APPENDIX B

Review of Tewksbury Build-Out Study

Introduction

This report provides a technical review of a recent study of Tewksbury's build-out potential. The study was prepared by the Northern Middlesex Council of Governments (NMCOG) approximately two years ago under a contract with the Executive Office of Environmental Affairs (EOEA). Measuring a town's room for growth is difficult, and no methodology accommodates all of the possible development permutations that can (and do) upset even the most painstaking build-out analysis. In addition, the validity of any development projection depends not only on skill, but also on accurate data, adequate time and resources, and a bias-free inquiry. The practice of development forecasting is influenced further by changing conditions, such as the impact of advancements in wastewater technology on the meaning of "developable land" or the acquisition of open space.

NMCOG found that Tewksbury has enough developable land to support 1,268 more housing units, for a build-out population impact of 3,688 new residents.[1] In addition, NMCOG estimated that Tewksbury could absorb an additional 4.7 million ft^2 of commercial and industrial space. For purposes of this technical review, NMCOG's methodology and the data used for the build-out study were compared to other sources of information and to the town's Zoning Map. While some aspects of the study are debatable, NMCOG's conclusions seem reasonable in relation to the land that was included in the build-out analysis. However, the study may have underestimated the total amount of land available for development, and errors in the data sources that were available to NMCOG at the time appear to have caused some parcels to be classified as developable when in fact they are subject to permanent use restrictions or other development constraints.

It is important to remember that a town's long-term development is not limited by today's unused land. As communities mature and land becomes scarce, the development process shifts toward a recycling of existing built assets. Opportunities to redevelop older properties and put them to a new, more valuable use are as influential as vacant land to a town's character and vitality. However, a build-out study rarely anticipates the changes brought about by reinvestment – that is, rebuilding. By emphasizing *quantity* over *quality* of development, build-out studies sometimes mask very important questions about the role that regulations can play in fostering a sustainable future.

Methods, Assumptions & Conclusions

Tewksbury's development potential was examined as part of a statewide program directed by EOEA. The program coincided with efforts to secure passage of the Community Preservation Act (CPA), a law that enables communities to impose a surcharge on property tax bills in order to raise revenue for open space, affordable housing and historic preservation. Through contracts with the state's regional planning agencies and several private firms, EOEA produced build-out studies for all 351 cities and towns in Massachusetts. EOEA's purpose was to forecast

[1] Northern Middlesex Council of Governments (NMCOG) [CD-ROM], filename "tewksbury_buildout-final.xls," 2001.

the maximum amount of residential, commercial and industrial development that could occur in a community under its existing land use policies. To achieve consistency in a large program carried out by several organizations, EOEA adopted standard data specifications and a Geographic Information System (GIS) model for use by all participating analysts.

The model that was instituted for EOEA's build-out program demonstrates both the power and limitations of GIS technology. Analysts working under contract with EOEA received several spatial data sets compiled by another state agency, MassGIS, and where possible they were required to update or correct the state's information. In GIS terms, a spatial data set (or data layer) refers simply to data that can be represented on a map. In order for several spatial data sets to be represented on the same map, they must be based on (or registered to) a common system of geographic coordinates. Since all of the data sets available from MassGIS are based on one coordinate system,[2] it is possible to create mapped representations of every community in the Commonwealth – individually or by groups of communities, e.g., counties, regional planning agency districts, watersheds, or shared highway corridors. Thus, the MassGIS data library was instrumental to preparing a large number of build-out studies in a very short period of time.

A single GIS data set often consists of several electronic files. When the data set is opened in GIS software such as ArcView or MapInfo, its spatial image becomes visible in a window that serves as a workspace for making maps. The image may be comprised of one or several shapes (or polygons), each of which is unique. The information that distinguishes these shapes is contained in a table of attributes that lies elsewhere in the data set. The table is crucial because the information it stores determines what can be represented on a map. For example, a GIS data layer of open space includes a table with many attributes for each shape in the workspace, e.g., the name of the land owner, the size of the parcel, and whether the land is a Chapter 61A farm, permanent open space or a recreation facility. Using a GIS open space data set with these attributes, it is possible to create a map of all Chapter 61A land in a community, or maps of all open space color-coded by level of protection, ownership, or use. Of course, an attribute table that contains inaccurate data will result in inaccurate maps. MassGIS and the other agencies that create GIS data sets work very hard to assure quality, but an occasional error is unavoidable.

