkability of villages	2 or .87%	19 or 8%	191 or 83%	13 or 6%	5 or 2%	230
Wildlife & natural areas	2 or .87%	26 or 11%	148 or 64%	45 or 20%	10 or 4%	231
Other	1 or 1%	2 or 3%	13 or 17%	16 or 21%	44 or 58%	76
Total:						

WHY DO YOU LIVE HERE?

Deerfield Questionnaire: Question 4

The following is a list of issues affecting the Town. In your opinion what are the top five planning

	Most Important	2nd Most Important	3rd Most Important	4th Most Important	5th Most Important	# of Responses	Percentage of Total
1 Air & Water pollution	77	35	31	37	33	213	7%
2 Excessive noise	4	10	20	12	21	67	2%
3 Few recreation areas & programs	23	26	37	40	39	165	5%
4 Inadequate highway services	5	3	5	7	6	26	1%
5 Inadequate medical services	5	8	8	9	16	46	1%
6 Inadequate police & fire services	7	4	4	5	5	25	1%
7 Insufficient space for walking	2	6	5	13	17	43	1%
8 Lack of affordable housing	28	16	25	20	18	107	3%
9 Lack of elderly services	19	23	20	23	25	110	3%
10 Lack of job opportunities	6	13	11	13	11	54	2%
11 Lack of public sewer system throughout town	107	59	36	28	27	257	8%
12 Lack of public transportation	16	21	32	31	35	135	4%
13 Loss of critical wildlife habitat & natural areas	24	53	60	36	35	208	6%
14 Loss of open space	75	64	61	60	48	308	9%
15 Malfunctioning septic systems	22	66	20	25	26	159	5%
16 No recycling/ poor waste disposal	6	17	22	20	20	85	3%
17 Population growth	56	53	68	57	45	279	9%
18 Quality of schools	65	54	44	44	34	241	7%
19 Tax increases	69	68	66	52	47	302	9%
20 Traffic safety & congestion	44	51	62	70	52	279	9%
21 Vandalism & theft	4	11	20	28	47	110	3%
22 Other(please list)	13	5	4	4	13	39	1%
Total:						3258	

Total Responses:

WHY DO YOU LIVE HERE?

Deerfield Questionnaire: Question 5

Considering everything about Deerfield, use the scale below to rate your overall satisfaction with the quality of life in this community.

		# of Responses	Responses per Category	Percentage of Total
Terrible	0	2	3	0.44%
	5	0		
	10	0		
	15	0		
	20	1		
Dissatisfied	25	2	5	0.73%
	30	0		
	35	1		
	40	1		
	45	1		
Mixed	50	71	150	22.03%
	55	4		
	60	29		
	65	29		
	70	17		
Satisfied	75	250	478	70.19%
	80	68		
	85	52		
	90	82		
	95	26		
Delighted	100	45	45	6.61%
Total Responses:		681		

HISTORIC, NATURAL, SCENIC and RECREATIONAL RESOURCES

Deerfield Questionnaire: Question 6

What are your favorite historic, natural and scenic features of Deerfield? Please list one example for each category.

Historic 1	number	Natural 2	number	Scenic 3	number
Old Deerfield	458	Mt. Sugarloaf	150	Mt. Sugarloaf	449
Bloody Brook Monument	15	Connecticut River	129	Pocumtuck Ridge	53
Bloody Brook	14	Pocumtuck Ridge and Trails	60	Views from the rock	30
Farmland	13	Deerfield River	48	CT. River	17
PVMA	12	Farmland	40	Deerfield River	10
Indian house	8	Stillwater bridge area	22	Fields	8
Sugarloaf Mt.	8	Old World	9	River Rd.	8
Town cemeteries	8	Rivers & streams	7	Hills in the area	6
Brick Church	6	Pocumtuck Range	6	Hillside Rd.	6
Deerfield Academy	4	North Meadows	6	Backroads	5
Deerfield Inn	4	Red Rock	6	North and South meadows	5
Memorial Hall	4	Trails	6	View from Clarkdale Peach Orchard	5
Colonial era homes	3	Woodlands	5	Upper Rd.	4
Indian Sites	2	Hawk Road Area	4	My house	3
Connecticut River	1	South Meadows- River	3	Pocumtuck RRock	3
Corner on N. Main St.	1	Whately Glen	3	Wildlife	3
Deerfield North meadows	1	Barns	2	Apple orchard	2
Dwight Barnard House	1	Mt. Parker	2	My frontyard view of Sugarloaf	2
Freery House	1	Pocumtuck Preserve	2	Views from both ridges	2

