Executive Office of Environmental Affairs

CHICOPEE RIVER

A Comprehensive Watershed Assessment
2003

EXECUTIVE OFFICE of ENVIRONMENTAL AFFAIRS

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs

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July 29, 2003

Dear Friends of the Chicopee River Watershed:

It is with great pleasure that I present you with the Year 3 Assessment Report for the Chicopee River Watershed. The report outlines the main environmental issues that face the watershed and provides the most current status of the Chicopee River. This report will help formulate the 5-Year Watershed Action Plan that will guide state and local environmental actions within the Chicopee River Watershed. The plan will implement the goals of the Executive Office of Environmental Affairs which include: improving water quality; restoring natural flows to rivers; protecting and restoring biodiversity and habitats; improving public access and balanced resource use; improving local capacity; and promoting a shared responsibility for watershed protection and management.

The former Chicopee River Watershed Team Leader developed this Assessment Report after extensive research and input by state and federal agencies, Regional Planning Agencies, watershed groups and organizations, and team members. The priority issues identified in the report include:

- Water Quality
- Water Quantity
- Biological Resources
- Open Space and Growth Planning
- Outreach
- Local Capacity Building
- Recreation

I commend everyone that was involved with the Chicopee River Watershed Assessment effort. Thank you for your dedication, perseverance, and commitment. The watershed approach is the best way for government and community partners to make significant progress in addressing the environmental challenges of the 21st Century. If you are not currently a participant, I strongly encourage you to become active in the Chicopee River Watershed restoration and protection efforts.

Regards,

Ellen Roy Herzfelder

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Any reference to 'Massachusetts Watershed Initiative (MWI)' in this document pertains to a program that existed at the Executive Office of Environmental Affairs from 1993-2003. Any reference to a 'Watershed Team' refers to a multi-stakeholder team, facilitated by a 'Watershed Team Leader' that existed from 1998-2003 as part of the MWI.

List of Acronyms

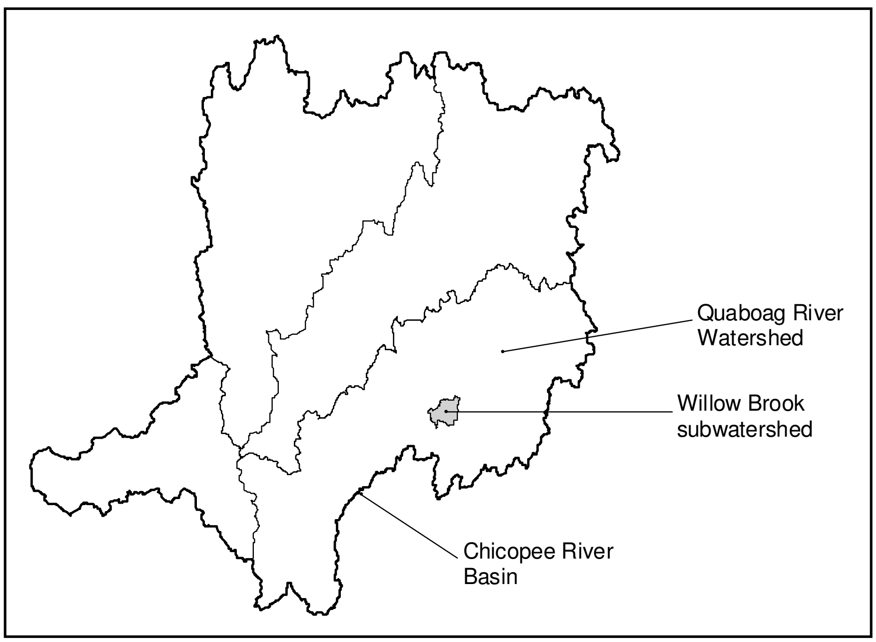
ACOE – Army Corps of Engineers
cfs – cubic feet per second
CMRPC – Central Massachusetts Regional Planning Commission
CSO – Combined Sewer Overflow
CY – Calendar Year
DEM – Department of Environmental Management*
DEP – Department of Environmental Protection
DFW – Division of Fisheries & Wildlife
EO 418 – Executive Order #418
EOEA – Executive Office of Environmental Affairs
EPA – Environmental Protection Agency
ESS – Environmental Science Services, Inc.
FERC – Federal Energy Regulatory Commission
FRCOG – Franklin Regional Council of Governments
FY – Fiscal Year
GIS – Geographic Information Services
IO – Indian Orchard
MAS – Massachusetts Audubon Society
MassGIS – Massachusetts office of Geographic Information Services
MDC – Metropolitan District Commission*
MGD – Million Gallons per Day
MISER – Massachusetts Institute of Social and Economic Research
MRIP – Massachusetts Resource Identification Project
MRPC – Montachusett Regional Planning Commission
MWI – Massachusetts Watershed Initiative
MWRA – Massachusetts Water Resources Authority
NHESP – Natural Heritage and Endangered Species Program
P8 – Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds
PAB – Public Access Board
PVPC – Pioneer Valley Planning Commission
REEA – Regional Environmental Education Alliance
SARIS – Stream And River Information System
SWQS – Surface Water Quality Standards
TAG – Technical Assistance Grant
Team – the Chicopee River Watershed Team
TKN – Total Kjeldahl Nitrogen
TMDL – Total Maximum Daily Load
TP – Total Phosphorous
TSS – Total Suspended Solids
TTOR – The Trustees of Reservations
USFWS – United States Fish & Wildlife Service
USGS – United States Geological Survey
WAP – Watershed Action Plan
WMA – Water Management Act
WTL – Watershed Team Leader
WWTP – Wastewater Treatment Plant

* DEM and MDC are now the Department of Conservation and Recreation

Terminology

Throughout this report, several terms are used to refer to drainage areas. In most cases, the meaning of those terms are as follows:
Basin is used to refer to the entire 721 mi^2 Chicopee River drainage area;
Watershed usually refers to the drainages of the four major river systems in the basin (e.g., the Swift River Watershed), although the lower-case *watershed* is sometimes used in a generic way;
Subwatershed refers to the drainage area of the main tributaries to the major rivers, of which 44 have been delineated in the basin.

Thus, for example, the report might refer to the *Willow Brook subwatershed, in the Quaboag River Watershed, of the Chicopee River Basin.* The graphic below further demonstrates the usage of these terms.



I. Introduction

A lone fisherman watches his line along the banks where the *Quinnetukq"* (long tidal river) joins the *Chickuppe"* (place of violent waters), much as his Native American predecessors may have done centuries earlier. In the intervening years however, much has happened near this spot. Fishermen still congregate near the confluence of the two great rivers (i.e., the Connecticut and the Chicopee), hoping to catch one of the thousands of American shad, blueback herring, Atlantic salmon, striped bass, and other species that make their annual passage upstream. But close by, cities and industries have sprung up along the riverbanks; tall dams now alter the rivers' flows along with the fishes' migratory routes; and the viewpoints of local residents towards the rivers have come virtually full circle – from viewing them as life-giving and sustaining resources, to using them as open-air sewers, and finally to the re-discovery of the uniqueness of the rivers as vital natural resources.

The Connecticut River originates near the Canadian border in the state of New Hampshire. Along its 400+ mile journey to Long Island Sound, the Connecticut is fed by numerous rivers and streams. The largest of these tributaries is the Chicopee River, which joins with the Connecticut just north of the Connecticut border, in the City of Chicopee, Massachusetts. The Chicopee River drains an area of more than 720 square miles, generally located between Springfield, Worcester, Gardner, and Montague. It is the largest of the 27 major basins delineated for planning purposes in Massachusetts.

This report summarizes much of the physical, ecological, and social information that is currently known about the Chicopee basin. The document is organized in two main sections: 1) a Watershed Description, which includes much of the factual "descriptive" information about the basin, and 2) a Watershed Assessment, in which the information presented in the first section is "assessed" or interpreted. The results of that assessment will form the basis for a Watershed Action Plan that will be subsequently prepared. Much of the information conveyed in the figures of this report comes from the Massachusetts Office of Geographic Information Systems (MassGIS) office at the Executive Office of Environmental Affairs (EOEA). Paul Lyons, former Watershed Team Leader (WTL) for the Chicopee River basin, is the primary author, although information and input for this report comes from a variety of other sources.

II. Watershed Description

A. Physical Characteristics

1. Location: The Chicopee River basin is located in west-central Massachusetts, and is bounded to the west by the Connecticut River basin, to the north by the Miller's River basin, to the south by the French/Quinebaug, and to the east by the Blackstone and Nashua River basins (Figure 1). The basin covers approximately 721 square miles, most of which is considered part of Central New England Upland, except for the lower Chicopee River section, which is in the Connecticut River Valley (UMass LARP 1996).

2. Climate: The climate in the region is considered to be of a modified continental type - warm to hot in summer and moderately cold in winter. The mean annual rainfall over the basin as a whole is 44" although this ranges from <40" in the southwest portion to >50" in the upper basin (DEQE 1981). Approximately half of all rainfall results in runoff, averaging 1.6 cubic feet per second (cfs) per sq mi annually. About half of the total annual rainfall occurs in March, April, and May, with the maximum occurring in April. The region lies in the path of "prevailing westerlies", and is also subject to cyclonic disturbances that contribute to frequent weather changes.

July is generally the warmest month (mean temperature - 67^{o} F), with January and February the coldest (mean - 21^{o} F). Mean monthly precipitation ranges from slightly under 3" in February to over 4" in November (Krejmas and Maevsky 1986).

3. Topography/geology/soils: Most of the basin is considered upland, and consists of rolling hills and valleys generally arranged along a N-S axis (Figure 2). Elevations range from ~50 feet above sea level at the mouth of the Chicopee River, to 1720 feet along the basin divide in Wachusett Mountain State Reservation.

Surficial geology in the central and eastern portions of the basin consists generally of uplands underlain by thin glacial till and/or bedrock interspersed with relatively narrow valleys where thin to moderately thick deposits of stratified drift and recent alluvium are present. Bedrock underlying the basin consists predominantly of metamorphosed plutonic igneous and sedimentary rocks in the central and eastern portions, and unmetamorphosed sedimentary rocks of the Connecticut River Valley in the southwest corner (ECS 1996).

Soils in the basin are largely glacial till, except for the Connecticut River Valley region, which mainly derive from glacial Lake Hitchcock (UMass LARP 1996). Glacio-lacustrine deposits are also locally present in valleys in the central and eastern portions of the basin. Thick glacio-lacustrine and glacio-fluvial deposits are locally present in the southwest portion of the basin. With the exception of that region, soils in the basin are relatively infertile, since most did not develop from bedrock, but instead the parent material was acid crystalline rock deposited by glaciers and glacial melt-water (DEQE 1981). Surficial geology and soil texture classifications are presented in Figures 3 and 4, respectively.

4. Hydrology: The Chicopee River basin consists of 4 major river systems – the Swift, Ware, Quaboag and Chicopee Rivers (Figure 5). The Swift, Ware, and Quaboag river basins each drain areas of approximately 200 square miles; the Chicopee River receives the collective flows of the other three, plus the runoff from an additional 76 square miles of watershed. U.S. Geological Survey stream gaging stations are located at strategic points along the four major rivers (Figure 6), and allow for analyses of the relative contributions of the four rivers to overall flows in the basin.

The Swift River drains approximately 215 square miles in the northwest portion of the basin, including all or parts of 11 communities (Table 1), before joining the Ware River in Palmer. Much of the Swift River drainage is controlled by Winsor Dam and Goodnough Dike, which were constructed in the

Figure 1. Location of Chicopee River basin.

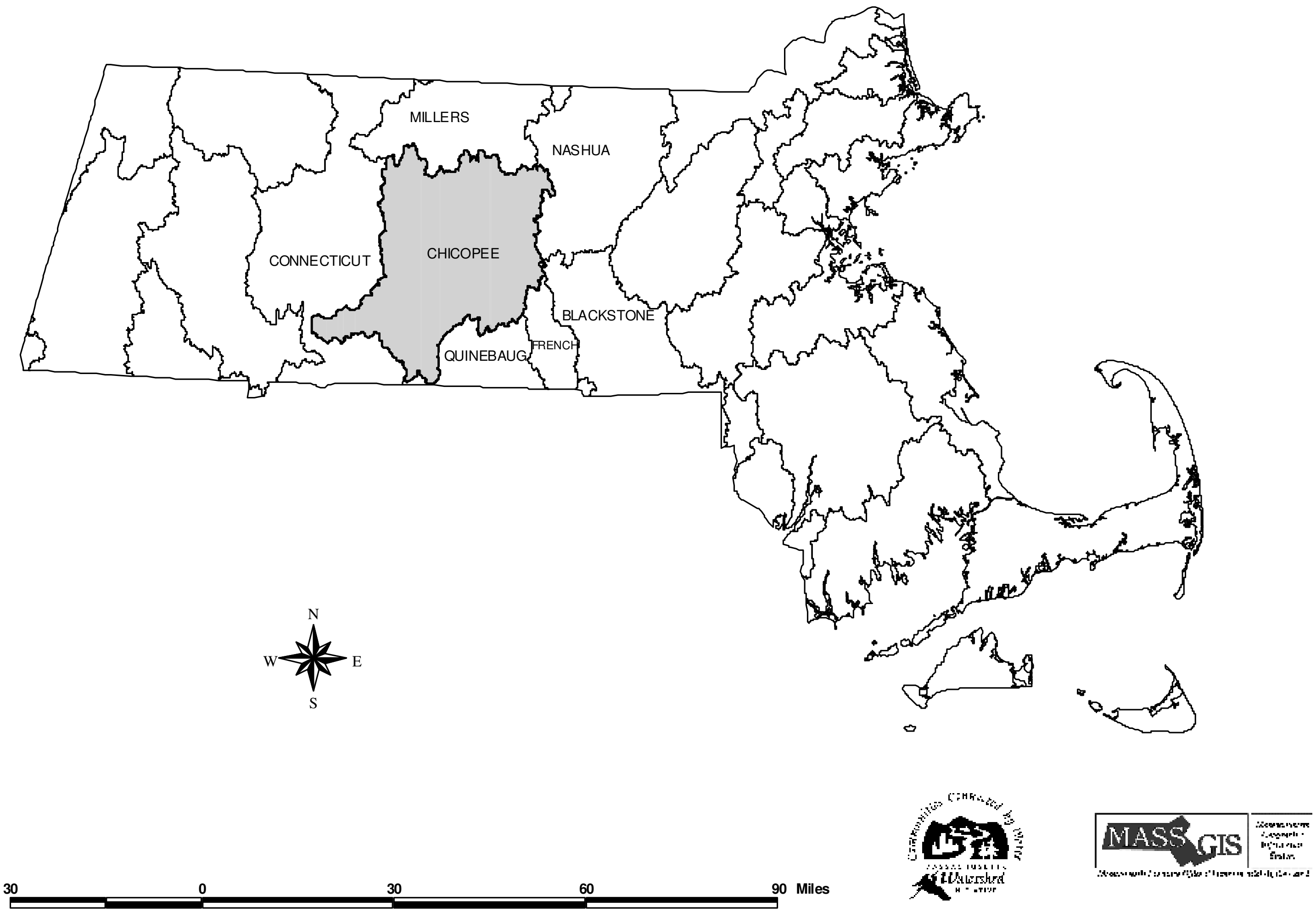


Figure 2. Topography of the Chicopee River basin (30-foot contours).

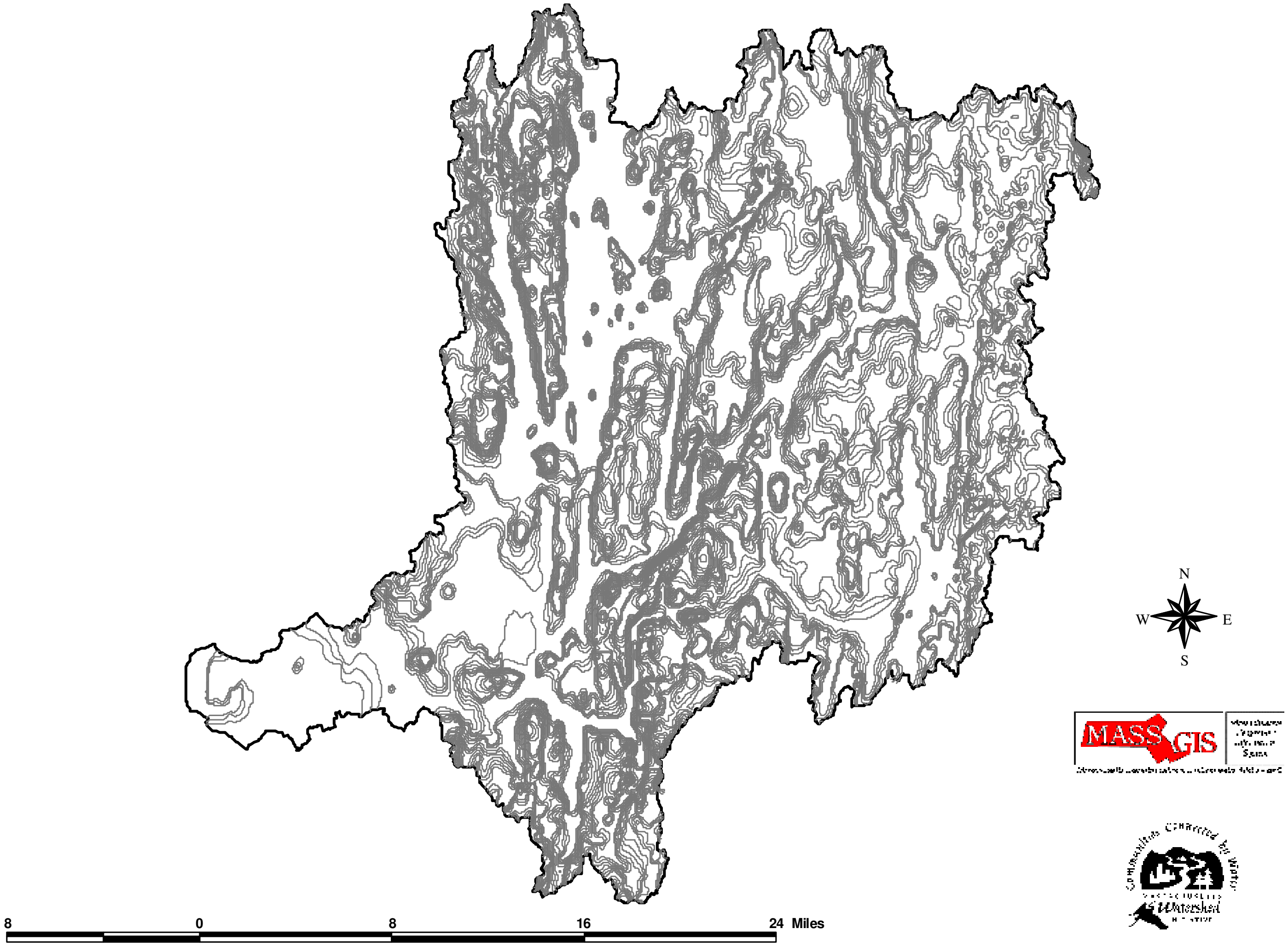


Figure 3. Surficial geology of the Chicopee River basin.

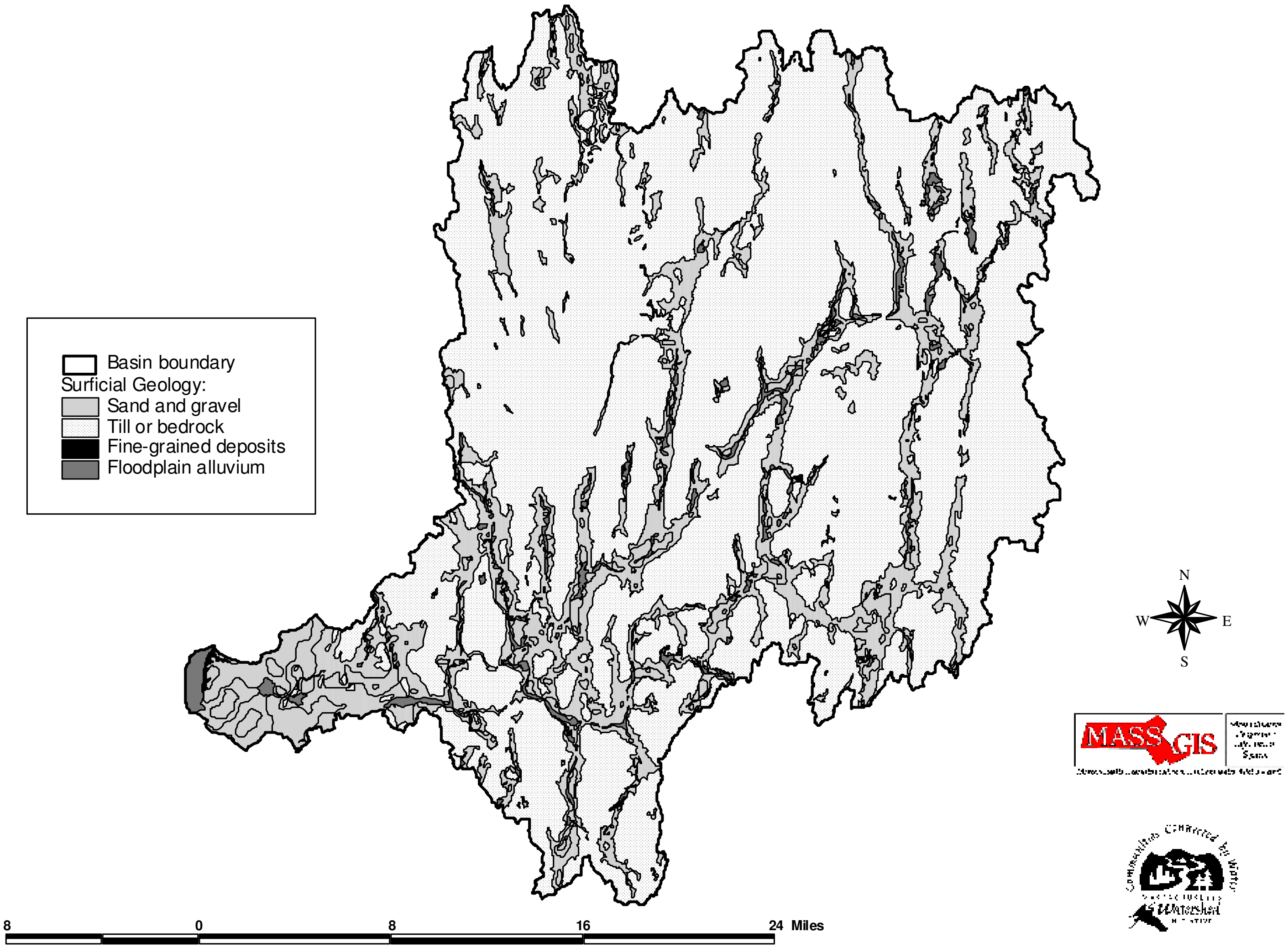
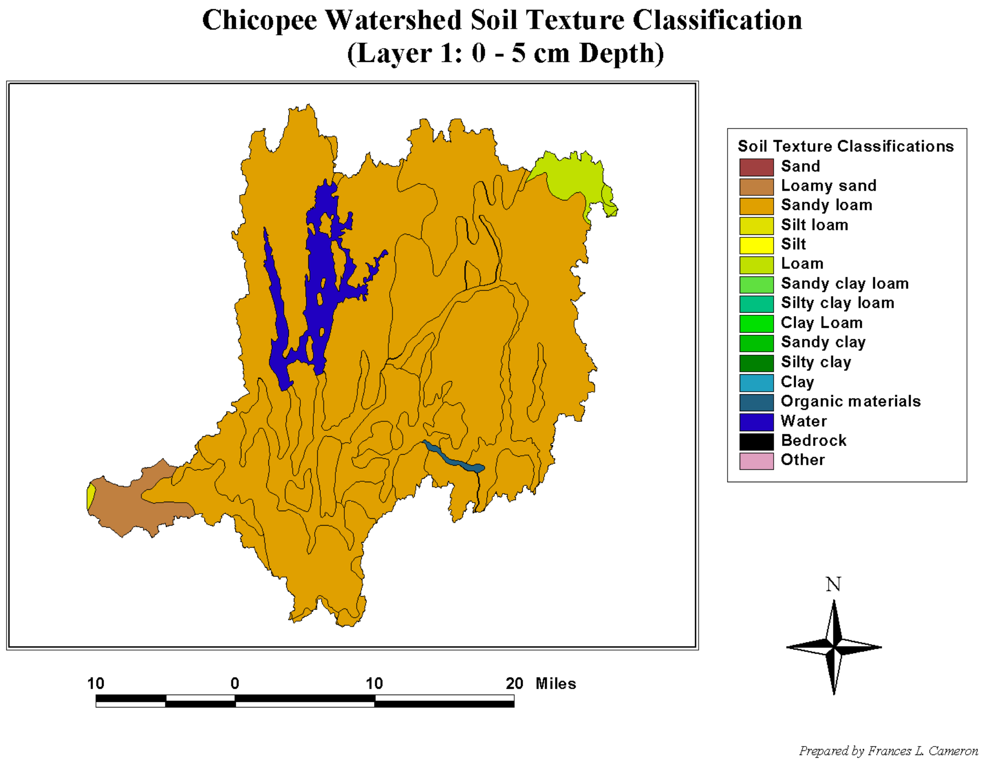


Figure 4. Soil texture classifications for the Chicopee River Basin.



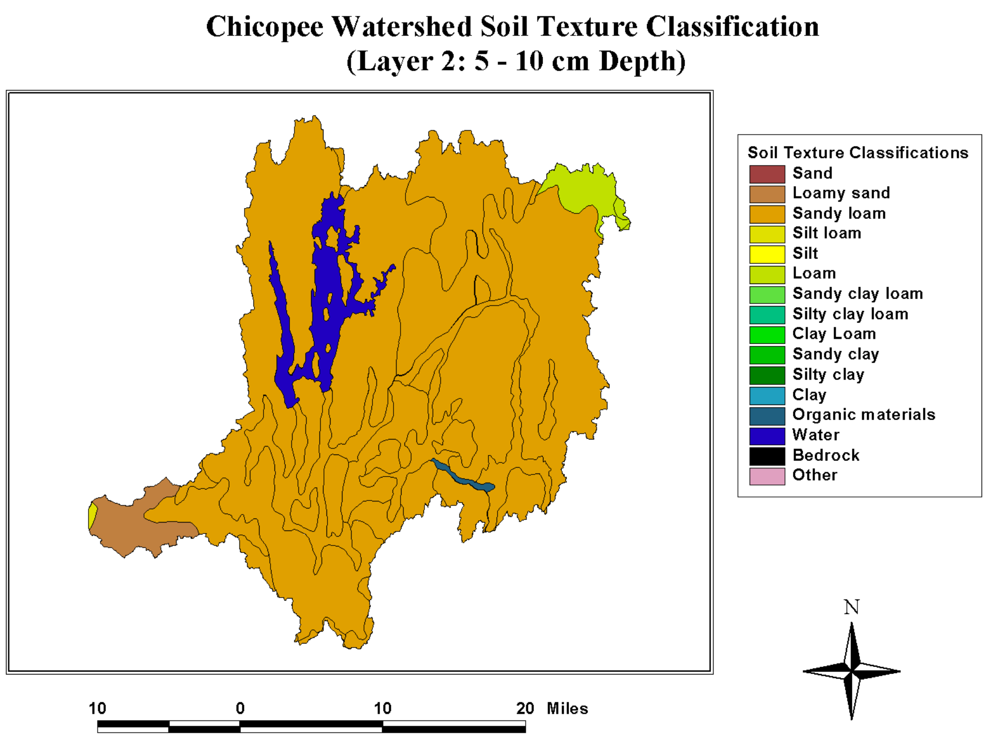
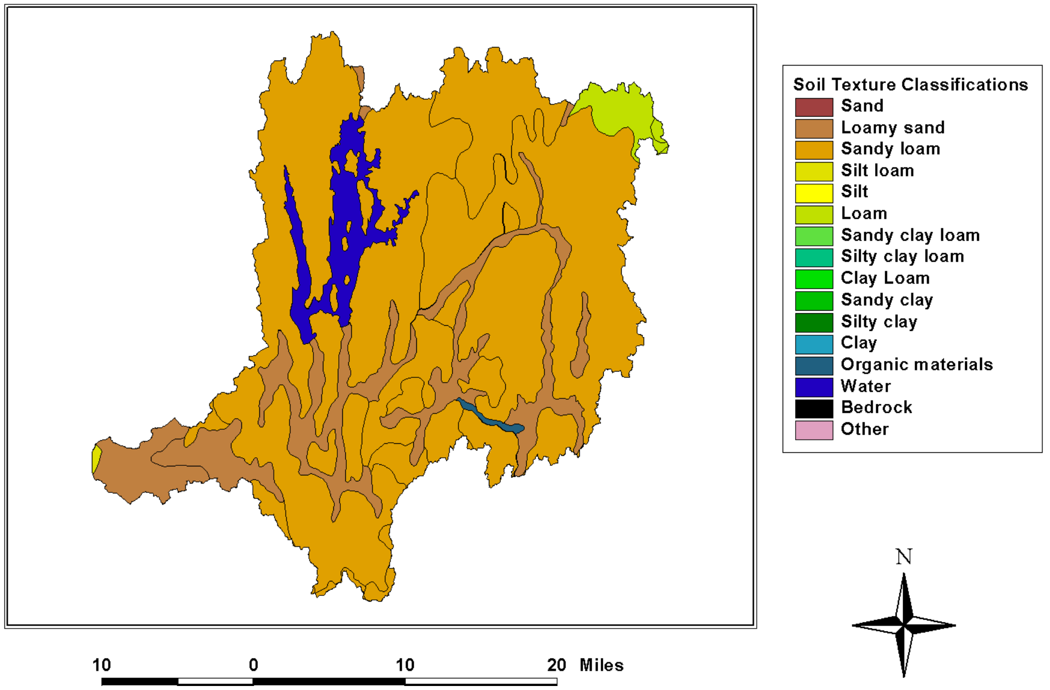
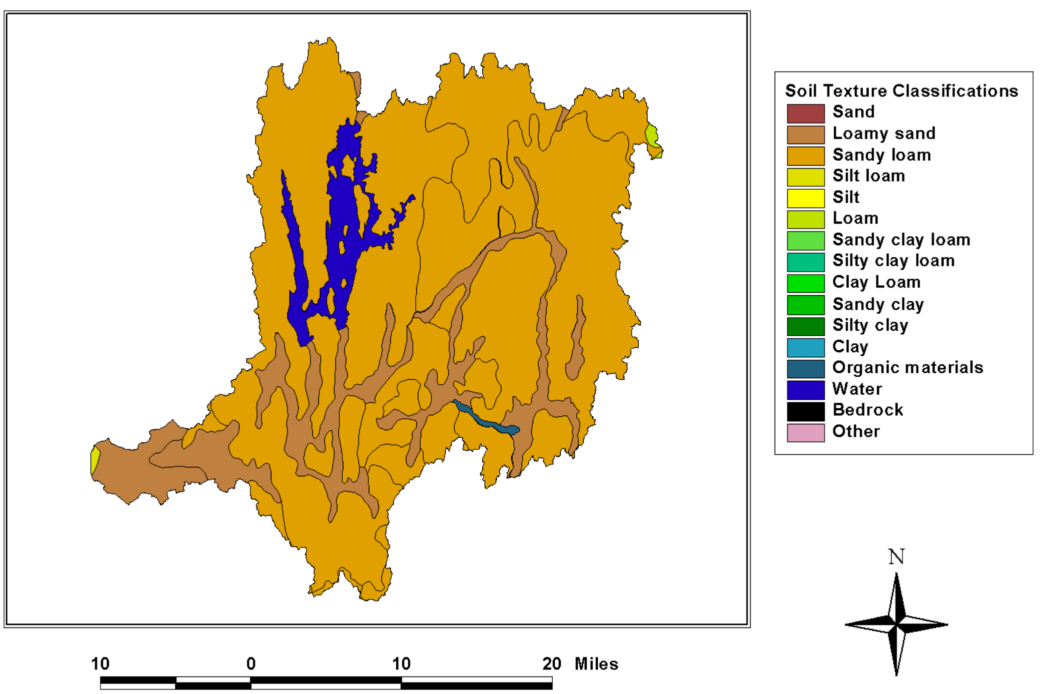


Figure 4 (cont.)