To carry out the statewide build-out studies, EOEA supplied participating organizations with the following data sets for each community:

- Zoning map
- Open space inventory, including lands with permanent, temporary, limited or no use restrictions
- 100-year floodplain areas
- Buffer zones around rivers and streams regulated by the Rivers Protection Act
- Areas of Critical Environmental Concern (ACEC), where applicable
- Local roads, state highways and mass transit facilities

[2] North American Datum (NAD) 1983.

- Wetlands, topography and slope classifications, derived from USGS maps
- Land use map[3]
- Black-and-white orthophotos (digital aerial photographs).

Since MassGIS did not have digital zoning maps for all cities and towns, in some instances build-out analysts had to create them using information from local authorities. In addition, when EOEA's build-out program began in the late 1990s, the age of available land use maps varied by community and across regions. The original source of information for the digital land use maps at MassGIS is aerial photography. Some parts of the state had been flown more recently than others. For many communities, the most current land use data sets represented development conditions as of 1991. As a result, analysts needed to update the land use maps by creating GIS data sets to represent new subdivisions and other types of new residential or commercial development. For Tewksbury's build-out study, NMCOG prepared a GIS data set of all subdivisions approved by the Planning Board since the late 1980s, and a second data set to represent other housing, business or institutional development visible on the orthophotos but omitted from the land use map.

The organizations participating in EOEA's build-out program were asked to meet with municipal officials at the outset of their work, in part to obtain and review local development regulations and also to evaluate the quality and accuracy of local maps and data that may be used to refine and update the state's GIS information. A thorough review of local development regulations was essential to making informed build-out estimates because EOEA's methodology required analysts to make a number of judgment calls. The most crucial judgment call involved classifying a community's land by degrees of development constraint: "absolute," "partial," or "not" constrained.

The difference between an absolute and a partial constraint is not always obvious and it varies from town to town. For example, in a community that requires all one-acre house lots to include one acre of contiguous upland, wetlands do not contribute any development potential and under EOEA's methodology, they would be classified as an absolute constraint against future development. However, in a community that requires all one-acre house lots to have at least 20,000 ft^2 of contiguous upland, wetlands offer some degree of development potential and would be classified as a partial constraint. Mastering the nuances of local zoning and wetlands bylaws, board of health regulations and other controls was an important part of the build-out analyst's job. The extent to which this kind of research was possible depended on the workload of participating organizations, access to knowledgeable local officials, and the time allotted by EOEA to complete all of the build-out studies.

Using the GIS data supplied by MassGIS and new data sets created from available information, the build-out analyst mapped and calculated the land area represented in each data set and

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[3] The state's digital land use maps are produced by the University of Massachusetts Resource Mapping Lab at the Landscape Ecology Program, a facility that dates to the early 1950s when Forest Professor William P. MacConnell initiated a statewide land cover mapping project to identify wildlife habitat from aerial photography. The Resource Mapping Lab has periodically updated land use maps for all communities in the Commonwealth, working under contracts with state and federal agencies in 1951, 1971, 1985 and 1999.

through a process of elimination, arrived at an estimate of "developable land" – that is, the land area most likely available for new development. As a rule, the approach outlined below was used to calculate developable land in EOEA's build-out studies:

Developable land = a community's total land area *minus* existing developed areas *minus* permanently protected open space *minus* areas with absolute development constraints, e.g., excessively steep slopes or open water.

NMCOG appears to have considered wetlands an absolute constraint as well, for approximately 3,041 identified wetland acres in Tewksbury were eliminated during the procedure that culminated in a developable land estimate of 1,712 acres.

Analysts were instructed to use "developable land" as a starting point for estimating how many new homes or businesses could be developed in each zoning district. Of course, not all of a community's developable acres can be converted to house lots because new subdivision roads and drainage areas will absorb some of the land. In addition, the development process often produces irregularly shaped, somewhat larger-than-required lots in order to comply with a community's lot area, upland and dimensional regulations. To account for these and other conditions, EOEA advised analysts to reduce "developable land" by a factor that had to be determined town-by-town, considering local zoning and other regulations. Across the state, the factors ranged from 10-30%.