HISTORIC, NATURAL, SCENIC and RECREATIONAL RESOURCES

Deerfield Questionnaire: Question 7

How Important is it to you that the following resources are maintained and preserved?
Please circle a number for each item:

	Very Important 1	Important 2	Somewhat Important 3	Indifferent 4	Not Important 5	Total Responses
Historic Buildings and landscapes	375 or 55%	206 or 30%	66 or 10%	22 or 3%	9 or 1%	678
Recreation areas	329 or 49%	215 or 32%	92 or 14%	28 or 4%	14 or 2%	678
Scenic views	410 or 60%	194 or 29%	56 or 8%	11 or 2%	8 or 1%	679
Wildlife habitat, Stream corridors	427 or 63%	173 or 26%	58 or 9%	11 or 2%	8 or 1%	677
Working farms	442 or 65%	163 or 24%	51 or 8%	15 or 2%	8 or 1%	679

HISTORIC, NATURAL, SCENIC and RECREATIONAL RESOURCES

Deerfield Questionnaire: Question 8

Which of the following facilities, parks, or areas do you or your household use for recreational activities?

	Frequently 1	Occasional 2	Seldom 3	Never 4	Total Responses
Arms property walking trails(Ridge Rd.)	24 or 4%	70 or 11%	89 or 14%	434 or 70%	617
Deerfield & Connecticut Rivers	131 or 20%	209 or 32%	186 or 28%	135 or 20%	661
Frontier Reg. High School rec. facilities	55 or 9%	52 or 8%	131 or 20%	409 or 63%	647
Mount Sugarloaf State Reservation	111 or 17%	251 or 38%	250 or 37%	58 or 9%	670
Old Deerfield Elem.School playing fields	61 or 10%	51 or 8%	115 or 18%	405 or 64%	632
Pocumtuck Ridge Nature Preserve(Hillside & Stage Roads	81 or 13%	95 or 15%	154 or 24%	311 or 49%	641
S.Deerfield Elem. School gym, playground & fields	90 or 14%	57 or 9%	109 or 17%	389 or 60%	645
Sugarloaf Field	43 or 7%	49 or 8%	119 or 19%	434 or 67%	645
Town Memorial Forest(Stream Mill Rd.)	11 or 2%	36 or 6%	87 or 14%	476 or 78%	610
Tri-Town Beach (Whately)	112 or 17%	81 or 12%	150 or 23%	311 or 48%	654

HISTORIC, NATURAL, SCENIC and RECREATIONAL RESOURCES

Deerfield Questionnaire: Question 9

Which of the following strategies do you believe Deerfield should pursue regarding recreation opportunities?

	# of Responses	Percentage of Total
1 Publicize recreation programs/opportunities	317	33%
2 Provide more recreational facilities only	102	11%
3 Provide more recreational programs only	77	8%
4 Place equal emphasis on providing both facilities and programming	293	30%
5 None of the above, recreation opportunities in Deerfield are adequate and well known among residents	177	18%
Total Responses:	966	

HISTORIC, NATURAL, SCENIC and RECREATIONAL RESOURCES

Deerfield Questionnaire: Question 10

What kind of recreational facilities, if any, would you like to see in Deerfield? Please mark the numbers that correspond to your choices.

	Most Desirable	2nd Most Desirable	3rd Most Desirable	4th Most Desirable	5th Most Desirable	# of Responses	Percentage of Total
1 No new facilities	76	10	7	3	13	109	4%
2 Access to rivers	91	83	44	48	31	297	12%
3 Basketball courts	10	15	22	20	15	82	3%
4 Golf course	26	29	16	13	27	111	5%
5 Indoor area (fitness center, gym)	84	60	52	59	23	278	11%
6 Parks & playgrounds	55	80	65	51	34	285	12%
7 Picnic & roadside rest areas	19	44	51	31	45	190	8%
8 Recreational fields	41	45	41	40	39	206	8%
9 Skateboarding areas	6	8	14	8	11	47	2%
10 Skating rink (ice or inline)	20	36	38	30	25	149	6%
11 Swimming pool	44	45	27	40	13	169	7%
12 Tennis courts	11	17	25	29	26	108	4%
13 Trails & paths (hiking, ski, bike)	99	97	83	54	38	371	15%
14 Other, please specify	6	7	4	7	6	30	1%
Total Responses:						2432	

HISTORIC, NATURAL, SCENIC and RECREATIONAL RESOURCES

Deerfield Questionnaire: Question 11

Which of the following special events, programs or efforts, if any, would you like to see more of in Deerfield? Circle all that apply.