Chicopee Watershed Soil Texture Classification (Layer 3: 10 - 20 cm Depth)



Chicopee Watershed Soil Texture Classification (Layer 4: 20 - 30 cm Depth)



Prepared by Frances L. Cameron

Figure 5. Major watershed areas in the Chicopee River basin.

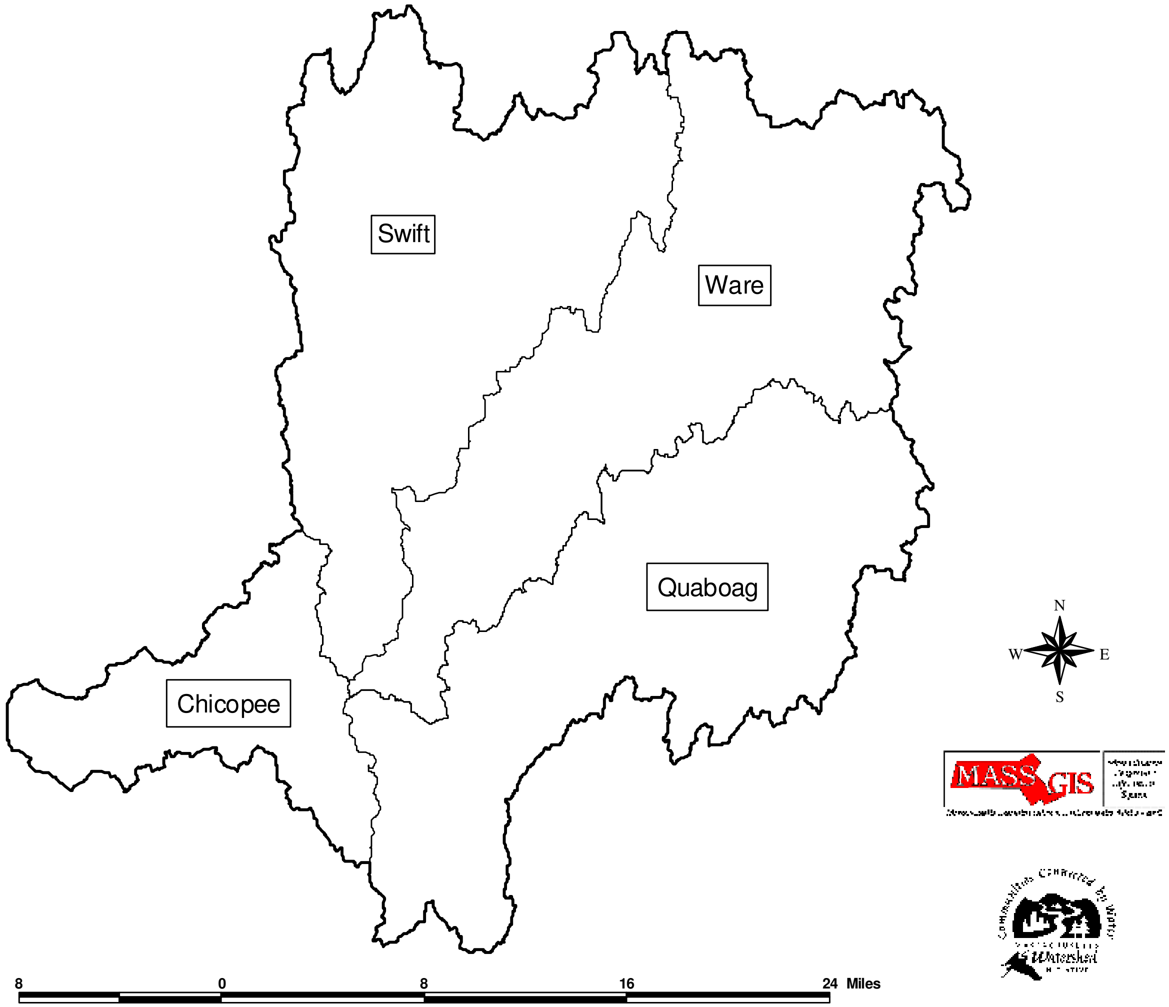
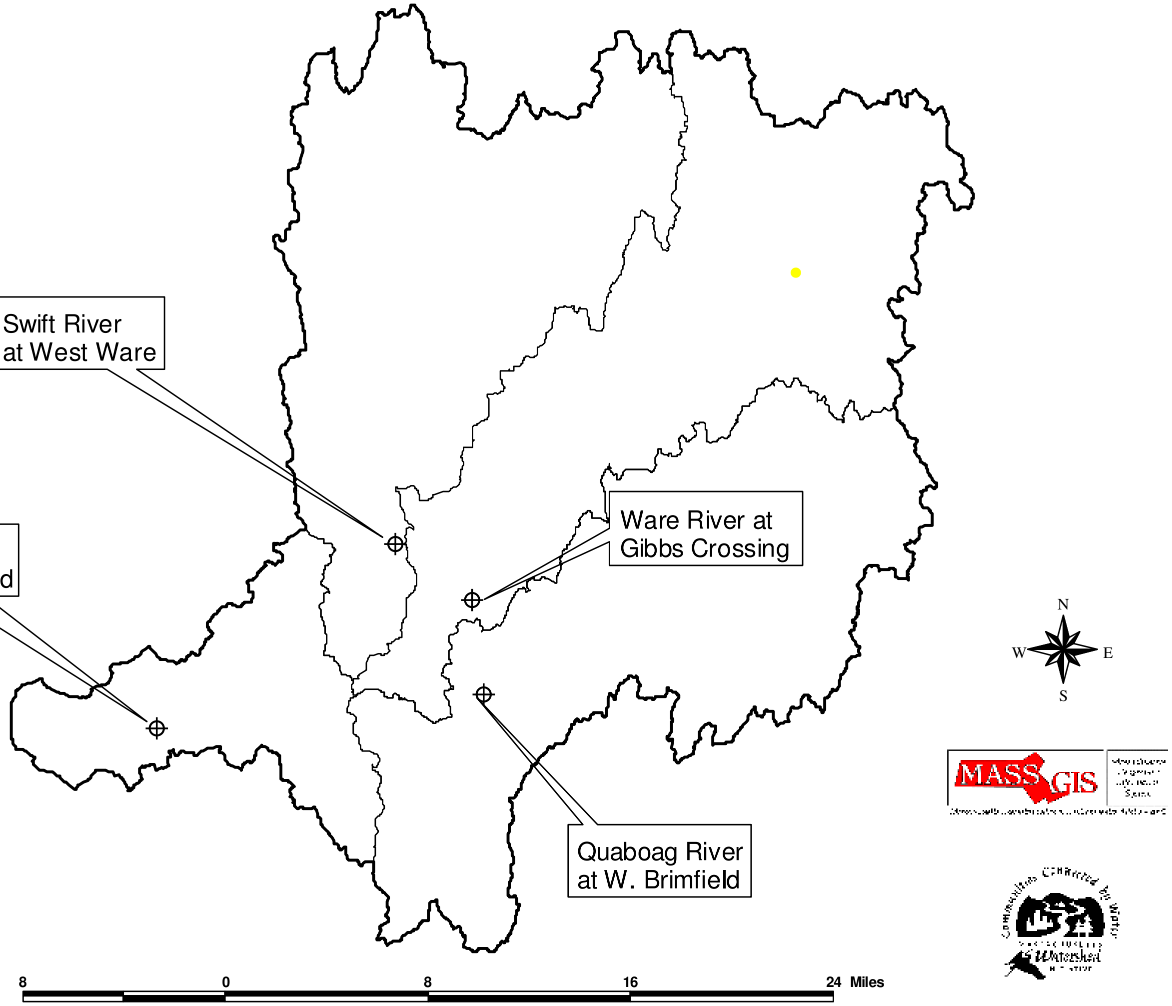


Figure 6. Major USGS stream gages in the Chicopee River basin.



1930's to form the Quabbin Reservoir (Quabbin). Water from the Quabbin is diverted out of the Swift River Watershed through two aqueducts. As a result, streamflows in the Swift River below Quabbin have been significantly altered since 1939 when the dam and dike were completed (Figure 7). Prior to that time, a USGS gaging station located approximately 1½ miles below the dam recorded average annual flows of 315 cfs. Since 1939, those flows have averaged just less than 100 cfs (Table 2).

The Ware River drains approximately 218 square miles in 15 communities (Table 1), from the northeast to the south-central portion of the basin. After receiving the flow of its largest tributary i.e. the Swift River in Palmer, the Ware flows southerly another .8 mile where it joins with the Quaboag River. This marks the beginning of the Chicopee River. A USGS gaging station 9 miles upstream of that confluence provides flow data for 197 mi^2 of the Ware River drainage. Those data show pre-1939 average annual flows of 327 cfs, and post-1939 flows of 285 cfs. It should be noted that the Massachusetts Water Resources Authority (MWRA) operates a diversion facility along the Ware River in Barre, and that water has been diverted from that location into the Quabbin, and sometimes to Wachusett Reservoir (in the Nashua River basin) on an irregular basis over the past 60 years. Since 1985, those diversions have ranged from 0 to 57 MGD (0 - 88 cfs).

The Quaboag River originates in Rutland and Paxton, and drains approximately 212 square miles in 18 communities (Table 1) as it flows from east to west through the southern portion of the basin. A USGS gaging station in Brimfield records flows from approximately 149 square miles of the watershed. The Quaboag River is not affected by major diversions, such as those in the Ware River Watershed and the Swift River Watershed, and has shown relatively consistent flows since the early 1900's (246 cfs prior to 1939; 250 cfs since that time).

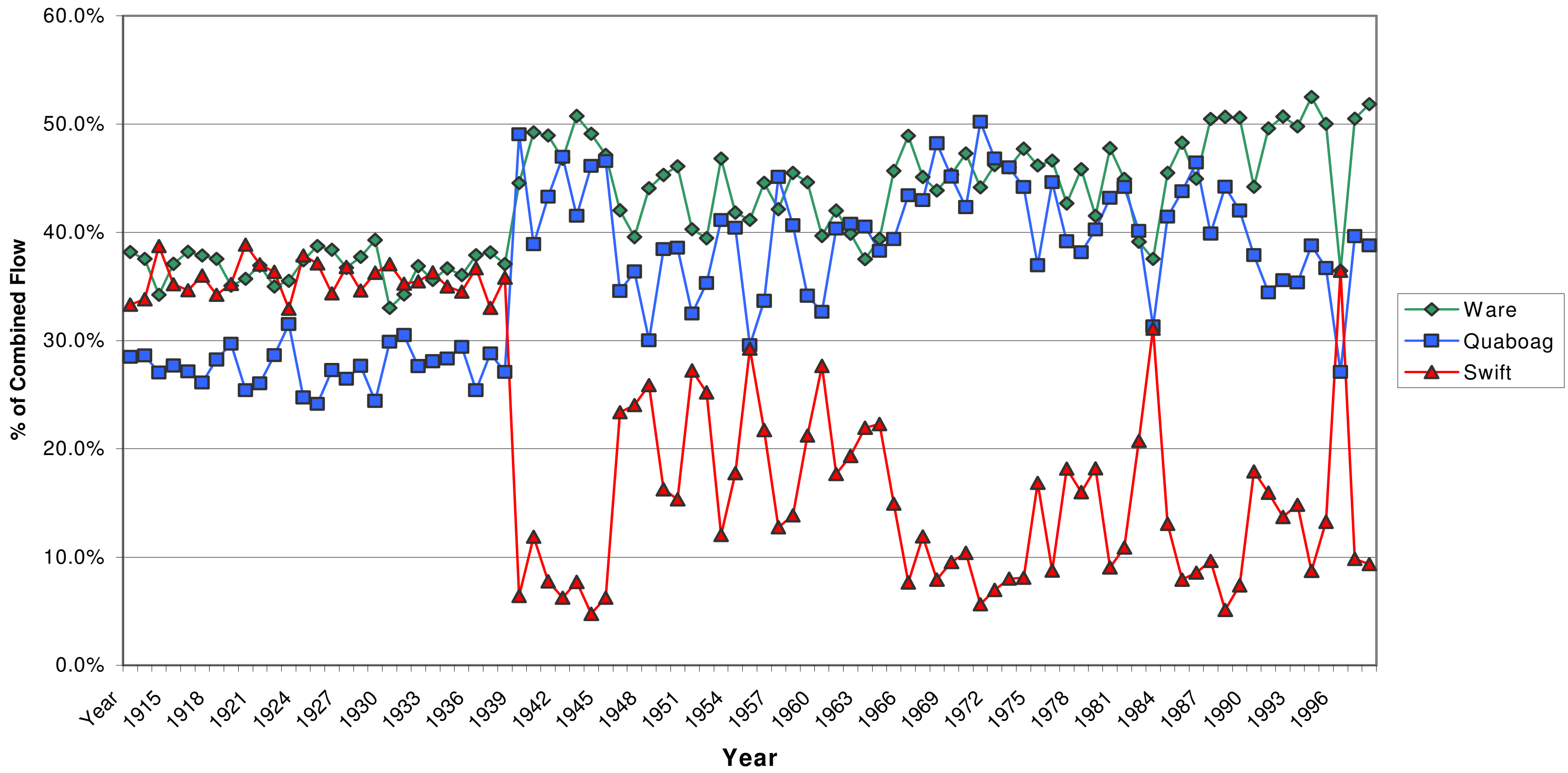
The Chicopee River starts in the village of Three Rivers (in the Town of Palmer) at the point where the Ware and Quaboag Rivers join. From there, it flows westerly approximately 18 miles until it empties into the Connecticut River in the City of Chicopee. In addition to receiving the combined flows from the Swift, Ware, and Quaboag Rivers, the Chicopee receives runoff from an additional 76 square miles of watershed adjacent to the river. The USGS gage at Indian Orchard (IO) has recorded flows from a total of 690 square miles of the combined watersheds since 1928. During that period, an average discharge of 909 cfs has been recorded.

Table 1. Characteristics of the four major river systems in the Chicopee River Basin

River System	Drainage Area	Communities
Swift River	215 sq mi	Barre, Belchertown, Hardwick, New Salem, Orange, Pelham, Petersham, Phillipston, Shutesbury, Ware, Wendell
Ware River	218 sq mi	Barre, Hardwick, Hubbardston, New Braintree, Oakham, Palmer, Petersham, Phillipston, Princeton, Rutland, Templeton, Ware, Warren, West Brookfield, Westminster
Quaboag River	212 sq mi	Brookfield, Brimfield, Charlton, E. Brookfield, Leicester, Monson, New Braintree, N. Brookfield, Oakham, Palmer, Paxton, Rutland, Spencer, Sturbridge, Wales, Ware, Warren, W. Brookfield
Chicopee River	(76 sq mi)	Belchertown, Chicopee, Granby, Hampden, Ludlow, Monson, Palmer, Springfield, Wilbraham

USGS gaging station data for the four major rivers is presented in Table 2. Pre- and post-1939 flow data for the three main tributaries of the Chicopee River is also presented in Figures 8 and 9, which clearly show how the creation of the Quabbin has "flattened out" the annual hydrograph of the Swift River. However, since the MWRA is required to release a minimum flow to the Swift River on a daily basis, the annual hydrograph also shows unusual consistency in mean monthly flows for most of the year

Figure 7. Annual flows in Chicopee Basin rivers - 1913-1999 (USGS data)



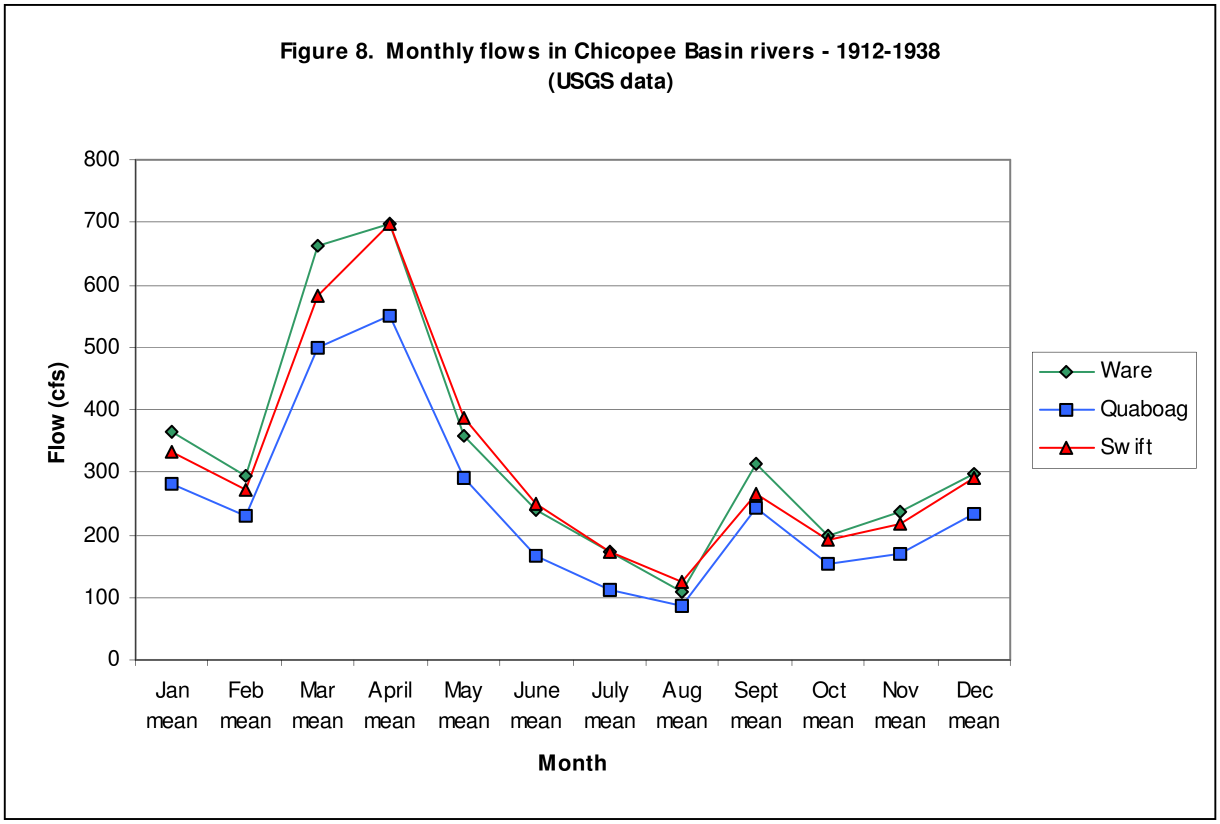


Figure 8. Monthly flows in Chicopee Basin rivers - 1912-1938
(USGS data)
800
700
600
500
400
300
200
100
0
Flow (cfs)
Jan mean
Feb mean
Mar mean
April mean
May mean
June mean
July mean
Aug mean
Sept mean
Oct mean
Nov mean
Dec mean
Month
Ware
Quaboag
Swift

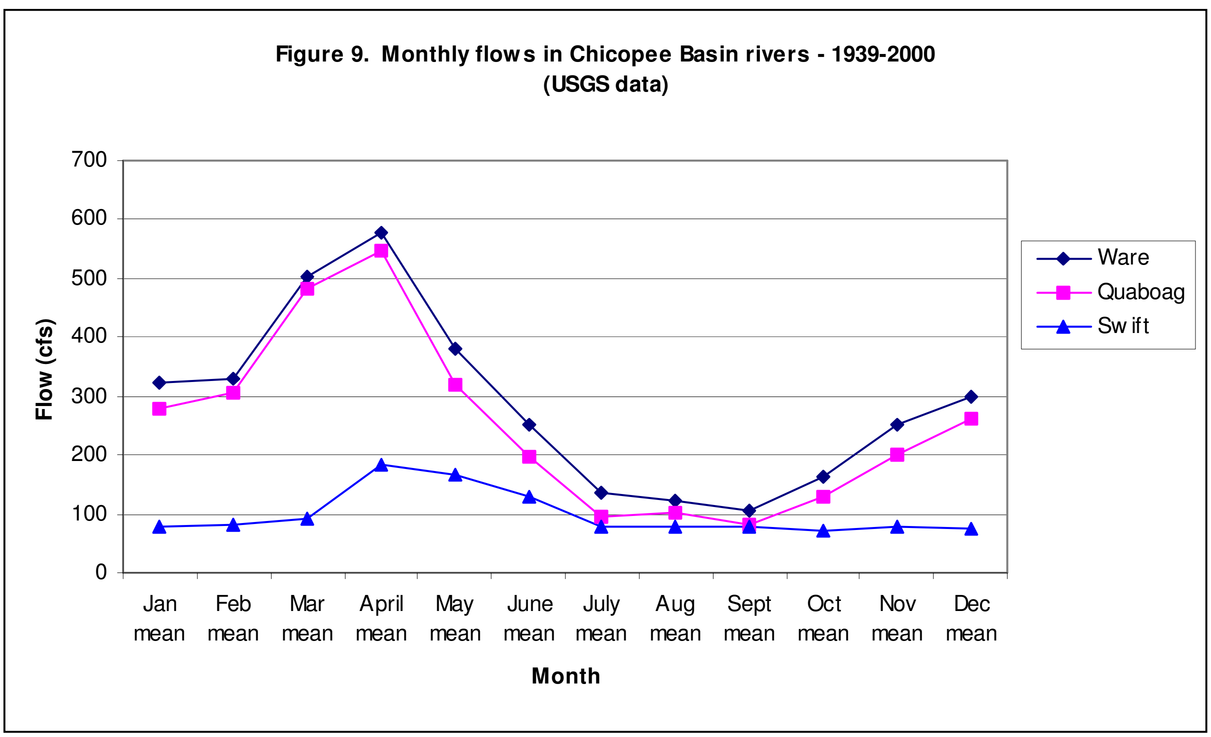


Figure 9. Monthly flows in Chicopee Basin rivers - 1939-2000
(USGS data)
700
600
500
400
300
200
100
0
Flow (cfs)
Jan mean
Feb mean
Mar mean
April mean
May mean
June mean
July mean
Aug mean
Sept mean
Oct mean
Nov mean
Dec mean
Month
Ware
Quaboag
Swift

except for April, May, and June, when a combination of additional controlled releases, spillway overflows and additional runoff below the dam result in higher monthly flows (Figure 9). A secondary effect of this altered flow regime is that the relative contribution of the Swift River to the combined flow of the three main tributaries increases dramatically during the summer's low-flow period. The percent contribution of the Swift River increases from less than 15% during the spring months to more than 35% in September, when the Ware and Quaboag Rivers experience their lowest flows (Figure 10).

Table 2. Flow data for the Swift, Ware, Quaboag and Chicopee Rivers (USGS data, 1912-2000)

	Swift River		Ware River		Quaboag River		Subtotal		Chicopee River (IO)	
	pre 1939	post 1939	pre	post	pre	post	pre	post	pre	post
Mean Annual Flow (cfs)	315	100	327	285	246	250	888	634	1169	871
cfs/mi2	1.67	0.53	1.66	1.45	1.64	1.66	1.66	1.18	1.70	1.26
% of subtotal	35.6	15.0	36.8	45.2	27.6	39.9	--	--	--	--
% of IO flow	27.2	11.1	28.0	32.8	21.5	28.9	76.7	72.7	--	--

In addition to the four major rivers, the Chicopee River basin contains numerous other natural and artificial water bodies, including lakes, ponds, streams, and wetlands (Figures 11 and 12). The Massachusetts Department of Environmental Protection (DEP) includes 136 named streams, flowing an estimated 464 miles, in their Stream and River Information System (SARIS) (DEP 2001). Similarly, their Pond and Lake Information System (PALIS) includes 174 lakes, ponds and impoundments, covering more than 32,000 acres. Major lakes and ponds in the basin are shown in Figure 12.

High and medium-yield aquifers are located throughout the southern portion of the basin (Figure 13), mainly in the stratified sand and gravel deposits left behind by glaciers (Krejmas and Maevsky 1986). The USGS publication "Principal Aquifers of the 48 Contiguous United States (1998)" considers most (691 mi2) of the basin to have "no principal aquifer", with the remaining 30 mi2 to be an "early mesozoic basin aquifer" in sandstone.

B. Ecosystem Characteristics

1. Ecoregion: According to the U.S. Environmental Protection Agency (EPA), the Chicopee River basin lies in three "ecoregions" (Figure 14): "Worcester-Monadnock Plateau" - includes the most hilly areas of the basin, with elevations ranging from 500 to 1400 feet; the high elevations and geology here result in generally cool acidic soils and more northern vegetation than is found in most other parts of MA; forests are transition hardwoods with some northern hardwoods, forested wetlands are common, surface waters tend to be acidic, and many major rivers drain this region.
"Lower Worcester Plateau" – distinct because of the moderate relief of its topography and its low elevation (500-1200 ft); generally acidic soils, but not as cool as those on the Worcester-Monadnock Plateau; supports more southern New England species as a result; lakes, ponds, and acidic wetlands are common; comprised of open hills and transition hardwood and central hardwood forests.
"Connecticut River Valley" – this region is distinguished from the surrounding uplands by its milder climate, relatively rich floodplain soils, and level terrain with some higher outcropping ridges; valley floor is primarily cropland and built land; central hardwoods and transitional hardwoods cover the ridges.