For Tewksbury's build-out study, NMCOG estimated the potential number of house lots by reducing the amount of developable land in each residential district by a unique factor for roads and irregular lots, and dividing the result by each district's minimum lot size. Additional reductions were made to account for the impact of partial constraints on some of the town's developable land, e.g., wetlands buffer zone and floodplain regulations. Similarly, commercial and industrial development estimates were made by multiplying an "effective floor-to-area ratio," or FAR, by the amount of developable land in each non-residential zoning district. The FAR represents the amount of floor space (gross) that can be built on a parcel of commercial or industrial land after access roads, parking, landscaped buffers and other site plan requirements are satisfied, along with building height, coverage and other dimensional controls. Table 1 identifies the residential, commercial and industrial multipliers that were used in Tewksbury's build-out study, along with the amount of developable land in each zoning district.

Test Areas for Review

Tewksbury is a maturely developed community. Approximately 47% of the town's land area is covered by residential, commercial and industrial land uses, including their associated roadways. Thirty years ago, the ratio of residential development to forests was .68 – that is, for every acre of forest, only .68 acres were covered with housing. Today, the ratio is 1.24, which means that residential development covers more land than the amount that remains forested. Given the town's developed suburban character and the prevalence of wetlands, it is not surprising that NMCOG's build-out forecast foresees a maximum of 1,268 new housing units in Tewksbury's future. For the build-out study technical review, a sample of the areas identified as developable land were examined to determine whether the assumptions in EOEA's methodology seemed appropriate. This examination also considered whether the GIS data sets available to NMCOG contained any inaccuracies.

[4]Area A: Trull Brook Golf Course Area

The build-out study identifies this site and adjacent areas off River Road in Tewksbury as developable residential land. According to the open space inventory on file at MassGIS, the 127-acre golf course is classified as an area of "limited" open space protection. NMCOG's build-out study estimates that the entire Area A – the golf course along with surrounding vacant land – includes approximately 175 developable acres. Allowing for odd lot configurations and new subdivision roads at 18%, the development potential of Area A would be about 143 buildable lots and an equivalent number of housing units (i.e., one single-family home per one-acre lot). Open space and a natural stream make up a portion of the area that the build-out study categorizes as developable. The primary purpose of the open space is recreation and the public has full access to it. It is a privately owned golf course in a residential zone.

Area A includes open water and bordering wetlands, and portions of the site are in a flood hazard zone. To the degree supported by existing GIS data, the build-out study accounts for these natural features. The golf course portion of Area A is most likely a low-risk candidate for development as long as the recreational facility remains profitable.

[5]Area B: Ames Hill

Surrounding the Tewksbury Water Department's two-acre site on Ames Hill is a 116-acre area classified as developable residential land. NMCOG's multiplier for odd lot configurations and new subdivision roads results in a potential development estimate of 95 house lots. Ames Hill is in a residential zone and according to the open space data set used for the build-out study, the small, town-owned portion has only a limited level of open space protection and no public access. There is a considerable amount of existing residential and industrial development nearby, and Ames Pond lies northeast of this area.

The build-out study appears to represent Area B's development potential reasonably well, though the land is steeply sloped. Tewksbury's *Open Space and Recreation Plan* (1998) characterizes Ames Hill as a scenic resource and a priority area for protection. The buffer required by Tewksbury's local Wetland Protection Law between natural features and development is accurately captured in the acreage that NMCOG subtracted from the calculation of developable land.

Area C: Long Meadow Golf Club

The build-out study indicates a potential for residential development at the Long Meadow Golf Club and a small area nearby. The country club is unprotected open space and it consists of approximately 52 acres. Under the formula that NMCOG used to estimate future growth, odd lot configurations and new subdivision roads would reduce the land available for homes to 33 potentially buildable lots. One-acre zoning may act as a limiting factor in the conversion of this property, since developing it would require a use that can absorb the value of the land and its existing improvements. An analysis of the developable land calculations suggests that NMCOG appropriately buffered the pond and other wetland features on the property. The

[4] Identified on Tewksbury Open Space map as "Trull Brook Golf Course."