		# of Responses	Percentage of Total
No new events/programs	1	82	4%
Arts festivals	2	220	10%
Community Fairs	3	252	12%
Concerts	4	326	15%
Dances	5	130	6%
Drama Productions	6	192	9%
Holiday Events	7	251	12%
Nature outings	8	219	10%
Road Races	9	63	3%
Summer Rec. programs	10	219	10%
Trips & Tours	11	165	8%
Other:	12	32	1%

Total Responses: 2151

Deerfield Questionnaire: Question 12

Currently, Deerfield's youth and recreational programming is supported by volunteers. Would you advocate any of the following? Circle your choices.

	# of Responses	Percentage of Total
Part-time town recreation and parks department	220	33%
Full-time town recreation and parks department	110	16%
Regional, multi-town recreation department	188	28%
Oppose town support of recreation, maintain volunteer program	155	23%

Total Responses: 673
Sheet9

HOUSING

Deerfield Questionnaire: Question 13

Do you believe there should be more residential development in Deerfield? Circle one.

	# of Responses	Percentage of Total
NO	1	464 70%
YES	2	202 30%
Total Responses:	666	

Deerfield Questionnaire: Question 14

If YES (to question 13) what is your opinion about the following housing options for Deerfield? Please circle your response.

	Favor	Oppose	Unsure	Total Responses
Single Family residential-less than 1-2 acre lots	1 82 or 30%	151 or 55%	42 or 15%	275
Single Family residential- 1/2 to 2 acre lots	2 179 or 70%	43 or 17%	33 or 13%	255
Single family residential- larger than 2 acre lots	3 128 or 49%	77 or 29%	57 or 22%	262
Multi-family residential: 3 or fewer units	4 87 or 31%	137 or 50%	53 or 19%	277
Apartment complexes	5 29 or 11%	223 or 81%	22 or 8%	274
Condominiums	6 95 or 34%	125 or 45%	60 or 21%	280
Other	7 30 or 67%	9 or 20%	6 or 13%	45
Total:				

HOUSING

Deerfield Questionnaire: Question 15

Do you support or oppose the following efforts to make housing in Deerfield more affordable?
Please circle your response.

	Support	Oppose	Unsure	Total Responses
Development of elderly housing	1 355 or 68%	78 or 15%	92 or 18%	525
Development of programs to assist first time buyers	2 289 or 51%	159 or 28%	122 or 21%	570
Development of affordable housing	3 190 or 33%	243 or 43%	139 or 24%	572
Other	4 10 or 24%	21 or 50%	11 or 26%	42
Total:				

TRANSPORTATION

Deerfield Questionnaire: Question 16

If you are currently employed, please answer the following three questions:

A. What is the zip code of workplace?

Top Ten Responses:

	# of Responses	Percentage of Total
Deerfield:	117	23%
Greenfield:	75	15%
Northfield:	69	14%
Amherst:	58	12%
Northampton:	31	6%
Springfield:	21	4%
Turners Falls:	18	4%
Holyoke:	13	3%
Shelburne Falls:	12	2%
Hadley:	8	2%

Total Responses: 498

TRANSPORTATION

Deerfield Questionnaire: Question 16

(continued parts B,C)

B. Do you work at home?

		# of Responses	Percentage of Total
YES	1	69	13%
NO	2	451	85%
Both		11	2%

Total Responses: 531

C. If you do not work at home, please list the times that you usually commute to and from work?

To Work	Responses	%	From Work	Responses	%
4-6 AM	24	6%	12-1 PM	1	0.25%
6-7 AM	60	14%	1-3 PM	18	4%
7-8 AM	156	37%	3-4 PM	54	13%
8-9 AM	119	28%	4-5 PM	89	22%
9-10 AM	33	8%	5-6 PM	148	36%
10-11AM	1	0.24%	6-8 PM	71	17%
11-12 AM	1	0.24%	8-11 PM	20	5%
PM	27	6%	AM	5	1%

Total Responses: 421

Total Responses: 406

Deerfield Questionnaire: Question 17

Where do you most often shop for necessities (e.g. groceries, hardware, pharmaceuticals)?