2. Land Cover: The Chicopee River basin is predominantly forested and undeveloped, except for the major Springfield-Chicopee urban area in the southwestern portion of the basin, plus scattered smaller concentrations of population and development in the rest of the basin (Figure 15). Overall, almost

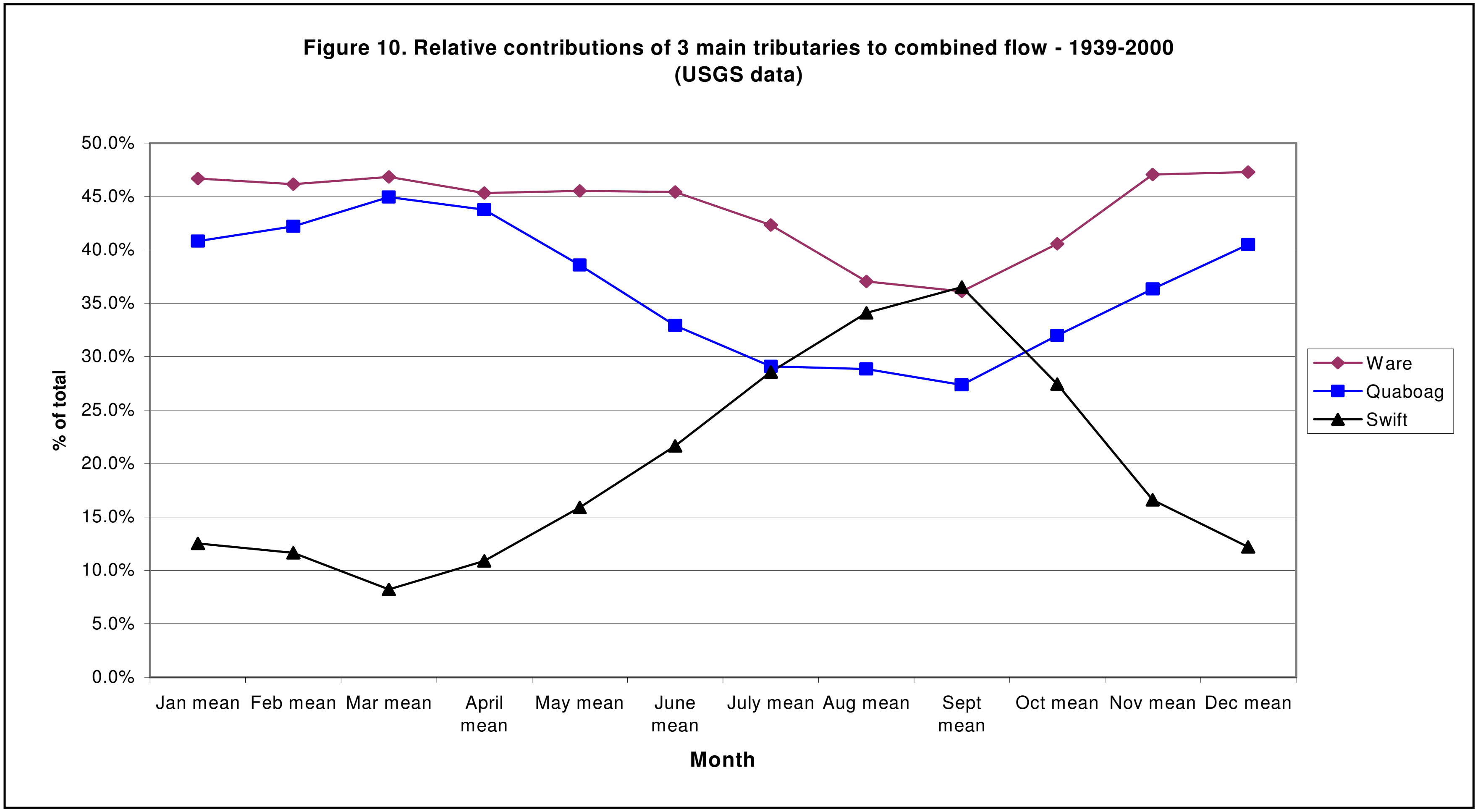


Figure 10. Relative contributions of 3 main tributaries to combined flow - 1939-2000
(USGS data)
50.0%
45.0%
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
% of total
Jan mean
Feb mean
Mar mean
April mean
May mean
June mean
July mean
Aug mean
Sept mean
Oct mean
Nov mean
Dec mean
Month
Ware
Quaboag
Swift

Figure 11. Water Resources in the Chicopee River Basin.

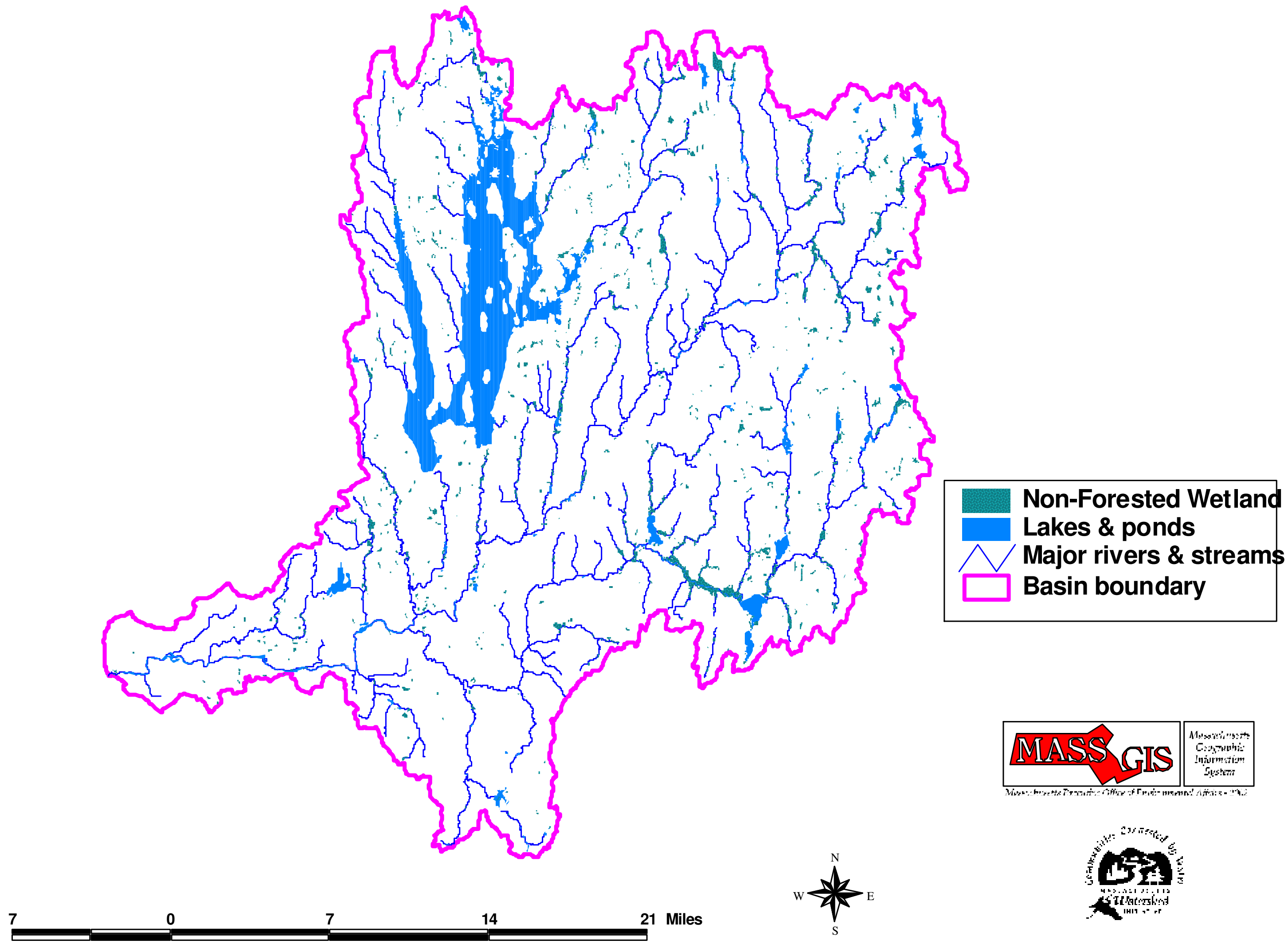


Figure 12. Rivers, streams and shorelines in the Chicopee River Basin.

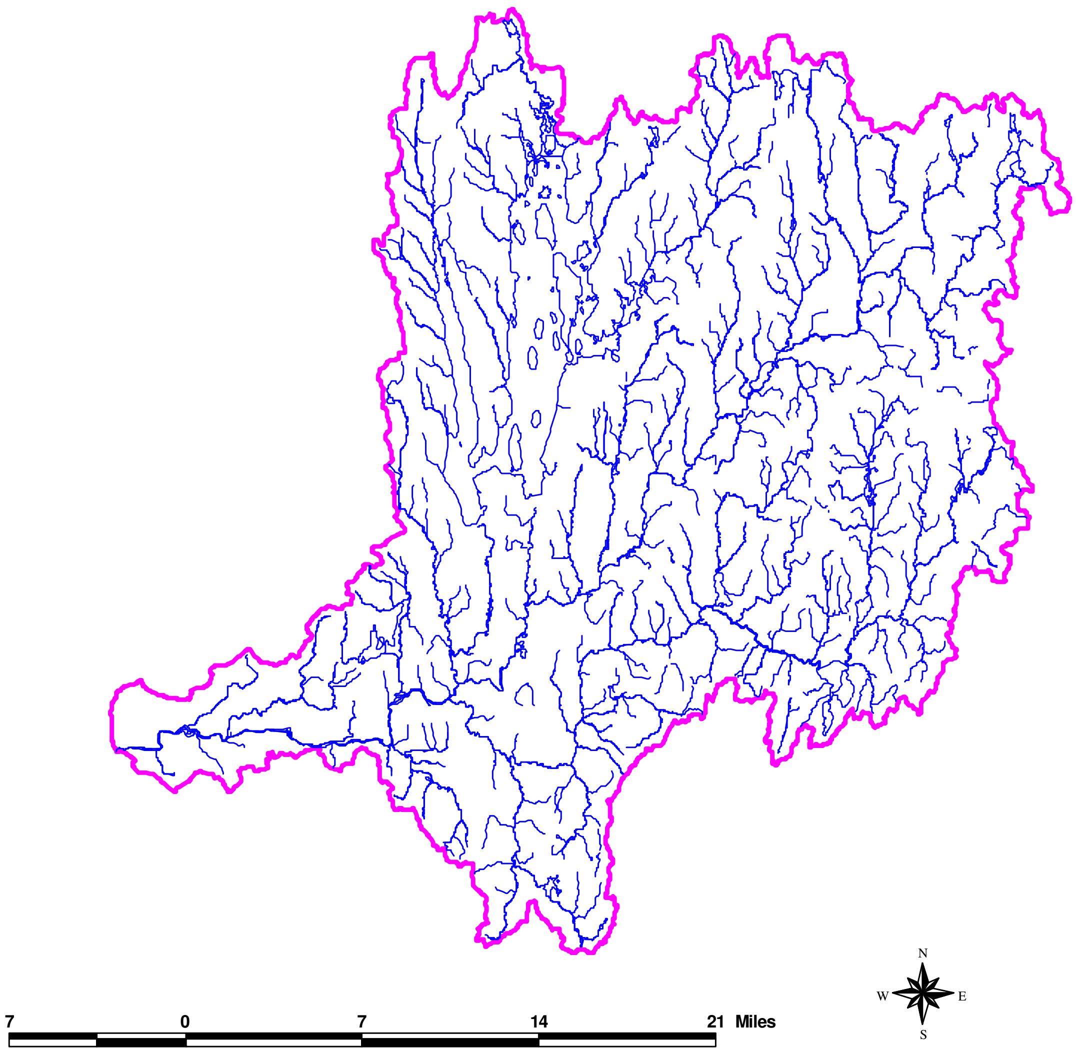


Figure 13. Aquifers in the Chicopee River Basin.

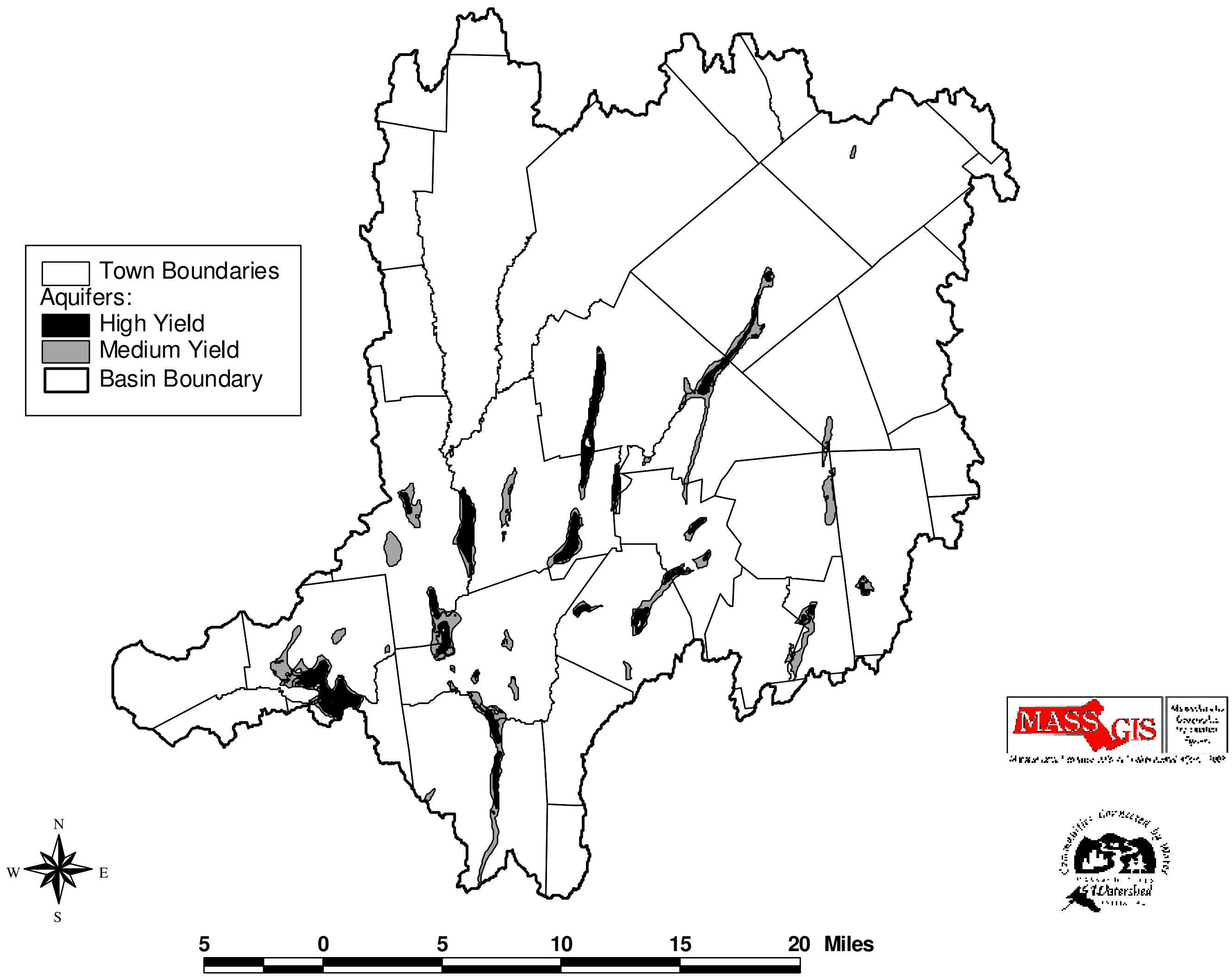


Figure 14. EPA Ecoregions in the Chicopee River Basin.

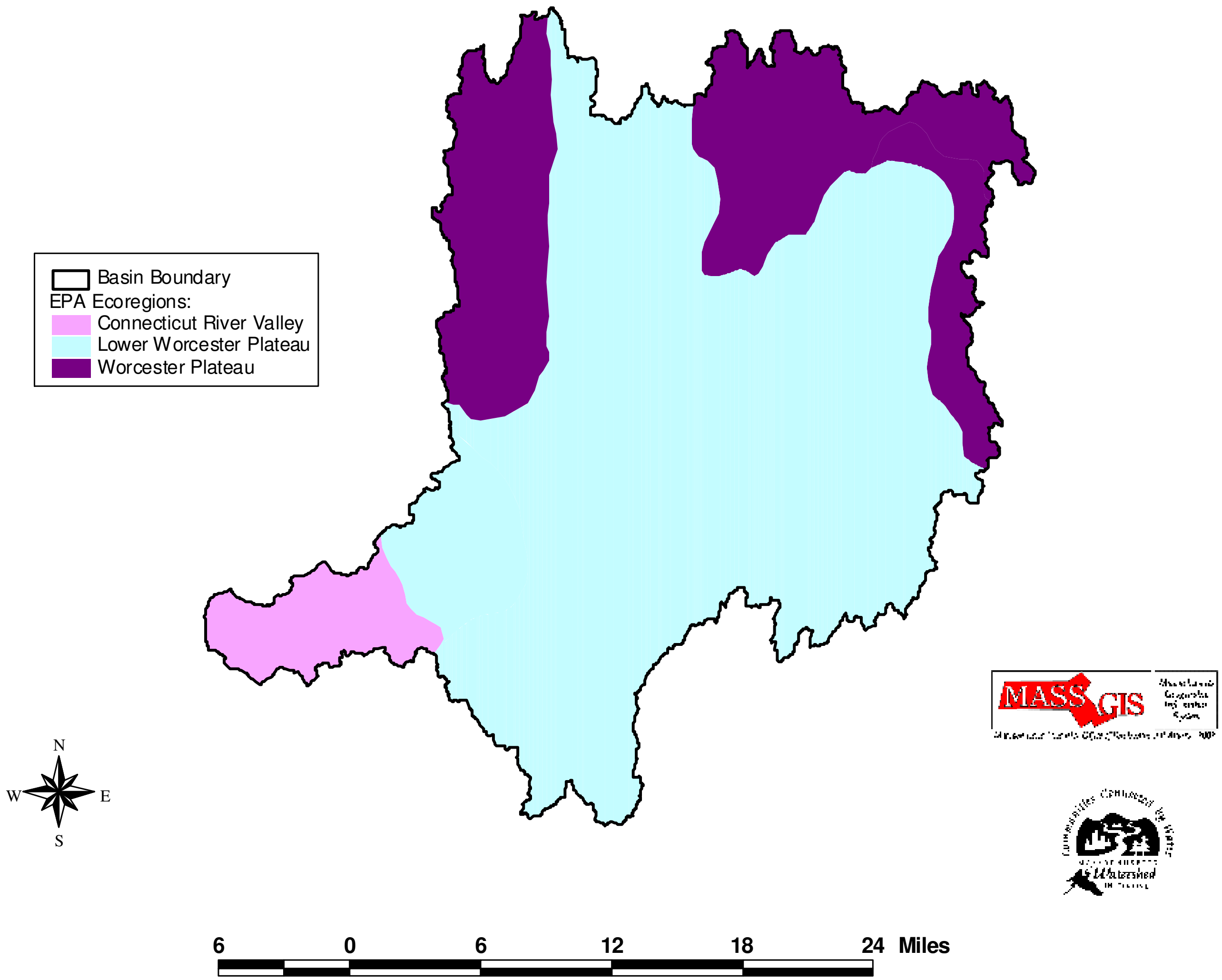
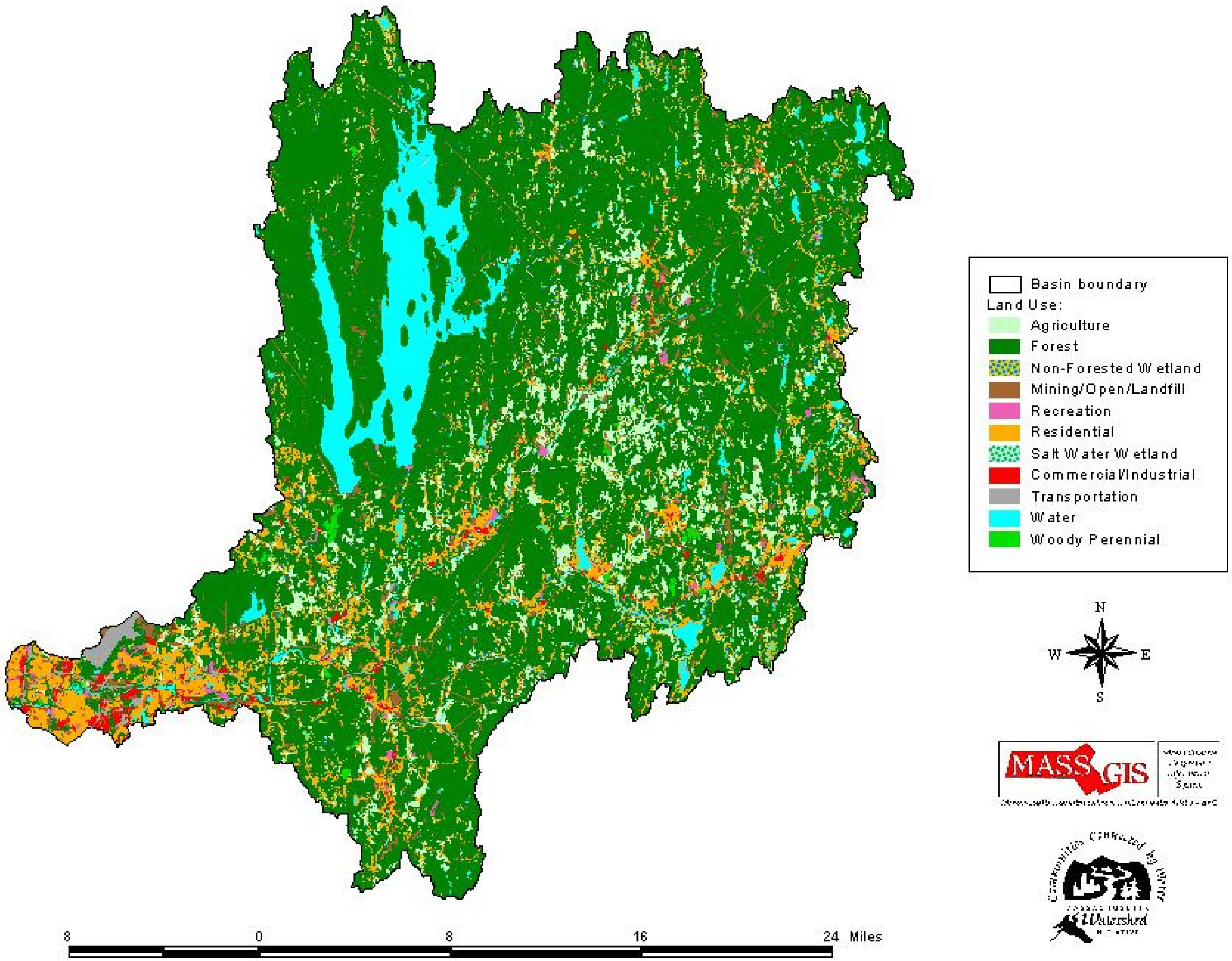


Figure 15. Chicopee River Basin Land Use.



70% of the basin is forested, with an additional 7.2% in agricultural use, 7.1% in water, and 2.3 % in wetlands. Approximately 10% is classified as residential, commercial or industrial (Table 3).

Table 3. Land use in the Chicopee River basin (from MassGIS data)

Land Use Category	Acres (1985)	% of Total ('85)	Acres (1999)	% of Total ('99)
Agriculture	39325.7	8.5	33340.1	7.2
Forest	325724.4	70.5	318336.5	68.9
Wetlands	9474.6	2.0	10511.6	2.3
Open Land	16354.6	3.5	17661.5	3.8
Residential	29645.7	6.4	40153.7	8.7
Commercial	1913.8	0.4	1655.6	0.4
Industrial	4057.4	0.9	4655.2	1.0
Transportation	2865.8	0.6	3041.8	0.7
Water	39932.0	7.1	32950.3	7.1

Generally, the forest cover in the basin is typical of that found in the "transitional forest" in southern New England, except for the southwest corner of the basin, which displays growths typical of a climax community forest (DEQE 1981). The Massachusetts Natural Heritage and Endangered Species Program (NHESP) describes the vegetation in the basin as: "mixed oak/conifer second-growth forest, with red maple in former pasturage and in acidic seepage swamps".

3. Fish & Wildlife

Fish and wildlife occurrences largely reflect the range of habitat conditions in a region, which in turn are affected by geologic and climatic conditions. Since much of the basin shares the acidic glacial till covering acidic, low-nutrient bedrock that is typical of much of Massachusetts, most of the plants and animals of the region are typical of the rest of the state. Many of the plants and animals of the area are habitat generalists, adapted to the widespread conditions in the basin.

Still, the NHESP database indicates that a number of rare habitats and species occur in the basin. Many are found in the Quabbin Reservation that offers refuge to easily-disturbed animals.

a. Vernal Pools: MassGIS data shows 315 certified vernal pools in the Chicopee River basin, although the vast majority of these are in the Town of Hubbardston (Figure 16). It is important to note that the data on certified vernal pools is more a reflection of local efforts to identify and certified those habitats rather than a reflection of the actual distribution of vernal pools in the basin. Interpretation of aerial photographs has resulted in the identification of more than 2300 "potential vernal pools" in the basin (Figure 17). Although most of these are not certified, substantial information on some of these pools is available. For example, the Metropolitan District Commission (MDC) has collected data on vernal pools on the Quabbin and Ware River Reservations for many years.

b. Estimated Habitats: The NHESP periodically publishes maps showing the locations of "estimated habitats of rare wildlife and certified vernal pools" for use in enforcing regulations related to the state Wetlands Protection Act (310 CMR 10.00), Endangered Species Act (321 CMR 10.00), and the Forest Cutting Practices Act (304 CMR 11.00). These maps delineate the approximate geographical extent of habitats of state-protected rare wildlife and indicate approximate locations of certified vernal pools, and are based on documented occurrences of rare species in the state (NHESP 1999). In the Chicopee River basin, more than 80 Estimated Habitats are included in the NHESP database (Figure 18). Current data indicates that at least 16 invertebrates, 21 plants, and 24 vertebrates of special concern occur in the basin (Appendix A).

c. Priority Habitats: As a companion to the Estimated Habitats described above, the NHESP also publishes locations of "Priority Habitats of Rare Species". These maps delineate habitats for rare plant

Figure 16. Chicopee River Basin Certified Vernal Pools.

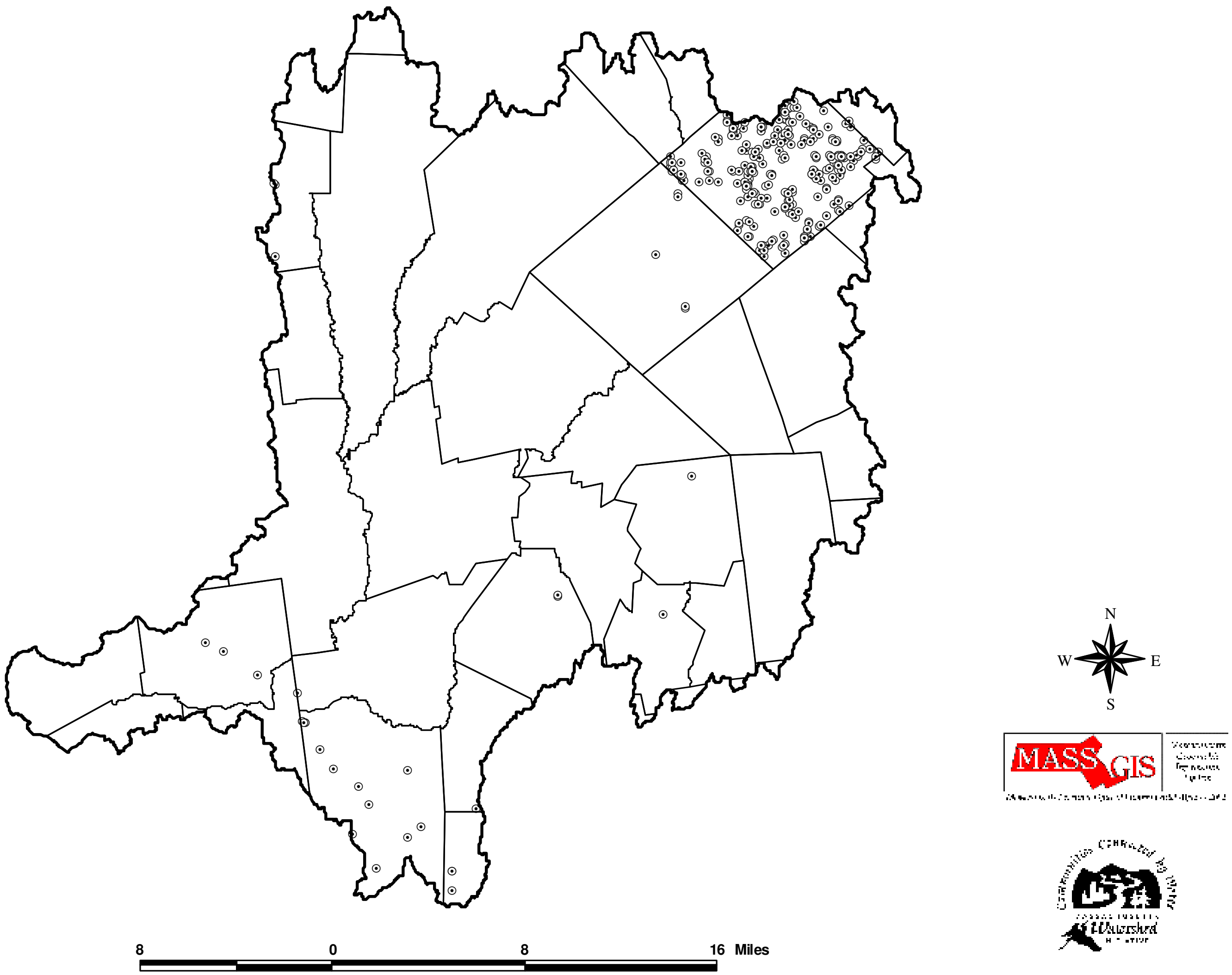


Figure 17. Potential Vernal Pools in the Chicopee River Basin.