[5] Identified on Tewksbury Open Space map as "Ames Hill."

nine-hole golf course is in a residential zone and its primary purpose is outdoor recreation. Access is restricted to club members.

[6]Area D: Vicinity of Point Lewis Land

NMCOG's map of developable land includes an area of residentially zoned land and two smaller industrially zoned areas along Pinnacle Road near the Point Lewis Land. Since these properties are not formally classified as areas of conservation interest, they are not included in the open space data set that was used for the build-out study or in a more recent open space data set available from MassGIS. Accordingly, it may be assumed that the land is privately owned and subject to no use or development restrictions. The developable land is surrounded on all sides with significant natural features that are reflected in the build-out map. Though Area D is not in a flood hazard area, it is surrounded almost completely by floodplain. Assuming that odd lot configurations and new subdivision roads would reduce the 69.3 acres by about 18%, Area D appears to have the potential to support up to 56 buildable one-acre house lots.

Area E: Area "93"

Area E is a large area of land on the eastern corner of Tewksbury, adjacent to I-93. Most of the 104.9 acres are zoned for residential development, with two smaller areas of industrially zoned land nearby. All of the land is privately owned and there are no known use restrictions that would impede future development. According to the formula used in the build-out study, this 104.9-acre area may support up to 86 one-acre house lots. There is no designated open space within Area E, and a review of NMCOG's developable land map shows appropriate buffering for identified natural features. The land is outside the 100-500 year floodplain, although one small part is near an area subject to inundation by a 100-year flood event. Given the relatively few natural constraints against development in Area E, the land appears developable at the level suggested by NMCOG's built-out study.

Area F: Fairlawn

The 65 acres of open space known as Fairlawn lie partially within the Community Development District and partially in the Heavy Industry District. According to the most recent open space data set available from MassGIS, Fairlawn is subject to a limited level of protection and its primary purposes are water supply and conservation, with public access. All of the land is municipally owned. NMCOG's build-out study maps provide for an appropriate buffer between the "developable" area and surrounding natural features.

Fairlawn is identified on a map attached to this report,"Tewksbury Open Space," which is based on an updated GIS data set from May 2002. Significantly, the open space map that was used to prepare the build-out study does not recognize Fairlawn as town-owned land. As a result, NMCOG included more than half of the Fairlawn acreage in the build-out study's inventory of developable land. Since the land appears to be classified as "limited protection" only, perhaps it could be developed in the future. If the land was acquired for water supply purposes, however, the information on file at MassGIS may be incorrect. Given the town's zoning regulations and the physical characteristics of the land, Area F clearly has development potential but it may not be developable at all because of legal constraints tied to the original

[6] Identified on Tewksbury Open Space map as "Point Lewis Land."

acquisition. In any case, because the land is owned by the town, it could not be developed without a two-thirds vote of approval by town meeting to sell the property.

GIS Data Limitations

Open Space

The town's build-out forecast may be distorted by errors and omissions in the open space data set that was supplied by EOEA. The two most important issues involve the classification of open space and the area depicted as Tewksbury State Hospital. First, the open space data layer was missing critical information about the level of protection for Tewksbury's open space. The state recognizes four levels of open space protection: limited, permanent, temporary, and none. Land for which the level of protection has not been verified is classified as "unknown" in the open space data sets maintained by MassGIS (see Table 2). The data set used in the build-out study identifies 1,903 acres of open space but classifies only 1,422 acres by level of protection. Owing to the design of EOEA's build-out model, open space that was unclassified (or inaccurately classified) would have been treated as potentially developable land. In comparison, the more recent open space data set from MassGIS assigns nearly all open space in Tewksbury to a level-of-protection category, as shown in Table 2. Any land characterized as developable which in fact is subject to a permanent use restriction would result in an inflated build-out forecast.

A more disconcerting error in the open space data set involves the boundaries of the Tewksbury State Hospital property. The area characterized as Tewksbury State Hospital in the build-out study is inconsistent with the most recent open space data layer from MassGIS. (See Build-out Open Space and Tewksbury Open Space Maps.) Several large areas identified as open space associated with Tewksbury State Hospital in the build-out study are not identified in the most recent MassGIS open space data layer for Tewksbury. Moreover, some of the land is classified as "limited protection" while the remainder is unclassified. The data discrepancies are visually evident and they are important because it appears that none of the Tewksbury State Hospital land is included in the town's build-out calculations.