		# of Responses	Percentage of Total
Deerfield	1	26	4%
Greenfield	2	409	59%
Hadley/Amherst	3	146	21%
Northampton	4	102	15%
Other: Total:	5	5	1%

Total Responses: 688

TRANSPORTATION

Deerfield Questionnaire: Question 18

Is there enough parking in downtown South Deerfield? Circle one.

	# of Responses	Percentage of Total
Yes	1 413	63%
No	2 245	37%
Total Responses:	658	

Deerfield Questionnaire: Question 19

What are the three most important transportation issues? Please indicate the number in the boxes provided that corresponds to your choices.

	1	2	3	4	5	6	7	8	9	Most Important	2nd Most Important	3rd Most Important	# of Responses	Percentage of Total
Enforcement of vehicular violations										63	54	47	164	9%
Expansion of bus service										80	56	50	186	10%
Improvement of transportation accessibility for elderly & disabled										34	56	80	170	9%
Installation of traffic lights at key locations										270	103	39	412	23%
Provision for sidewalks & crosswalks										37	84	80	201	11%
Public parking areas & spaces										26	67	62	155	9%
Re-evaluation of traffic speeds										17	55	51	123	7%
Road improvements & maintenance										127	134	113	374	21%
Other (please list)										14	8	11	33	2%
Total:														
													1818	100%

What transportation issues do you think Deerfield should prioritize for action?
Please circle the number that corresponds to your response.

		# of Responses	Percentage of Total
Improve pedestrian areas in town (sidewalk, streetscape)	1	200	18%
Improve vehicular areas in town (parking, traffic flow)	2	223	20%
Improve both pedestrian and vehicular areas equally	3	379	34%
Leave as is, all pedestrian and vehicular areas work well.	4	312	28%

Total Responses: 1114

BALANCING THE BUDGET

Deerfield Questionnaire: Question 21

Which of the following capital expenditures do you feel should be Deerfield's top priorities for the future? Please mark the numbers in the boxes provided that corresponds to the five(5) expenses you consider most important.

	Most Important	2nd Most Important	3rd Most Important	4th Most Important	5th Most Important	# of Responses	Percentage of Total
1 Const. of municipal parking lots	26	29	20	28	27	130	5%
2 Const. of new recreation/playing fields	35	45	40	46	35	201	7%
3 Expans. of sewage treatment plants & lines	220	46	42	21	32	361	13%
4 Highway Department relocation	4	7	13	29	14	67	2%
5 Improve. of the downtown streetscape	73	81	84	57	54	349	12%
6 Maint. & replace. of existing sewer lines	39	113	44	43	27	266	9%
7 New roof and walls for Tilton Library	18	59	70	63	68	278	10%
8 Periodic road maint./improvements	96	117	111	87	52	463	16%
9 Purchase of open space	76	45	70	48	46	285	10%
10 Renovation of Senior Center	17	29	60	70	56	232	8%
11 Repair of Stillwater Bridge	18	26	29	47	36	156	5%
12 Other(specify)	27	9	4	7	7	54	2%
Total:							

BALANCING THE BUDGET

Deerfield Questionnaire: Question 22

What are your feelings about the quality of the following public services? Please circle the number that corresponds with your level of satisfaction.

	Delighted 1	Mostly Satisfied 2	Mixed 3	Dissatisfied 4	Terrible 5	Total Responses
Deerfield Rescue Service	288 or 47%	299 or 48%	23 or 4%	6 or 10%	3 or .48%	619
Fire Services	266 or 46%	285 or 49%	31 or 5%	2 or .34%	0	584
Public school system:						
Elementary	69 or 12%	279 or 47%	151 or 25%	80 or 13%	19 or 3%	598
Middle School	37 or 6%	214 or 37%	196 or 34%	95 or 16%	41 or 7%	583
High School	37 or 6%	194 or 33%	185 or 31%	106 or 18%	71 or 12%	593
Public Sewer system	31 or 6%	158 or 29%	157 or 29%	123 or 23%	70 or 13%	539
Public Water system	49 or 7%	256 or 39%	164 or 25%	120 or 18%	75 or 11%	664
Recycling&Waste mgmt.	50 or 8%	280 or 42%	204 or 31%	96 or 14%	36 or 5%	666
Town Administration	39 or 6%	315 or 48%	227 or 35%	52 or 8%	24 or 4%	657
Other: Police	0	1 or 50%	1 or 50%	0	0	2