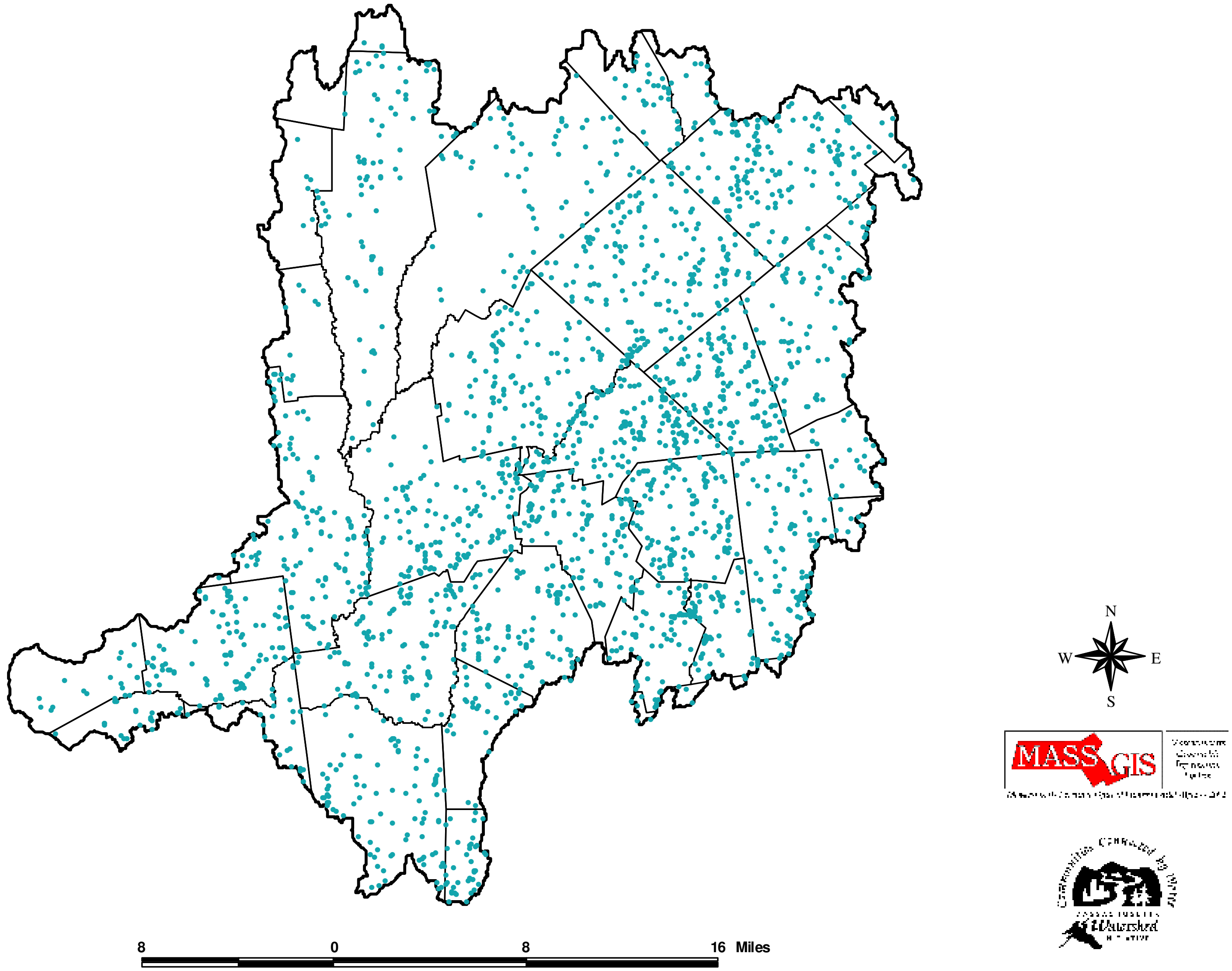
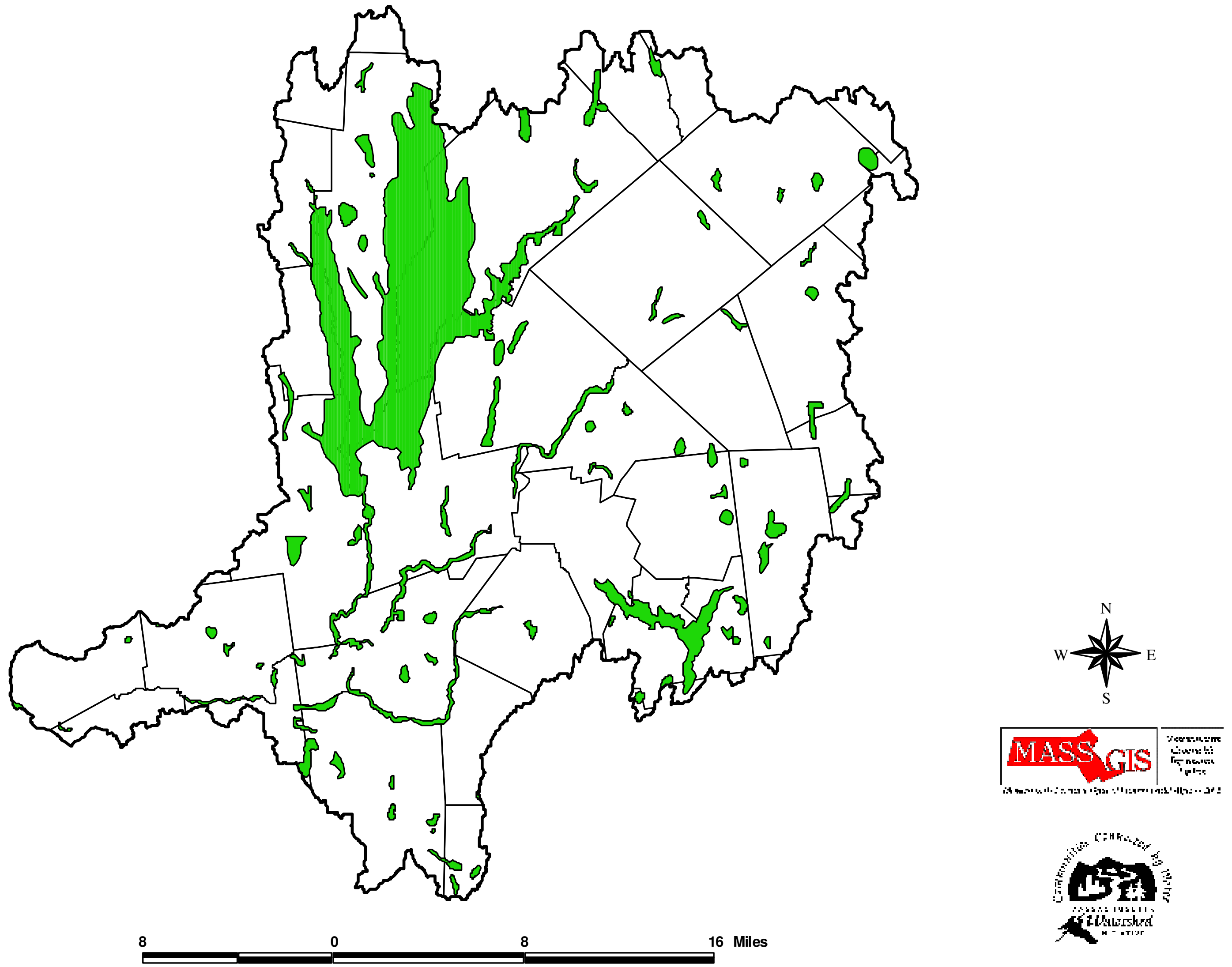


Figure 18. Estimated Rare Species Habitats in the Chicopee River Basin (from NHESP).



and animal populations that are protected under the Massachusetts Endangered Species Act Regulations (321 CMR 10.00), and are based on the approximated extent of rare species populations taken from records in the NHESP database (NHESP 1999). While there is often substantial overlap between locations of Estimated and Priority Habitats, there are also significant differences between the two. In the Chicopee River basin, more than 100 Priority Habitats have been identified (Figure 19), representing 14 different habitat types (Appendix A).

d. Fisheries data: Fisheries data for the Chicopee River basin is not readily available, although with its variety of aquatic habitats, the basin contains a wide variety of fish species. Shad, herring, Atlantic salmon, and other anadromous species migrating up the Connecticut River each spring enter the Chicopee River, although their journey is abruptly stopped at the Dwight Dam, just a short distance upstream of the confluence. This situation makes for some excellent springtime fishing opportunities along the lower reaches of the Chicopee River.

Several portions of the basin, including the Quabbin Reservoir and several rivers or streams, contain cold-water habitat that is suitable for trout and salmon survival. The Division of Fish and Wildlife (MDFW) stocks both of these species in many locations. Numerous other waterbodies provide warm-water habitat, suitable for bass, pickerel, perch, and other warm-water species. Further information on fish habitat will be available in 2003, when a habitat assessment will be conducted by MDFW in the basin.

C. Social Setting

1. Towns and Counties: The Chicopee River basin contains all or part of 39 communities (Figure 20) in 4 counties (Figure 21). Of historical note, prior to the creation of the Quabbin Reservoir, there were 4 additional towns in the basin. When the reservoir was constructed, the Towns of Prescott, Dana, Greenwich, and Enfield were dis-incorporated, and their land area was distributed among the adjacent communities.

The 39 basin communities range in size from 9.89 square miles (East Brookfield) to 54.27 square miles (Petersham), although only 7 communities are totally within the basin (Table 4). Most (37 of 39) are classified as towns; only Springfield and Chicopee are considered cities. Most communities in the basin (i.e., 64 %) are considered “rural economic centers” (16 of 39) or “small rural communities” (9 of 39), in contrast to the state as a whole, in which less than 31% of communities are classified as such. In comparison to communities statewide, basin communities are larger than average (30.5 versus 22.3 mi^2), and contain fewer roads (2.65 miles per mi^2, versus 4.61 statewide) (Table 5).

2. Population and Demographics: Population estimates from the year 2000 U.S. Census confirm that the basin is comprised of mostly small towns. Twenty-nine communities (74%) contain fewer than 10,000 residents (Table 6). Only Ludlow (21,209 residents), Chicopee (54,653) and Springfield (152,082) have more than 20,000 people. Estimates of the number of people actually living in the basin range from about 175,000 to 185,000. Generally, population density in basin communities increased from north to south, with the highest densities in the Springfield area communities in the southwest portion of the basin (Figure 22).

Overall, population in the 39 basin communities increased by 2.3%, from 1990 to 2000. However, changes for individual communities ranged from a low of –3.5% in Chicopee to a high of 39.8% in Hubbardston (see Table 6 and Figure 23). Compared to statewide averages, basin communities are much less dense (average of 361 people/mi2 versus 810 statewide), with more land area per capita (1.77 acres vs. 0.79).

Politically, basin communities appear similar to the rest of the state, with most residents registered as “unenrolled” (57% vs. 56% statewide); 29% are registered as Democrats (29% statewide), and 13.5% as Republican (15% statewide). However, these percentages vary substantially across basin communities. For example, Democratic enrollment ranges from about 15% in Petersham to more than 58% in Ludlow (Table 7).

Figure 19. Priority Habitats in the Chicopee River Basin (from NHESP).

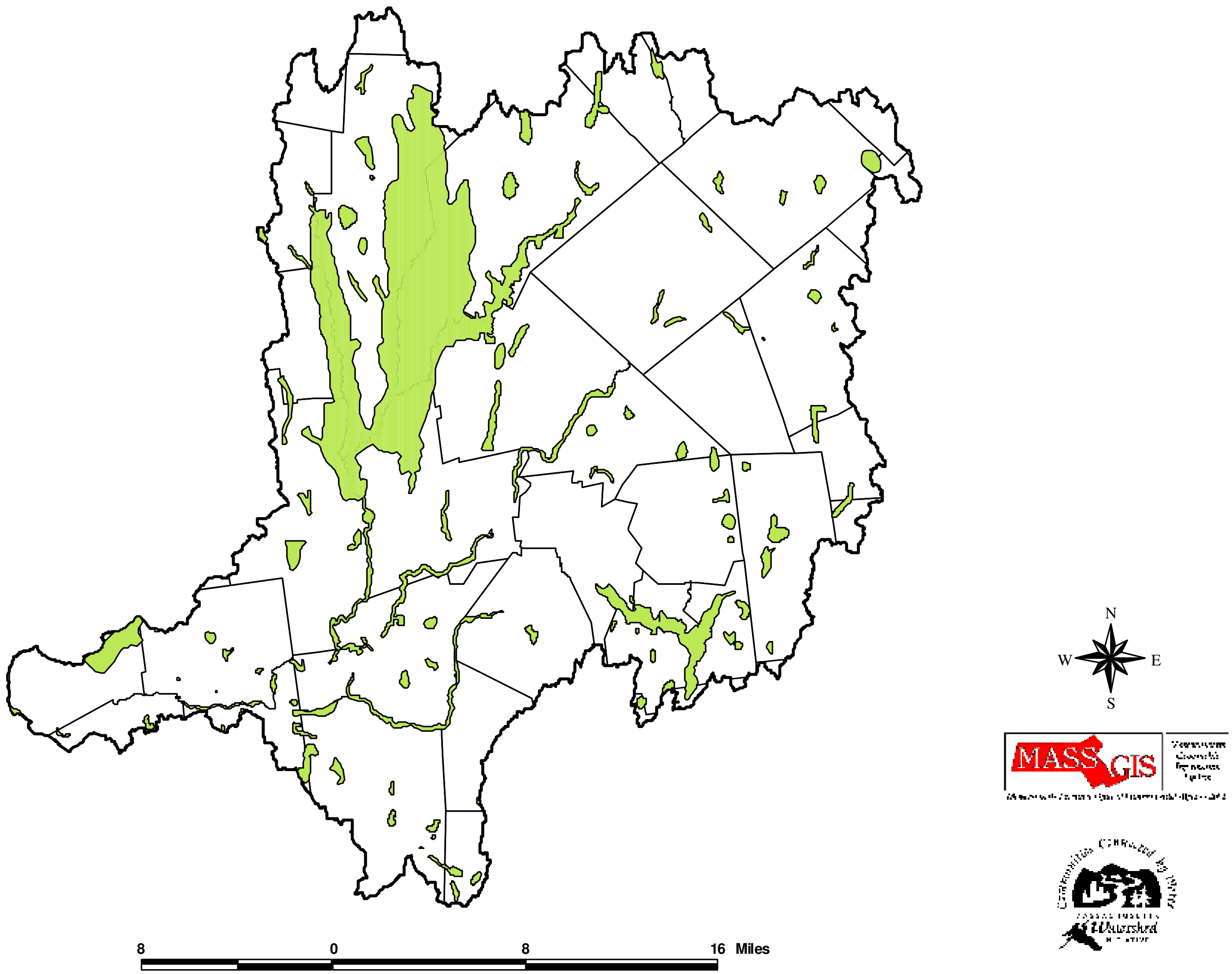


Figure 20. Cities and Towns in the Chicopee River Basin.

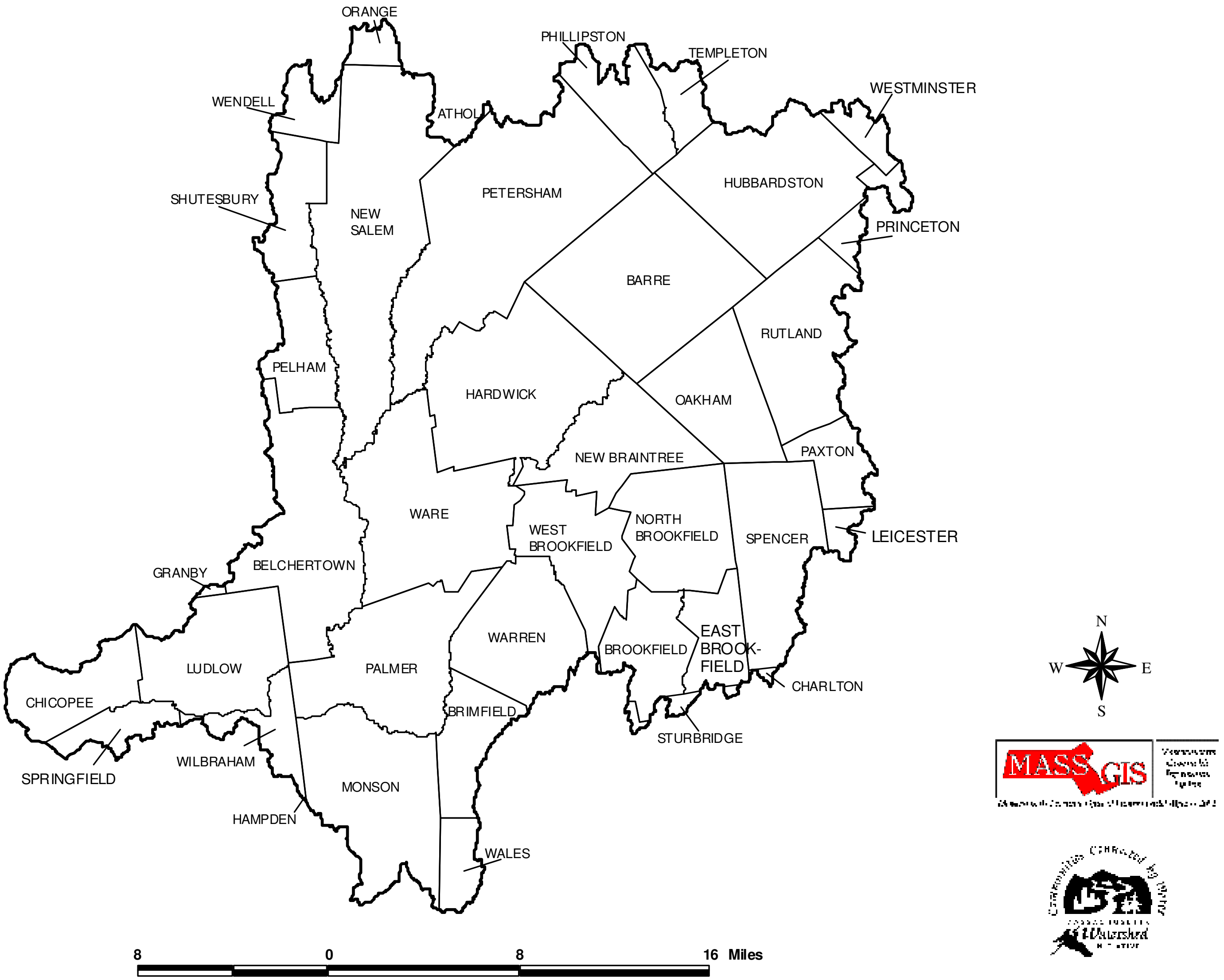


Figure 21. County Boundaries in the Chicopee River Basin.

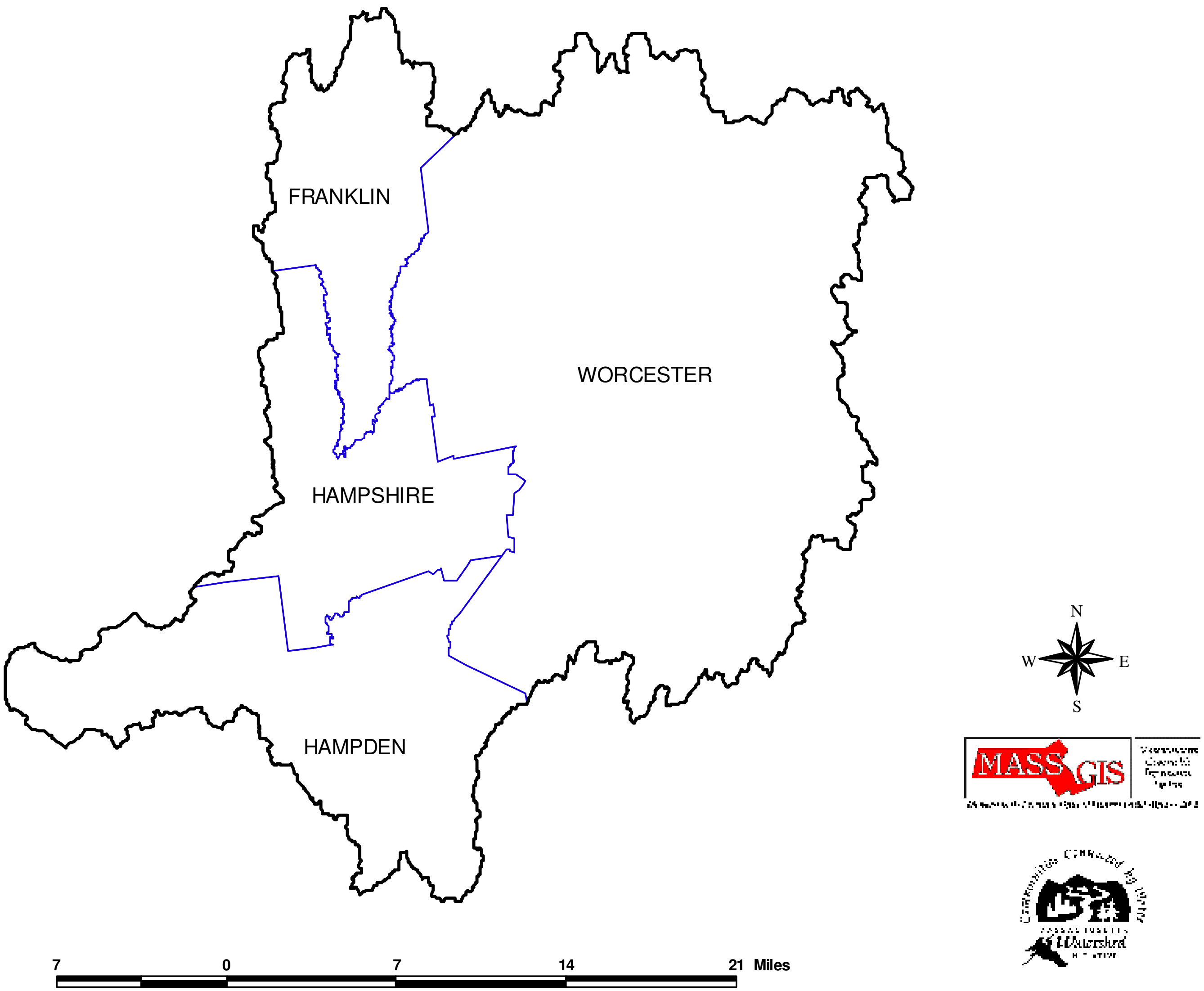


Table 4. Chicopee River Basin Communities

Municipality	County	Land Area (sq. mi.)	Percent in basin	Sq. mi. in basin
Athol	Worcester	32.3	0.6	0.2
Barre	Worcester	44.3	100.0	44.3
Belchertown	Hampshire	52.5	66.7	35.0
Brimfield	Hampden	35.4	35.9	12.7
Brookfield	Worcester	15.7	85.9	13.5
Charlton	Worcester	42.9	0.9	0.4
Chicopee	Hampden	22.9	64.9	14.9
East Brookfield	Worcester	9.9	99.3	9.8
Granby	Hampshire	28.0	1.6	0.4
Hampden	Hampden	19.7	0.04	0.01
Hardwick	Worcester	38.4	100.0	38.4
Hubbardston	Worcester	40.3	88.8	35.8
Leicester	Worcester	22.7	10.7	2.4
Ludlow	Hampden	27.1	89.1	24.2
Monson	Hampden	44.8	76.6	34.4
New Braintree	Worcester	20.8	100.0	20.8
New Salem	Franklin	45.0	93.4	42.1
North Brookfield	Worcester	21.1	100.0	21.1
Oakham	Worcester	21.0	100.0	21.0
Orange	Franklin	35.0	9.3	3.2
Palmer	Hampden	31.4	100.0	31.4
Paxton	Worcester	14.9	52.9	7.9
Pelham	Hampshire	24.8	48.1	11.9
Petersham	Worcester	54.3	93.3	50.6
Phillipston	Worcester	23.7	50.8	12.0
Princeton	Worcester	35.4	14.4	5.1
Rutland	Worcester	35.4	76.5	27.1
Shutesbury	Franklin	26.7	45.3	12.1
Spencer	Worcester	33.2	77.6	25.7
Springfield	Hampden	31.7	20.2	6.4
Sturbridge	Worcester	37.4	4.7	1.8
Templeton	Worcester	31.5	18.9	5.9
Wales	Hampden	16.2	37.9	6.1
Ware	Hampshire	34.9	100.0	34.9
Warren	Worcester	27.5	86.8	23.9
Wendell	Franklin	31.7	18.8	5.9
West Brookfield	Worcester	20.7	98.8	20.4
Westminster	Worcester	35.6	11.7	4.2
Wilbraham	Hampden	22.2	34.9	7.8

Table 5. Miscellaneous information on Chicopee River Basin communities

MUNICIPALITY	KOC	2000 US Census	1989 Income per Capita	Land SQ Miles	1999 Public Rd Mileage	Pop. Per sq mile	Land area per capita	Roads per sq mile
ATHOL	5	11,299	$12,444	32.34	96.45	349.38	1.83	2.98
BARRE	5	5,113	$14,012	44.30	99.59	115.42	5.55	2.25
BELCHERTOWN	3	12,968	$15,493	52.52	118.85	246.92	2.59	2.26
BRIMFIELD	6	3,339	$13,563	35.37	64.27	94.40	6.78	1.82
BROOKFIELD	5	3,051	$12,368	15.68	35.69	194.58	3.29	2.28
CHARLTON	6	11,263	$15,128	42.86	119.30	262.79	2.44	2.78
CHICOPEE	1	54,653	$13,525	22.91	153.37	2385.55	0.27	6.69
EAST BROOKFIELD	5	2,097	$14,988	9.89	19.24	212.03	3.02	1.95
GRANBY	3	6,132	$16,748	28.01	56.71	218.92	2.92	2.02
HAMPDEN	4	5,171	$18,674	19.66	53.09	263.02	2.43	2.70
HARDWICK	5	2,622	$13,387	38.40	86.79	68.28	9.37	2.26
HUBBARDSTON	6	3,909	$15,575	40.34	81.29	96.90	6.60	2.02
LEICESTER	5	10,471	$15,806	22.70	80.62	461.28	1.39	3.55
LUDLOW	3	21,209	$14,273	27.14	100.71	781.47	0.82	3.71
MONSON	5	8,359	$14,454	44.84	101.07	186.42	3.43	2.25
NEW BRAINTREE	5	927	$15,409	20.76	49.44	44.65	14.33	2.38
NEW SALEM	6	929	$14,762	45.04	38.03	20.63	31.03	0.84
NORTH BROOKFIELD	5	4,683	$13,710	21.11	68.62	221.84	2.88	3.25
OAKHAM	6	1,673	$15,162	20.99	43.48	79.70	8.03	2.07
ORANGE	5	7,518	$11,106	35.03	84.06	214.62	2.98	2.40
PALMER	5	12,497	$14,648	31.43	86.69	397.61	1.61	2.76
PAXTON	4	4,386	$20,893	14.87	37.03	294.96	2.17	2.49
PELHAM	4	1,403	$19,640	24.82	22.68	56.53	11.32	0.91
PETERSHAM	6	1,180	$17,542	54.27	62.68	21.74	29.43	1.15
PHILLIPSTON	6	1,621	$13,216	23.70	44.41	68.40	9.36	1.87
PRINCETON	4	3,353	$21,386	35.39	79.68	94.74	6.76	2.25
RUTLAND	6	6,353	$16,661	35.42	66.77	179.36	3.57	1.89
SHUTESBURY	7	1,810	$15,936	26.68	31.15	67.84	9.43	1.17
SPENCER	5	11,691	$14,222	33.15	94.33	352.67	1.81	2.85
SPRINGFIELD	1	152,082	$11,584	31.70	394.64	4797.54	0.13	12.45
STURBRIDGE	3	7,837	$16,642	37.39	78.18	209.60	3.05	2.09
TEMPLETON	5	6,799	$13,347	31.49	68.31	215.91	2.96	2.17
WALES	6	1,737	$13,337	16.21	23.67	107.16	5.97	1.46
WARE	5	9,707	$13,082	34.85	84.42	278.54	2.30	2.42
WARREN	5	4,776	$12,805	27.50	62.83	173.67	3.69	2.28
WENDELL	3	986	$11,990	31.65	48.33	31.15	20.54	1.53
WEST BROOKFIELD	5	3,804	$14,238	20.67	50.28	184.03	3.48	2.43
WESTMINSTER	3	6,907	$16,798	35.64	84.83	193.80	3.30	2.38
WILBRAHAM	4	13,473	$21,748	22.22	91.96	606.35	1.06	4.14
Statewide totals/mean:		6,349,097	$17,801	7839.13	27999.70	809.92	0.79	3.57
Chicopee totals/mean:		429,788	$15,136	1188.94	3063.54	361.49	1.77	2.58