Zoning

An accurate zoning map is essential to making valid development projections. Though the zoning data set used for Tewksbury's build-out study is reasonably complete, there are several differences between the districts it includes and those shown on the Town of Tewksbury Zoning Map dated March 27, 2002. The differences exist mainly in the eastern part of town where there is a cluster of several zoning districts. Two major discrepancies involve land that the current Zoning Map represents as Municipal and Residential but the GIS data set represents as Multifamily. The triangle formed by Main, Chandler and Livingston Streets has no zoning district identity in the GIS data set. However, the build-out calculations assign little if any development potential to these locations.

Wetlands

NMCOG's build-out study may have included many of Tewksbury's important wetlands as developable land. There are several GIS sources of wetlands data, though not all are equally available statewide. The organizations that worked on EOEA's build-out studies were allowed to use one of the following wetland data sets:

- The United States Geological Survey's (USGS) digitized Hydrography data.

- The National Fish and Wildlife Service's National Wetlands Inventory.
- The Massachusetts Department of Environmental Protection (DEP) Wetlands Conservancy Program maps.

The USGS Hydrography data layer is the least accurate, in part because it was not developed at a scale to capture small wetlands. The National Wetlands Inventory is a more accurate source, and DEP's Wetlands Conservancy Program is generally considered the most reliable because its GIS data sets are based on high-quality aerial photographs. It is clear that NMCOG used the latter to identify wetlands in Tewksbury. However, MassGIS has continued to upgrade the library of DEP Wetlands Conservancy Program maps and as of July 2002, new wetland maps became available for the entire state. Table 3 compares the data set used in the build-out study to the recently released data set from DEP. It shows that approximately 466 acres of wetlands were not accounted for in the data that NMCOG received from the state for Tewksbury's build-out study.

Chapter 40B

Like any other analytical model, EOEA's build-out methodology embraced several assumptions. Among them: all municipalities would be in compliance with the 10% low- and moderate-income housing standard set by Chapter 40B, the Anti-Snob Zoning Act. Chapter 40B creates a streamlined permitting process to build low- and moderate-income housing and assigns permit granting responsibility to local zoning boards of appeal. Since the law's purpose is to assure an equitable distribution of low-income housing throughout Massachusetts, it sets a minimum goal of 10% low- and moderate-income housing in every community. While processing a comprehensive permit application, the board of appeals has jurisdiction to waive local zoning regulations that impede low-income housing production – regulations such as a ban on multi-family and townhouse development, a large minimum lot size for new homes, or a low unit/acre density cap that makes multi-family development impractical even when it is allowed.

When less than 10% of a community's year-round homes qualify as low-income housing under Chapter 40B, the board of appeals is essentially obligated to issue a comprehensive permit. If the board denies or places burdensome conditions on a permit, the developer may appeal to the state's Housing Appeals Committee (HAC). Communities that do not meet the 10% threshold find it almost impossible to prevail when a developer appeals to HAC because Chapter 40B creates a statutory presumption that the need for low-income housing outweighs other local considerations.

The "maximum" residential build-out projections released by EOEA make no provision for additional homes generated by comprehensive permits. It is not clear why EOEA took this position because only 27 communities in Massachusetts meet or exceed 10%. According to the most recent Chapter 40B Inventory, the 410 low- and moderate-income housing units in Tewksbury equal 4.05% of the town's year-round housing stock, which means that Tewksbury has a yet-to-be-built liability of 603 low-income housing units. Discounting the 43 towns that have no low- and moderate-income housing, the average percentage of Chapter 40B units in Massachusetts communities today is 5.35%. Statewide, the low-income housing shortfall (as defined by Chapter 40B) is 39,237 units.