BALANCING THE BUDGET

Deerfield Questionnaire: Question 23

To ensure that land for environmental protection needs, public facilities, recreation, and the water supply is protected or available in the future, would you support budgeting money for the following purposes over the next ten years? Please circle your response.

	Yes	No	Unsure	# of Responses
Purch. land to improve access to Deerfield and Connecticut Rivers	1 335 or 55%	137 or 22%	140 or 23%	612
Purch. land for water supply	2 463 or 73%	63 or 10%	105 or 17%	631
Purch. land for habitat protection and passive outdoor recreation	3 416 or 67%	106 or 17%	98 or 16%	620
Purch. land for other rec activities (playing fields, bike paths, playgrounds)	4 350 or 57%	144 or 24%	118 or 19%	612
Purch. land for town buildings or facilities (school additions, highway dept. bldgs.)	5 151 or 26%	243 or 41%	197 or 33%	591

Deerfield Questionnaire: Question 24

Currently Deerfield's tax rate is \$14.35 per \$1000 assessed property value (AVP). Rates in surrounding towns are: Conway- \$18.60; Greenfield- \$20.50; Sunderland-\$17.08; and Whately-\$18.04. What is your opinion of Deerfield's tax rate? Circle one.

	# of Responses	Percentage of Total
Just right for services provided	1 360	57%
Too low for services needed	2 53	8%
Too high for services received	3 136	22%
No opinion	4 78	12%
Total Responses:	627	

LOOKING TO THE FUTURE: GROWTH AND LAND USE ISSUES

Deerfield Questionnaire: Question 25

What is your opinion about commercial and industrial development in Deerfield? Circle one.

Support commercial development only	1	75	12%
Support industrial development only	2	44	7%
Support both commercial and industrial development	3	349	58%
Oppose both commercial and industrial development (go to Ques 27)	4	136	23%
Total Responses:		604	

Deerfield Questionnaire: Question 26

What types of industries and businesses, if any, would you favor or oppose locating in Deerfield?
Please circle your response.

		Favor	Oppose	Unsure	Total Responses
Small/moderate sized manufacturers	1	277 or 61%	88 or 19%	89 or 20%	454
Light industry that emphasizes non-mfg activities	2	426 or 76%	72 or 13%	63 or 11%	561
Business/professional offices	3	460 or 83%	44 or 8%	48 or 9%	552
Tourist & recreation attractions/services	4	335 or 64%	109 or 21%	83 or 16%	527
Retail establishments	5	385 or 67%	108 or 19%	86 or 15%	579
Farming: dairy, truck, nurseries, aquaculture	6	510 or 90%	15 or 3%	40 or 7%	565
Other	7	34 or 85%	6 or 15%	0	40
Total:					

TELL US ABOUT YOURSELF

Deerfield Questionnaire: Question 28

How many years of school did you complete? Please circle your response.

	# of Responses	Percentage of Total
0-8 grades	6	1%
some high school	18	3%
high school graduate	115	16%
some college	120	17%
college graduate	244	34%
postgraduate degree	206	29%
Total Responses:	709	

Deerfield Questionnaire: Question 29

Please indicate your occupation and the occupation of your spouse, or other significant adult in your household in the appropriate column.

	Your Occupation	Spouse/Other's Occupation	# of Responses	Percentage of Total
executive, administrator or manager	196	109	305	25%
farming, forestry or fishing occupation	27	15	42	3%
operator, fabricator or laborer	16	26	42	3%
precision production, craft or repair occupation	33	23	56	5%
service occupation	116	95	211	17%
technical, sales or administrative support	64	48	112	9%
homemaker	16	35	51	4%
student	4	5	9	1%
retired	146	72	218	18%
unemployed	5	1	6	0%
other	146	10	156	13%
Total:	769	439	1208	

TELL US ABOUT YOURSELF

Deerfield Questionnaire: Question 30

What is your gross annual household income before taxes? Circle one.