KOC (KIND OF COMMUNITY): 1= Urbanized Center 4= Residential Suburb 7= Resort, Retirement, Artistic
6= Small Rural Community 3= Growth Community 5= Rural Economic Center

Table 6. U.S. Census and other population data for Chicopee River Basin communities

MUNICIPALITY	Population:		Change 1990 to 2000		Pop/sq.mi.	Est. pop in watershed in 2000 based on:	
	1990	2000	Numeric	Percent		% in basin	TIGER
Athol	11,451	11,299	-152	-1.3%	349.4	63	19
Barre	4,546	5,113	567	12.5%	115.4	5113	5113
Belchertown	10,579	12,968	2,389	22.6%	246.9	8654	7589
Brimfield	3,001	3,339	338	11.3%	94.4	1198	974
Brookfield	2,968	3,051	83	2.8%	194.6	2619	2829
Charlton	9,576	11,263	1,687	17.6%	262.8	106	131
Chicopee	56,632	54,653	-1,979	-3.5%	2385.6	35475	36082
East Brookfield	2,033	2,097	64	3.1%	212.0	2083	2083
Granby	5,565	6,132	567	10.2%	218.9	97	51
Hampden	4,709	5,171	462	9.8%	263.0	2	1
Hardwick	2,385	2,622	237	9.9%	68.3	2622	2622
Hubbardston	2,797	3,909	1,112	39.8%	96.9	3472	3200
Leicester	10,191	10,471	280	2.7%	461.3	1122	704
Ludlow	18,820	21,209	2,389	12.7%	781.5	18889	20157
Monson	7,776	8,359	583	7.5%	186.4	6405	6875
New Braintree	881	927	46	5.2%	44.7	927	927
New Salem	802	929	127	15.8%	20.6	868	817
North Brookfield	4,708	4,683	-25	-0.5%	221.8	4683	4683
Oakham	1,503	1,673	170	11.3%	79.7	1673	1673
Orange	7,312	7,518	206	2.8%	214.6	695	389
Palmer	12,054	12,497	443	3.7%	397.6	12497	12497
Paxton	4,047	4,386	339	8.4%	295.0	2322	1440
Pelham	1,373	1,403	30	2.2%	56.5	675	625
Petersham	1,131	1,180	49	4.3%	21.7	1101	1038
Phillipston	1,485	1,621	136	9.2%	68.4	824	820
Princeton	3,189	3,353	164	5.1%	94.7	482	352
Rutland	4,936	6,353	1,417	28.7%	179.4	4861	4847
Shutesbury	1,561	1,810	249	16.0%	67.8	820	807
Spencer	11,645	11,691	46	0.4%	352.7	9068	10379
Springfield	156,983	152,082	-4,901	-3.1%	4797.5	30751	19482
Sturbridge	7,775	7,837	62	0.8%	209.6	368	253
Templeton	6,438	6,799	361	5.6%	215.9	1284	876
Wales	1,566	1,737	171	10.9%	107.2	659	552
Ware	9,808	9,707	-101	-1.0%	278.5	9707	9707
Warren	4,437	4,776	339	7.6%	173.7	4143	4455
Wendell	899	986	87	9.7%	31.2	185	183
West Brookfield	3,532	3,804	272	7.7%	184.0	3759	3720
Westminster	6,191	6,907	716	11.6%	193.8	808	812
Wilbraham	12,635	13,473	838	6.6%	606.3	4699	3318
Totals	419,920	429,788	9,868	2.3%	361.5	185,779	173,084

Sources: U.S. Census Bureau, 1990 Census of Population, File STF1 and Census 2000 Redistricting Data Summary File (P.L. 94-171)

Figure 22. Population Density (2000) in Chicopee River Basin Communities.

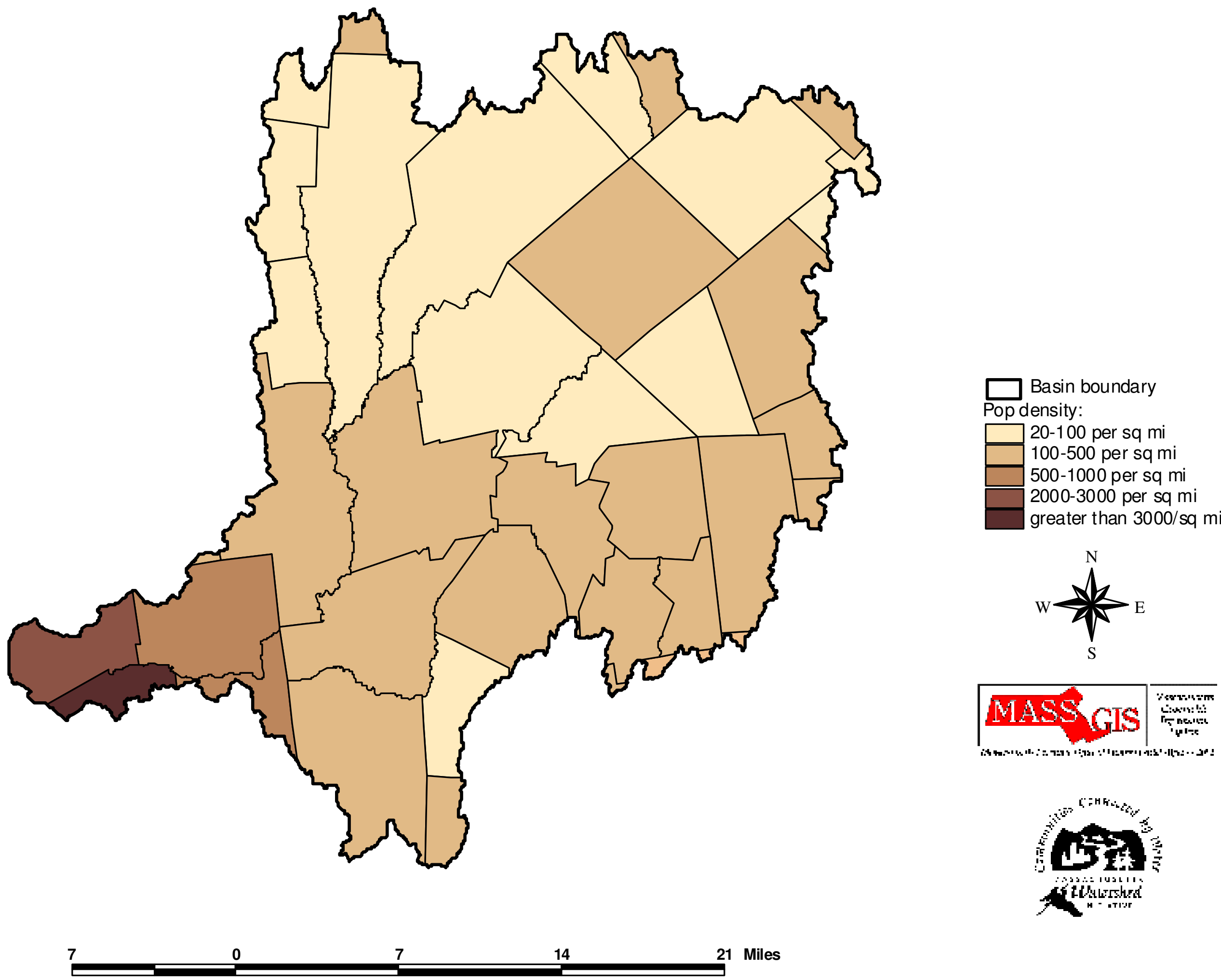


Figure 23. Population Change in Chicopee River Basin Communities (1990-2000).

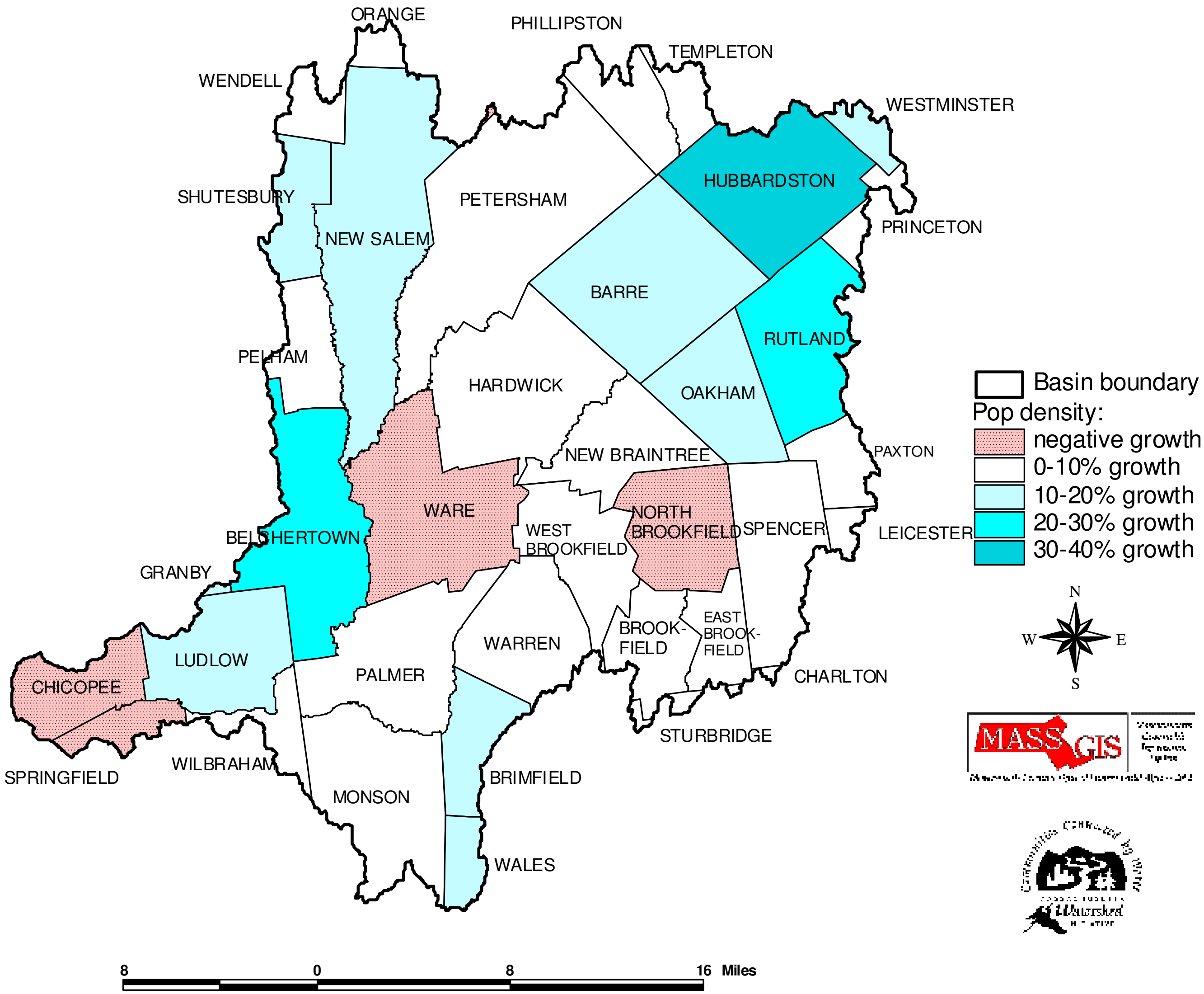


Table 7. Political party affiliation in Chicopee River Basin communities (1996 data from Mass. Sec. of State)

	Registered voters for 1996 state primary election						
Municipality	Total	Democrat	%	Republican	%	Unenrolled	%
ATHOL	5,680	1,460	25.7%	839	14.8%	3,381	59.5%
BARRE	2,723	891	32.7%	330	12.1%	1,502	55.2%
BELCHERTOWN	6,503	1,819	28.0%	904	13.9%	3,780	58.1%
BRIMFIELD	1,862	413	22.2%	295	15.8%	1,154	62.0%
BROOKFIELD	1,692	378	22.3%	201	11.9%	1,113	65.8%
CHARLTON	6,557	1,548	23.6%	1,007	15.4%	4,002	61.0%
CHICOPEE	27,840	15,146	54.4%	2,640	9.5%	10,054	36.1%
EAST BROOKFIELD	1,071	289	27.0%	171	16.0%	611	57.0%
GRANBY	3,312	917	27.7%	538	16.2%	1,857	56.1%
HAMPDEN	2,836	636	22.4%	555	19.6%	1,645	58.0%
HARDWICK	1,495	545	36.5%	148	9.9%	802	53.6%
HUBBARDSTON	1,884	350	18.6%	299	15.9%	1,235	65.6%
LEICESTER	5,545	2,313	41.7%	548	9.9%	2,684	48.4%
LUDLOW	10,208	5,936	58.2%	1,024	10.0%	3,248	31.8%
MONSON	4,206	1,520	36.1%	565	13.4%	2,121	50.4%
NEW BRAINTREE	492	87	17.7%	53	10.8%	352	71.5%
NEW SALEM	547	138	25.2%	89	16.3%	320	58.5%
NORTH BROOKFIELD	2,551	813	31.9%	436	17.1%	1,302	51.0%
OAKHAM	921	166	18.0%	113	12.3%	642	69.7%
ORANGE	3,531	786	22.3%	618	17.5%	2,127	60.2%
PALMER	7,100	2,629	37.0%	700	9.9%	3,771	53.1%
PAXTON	2,399	556	23.2%	452	18.8%	1,391	58.0%
PELHAM	843	328	38.9%	90	10.7%	425	50.4%
PETERSHAM	837	129	15.4%	125	14.9%	583	69.7%
PHILLIPSTON	715	117	16.4%	83	11.6%	515	72.0%
PRINCETON	2,078	385	18.5%	448	21.6%	1,245	59.9%
RUTLAND	3,094	728	23.5%	506	16.4%	1,860	60.1%
SHUTESBURY	1,167	333	28.5%	75	6.4%	759	65.0%
SPENCER	6,047	2,137	35.3%	803	13.3%	3,107	51.4%
SPRINGFIELD	65,506	37,155	56.7%	6,884	10.5%	21,467	32.8%
STURBRIDGE	4,415	1,263	28.6%	702	15.9%	2,450	55.5%
TEMPLETON	3,484	940	27.0%	387	11.1%	2,157	61.9%
WALES	878	162	18.5%	49	5.6%	667	76.0%
WARE	5,199	2,283	43.9%	464	8.9%	2,452	47.2%
WARREN	2,371	897	37.8%	234	9.9%	1,240	52.3%
WENDELL	525	140	26.7%	29	5.5%	356	67.8%
WEST BROOKFIELD	2,122	484	22.8%	341	16.1%	1,297	61.1%
WESTMINSTER	3,728	872	23.4%	595	16.0%	2,261	60.6%
WILBRAHAM	8,195	2,712	33.1%	2,012	24.6%	3,471	42.4%
Mean (Chicopee)			29.4%		13.5%		57.1%
Mean (Statewide)			29.2%		15.0%		55.8%

3. Local Government: 37 of the 39 basin communities (i.e., 95%) have Selectmen and Town Meeting forms of government (compared to 86% statewide). Only 2 (Chicopee and Springfield) have mayors, with either aldermen or city council (Table 8). All but one community with Town Meetings have "Open" Town Meetings; only Ludlow has a "Representative Town Meeting".
Sources of local revenue in basin communities are similar to the state as a whole, although there is substantial variability among individual communities (Table 9). Overall, basin communities derive more than 52% of revenues from the local tax levy (56% statewide), 24% from state aid (vs. 20%), 15% from local receipts (vs. 15%), and 9% from other sources (vs. 8%). Dependence on state aid ranges from a low of about 6% in Wilbraham to almost 62% in Springfield.

4. Regional planning districts: The Chicopee River Basin is split among four Regional Planning Agencies – Pioneer Valley Planning Commission (PVPC), Central Massachusetts Regional Planning Commission (CMRPC), Montachusett Regional Planning Commission (MRPC), and Franklin Regional Council of Governments (FRCOG) (Figure 24). At least two of these have recently developed landuse-based plans or visions for their respective portions of the basin: "Valley Vision", produced by PVPC, and "Development Framework: A Guide for Growth and Change in Central Massachusetts" by CMRPC.

5. Local zoning: Communities use a variety of planning tools to control or otherwise guide growth. Appendix B lists some of the local by-laws and ordinances used in basin communities. That information is also summarized in the table below, which shows the number of basin communities that have enacted various zoning tools. As indicated, many communities in the basin still do not employ many currently-available growth management zoning tools.

	Site Plan Review	Cluster	Phased Growth	Planned Unit Development	Overlay Zoning	Village Center Zoning	Design Review Board	Scenic Roads	Local Historic District
No	25	28	37	33	24	35	38	31	33
Yes	14	11	2	6	15	4	1	7	6

Total communities in basin = 39

6. Legislative districts:
a. Senate: The Chicopee River Basin contains 8 State Senate districts (Figure 25), although the majority of basin is contained in just one (Worcester, Hampden, Hampshire, and Franklin). A list of current senators representing basin communities is included in Table 10.
b. House: There are 18 House districts in the basin (Figure 26); current representatives are listed in Table 11.

7. Conservation organizations: Several regional or statewide conservation organizations have a presence in the basin. These include the Massachusetts Audubon Society (MAS), The Trustees of Reservations (TTOR), Norcross Wildlife Sanctuary, and the Mt. Grace Land Conservation Trust, all of which are holders of protected conservation land in the basin. At least 14 sportsmen's clubs also operate in the basin, and generally hold title to land and/or buildings. Other organizations, such as Trout Unlimited, the Sierra Club, and others, frequently get involved in specific conservation issues that relate to their main areas of interest.

8. Infrastructure
a. Public water supplies: Numerous public water supplies occur throughout the basin (Figure 27). These include 11 surface water reservoirs, 7 of which are currently active (Figure 28 and Table 12). The combined watershed area of these surface supplies is approximately 307 square miles (more than 42% of the basin). Most of this total (276 mi^2) is part of the MDC/MWRA

Table 8. Forms of Government in Chicopee River Basin communities (from Mass. Municipal Association)

MUNICIPALITY	TYPE	# MEMBERS	ADMINISTRATOR	TOWN MEETING
ATHOL	S	5	ES	OTM
BARRE	S	3	TA	OTM
BELCHERTOWN	S	5	TA	OTM
BRIMFIELD	S	3	--	OTM
BROOKFIELD	S	3	AA	OTM
CHARLTON	S	5	TA	OTM
CHICOPEE	M/A	13	--	--
EAST BROOKFIELD	S	3	--	OTM
GRANBY	S	3	AA	OTM
HAMPDEN	S	3	AA	OTM
HARDWICK	S	3	AA	OTM
HUBBARDSTON	S	3	AA	OTM
LEICESTER	S	5	TA	OTM
LUDLOW	S	5	ES	RTM
MONSON	S	3	TA	OTM
NEW BRAINTREE	S	3	AA	OTM
NEW SALEM	S	3	ES	OTM
NORTH BROOKFIELD	S	3	TC	OTM
OAKHAM	S	3	AA	OTM
ORANGE	S	3	TA	OTM
PALMER	S	3	TA	OTM
PAXTON	S	3	--	OTM
PELHAM	S	3	AA	OTM
PETERSHAM	S	3	TS	OTM
PHILLIPSTON	S	3	AA	OTM
PRINCETON	S	3	TA	OTM
RUTLAND	S	3	--	OTM
SHUTESBURY	S	3	TA	OTM
SPENCER	S	5	TA	OTM
SPRINGFIELD	M/C	9	--	(A)
STURBRIDGE	S	5	TA	OTM
TEMPLETON	S	5	TC	OTM
WALES	S	3	--	OTM
WARE	S	3	AA	OTM
WARREN	S	5	AA	OTM
WENDELL	S	3	AA	OTM
WEST BROOKFIELD	S	3	TC	OTM
WESTMINSTER	S	3	TC	OTM
WILBRAHAM	S	3	TA	OTM

TYPE: S=Selectmen; M/A=Mayor and Aldermen; M/C=Mayor and City Council

ADMINISTRATOR: AA=Administrative Assistant; ES=Executive Secretary;
TA=Town Administrator; TC=Town Coordinator; TS=Town Secretary

TOWN MEETING: OTM=Open Town Meeting; RTM=Representative Town Meeting;
(A) = Optional Plan for City Government

Table 9. Sources of local revenues in Chicopee River basin communities (from Mass. Dept. of Revenue, FY-01 data)									
						AS % OF THE TOTAL			
MUNICIPALITY	Tax Levy	State Aid	Local Receipts	All Other	Total Receipts	Tax Levy	State Aid	Local Receipts	All Other
ATHOL	$5,869,269	$2,370,763	$3,063,912	$1,108,671	$12,412,615	47.28%	19.10%	24.68%	8.93%
BARRE	3,272,393	919,167	1,711,758	652,626	6,555,944	49.91%	14.02%	26.11%	9.95%
BELCHERTOWN	12,074,175	10,476,060	3,314,232	1,233,832	27,098,299	44.56%	38.66%	12.23%	4.55%
BRIMFIELD	3,256,234	1,913,004	713,720	713,331	6,596,289	49.36%	29.00%	10.82%	10.81%
BROOKFIELD	2,147,236	2,655,006	504,256	535,464	5,841,962	36.76%	45.45%	8.63%	9.17%
CHARLTON	9,074,287	1,416,714	2,006,064	1,115,188	13,612,253	66.66%	10.41%	14.74%	8.19%
CHICOPEE	42,776,247	48,390,757	17,498,571	1,589,164	110,254,739	38.80%	43.89%	15.87%	1.44%
EAST BROOKFIELD	1,318,088	330,351	471,305	516,952	2,636,697	49.99%	12.53%	17.87%	19.61%
GRANBY	4,953,665	3,882,643	1,190,440	2,022,798	12,049,546	41.11%	32.22%	9.88%	16.79%
HAMPDEN	5,733,512	684,001	695,367	349,925	7,462,805	76.83%	9.17%	9.32%	4.69%
HARDWICK	2,001,178	500,473	569,604	703,299	3,774,554	53.02%	13.26%	15.09%	18.63%
HUBBARDSTON	3,058,888	422,356	661,263	421,462	4,563,969	67.02%	9.25%	14.49%	9.23%
LEICESTER	6,940,348	10,858,623	1,080,000	1,155,086	20,034,057	34.64%	54.20%	5.39%	5.77%
LUDLOW	17,191,150	12,821,324	6,583,950	1,800,357	38,396,781	44.77%	33.39%	17.15%	4.69%
MONSON	7,372,425	7,695,351	2,425,299	1,339,407	18,832,482	39.15%	40.86%	12.88%	7.11%
NEW BRAINTREE	897,873	201,506	86,800	156,461	1,342,640	66.87%	15.01%	6.46%	11.65%
NEW SALEM	768,797	189,335	409,800	218,920	1,586,852	48.45%	11.93%	25.82%	13.80%
NORTH BROOKFIELD	2,643,091	4,662,785	1,749,179	895,925	9,950,981	26.56%	46.86%	17.58%	9.00%
OAKHAM	1,263,790	297,999	219,500	251,586	2,032,875	62.17%	14.66%	10.80%	12.38%
ORANGE	4,859,819	7,558,396	2,398,871	2,028,763	16,845,849	28.85%	44.87%	14.24%	12.04%
PALMER	10,133,527	13,741,013	2,884,369	2,838,526	29,597,435	34.24%	46.43%	9.75%	9.59%
PAXTON	4,455,406	598,856	1,176,597	786,403	7,017,262	63.49%	8.53%	16.77%	11.21%
PELHAM	1,822,755	318,139	333,300	162,494	2,636,688	69.13%	12.07%	12.64%	6.16%
PETERSHAM	1,137,515	360,413	381,900	137,681	2,017,509	56.38%	17.86%	18.93%	6.82%
PHILLIPSTON	1,335,354	232,585	224,300	236,482	2,028,721	65.82%	11.46%	11.06%	11.66%
PRINCETON	4,606,374	860,763	823,299	176,388	6,466,824	71.23%	13.31%	12.73%	2.73%
RUTLAND	4,436,949	901,075	1,871,151	1,945,739	9,154,914	48.47%	9.84%	20.44%	21.25%
SHUTESBURY	2,605,201	931,531	357,717	331,986	4,226,435	61.64%	22.04%	8.46%	7.85%
SPENCER	6,382,026	2,480,846	2,783,334	420,778	12,066,984	52.89%	20.56%	23.07%	3.49%

SPRINGFIELD	106,688,830	245,974,458	42,498,239	2,500,000	397,661,527	26.83%	61.86%	10.69%	0.63%
Table 9 (Cont.) STURBRIDGE	9,914,311	2,136,573	3,436,456	1,289,445	16,776,785	59.10%	12.74%	20.48%	7.69%
TEMPLETON	3,773,726	1,395,417	2,502,357	550,787	8,222,287	45.90%	16.97%	30.43%	6.70%
WALES	1,587,645	968,951	284,065	98,240	2,938,901	54.02%	32.97%	9.67%	3.34%
WARE	7,524,985	10,136,264	1,788,000	1,741,100	21,190,349	35.51%	47.83%	8.44%	8.22%
WARREN	3,457,506	785,557	1,188,612	292,887	5,724,562	60.40%	13.72%	20.76%	5.12%
WENDELL	940,197	353,946	271,177	68,222	1,633,542	57.56%	21.67%	16.60%	4.18%
WEST BROOKFIELD	2,726,620	515,046	700,000	958,921	4,900,587	55.64%	10.51%	14.28%	19.57%
WESTMINSTER	7,715,711	831,793	1,453,000	1,867,852	11,868,356	65.01%	7.01%	12.24%	15.74%
WILBRAHAM	17,394,092	1,459,521	4,595,744	1,274,831	24,724,188	70.35%	5.90%	18.59%	5.16%
Statewide means:						56.37%	20.32%	15.30%	7.84%
Chicopee means:						51.96%	23.90%	15.03%	9.12%

Table 10. Senate districts and current senators in Chicopee River Basin, January, 2002

SENATE DISTRICT	SENATOR
1st Hampden and Hampshire	Brian P. Lees (R)
Second Worcester	Guy William Glodis (D)
Hampden	Linda J. Melconian (D)
Second Hampden and Hampshire	Michael R. Knapik (R)
Worcester and Norfolk	Richard T. Moore (D)
Worcester and Middlesex	Robert A. Antonioni (D)
Franklin and Hampshire	Stanley C. Rosenberg (D)
Worcester Hampden Hampshire Franklin	Stephen M. Brewer (D)

Figure 24. Regional Planning Agencies in the Chicopee River Basin.