Presumably, EOEA decided to assume Chapter 40B compliance because a build-out study should attempt to account for all of a community's developable land. If Tewksbury's

developable land can accommodate up to 1,258 new homes under current zoning, then there is no remaining land for additional development. In effect, the acreage that NMCOG allocated to 1,258 housing units may be tapped to support other land uses as well – including future Chapter 40B developments. Since it is not economically feasible to build low-income housing at a density of one unit/40,000 ft^2, Tewksbury's build-out forecast of 1,258 homes seemingly underestimates the amount of residential development that will occur in the future. However, the usable land calculations on which the 1,268-unit forecast is based need to be revisited.

Summary

When the state's build-out studies were released to cities and towns, EOEA and regional planning agency representatives explained that their future development estimates should be viewed as "worst-case" scenarios – that is, a high-end forecast designed to illustrate the implications of local land use policies. The build-out study for Tewksbury may overestimate the number of acres available for new growth in some parts of town, yet the decision to exclude the grounds of Tewksbury State Hospital from the build-out forecast most likely means that the town's developable land has been underestimated. However, local zoning alone will not determine the fate of the hospital property because the land is owned and controlled by state government. This makes it very difficult for any analyst to make informed judgments about the site's reuse and development potential. If used as an order-of-magnitude projection, the build-out study can be a valuable guide for local policy and planning decisions.

A master plan must address more important questions than simply how many housing units the future holds. The impacts of 1,268 new homes on Tewksbury's natural resources, community services, water supply and infrastructure will differ significantly by where they are built and at what density, the types of housing they represent, the costs they generate and the benefits they bring to the community as a whole. Similarly, the impacts of 4.7 million ft^2 of commercial and industrial development will vary by the mix, use intensity, design and site plan quality of the projects that produce this growth. The build-out study sponsored by EOEA does an effective job of drawing attention to some of the potential impacts of future development. It highlights places that could be lost if the town's open land is not managed sustainably and it creates an opportunity for dialogue about how the town should grow in the future.

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October 4, 2002

APPENDIX B

Table 1: Zoning Districts Build-Out Multipliers

Residential Zoning District	Minimum Lot Size (sq.ft.)	Build Factor	Estimated Developable Acres
Residential-40	43,560	0.82	1,336.3
Multi-Family District	174,240	0.88	10.0
Multi-Family District/55	522,720	0.89	12.1
Community Development District	522,720	0.89	22.0
Farm District	43,560	0.82	18.1
Non-Residential	Effective FAR	Estimated Developable Acres	
Municipal	0.41	6.4	
Transitional	0.47	3.0	
Commercial	0.322	20.7	
Heavy Industry	0.345	283.0	

Table 2. Open Space and Levels of Protection

	EOEA Buildout		MA-GIS Data	
Level of Protection	**Acres**	**% of OS**	**Acres**	**% of OS**
In Perpetuity	84.5	5.9	82.6	5.5
Limited	1,195.4	84	1,233.0	82.5
No Protection	82.1	5.8	116.1	8
Unknown	60.5	4.3	59.1	4
Subtotal	1,422.4	100.0	1,490.8	100.0
Arcres Not Classified	481.3		0.0	
Total Open Space in Acres	1,903.7		1,490.8	