	# of Responses	Percentage of Total
1	17	3%
2	72	12%
3	180	31%
4	168	29%
5	90	15%
6	62	11%

Total Responses: 589

TELL US ABOUT YOURSELF

Deerfield Questionnaire: Question 31

Including yourself, what is the gender and age (in years) of all adults and all children living in your house? Please indicate age by gender line for each individual in the spaces provided.

Females:		Males:		All Residents:				
Age:	Responses	Age:	Responses	Age:	Responses			
	Females		Females		Total			
	% of		% of		% of			
Under 5 years:	42	5%	Under 5 years:	33	4%	Under 5 years:	75	5%
5 to 9 years:	49	6%	5 to 9 years:	65	8%	5 to 9 years:	114	7%
10 to 14 years:	49	6%	10 to 14 years:	70	9%	10 to 14 years:	119	7%
15 to 19 years:	59	7%	15 to 19 years:	62	8%	15 to 19 years:	121	7%
20 to 24 years:	37	4%	20 to 24 years:	30	4%	20 to 24 years:	67	4%
25 to 29 years:	25	3%	25 to 29 years:	24	3%	25 to 29 years:	49	3%
30 to 34 years:	43	5%	30 to 34 years:	44	5%	30 to 34 years:	87	5%
35 to 39 years:	66	8%	35 to 39 years:	54	7%	35 to 39 years:	120	7%
40 to 44 years:	95	11%	40 to 44 years:	69	8%	40 to 44 years:	164	10%
45 to 49 years:	98	12%	45 to 49 years:	87	11%	45 to 49 years:	185	11%
50 to 54 years:	78	9%	50 to 54 years:	74	9%	50 to 54 years:	152	9%
55 to 59 years:	42	5%	55 to 59 years:	47	6%	55 to 59 years:	89	5%
60 to 64 years:	42	5%	60 to 64 years:	36	4%	60 to 64 years:	78	5%
65 to 69 years:	38	5%	65 to 69 years:	60	7%	65 to 69 years:	98	6%
70 to 74 years:	26	3%	70 to 74 years:	29	4%	70 to 74 years:	55	3%
75 to 79 years:	24	3%	75 to 79 years:	16	2%	75 to 79 years:	40	2%
80 to 84 years:	9	1%	80 to 84 years:	10	1%	80 to 84 years:	19	1%
85 years and over:	9	1%	85 years and over:	11	1%	85 years and over:	20	1%
Total Females:	831		Total Males:	821		Total Males:	1652	

TELL US ABOUT YOURSELF

Deerfield Questionnaire: Question 32

Please indicate the number of school age children who attend public schools and the number who attend private schools

	# of Responses	Percentage of Total
Public Schools	279	77%
Private Schools	85	23%

Total Responses: 364

Deerfield Questionnaire: Question 33

Do you own or rent your home? circle one

	# of Responses	Percentage of Total
Own	531	86%
Rent	85	14%

Total Responses: 616

Deerfield Questionnaire: Question 34

Which area of the Town of Deerfield best describes the location of your residence?
Please circle number or describe in space provided.

		# of Responses	Percentage of Total
East Deerfield(along Ct. River)	1	29	5%
Old Deerfield(in/near Historical Deerfield)	2	82	13%
South Deerfield(in/near S. Deerfield)	3	370	59%
West Deerfield(beyond Interstate 91 towards Conway)	4	134	22%
Other:	5	8	1%
Total Responses:		623	

TELL US ABOUT YOURSELF

Deerfield Questionnaire: Question 35

How much land in the Town of Deerfield do you own?

Acreage	# of Responses	Percentage of Total
<1	172	39%
1 - 2	144	33%
2.1 - 3	49	11%
3.1 - 4	12	3%
5.1 - 6	20	5%
>6	48	11%
7-10	25	
11-15	4	
16-20	6	
21-30	4	
31-35	2	
36-40	0	
41-45	5	
400	2	

Total Responses: 443

Deerfield Questionnaire: Question 36

Please indicate if your home is serviced by (circle your responses)

		Yes	NO	Total Responses
Public water supply	1	585 or 86%	99 or 15%	684
Public sewer system	2	282 or 41%	409 or 59%	691

Deerfield Questionnaire: Question 37

Would you consider retiring in Deerfield?