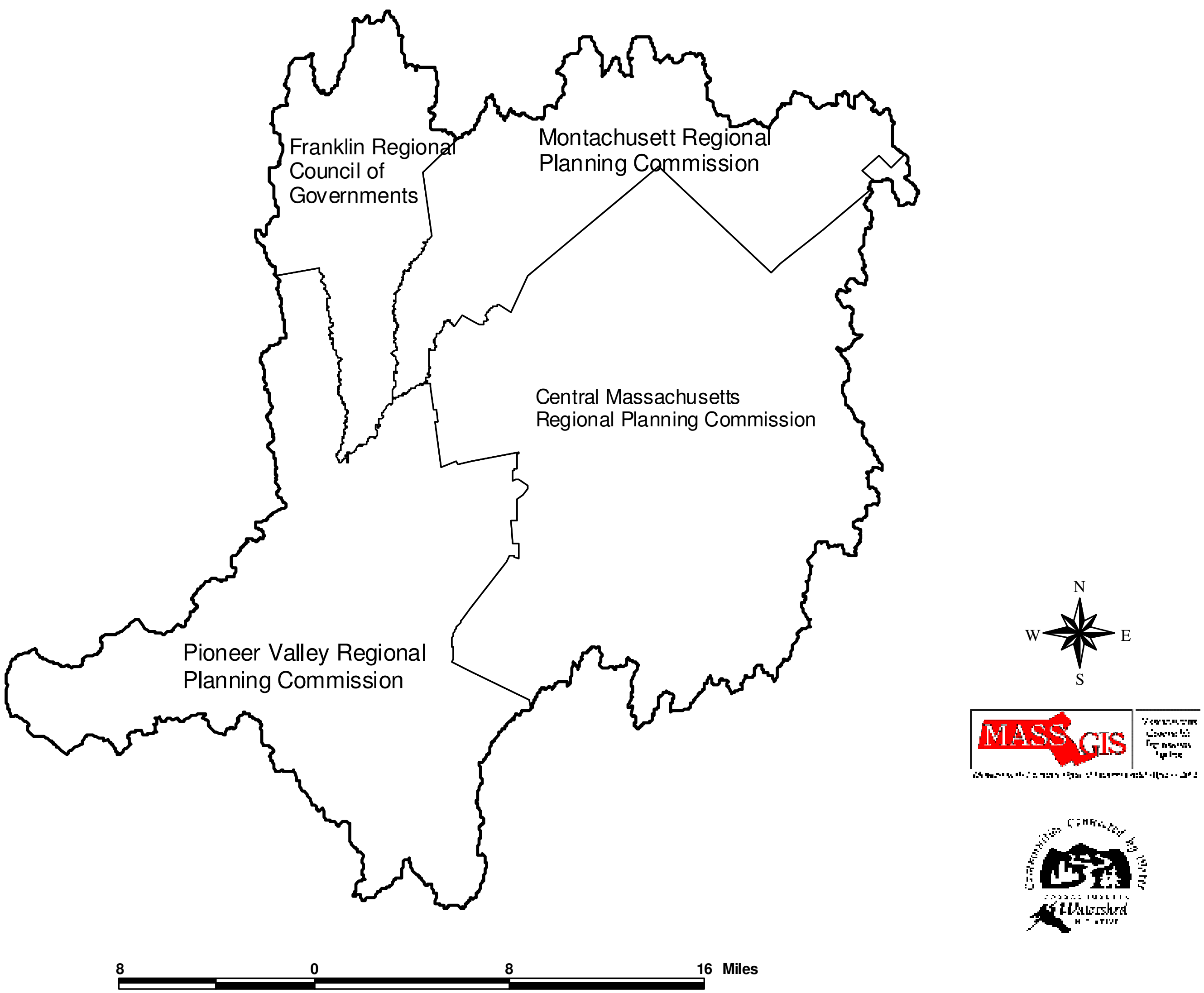


Figure 25. State Senate Districts in the Chicopee River Basin.

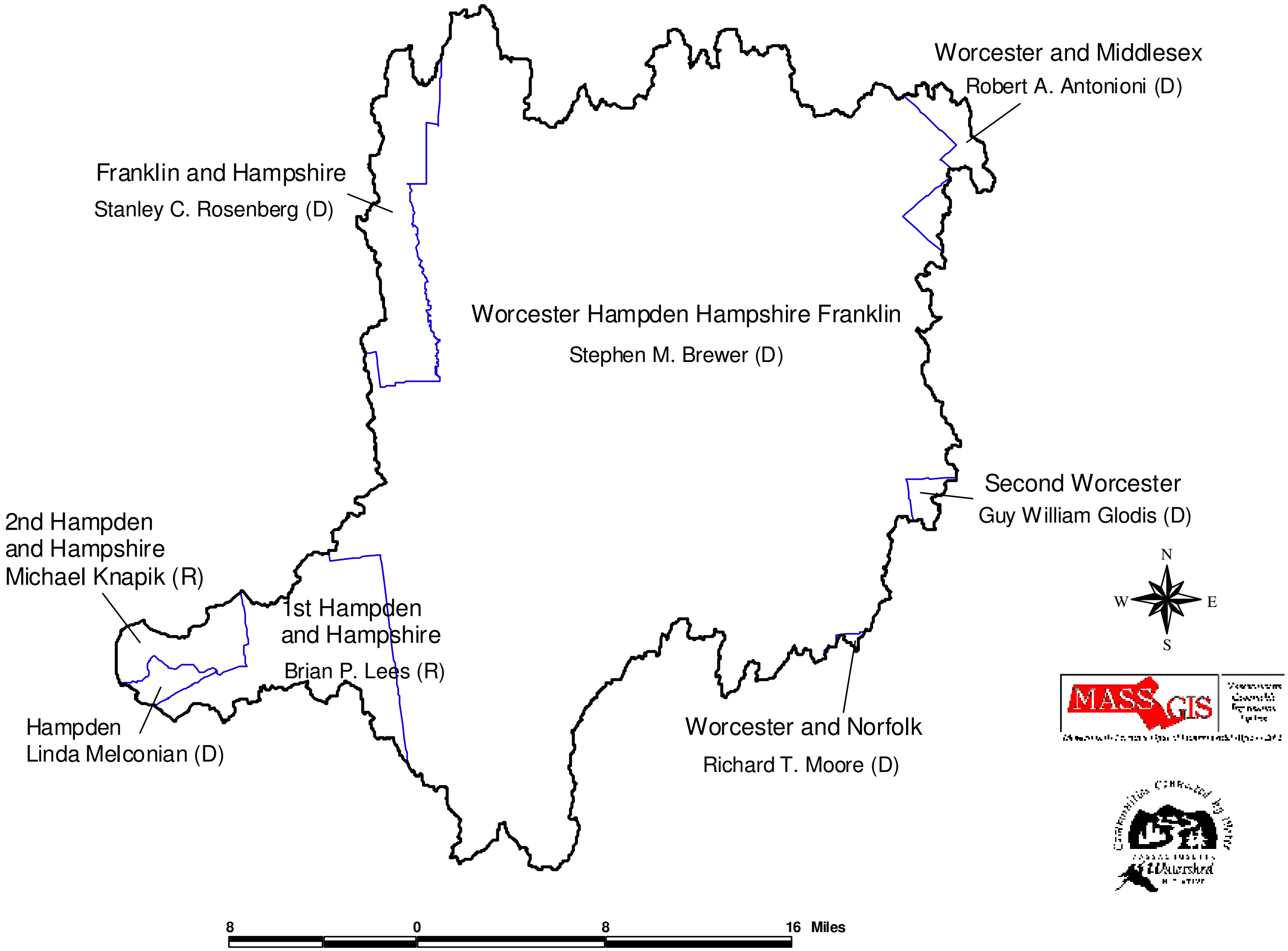


Figure 26. State House Districts in the Chicopee River Basin.

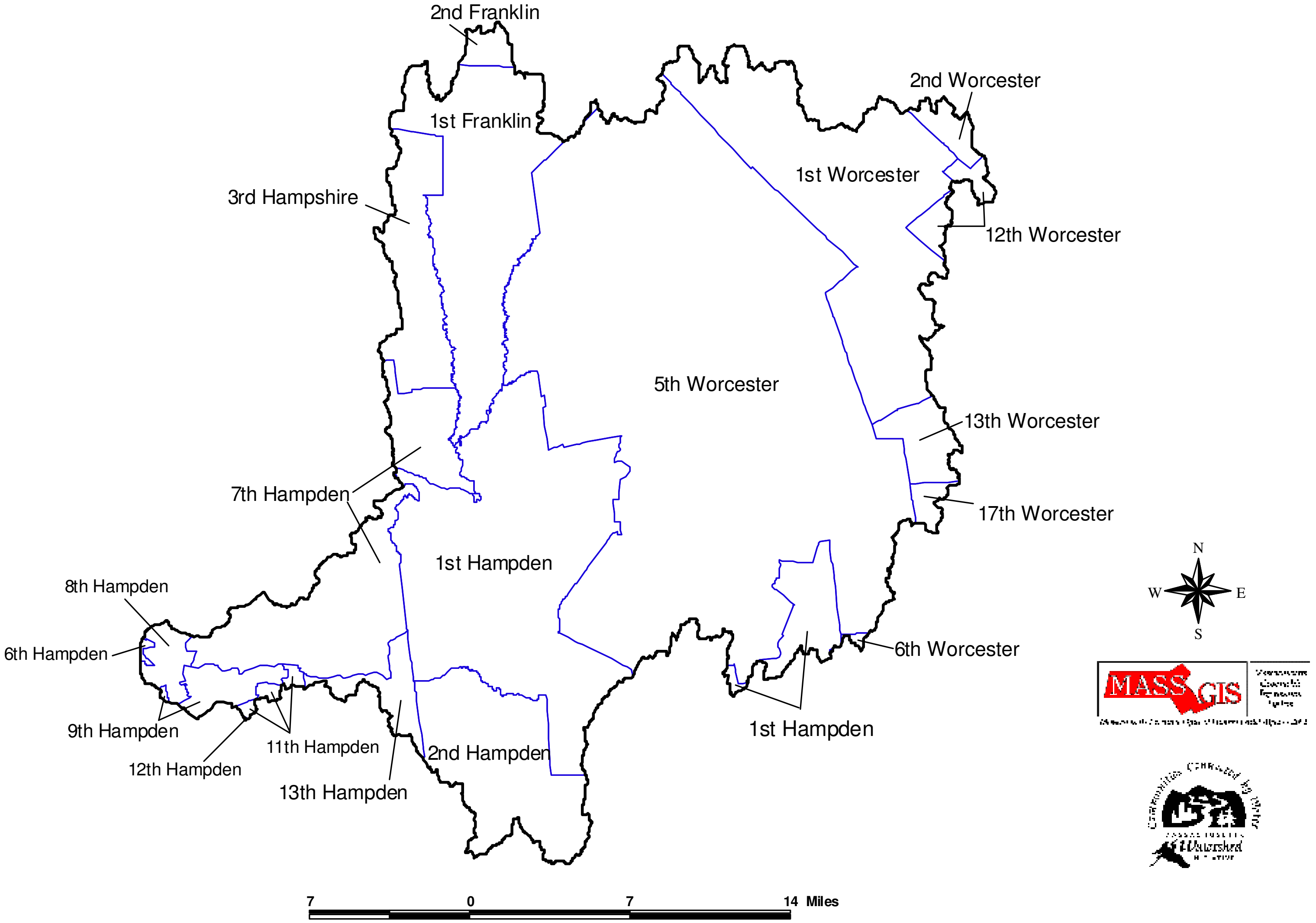


Table 11. House districts and current representatives in Chicopee River Basin, January, 2002

HOUSE DISTRICT	REPRESENTATIVE
1st Franklin	Stephen Kulik (D)
2nd Franklin	John F. Merrigan (D)
1st Hampden	Hillman V. Reed (R)
2nd Hampden	Mary S. Rogeness (R)
6th Hampden	Stephen J. Buoniconti (D)
7th Hampden	Thomas M. Petrolati (D)
8th Hampden	Joseph F. Wagner (D)
9th Hampden	Christopher P. Asselin (D)
11th Hampden	Paul E. Caron (D)
12th Hampden	Benjamin Swan (D)
13th Hampden	Gale D. Candaras (D)
3rd Hampshire	Ellen Story (D)
1st Worcester	David C. Bunker (D)
2nd Worcester	Brian R. Knuuttila (D)
5th Worcester	Anne Gobi (D)
6th Worcester	Mark J. Carron (D)
13th Worcester	Robert Spellane (D)
17th Worcester	John J. Binienda (D)

Figure 27. Public Water Supplies in the Chicopee River Basin.

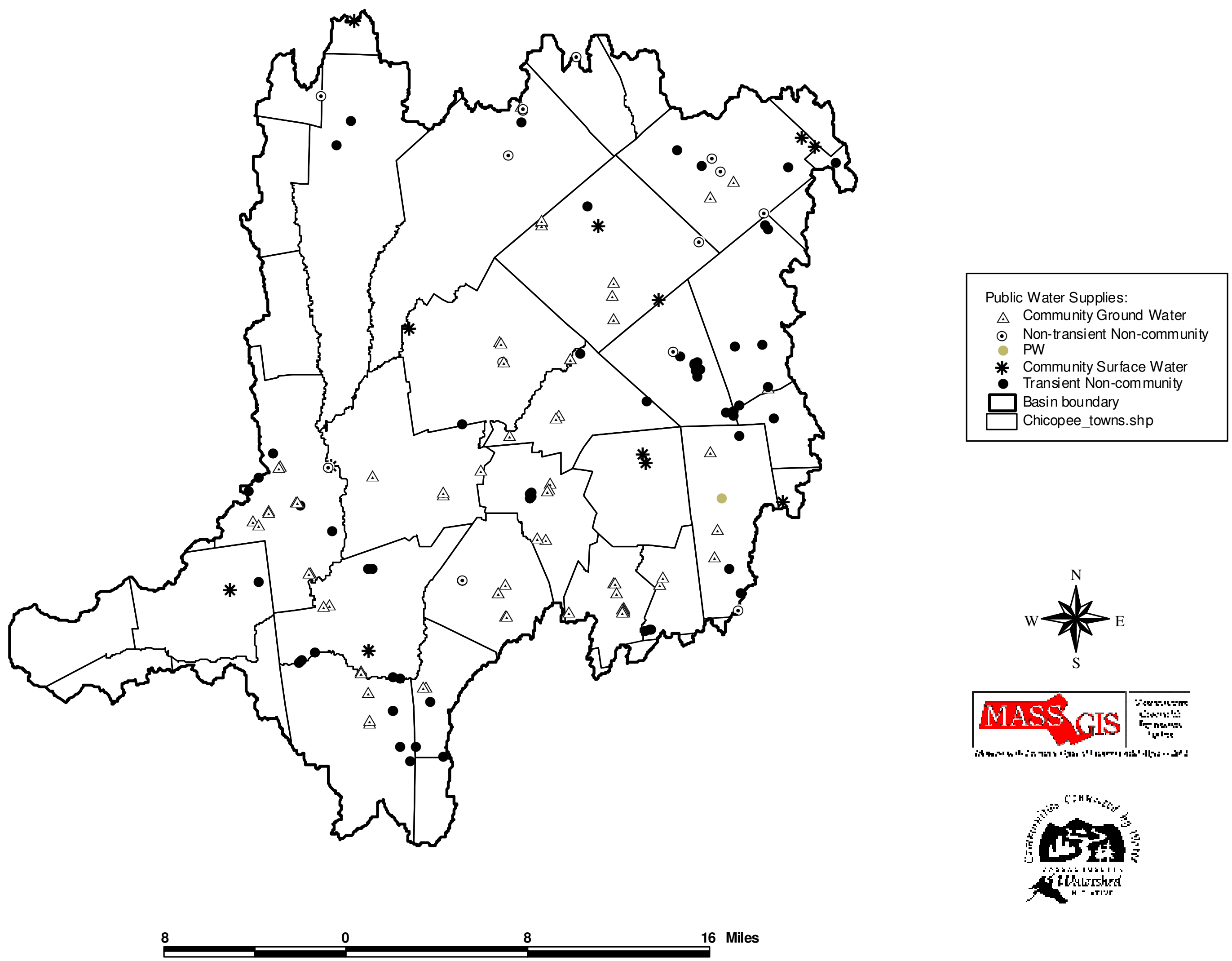


Figure 28. Surface Water Sub-basins in the Chicopee River Basin.

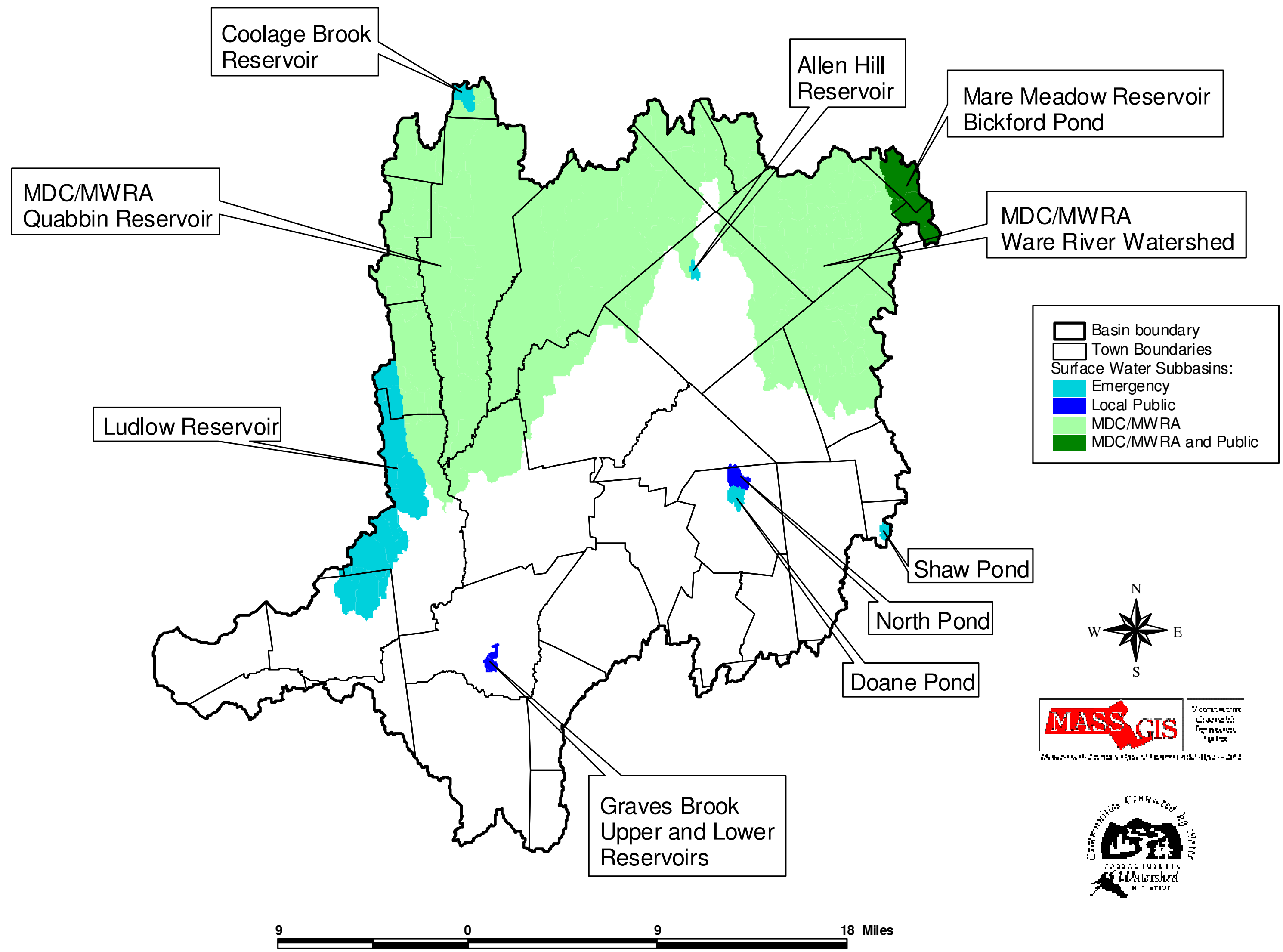


Table 12. Surface water reservoirs in the Chicopee River Basin.

SITE NAME	TOWN	TOWN SERVED	PWSID	STATUS
ALLEN HILL RESERVOIR	BARRE	BARRE	2021000	Emergency
BICKFORD POND	HUBBARDSTON	FITCHBURG	2097000	Active
COOLAGE BROOK RESERVOIR	ORANGE	ORANGE	1223000	Emergency
DOANE POND	NORTH BROOKFIELD	NORTH BROOKFIELD	2212000	Emergency
GRAVES BROOK LOWER RES.	PALMER	PALMER	1227000	Active
GRAVES BROOK UPPER RES.	PALMER	PALMER	1227000	Active
LUDLOW RESERVOIR	LUDLOW	SPRINGFIELD	1161000	Emergency
MARE MEADOW RESERVOIR	HUBBARDSTON	FITCHBURG	2097000	Active
NORTH POND	NORTH BROOKFIELD	NORTH BROOKFIELD	2212000	Active
QUABBIN RESERVOIR	HARDWICK	MWRA COMMUNITIES	6000000	Active
MWRA (Shaft 8)	BARRE	MWRA COMMUNITIES	6000000	Active
SHAW POND	LEICESTER	SPENCER	2280000	Emergency

Quabbin/Ware River system, which provides drinking water to almost half the population of the state. Of the others, approximately 8 mi^2 represent active local supplies; the remaining 23 mi^2 are emergency or backup supplies.
Numerous groundwater supplies also occur in the basin, including many community (Table 13), non-transient non-community (Table 14) and transient non-community supplies (Table 15).

b. Waste Water Treatment Plants (WWTP): Nine WWTP's are currently permitted to discharge treated wastewater into the basin (Figure 29 and Table 16). Four of these (Barre, Gilbertville, Wheelwright, and Ware) discharge to the Ware River; three (Spencer, N. Brookfield and Warren) discharge to the Quaboag River or a tributary; the Palmer WWTP discharges to the Chicopee River, close to the confluence of the Ware and Quaboag Rivers; the Chicopee WWTP discharges to a point at the confluence of the Chicopee and Connecticut Rivers. Together, their permit limits amount to just over 26 MGD. Springfield, Chicopee, and Palmer are also permitted to discharge into the Chicopee River through a number of combined sewer overflows (CSOs).
In addition, wastewater from several additional communities is collected and transferred out of the basin. This occurs in all or parts of Belchertown, Templeton, Rutland, Ludlow, Wilbraham, and Springfield.

c. Roads: Roads of various types cover the Chicopee River basin (Figure 30), including Interstate Highways (I-90, I-291 and I-391), numerous state highways (e.g., Routes 2, 202, 122, 32, 9, 62, 68, 56, 67, 21, 141, 20, 19, 148, 101, 49), and even more local roads. Road density in basin communities is variable (Table 17) ranging from 0.84 mi/mi^2 in New Salem to 12.45 in Springfield. The highest road density in the basin corresponds with the highest population densities in the southwest portion of the basin (Figure 30). Compared to statewide averages, Chicopee River basin communities have lower road density, again reflecting the more rural nature of many of these towns.

d. Landfills: Massachusetts DEP data lists 6 active landfills in the Chicopee River basin (Figure 31). These include several fairly large landfills that deal with municipal solid waste (e.g. ,Chicopee, Martone (Barre), Hardwick), and several smaller local landfills.

e. Railroads: MassGIS data indicates that there are 72 railway segments in the basin, including 50 active segments, 18 that are abandoned, and 4 for which current status is unknown (Figure 32).

f. Dams: In December of 1996, the Connecticut River Coordinators Office of the USFWS published a report on the status of migratory fish passage in the Connecticut River Watershed (USFWS 1996). That report included a listing of known barriers to fish passage along the river, and its tributaries. For the Chicopee River basin, 111 dams were listed. These are located throughout the basin (Figure 33). Eleven of these dams are Federal Energy Regulatory Commission (FERC) regulated hydroelectric generating dams (Table 18). The EPA Index of Watershed Indicators (through their Surf Your Watershed web site) lists 88 dams in the basin, ranging from small dams with just only a couple acre feet of normal storage, to the Winsor Dam at Quabbin Reservoir, with almost 1.3 million acre-feet of storage (Table 19). The combined storage of all 88 listed dams is 1,306,587 acre-feet (about 426 billion gallons, or 57 billion cubic feet). Additional information on dams in the basin is included in Appendix C.

Table 13. Community Ground Water Supplies in the Chicopee River Basin.

TOWN	POPULATION SERVED	SOURCE_ID	SITE_NAME	STATUS
BELCHERTOWN	Belchertown	1024000-01G	WELL #1	Active
BELCHERTOWN	Belchertown	1024000-02G	WELL #2	Active
BELCHERTOWN	Belchertown	1024000-03G	WELL #3	Active
BELCHERTOWN	Belchertown	1024000-04G	WELL #4	Active
BELCHERTOWN	Belchertown	1024000-06G	JABISH BROOK WELLFIELD	Emergency
BELCHERTOWN	Sports Haven Mobile Home Park	1024001-01G	OLD DUG WELL	
BELCHERTOWN	Sports Haven Mobile Home Park	1024001-02G	NEW DUG WELL	Active
BELCHERTOWN	Pine Valley Plantation	1024002-01G	WELL # 1	Active
BELCHERTOWN	Pine Valley Plantation	1024002-02G	WELL # 2	Active
BELCHERTOWN	Pine Valley Plantation	1024002-03G	WELL # 3	Active
BELCHERTOWN	Pine Valley Plantation	1024002-04G	WELL # 4	Active
BRIMFIELD	Meadowbrook Acres	1043001-01G	UPPER WELL	Active
BRIMFIELD	Meadowbrook Acres	1043001-02G	LOWER WELL	Active
MONSON	Monson	1191000-03G	GP WELL # 1 (BETHANY RD WELL)	Active
MONSON	Monson	1191000-04G	GP WELL # 2 (PALMER RD. WELL)	Active
MONSON	Monson	1191000-05G	GP WELL # 3 (BUNYAN RD. WELL)	Active
PALMER	Palmer	1227000-01G	GALAXY WELLFIELD	Active
PALMER	Palmer	1227000-02G	GP WELL # 2	Active
BELCHERTOWN	Bondsville (Palmer)	1227002-01G	WELL # 1	Active
BELCHERTOWN	Bondsville (Palmer)	1227002-02G	WELL # 2	Active
BELCHERTOWN	Bondsville (Palmer)	1227002-03G	WELL # 3	Inactive
BELCHERTOWN	Bondsville (Palmer)	1227002-04G	WELL # 4	Active
PALMER	Three Rivers (Palmer)	1227003-01G	WELL # 1	Active
PALMER	Three Rivers (Palmer)	1227003-03G	WELL # 3	Active
WARE	Ware	1309000-01G	DRIVEN WELLS 1/2/3	Active
WARE	Ware	1309000-02G	GP WELL # 4 SNOW POND	Active
WARE	Ware	1309000-03G	DISMAL SWAMP WELL	Inactive
WARE	Oakwood Park	1309001-01G	WELL # 1	Active
BARRE	Barre	2021000-01G	GP WELL #1	Active

Table 13 (Cont.)

BARRE	Barre	2021000-02G	GP WELL # 2	Active
BARRE	Barre	2021000-03G	SOUTH BARRE GRAVEL PACKED WELL # 3	Active
BARRE	Barre Mobile Home Park	2021001-01G	WELL # 1	Active
BARRE	Barre Mobile Home Park	2021001-02G	WELL # 2	Active
BARRE	Barre Mobile Home Park	2021001-03G	WELL # 3	Active
EAST BROOKFIELD	Brookfield	2045000-02G	QUABOAG ST. 02G GRAVEL DEVELOPED WELL	Active
EAST BROOKFIELD	Brookfield	2045000-03G	QUABOAG ST. 03G GRAVEL DEVELOPED WELL	Active
EAST BROOKFIELD	Brookfield	2045000-04G	QUABOAG ST. 04G GRAVEL DEVELOPED WELL	Active
EAST BROOKFIELD	Brookfield	2045000-05G	QUABOAG ST. 05G GRAVEL DEVELOPED WELL	Active
BROOKFIELD	Nanatomqua Mobile Home Park	2045001-01G	ROCK WELL # 1	Active
BROOKFIELD	Nanatomqua Mobile Home Park	2045001-02G	ROCK WELL # 2	Active
BROOKFIELD	Nanatomqua Mobile Home Park	2045001-03G	ROCK WELL # 3	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-01G	ROCK WELL # 1	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-02G	ROCK WELL # 2	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-03G	ROCK WELL # 3	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-04G	ROCK WELL # 4	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-05G	ROCK WELL # 5	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-06G	ROCK WELL # 6	Active
BROOKFIELD	Brookfield Meadows	2045005-01G	ROCK WELL # 1	Active
EAST BROOKFIELD	East Brookfield	2084000-01G	WEST ST. GP WELL	Active
HARDWICK	Hardwick Center	2124000-01G	RUGGLES HILL WELL	Active
NEW BRAINTREE	Gilbertville (Hardwick)	2124001-01G	GP WELL # 1	Active
HARDWICK	Wheelwright (Hardwick)	2124002-01G	GP WELL # 1	Active
HARDWICK	Wheelwright (Hardwick)	2124002-02G	GP WELL # 2	Emergency
HARDWICK	Eagle Hill School	2124003-01G	WELL # 1	Active
HARDWICK	Eagle Hill School	2124003-02G	WELL # 2	Active
HUBBARDSTON	Hubbardston Housing Apartments	2140010-01G	ROCK WELL # 1	Active
HUBBARDSTON	Briarwood Townhouses	2140013-01G	WELL # 1	Active
HUBBARDSTON	Briarwood Townhouses	2140013-02G	WELL # 2	Active
NEW BRAINTREE	Mass.State Police Training Acad.	2202001-01G	ROCK WELL #1	Active
NEW BRAINTREE	Mass.State Police Training Acad.	2202001-02G	ROCK WELL #2	Active

Table 13 (Cont.)