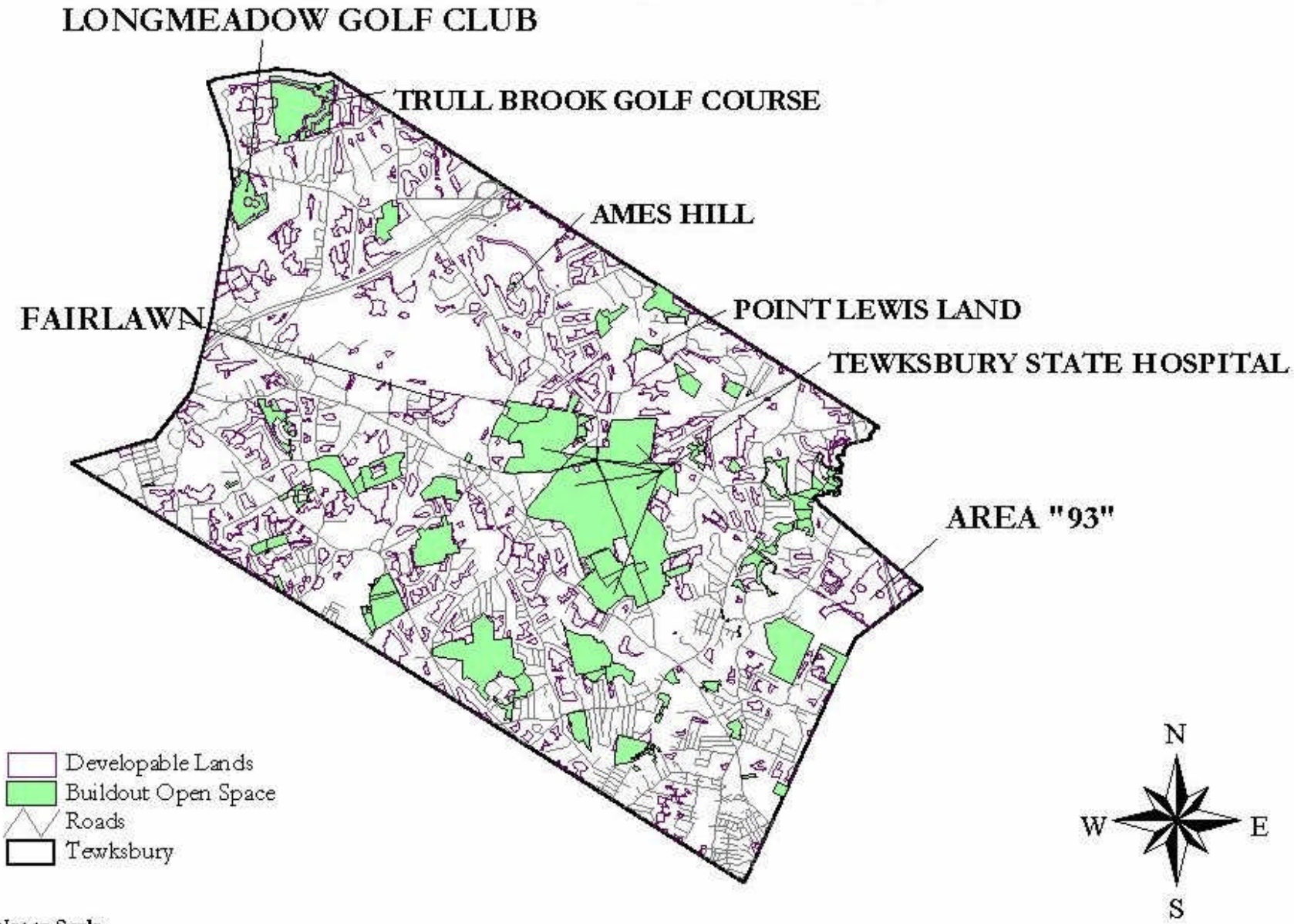
Sources: MassGIS, Statewide Vector Data, filename "osp295p1.dbf", updated May 2002; and NMCOG [CD-ROM], filename "os295.dbf," 31 January2001.

Table 3: Comparative Wetland Estimates

Classification	Build-Out Study	MassGIS Wetlands Data (2002)
Bog	8.1	8.1
Deep Marsh	56.9	56.9
Open Water	414.3	728.7
Shallow Marsh Meadow	406.3	481.9
Shrub Swamp	457.6	457.6
Coniferous Swamp	18.8	18.8
Deciduous Swamp	1,504.7	1,589.3
Mixed Swamp	174.3	174.3
Totals	3,041.0	3,515.6

Sources: MassGIS Statewide Vector Data, filenames "w3658p1.dbf, w3578p1.dbf, w3577p1.dbf, w3576p1.dbf, w3496p1.dbf, w3495p1.dbf, w3494p1.dbf, w3493p1.dbf, w3414p1.dbf, w3413p1.dbf," updated August 2002; and NMCOG [CD-ROM], filename "wet5k295.dbf," 31 January 2001.

Buildout Open Space



Map Not to Scale

Data Source: Metropolitan Area Planning Council (MAPC) [CD-ROM], filename "eoea_tewk.zip/os295.shp" 31 January 2001.

Data Source: Metropolitan Area Planning Council (MAPC) [CD-ROM], filename "eoea_tewk.zip/developablelands.shp" 31 January 2001.