			Percentage of Total
1	YES	520	82%
2	NO	101	16%
	Undecided	16	3%
Total Responses:		637	

TELL US ABOUT YOURSELF

Deerfield Questionnaire: Question 38

Did you attend Deerfield's Annual Town Meeting last year (in 1998)?

			Percentage of Total
1	YES	215	32%
2	NO	459	68%
Total Responses:		674	

COMMENTS:

PRINT SEPARATELY

Summary of Survey Comments

Quality of Life Concerns

1. One loves South Deerfield's friendly atmosphere and wonderful community spirit.
2. Two feel that the quality of life in Deerfield is superior.
3. Nine people hope to see an improvement in the sense of community in Deerfield.
4. Two feel that Deerfield should not be exclusionary and should be kept open to all.
5. One feels that diverse groups are not welcome.
6. One feels that residents of Old Deerfield patronize outsiders.
7. One feels that South Deerfield has nothing to offer.
8. One feels that there are too many tourists coming to town.

Protection of Rural Character and Natural Resources

1. Thirty-one feel it is important to protect natural and cultural resources such as prime farmland, scenic views, and other open spaces.
2. Twenty-eight feel it is crucial to preserve Deerfield's rural character.
3. One suggested that Deerfield investigate purchasing the University of Massachusetts' property along River Road for conservation or park development.
4. One felt that farmland should be preserved but other open spaces can be built upon.
5. One felt that the town should help farmers purchase farmland.
6. One insisted that farmers need more relief from taxes and unrealistic restrictions on operation.
7. One expressed interest in establishing a farmer's market.
8. One suggested expanding the town common by blocking off Park Street.
9. One is concerned with the water quality of Tri-Town Beach.

10. One feels that management of the Sugarloaf DEDIC site should not be dictated exclusively by state commissions via a do-nothing policy.
11. One said that the Bloody Brook Memorial should be protected and promoted.

Quality of Natural Resources

1. Eight are concerned with the quality of the drinking supply.
2. One suggested offering incentives to farmers to encourage them to use environmentally sensitive practices, especially near the Deerfield River.
3. One is concerned about the effects of pesticides on public health and the environment.
4. One wants public health laws enforced.
5. One is interested in a town-wide litter pickup program.
6. One is interested in a pet clean-up ordinance.
7. One feels that Deerfield's air and water quality are degraded.

Recreation

1. Fourteen feel that there are insufficient recreation opportunities for all ages.
2. Several offered suggestions for recreational opportunities that they would like to see in town such as playgrounds, a skating rink, festivals, holiday events, cultural activities, a road race, a community center to act as a central meeting place, a band stand gazebo, a swimming pool, amphitheater, fitness center, paved bike paths, completion of the Pocumtuck Ridge Trail, improved access to the Connecticut River.
3. Seven feel that recreation activities should be publicized.
4. One supports creation of a recreation department.
5. One suggests focusing activities at the elementary school or the senior center.
6. One suggests making Mount Sugarloaf a center of conscious environmental awareness and activity.
7. One hopes to see the recreation potential of the area south of Kelleher Drive tapped.
8. One is very supportive of handicapped access to the Deerfield River.

9. One suggests selling the Old Deerfield ballfield to fund a top-notch recreation facility at the Tri-town beach.
10. One suggests expanding recreation programming at Tri-Town Beach to include arts and crafts and a ballfield.
11. One suggests placing a walkway and benches along the Deerfield River.
12. Two feel that the Stillwater Bridge area is abused and a haven for non-residents.
13. One is concerned about illegal activities on the Connecticut River and at the Sugarloaf State Reservation.
14. One wants ski-dos and four wheelers to be banned in Deerfield.

Industrial and Commercial Development

1. Twenty-two are concerned about excessive growth and eleven expressed particular concerns about suburban sprawl.
2. Sixteen hope to see more industrial and commercial development, especially shops, pubs and restaurants.
3. Twelve want future growth to be thoughtful and managed.
4. Four would like to see a cap placed on the growth rate.
5. Two feel that quality industries should be directed to Routes 5/10 and the Route 116 corridors.
6. One supports more agricultural operations and industrial development, but not more commercial development.
7. One opposes more industrial development.
8. One suggests design review for all physical alterations of commercial property.
9. One feels that existing structures should be renovated rather than building on open spaces.
10. One is concerned about development on wet areas.
11. One feels that the search for future development should focus upon existing eyesores and neglected properties.
12. One feels that Deerfield has grown well and with a compatible layout.