PETERSHAM	Sisters of the Assumption Retreat	2234003-01G	ARTESIAN WELL # 1	Active
RUTLAND	Cool Sandy Beach	2257003-01G	DRILLED WELL TAP	Inactive
SPENCER	Spencer	2280000-01G	CRANBERRY BROOK GRAVEL PACKED WELL	Active
SPENCER	Spencer	2280000-02G	MEADOW ROAD GRAVEL PACKED WELL	Active
SPENCER	St. Joseph's Abbey	2280002-01G	SJA MAIN WELL # 1	Active
WARREN	Warren	2311000-01G	COMINS POND TUBULAR WELL FIELD	Active
WARREN	West Warren	2311001-01G	GP WELL # 1	Active
WARREN	West Warren	2311001-02G	GP WELL # 2	Active
WARREN	Heritage Village Mobile Park	2311002-01G	ROCK WELL # 1	Inactive
WARREN	Heritage Village Mobile Park	2311002-02G	ROCK WELL # 2	Active
WARREN	Heritage Village Mobile Park	2311002-03G	ROCK WELL # 3	Active
WARREN	Heritage Village Mobile Park	2311002-04G	ROCK WELL # 4	Active
WEST BROOKFIELD	West Brookfield	2323000-01G	GPW WELL # 1	Active
WEST BROOKFIELD	West Brookfield	2323000-02G	WELL # 2 (DRIVEN)	Active
WEST BROOKFIELD	Woodland Estates	2323002-01G	WELL # 1, ROCK WELL	Active
WEST BROOKFIELD	Woodland Estates	2323002-02G	WELL # 2, DUG WELL	Active
WEST BROOKFIELD	Woodland Estates	2323002-03G	WELL # 3, DUG WELL	Active

Table 14. Non-Transient Non-Community Water Supplies in the Chicopee River Basin.

SITE NAME	TOWN	SOURCE_ID	STATUS
MDC QUABBIN ADMINISTRATION BUILDING	BELCHERTOWN	1024011-01G	Active
SWIFT RIVER ELEMENTARY SCHOOL	WENDELL	1204001-01G	Active
BARRE FALLS DAM / US ARMY ENV. LAB	BARRE	2021005-01G	Active
HARDWICK ELEMENTARY SCHOOL	HARDWICK	2124008-01G	Active
WOODS EQUIPMENT COMPANY [WAIN ROY]	HUBBARDSTON	2140003-01G	Active
HUBBARDSTON CENTER SCHOOL	HUBBARDSTON	2140004-01G	Active
GREAT NORTHERN RECYCLERS	HUBBARDSTON	2140007-01G	?
OAKHAM ELEMENTARY SCHOOL	OAKHAM	2222001-01G	Active
HARVARD SCHOOL OF FORESTRY	PETERSHAM	2234001-01G	Active
HARVARD SCHOOL OF FORESTRY	PETERSHAM	2234001-02G	Emergency
PETERSHAM CENTER SCHOOL	PETERSHAM	2234006-01G	Active
PETERSHAM MONTESSORI SCHOOL	PETERSHAM	2234011-01G	Active
PHILLIPSTON MEMORIAL SCHOOL	PHILLIPSTON	2235002-01G	Active
WILLIAM E. WRIGHT CO. - INACT.	WARREN	2311006-01G	?
WILLIAM E. WRIGHT CO. - INACT.	WARREN	2311006-02G	?
WILLIAM E. WRIGHT CO. - INACT.	WARREN	2311006-03G	?

Table 15. Transient Non-Community Water Supplies in the Chicopee River Basin

TOWN	SOURCE_ID	STATUS	SITE_NAME
BELCHERTOWN	1024004-01G	Active	SWIFT RIVER SPORTSMAN CLUB
BELCHERTOWN	1024006-01G	Active	MILL VALLEY GOLF LINKS, INC.
BELCHERTOWN	1024007-01G	?	C & C FITNESS & BACKROOM LOUNGE
BELCHERTOWN	1024010-01G	Active	TAVERN 21
BELCHERTOWN	1024012-01G	Active	BELCHERTOWN WELLNESS CENTER
BRIMFIELD	1043004-01G	Active	DEM BRIMFIELD STATE FOREST
MONSON	1043004-02G	Active	DEM BRIMFIELD STATE FOREST
LUDLOW	1161002-01G	Inactive	VILLA ROSE RESTAURANT
MONSON	1191001-01G	Active	PARTRIDGE HOLLOW
MONSON	1191004-01G	Active	SUNSET VIEW FARM
MONSON	1191004-02G	?	SUNSET VIEW FARM
MONSON	1191005-01G	?	QUEST ENTERPRISES
MONSON	1191007-01G	Active	WESTVIEW FARM INC
PALMER	1191008-01G	Active	MAGIC LANTERN
NEW SALEM	1204002-01G	?	HAMILTON ORCHARDS
NEW SALEM	1204002-02G	?	HAMILTON ORCHARDS
NEW SALEM	1204003-01G	?	NEW SALEM GENERAL STORE
PALMER	1227005-01G	Active	THE WOODEN SHOE
PALMER	1227006-01G	?	HAPPY VALLEY
PALMER	1227007-01G	Active	CJ'S RESTAURANT
BRIMFIELD	1227008-01G	?	MAPLE LAKE ARMS
PALMER	1227010-01G	Active	CAMP RAMAH
PALMER	1227010-02G	Active	CAMP RAMAH
PALMER	1227010-03G	Active	CAMP RAMAH
PALMER	1227012-01G	Active	ROUTE 20 SPORTS BAR
BARRE	2021006-01G	Active	INSIGHT MEDITATION SOCIETY
EAST BROOKFIELD	2084001-01G	Active	YMCA CAMP FRANK A. DAY
EAST BROOKFIELD	2084001-02G	Active	YMCA CAMP FRANK A. DAY
EAST BROOKFIELD	2084001-03G	Active	YMCA CAMP FRANK A. DAY
HARDWICK	2124007-01G	Active	JUBILEE CONFERENCE & RETREAT CENTER
HUBBARDSTON	2140005-01G	Active	PEACEFUL ACRES CAMPGROUND
HUBBARDSTON	2140006-01G	?	HUBBARSTON ROD & GUN CLUB
HUBBARDSTON	2140008-01G	?	PINECREST - INACT.
NEW BRAINTREE	2202003-01G	Active	CAMP PUTNAM
OAKHAM	2222002-01G	Active	PINE ACRES CAMPGROUNDS
OAKHAM	2222002-02G	Active	PINE ACRES CAMPGROUNDS
OAKHAM	2222002-03G	Active	PINE ACRES CAMPGROUNDS
OAKHAM	2222003-01G	Active	LAKE DEAN CAMPGROUND
OAKHAM	2222003-02G	Active	LAKE DEAN CAMPGROUND
OAKHAM	2222003-03G	Active	LAKE DEAN CAMPGROUND
PAXTON	2228005-01G	Active	DEM MOORE STATE PARK
PETERSHAM	2234009-01G	?	MARIA ASSUMPTION ACADEMY
PRINCETON	2241011-01G	Active	HARRINGTON FARMS RESTAURANT
RUTLAND	2257001-01G	Active	TREASURE VALLEY SCOUT RESERVATION
OAKHAM	2257001-02G	Active	TREASURE VALLEY SCOUT RESERVATION
OAKHAM	2257001-03G	Active	TREASURE VALLEY SCOUT RESERVATION

Table 15 (cont.)

OAKHAM	2257001-04G	Active	TREASURE VALLEY SCOUT RESERVATION
RUTLAND	2257002-01G	Active	POUT & TROUT CAMPRGOUND
RUTLAND	2257004-01G	Active	DEM RUTLAND STATE PARK
RUTLAND	2257005-01G	Active	RUTLAND SPORTSMANS CLUB
SPENCER	2280004-01G	?	PINE TREE DRIVE IN
SPENCER	2280006-01G	Active	POMEROYS BLACK WHITE REST
SPENCER	2280008-01G	Active	DEM SPENCER ST.PARK HOWE POND
WEST BROOKFIELD	2323001-01G	Active	HIGH VIEW VACATION CAMPGROUND
WEST BROOKFIELD	2323001-02G	Active	HIGH VIEW VACATION CAMPGROUND
WEST BROOKFIELD	2323001-03G	Active	HIGH VIEW VACATION CAMPGROUND
WEST BROOKFIELD	2323001-04G	Active	HIGH VIEW VACATION CAMPGROUND

Table 16. Information on Wastewater Treatment Plants in Chicopee River Basin

Facility Name	NPDES No.	Receiving water body	Mean Monthly Flow (MGD)	Design Flow (MGD)	Town(s) served	Population Served
Barre WWTP	MA0103152	Ware River	.21	.3	Barre	(1670)
Chicopee WWTP	MA0101508	Chicopee and Connecticut Rivers	9.8	15.5	Chicopee	(54590)
Gilbertville WWTP	MA0100102	Ware River	.14	.23	Hardwick	1270
North Brookfield WWTP	MA0101061	Dunn Brook	.47	.76	N. Brookfield	2800
Palmer WWTP	MA0101168	Chicopee River	2.26	5.6	Palmer, Monson	(13,200)
Spencer	MA0100919	Cranberry Brook	.67	1.08	Spencer	(6500)
Ware WWTP	MA0100889	Ware River	.72	1.0	Ware	(6030)
Warren WWTP	MA0101567	Quaboag River	.67	1.5	Warren	(2830)
Wheelwright WWTP	MA0102431	Ware River	.027	.043	Hardwick	160
Totals:			*14.97*	*26.01*		*(89050)*

NOTE: Information is from Medalie (1996) and the individual NPDES permits for the facilities. Numbers in parentheses are from 1990, and therefore are likely to be underestimates.

Table 17. Road data for Chicopee River Basin communities (from MassDOR)					
MUNICIPALITY	**2000 Population**	**Area (mi^2)**	**Road Mileage**	**Roads/mi^2**	**Road miles/capita**
ATHOL	11299	32.34	96.45	2.98	0.009
BARRE	5113	44.3	99.59	2.25	0.019
BELCHERTOWN	12968	52.52	118.85	2.26	0.009
BRIMFIELD	3339	35.37	64.27	1.82	0.019
BROOKFIELD	3051	15.68	35.69	2.28	0.012
CHARLTON	11263	42.86	119.3	2.78	0.011
CHICOPEE	54653	22.91	153.37	6.69	0.003
EAST BROOKFIELD	2097	9.89	19.24	1.95	0.009
GRANBY	6132	28.01	56.71	2.02	0.009
HAMPDEN	5171	19.66	53.09	2.70	0.010
HARDWICK	2622	38.4	86.79	2.26	0.033
HUBBARDSTON	3909	40.34	81.29	2.02	0.021
LEICESTER	10471	22.7	80.62	3.55	0.008
LUDLOW	21209	27.14	100.71	3.71	0.005
MONSON	8359	44.84	101.07	2.25	0.012
NEW BRAINTREE	927	20.76	49.44	2.38	0.053
NEW SALEM	929	45.04	38.03	0.84	0.041
NORTH BROOKFIELD	4683	21.11	68.62	3.25	0.015
OAKHAM	1673	20.99	43.48	2.07	0.026
ORANGE	7518	35.03	84.06	2.40	0.011
PALMER	12497	31.43	86.69	2.76	0.007
PAXTON	4386	14.87	37.03	2.49	0.008
PELHAM	1403	24.82	22.68	0.91	0.016
PETERSHAM	1180	54.27	62.68	1.15	0.053
PHILLIPSTON	1621	23.7	44.41	1.87	0.027
PRINCETON	3353	35.39	79.68	2.25	0.024
RUTLAND	6353	35.42	66.77	1.89	0.011
SHUTESBURY	1810	26.68	31.15	1.17	0.017
SPENCER	11691	33.15	94.33	2.85	0.008
SPRINGFIELD	152082	31.7	394.64	12.45	0.003
STURBRIDGE	7837	37.39	78.18	2.09	0.010
TEMPLETON	6799	31.49	68.31	2.17	0.010
WALES	1737	16.21	23.67	1.46	0.014
WARE	9707	34.85	84.42	2.42	0.009
WARREN	4776	27.5	62.83	2.28	0.013
WENDELL	986	31.65	48.33	1.53	0.049
WEST BROOKFIELD	3804	20.67	50.28	2.43	0.013
WESTMINSTER	6907	35.64	84.83	2.38	0.012
WILBRAHAM	13473	22.22	91.96	4.14	0.007
Statewide Means:				4.61	0.014
Chicopee Means:				2.65	0.017

Table 18. Hydroelectric projects exempted from FERC licensing requirements in the Chicopee River Basin

PROJECT #	STATE	COUNTY	ISSUED	RIVER	PROJECT NAME	KW	OWNER NAME
6522	MA	HAMPDEN	821208	CHICOPEE R	CHICOPEE	2500	CHICOPEE MUNICIPAL LIGHTING PLANT
6544	MA	HAMPDEN	840209	CHICOPEE R	COLLINS	1500	I MAXMAT CORP
10675	MA	HAMPDEN	920911	CHICOPEE R	DWIGHT	1440	WESTERN MASS ELECTRIC CO
10676	MA	HAMPSHIRE	920911	CHICOPEE R	RED BRIDGE	3600	WESTERN MASS ELECTRIC CO
10677	MA	HAMPDEN	920911	CHICOPEE R	PUTTS BRIDGE	3200	WESTERN MASS ELECTRIC CO
10678	MA	HAMPDEN	920911	CHICOPEE R	INDIAN ORCHARD	3700	WESTERN MASS ELECTRIC CO
11523	MA	HAMPSHIRE	870127	SWIFT R	QUABBIN-WINSOR	1200	MA WATER RESOURCES AUTHORITY
4320	MA	WORCESTER	810724	WARE R	SOUTH BARRE	150	S BARRE HYDROELEC CO INC
3127A	MA	HAMPSHIRE	820212	WARE R	WARE LOWER	320	WARE RIVER POWER
3127B	MA	HAMPSHIRE	820212	WARE R	WARE UPPER		WARE RIVER POWER
9728	MA	WORCESTER	861015	WARE R	POWDER MILL	120	S BARRE HYDROELEC CO INC

Listed are projects exempt from the requirements of Part I of the Federal Power Act. Exemptions may be obtained for projects if generating capacity is being installed or increased; the applicant has all of the real property interests necessary to develop and operate the project; and either the project will be located at pre-1977 dam and have 5 megawatts (MW) or less installed capacity or the project will use the hydropower potential of a manmade conduit used primarily for the purposes other than hydropower and the installed capacity is 15 MW or less (40 MW or less for states and municipalities.) Exemptions are issued in perpetuity, are made subject to mandatory terms and conditions set by federal and state fish and wildlife agencies and by the Commission, and they do not convey the right of eminent domain.

Updated: February 2001

Fig. 29. Waste Water Treatment Plants in the Chicopee River Basin.

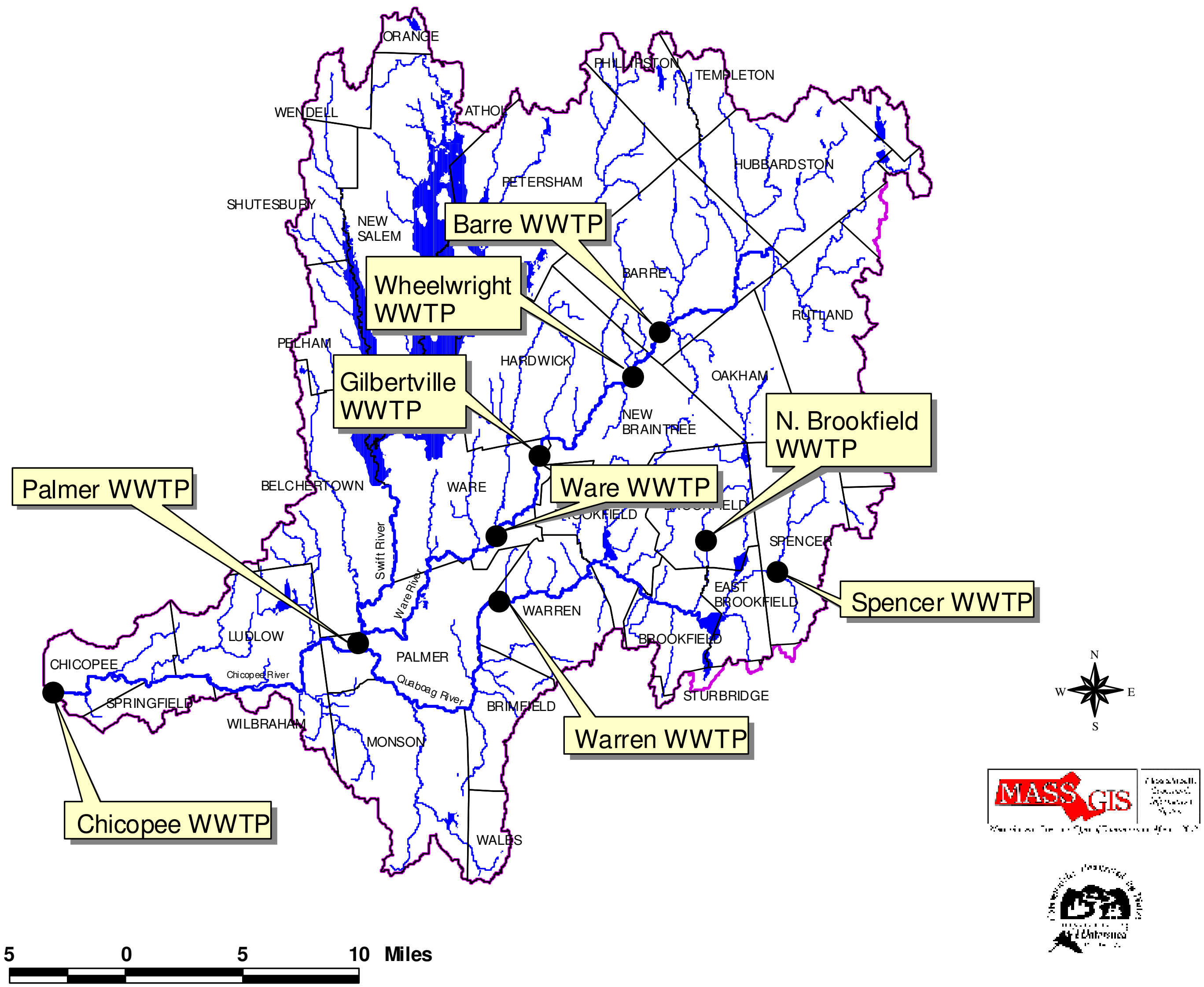


Figure 30. Major Roads in the Chicopee River Basin.

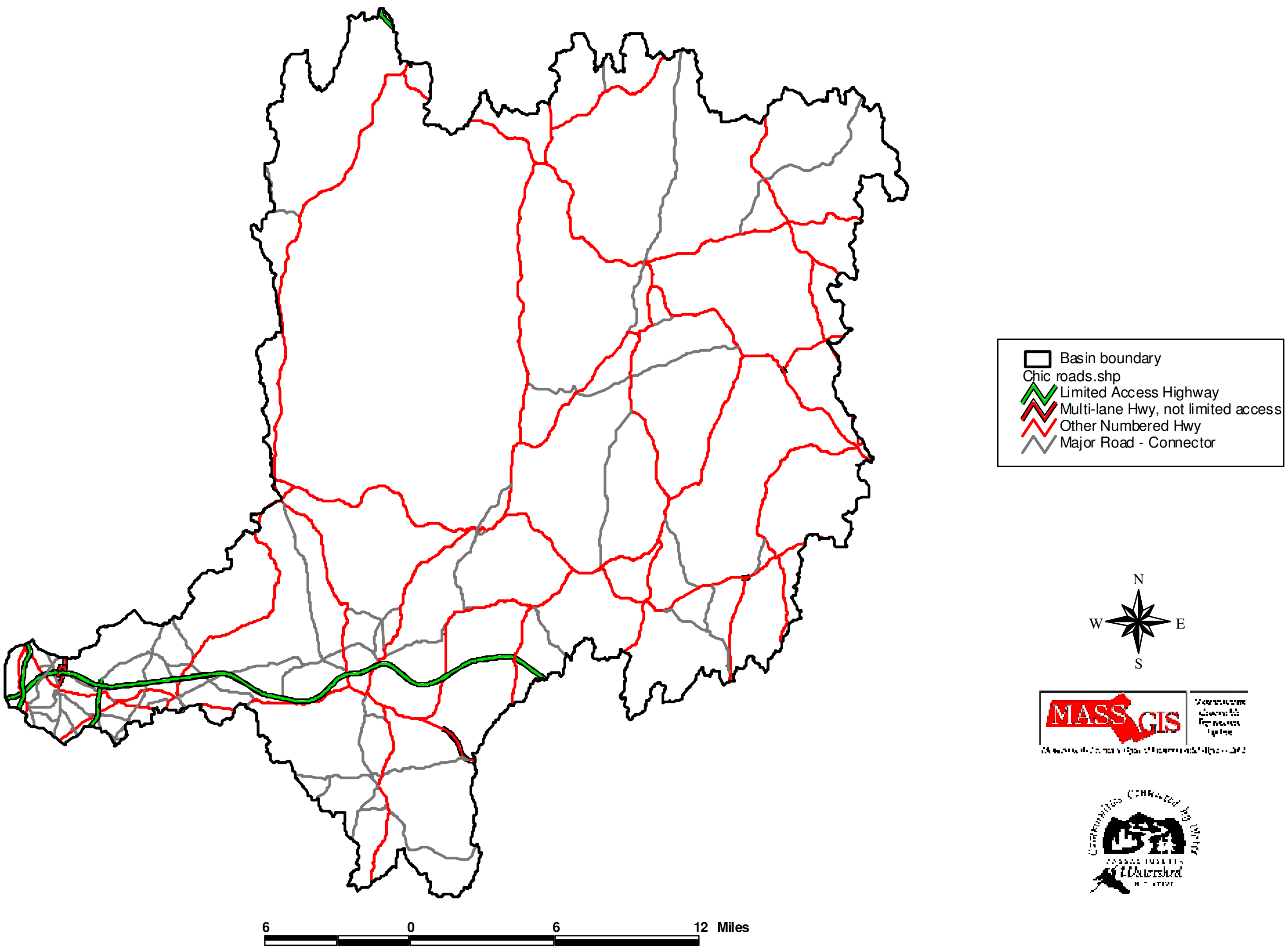


Figure 31. Active Landfills in Chicopee River Basin.

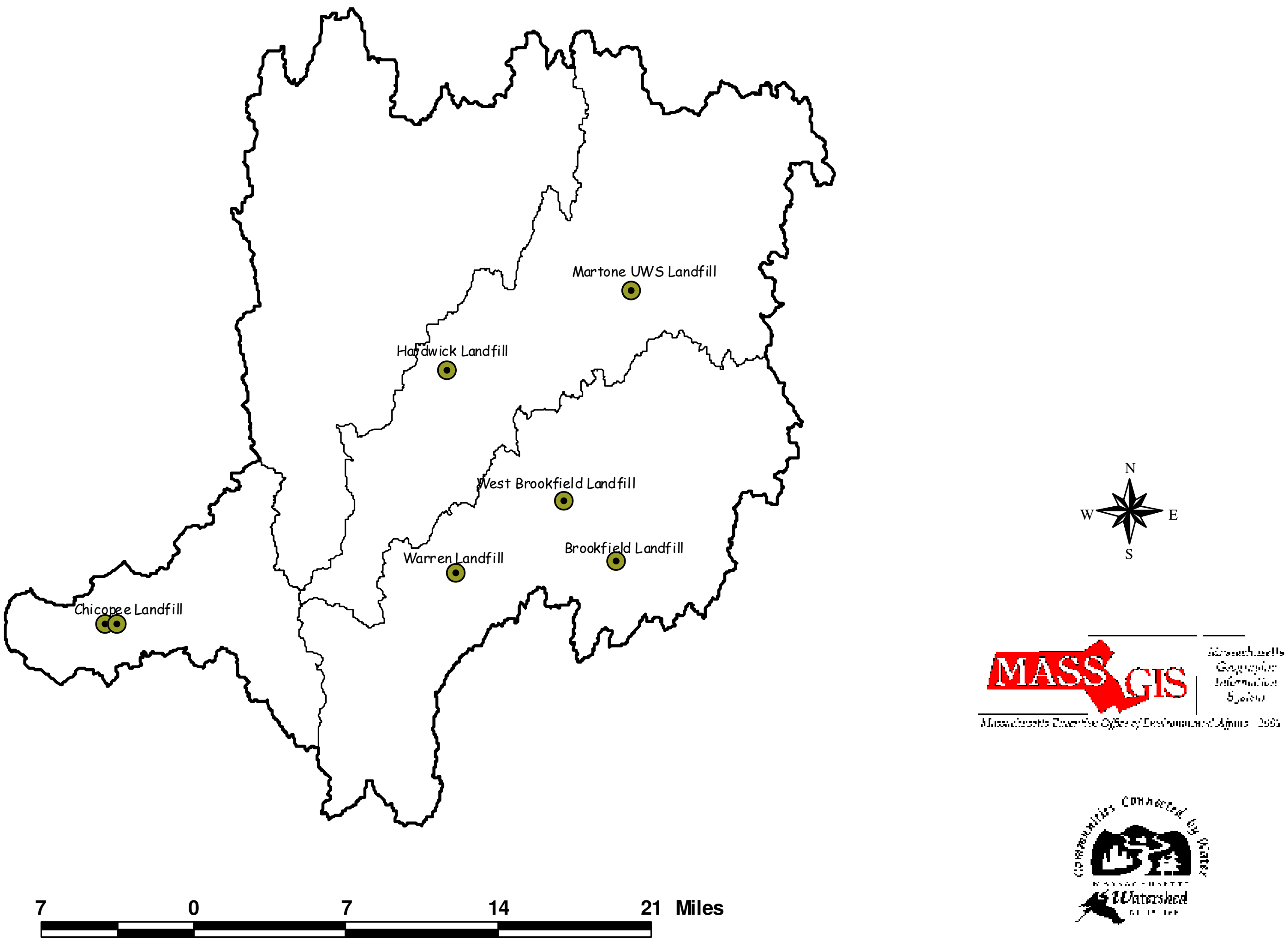
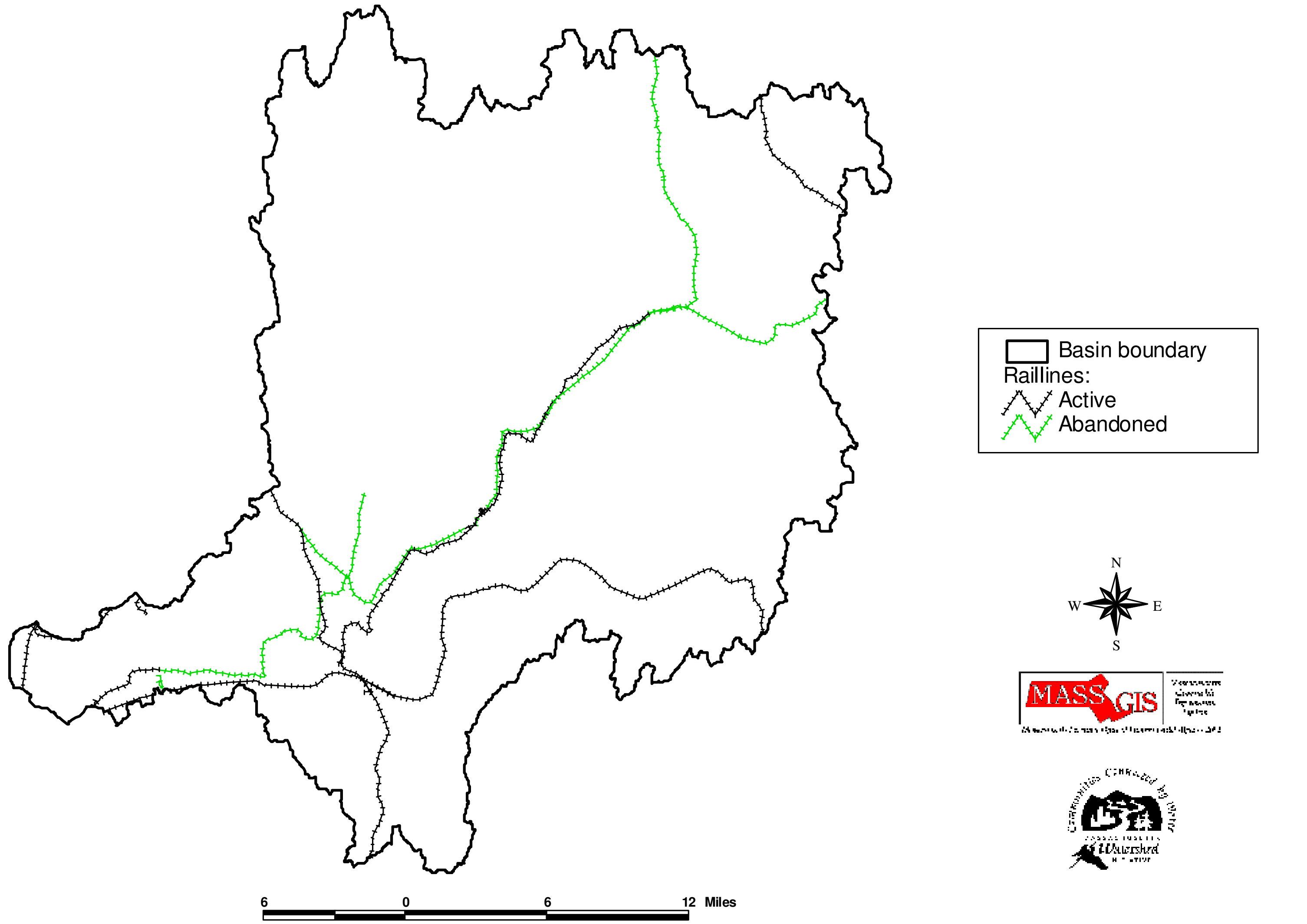


Figure 32. Active and Abandoned Raillines in the Chicopee River Basin.