Residential Development

1. Ten hope to see more affordable housing.
2. Nine do not want more low-income housing.
3. Five see the need for elderly housing in town.
4. One wants affordable housing clustered near shopping and services.
5. One opposes more residential development.
6. One wishes the town would help deter the conversion of prime farmland to housing.
7. One feels that houses should be clustered on $\frac{1}{4}$ to $\frac{1}{2}$ acre lots and that the remaining land should be preserved as open space.

Town Services and Capital Improvements

1. Twenty people feel that it is necessary to improve the aesthetics of downtown South Deerfield (streetscape).
2. One feels that the gateways to South Deerfield and Old Deerfield should be kept scenic and rural.
3. One suggests improving the gateway to downtown South Deerfield at Elm Street.
4. Twenty-eight respondents express strong support for public sewer expansion.
5. At least six fear that septic system mounds will reduce their property values.
6. One wants the town to grant financial assistance to homeowners with septic system problems.
7. One wants the sewer treatment plant to be upgraded.
8. Five people state that they are against expansion of the public sewer systems.
9. Six are concerned that the tax rate will rise to the point of being prohibitively expensive.
10. Three feel that the residential tax rate should be decreased and the industrial/commercial tax rate should be increased.
11. One feels that the tax rate should be raised to improve Deerfield.

12. One feels that taxes should be flat-lined until the town decides what to do with the money.
13. Nine are happy with the public services.
14. Two feel that services in Deerfield should be improved.
15. One feels that town services should remain minimal, but they should be adequately supported.
16. Two feel it is not the town's responsibility to provide recreation opportunities.
17. Three would like the bus network to expand.
18. One sees a need for more handicapped parking.

Miscellaneous Comments

1. One feels that there is an insufficient level of communication and cooperation between town boards, elected officials, and local government.
2. One hopes to see a stronger partnership between the town and non-profit organizations.
3. One feels that there is a lack of coordination and interaction between Old Deerfield and South Deerfield.
4. One does not want Deerfield to participate in regional programs.
5. One feels that Deerfield should not try to be all things to all people.

APPENDIX II

FARMLAND RETENTION MAPPING PROCESS

The following methodology was used to rank contiguous farmland areas by their value as agricultural land, as part of a larger network of natural resources, and by the relative threat of residential or commercial development. Sources of information included the MassGIS 1997 Land Use data layer. New Geographic Information Systems data layers were created including an updated (1999) permanently protected parcels data layer, the extent of the public sewer lines, and existing zoning. The rating system utilized the criteria below to rank high, medium, and lower priority parcels. A maximum of ten points is permitted per category.

Farmland Prioritized for Preservation Based on the Value of the Agricultural Land

1. Size of Farm Area (acres)
 - 75+ acres.....10 points
 - 50-74 acres.....7 points
 - 25-49 acres.....4 points
 - 5-24 acres.....2 points
 - less than 5 acres.....not mapped
2. Predominant Land Use
 - Cropland (intensive agriculture).....10 points
 - Orchard, Nursery, Cranberry bog.....10 points
 - Pasture (extensive agriculture)...6 points
3. Collateral Environmental Objectives: The greater the opportunity for linkages, the higher the rating.
 - Farmland area is adjacent to other permanently protected property...5 points
 - Farmland area is within water supply protection area.....2 points
 - Farmland area includes rare and endangered species.....2 points
 - Farmland area is within 1/2 mile of permanently protected land.....1 point

Farmland Prioritized for Preservation Based on the Threat of Development

1. Proximity to Commercial Areas
 - Property is within 500 feet of commercial zone...10 points
 - Property is within 1500 feet of commercial zone ... 5 points
 - Property is within 2500 feet of commercial zone ...2 points
2. Current Zoning
 - Zoned commercial or industrial.....10 points
 - Zoned residential..... 5 points
 - Zoned agriculture.....2 points
 - Protected by APR or permanent easement....0 points

3. Availability of Sewer Service

- Sewer lines are located within 500 feet of farmland area....10 points
- Sewer lines are located within 2500 feet of farmland area7 points
- Sewer lines are located within 5000 feet of farmland area3 points