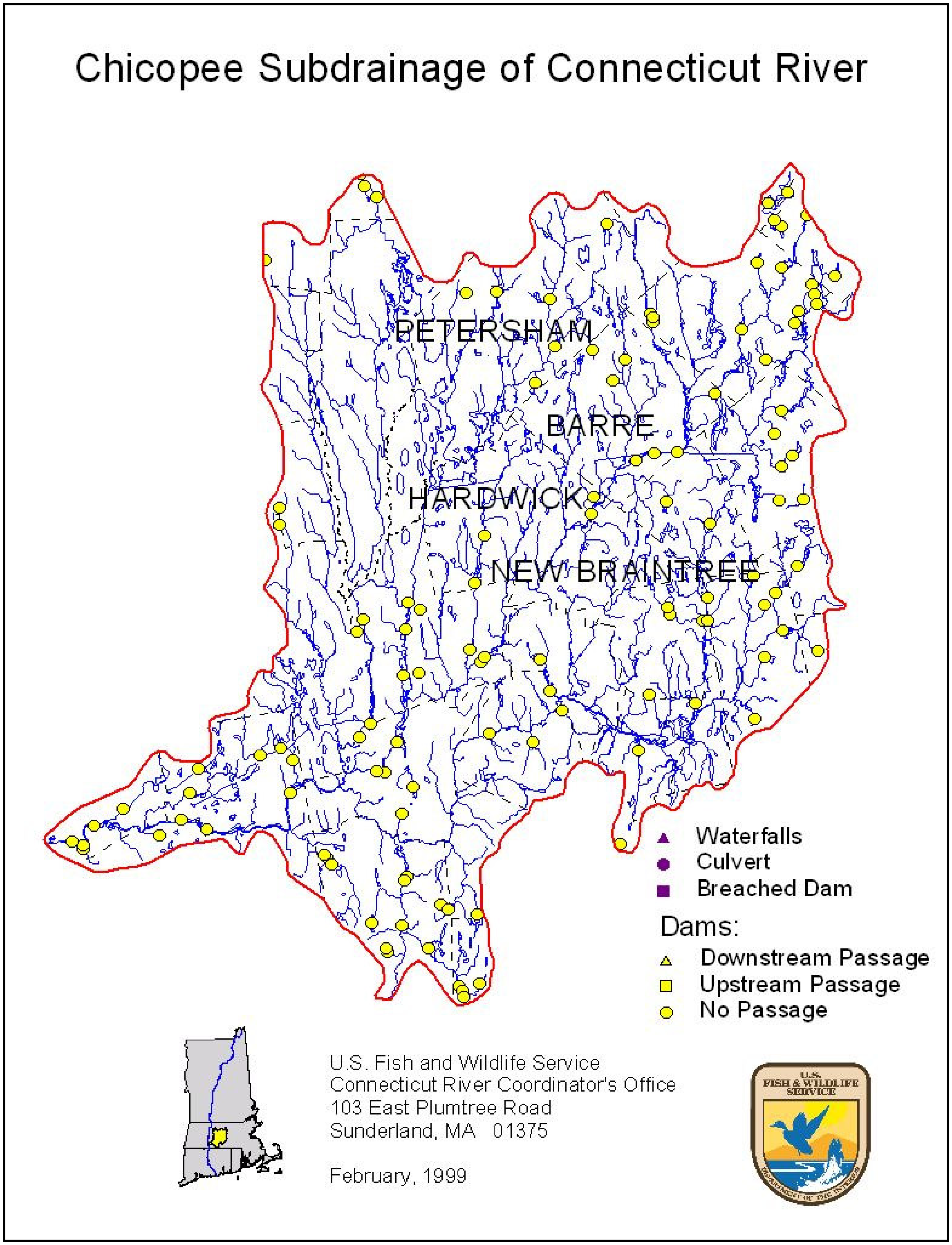


Figure 33. Dams and other barriers to fish passage in the Chicopee River Basin (from USFWS).

Table 19. Impoundments in the Chicopee River Basin (from USEPA)

DAM NAME	Normal STORAGE (acre-feet)	ID #	IMPOUNDMENT NAME
CONANT BROOK DAM	1.0	MA00965	CONANT BROOK RES
	2.0	MA02539	
PULPIT ROCK POND SMALL DAM	3.0	MA00554	PULPIT ROCK POND SMALL
	4.0	MA02597	
UPPER BEMIS POND DAM	5.0	MA00069	BEMIS POND UPPER
LAMBERTON BROOK DAM	7.0	MA00905	LAMBERTON BROOK
	8.0	MA02528	
WOODMAN POND DAM	13.0	MA00529	WOODMAN PONDMA
MOULTON DAM DROPPED	17.0	MA00728	CHICOPEE BROOK
ALDEN POND DAM	20.0	MA00546	ALDEN POND
JUDA DAM	21.0	MA00593	
LOWER BEMIS POND DAM	22.0	MA00531	BEMIS POND LOWER
KITTREDGE DAM	23.0	MA00951	KITTREDGE POND
CALKINS POND LOWER	25.0	MA01003	CALKINS POND
BRADWAY DAM	26.0	MA00556	
GAUCO POND DAM	27.0	MA01302	GAUCO POND
CROSS POND DAM	28.0	MA00666	CROSS PONDMA
WEST WARREN MILL POND DAM	29.0	MA00902	QUOBOAG RIVERMA
DIAMOND INTERNATIONAL CORP LOW	30.0	MA00563	WARE RIVERMA
MONSANTO COMPANY UPPER DAM	34.0	MA00573	PLASTIC PARK PONDMA
BUXTON HILL POND	35.0	MA00776	
HOWE POND DAM	37.0	MA01175	HOWE POND
VINICA POND	38.0	MA00538	VINICA POND
BONDSVILLE LOWER	40.0	MA00561	SWIFT RIVER
STEVENS POND DAM	43.0	MA01301	STEVENS PONDMA
WAX FACTORY POND DAM	49.0	MA00664	WAX FACTORY PONDMA
SAW MILL POND DAM	50.0	MA00098	RICE PONDMA
DEAN POND DAM	51.0	MA00078	DEAN PONDMA
LOWER CANAL DAM	60.0	MA00751	WARE RIVERMA
BEMS POND DAM	64.0	MA00665	BEMS PONDMA
PALMER RESERVOIR UPPER DAM	65.0	MA00557	PALMER RESERVOIRMA
PINE BROOK DAM	70.0	MA00617	PINE HILL BROOKMA
BROWN POND	75.0	MA00652	BROWN PONDMA
NASH HILL RESERVOIR	77.0	MA00550	NASH HILL RESERVOIRMA
WAITE POND DAM	80.0	MA01016	WAITE PONDMA
DOANE POND DAM	81.0	MA00948	DOANE PONDMA
PATRILL HOLLOW POND DAM	83.0	MA00618	PATRILL HOLLOW PONDMA
ADAMS POND DAM	84.0	MA00949	ADAMS PONDMA
BATES POWER RESERVOIR DAM	90.0	MA00650	BATES POWER RESERVOIRMA
COMINS POND DAM	91.0	MA00903	COMINS PONDMA
BRIGHAM POND DAM	96.0	MA00661	BRIGHAM PONDMA
THAYER POND DAM	114.0	MA01249	THAYER PONDMA
SOUTH BARRE MILL POND DAM	115.0	MA00091	SOUTH BARRE MILL POND WAREMA
PULPIT ROCK POND NEW DAM	120.0	MA00552	PULPIT ROCK PONDMA
BARRE RESERVOIR DAM/DIKE	125.0	MA00094	BARRE RESERVOIRMA
BROOKHAVEN LAKE DAM	126.0	MA00980	BROOKHAVEN LAKEMA
CARTER POND DAM	130.0	MA00653	CARTER PONDMA

Table 19 (cont.)

DAM NAME	Normal STORAGE (acre-feet)	ID #	IMPOUNDMENT NAME
WHEELWRIGHT POND DAM	150.0	MA00616	WHEELWRIGHT PONDMA
EDSON POND DAM	152.0	MA00930	EDSON PONDMA
BROWNING POND DAM	176.0	MA00695	BROWNING PONDMA
WILLIAMSVILLE POND DAM	190.0	MA00663	WILLIAMSVILLE PONDMA
WILLIAMSVILLE POND DAM	192.0	MA00662	WILLIAMSVILLE PONDMA
DWIGHT DAM	200.0	MA00721	CHICOPEE RIVERMA
LAKE WHITTEMORE DAM	202.0	MA00699	LAKE WHITTEMOREMA
LOVEWELL POND DAM	210.0	MA00646	LOVEWELL PONDMA
NOYES POND DAM	220.0	MA00643	NOYES PONDMA
DEAN POND DAM	248.0	MA01304	DEAN PONDMA
FOREST LAKE DAM	250.0	MA00559	FOREST LAKEMA
BROOKS POND DAM	260.0	MA00654	BROOKS PONDMA
KNIGHTS POND	270.0	MA00485	KNIGHTS PONDMA
HARDWICK POND DAM	310.0	MA00080	HARDWICK PONDMA
CHICOPEE RESERVOIR	322.0	MA00720	CHICOPEE RESERVOIRMA
MOULTON POND DAM	328.0	MA00931	MOULTON PONDMA
POWDER MILL POND DAM	336.0	MA00092	POWDER MILL POND WARE RIVERMA
DEMOND POND DAM	368.0	MA00991	DEMOND PONDMA
COLD BROOK INTAKE DAM	375.0	MA00093	WARE RIVERMA
	378.0	MA83013	
LAKE MATTAWA SOUTH OUTLET	438.0	MA00502	LAKE MATTAWAMA
QUEEN LAKE DAM	448.0	MA00648	QUEEN LAKEMA
TEXTILE PRINTING COMPANY-UPPER	460.0	MA00560	SWIFT RIVERMA
HORSE POND DAM	650.0	MA00947	HORSE PONDMA
WESTERN MASS ELECTRIC DAM	715.0	MA00724	CHICOPEE RIVERMA
WARE INDUSTRIES MAIN UPPER DAM	746.0	MA00594	WARE RIVERMA
BROOKS POND	760.0	MA00696	BROOKS PONDMA
DIAMOND INTERNATIONAL CORP UPP	780.0	MA00562	WARE RIVERMA
THOMPSONS POND DAM	791.0	MA00697	THOMPSONS PONDMA
	880.0	MA02583	
BEAVER LAKE	930.0	MA00592	BEAVER LAKEMA
SUGDEN RESERVOIR DAM	980.0	MA00698	SUGDEN RESERVOIRMA
INDIAN ORCHARD DAM	1050.0	MA00722	CHICOPEE RIVERMA
LAKE LASHAWAY DAM	1320.0	MA00961	LAKE LASHAWAYMA
BICKFORD POND DAM	3029.0	MA01021	BICKFORD PONDMA
RED BRIDGE DAM	3200.0	MA00723	CHICOPEE RIVERMA
MARE MEADOW RESERVOIR DAM	4849.0	MA01020	MARE MEADOW RESERVOIRMA
LUDLOW DAM	5500.0	MA00547	SPRINGFIELD RESERVOIRMA
CHERRY VALLEY DAM	6150.0	MA00548	SPRINGFIELD RESERVOIRMA
QUABBIN WINSOR DAM	1265200.0	MA00588	QUABBIN RESERVOIRMA
TOTALS	1306587.0	acre feet	
	425947.4	gallons	
	56914929720.0	ft3	

9. Recreational resources: A variety of outdoor recreational resources occur in the Chicopee River basin. Perhaps the most prominent of these is Quabbin Reservation, which constitutes the largest state-owned public land holding in Massachusetts. However, numerous other recreational opportunities exist at state, federal, and privately-owned sites.

a. PAB and other boat launch sites: The state Public Access Board (PAB) has been instrumental in constructing boat launch areas throughout the state, including 15 in the Chicopee River basin (Figure 34 and Table 20). These launch sites provide access to 3 rivers (Ware, Swift, Chicopee), 9 lakes/ponds, and to the Quabbin Reservoir.

b. DEM parks and forests: The former Massachusetts Department of Environmental Management (now DCR) manages a number of lands and facilities in the basin, including 14 state forests, 5 state parks, 3 flood control areas, 2 swimming pools, a state reservation, a boat launch area and one rail trail (Figure 35).

c. MDC lands: The former Metropolitan District Commission (now DCR) controls more than 80,000 acres of watershed lands in the basin, and represents the largest holder of public land in the Chicopee. These lands are in two main blocks – Quabbin Reservation and the Ware River Reservation (Figure 36). Both occur in the upper portions of the Swift and Ware River drainages, respectively, and are managed as public surface water supply watersheds.

d. DFW management areas: The Massachusetts Division of Fisheries and Wildlife (DFW) manages more than 170 parcels in the basin (Figure 37); these include about two dozen Wildlife Management Areas, 5 river access areas, several pond access areas, 2 fish hatcheries, and several other miscellaneous properties.

e. Federal lands: The federal government is represented in the basin in the form of two U.S. Army Corps of Engineer (ACOE) flood control facilities that also provide for public recreational opportunities. These facilities include the Barre Falls project in Barre, Rutland, Hubbardston, and Oakham, and the Conant Brook project in Monson. These facilities provide picnicking, hiking, fishing, hunting, horseback riding and cross-country skiing. Indirectly, the federal government also "provides" for outdoor recreation at the FERC-governed hydroelectric facilities in the basin. As part of their operating permit, dam owners are often required to install and maintain facilities for picnicking, fishing, and boat launching.

f. Local lands: Many recreational resources in the Chicopee River basin are owned and operated by municipalities. For example, numerous small local parks exist throughout the basin. Some communities have larger, more developed recreational facilities (e.g., Szot Park in Chicopee, Spencer Fair Grounds in Spencer). Municipal golf courses, swimming pools or beaches, conservation areas, and various other local facilities provide for a variety of outdoor recreational opportunities.

g. Private facilities: Outdoor recreation in the basin is greatly enhanced by the wide array of opportunities offered by private entities – both non-profit and for-profit. Some excellent hiking, biking, and cross-country skiing is available on some of the lands owned by non-profit conservation organizations such as The Trustees of Reservations, Massachusetts Audubon Society, Harvard Forest and the Norcross Wildlife Sanctuary. The East Quabbin Land Trust has been instrumental in establishing a "canoe route" along the Ware River in Hardwick. Sportsmen's club lands provide for hunting, fishing, and other outdoor pursuits across the basin. The Wachusetts Greenways group is pushing westward with their bikeway construction activity, and has recently entered the easternmost portion of the basin. Future plans call for extension of bike and walkways well into the basin. Private golf courses and campgrounds round out the recreational offerings.

Figure 34. Public Boat Launch Sites in the Chicopee River Basin.

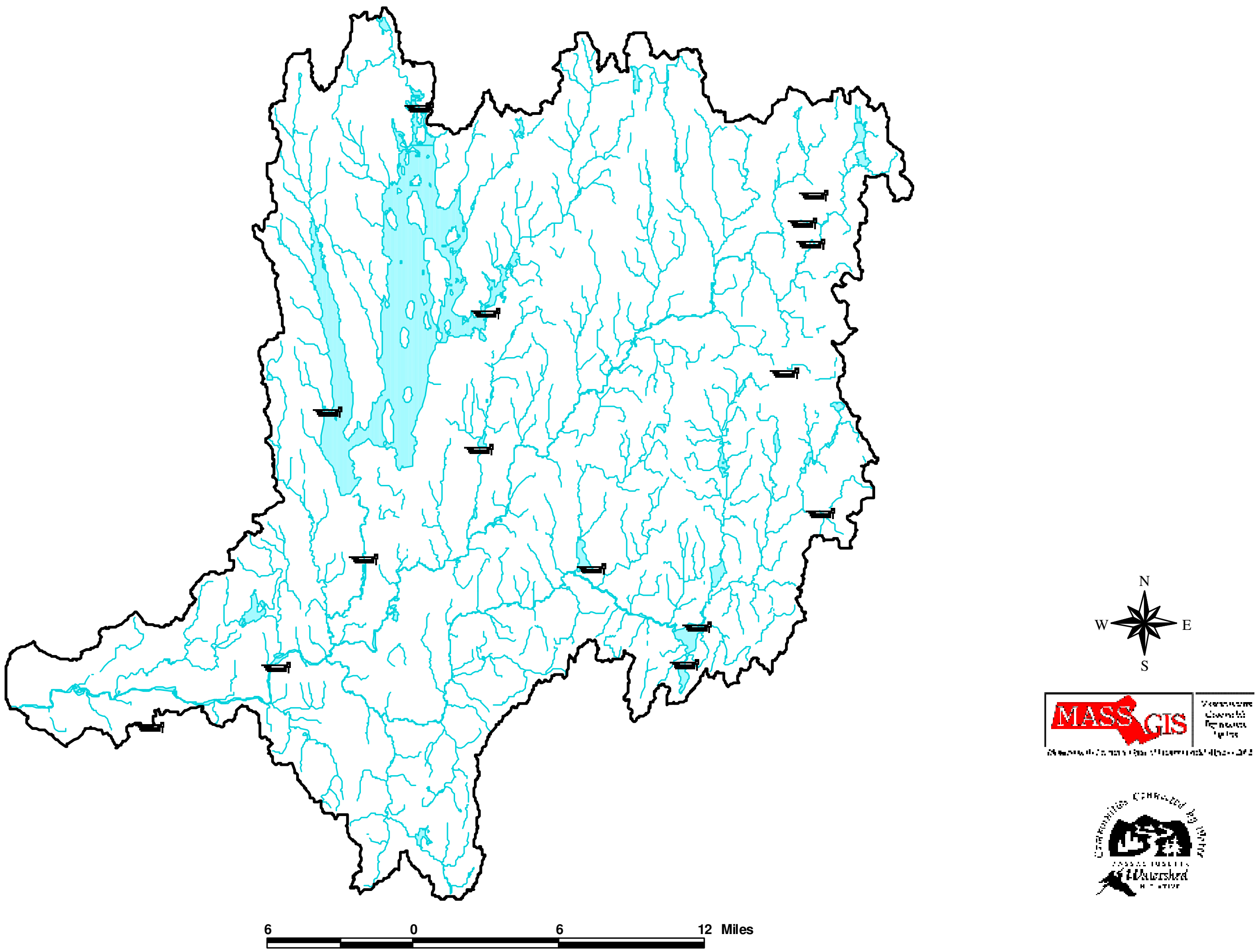


Table 20. Public boat launch information, Chicopee River Basin (data from MassGIS)

Name	Managing Authority	Construction	# Ramps	Parking	Condition	Fee?	Permit?	Restrictions?	Town
QUABBIN RESERVOIR	M.D.C.	CONCRETE	--	--	GOOD	Y	N	Y	NEW SALEM
MOOSEHORN POND	DFWELE:F&W	GRAVEL	1	6	GOOD	N	N	N	HUBBARDSTON
ASNACOMET POND	M.D.C.	CONCRETE	1	40	GOOD	N	N	N	HUBBARDSTON
WARE RIVER-EAST BR.	DFWELE:F&W	GRAVEL	1	6	FAIR	N	N	N	RUTLAND
QUABBIN RESERVOIR	M.D.C.	CONCRETE	--	--	GOOD	Y	N	Y	HARDWICK
LONG POND	DEM DIV. OF FORESTS AND PARKS	CONCRETE	1	25	GOOD	N	N	N	RUTLAND
QUABBIN RESERVOIR	M.D.C.	CONCRETE	--	--	GOOD	Y	N	Y	BELCHERTOWN
HARDWICK POND	PAB	ASPHALT	1	6	GOOD	N	N	N	HARDWICK
SUGDEN RESERVOIR	DFWELE:F&W	GRAVEL	1	10	FAIR	N	N	N	SPENCER
SWIFT RIVER	DFWELE:F&W	CONCRETE	1	20	GOOD	N	N	N	BELCHERTOWN
WICKABOAG POND	TOWN OF WEST BROOKFIELD	CONCRETE	1	6	GOOD	N	N	N	WEST BROOKFIELD
QUABOAG POND	TOWN	ASPHALT	1	50	FAIR	N	N	N	BROOKFIELD
SOUTH POND	TOWN OF BROOKFIELD	CONCRETE	1	12	GOOD	N	N	N	BROOKFIELD
RED BRIDGE LANDING	DEM DIV. OF FORESTS AND PARKS	ASPHALT	1	10	GOOD	N	N	N	WILBRAHAM
FIVE MILE POND	CITY	CONCRETE	1	40	GOOD	N	N	Y	SPRINGFIELD

Figure 35. DEM Lands in Chicopee River Basin.

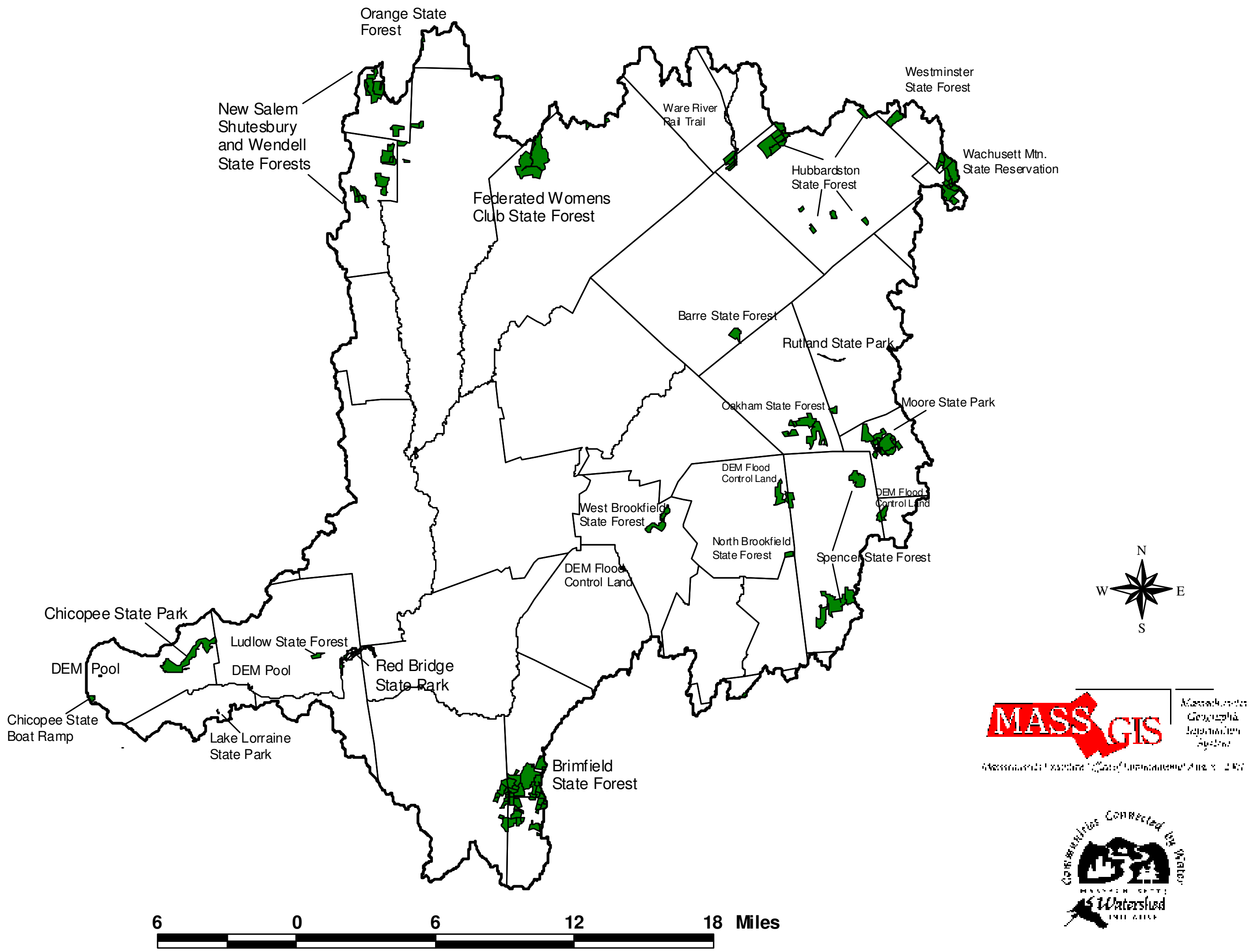


Figure 36. MDC Lands in the Chicopee River Basin.

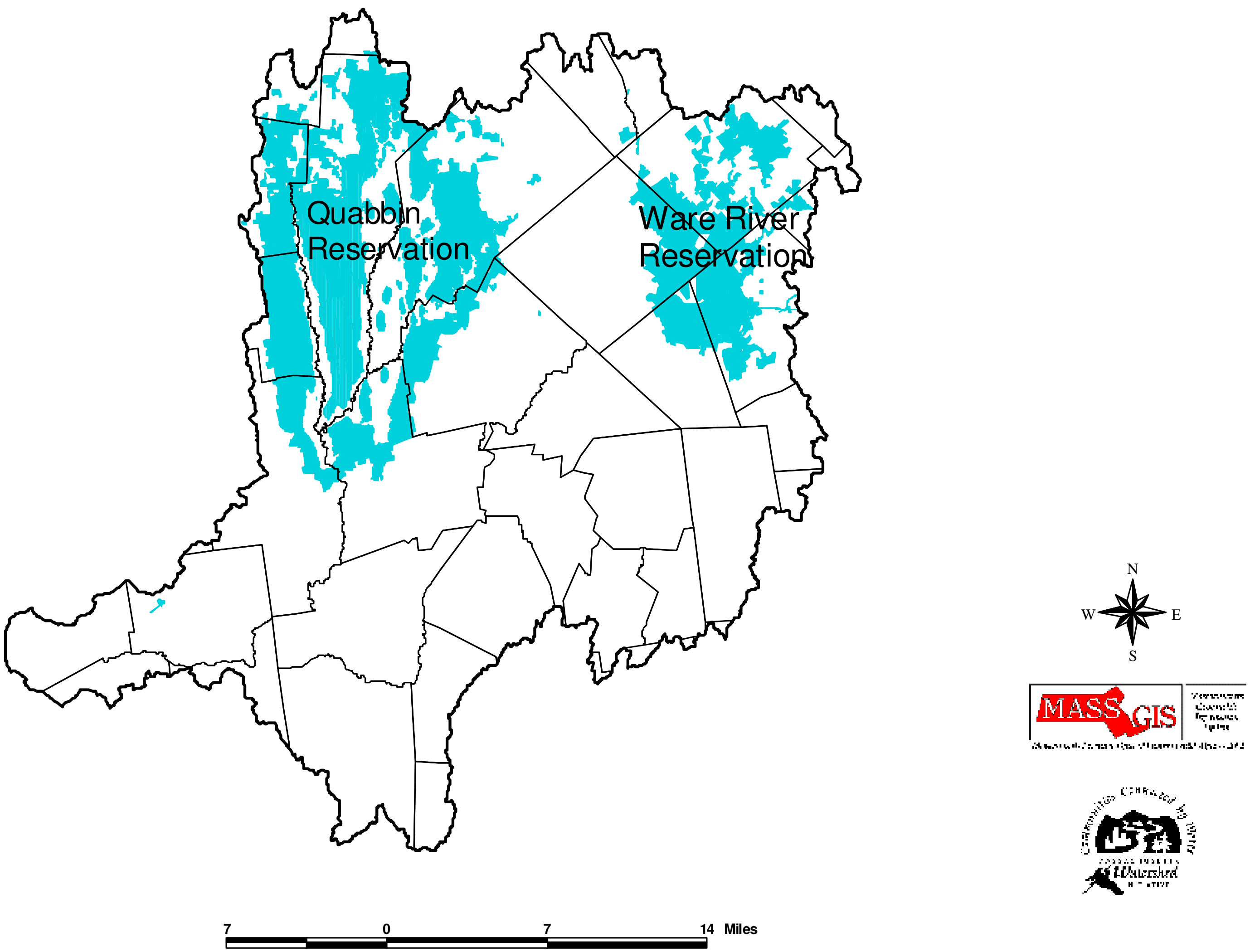
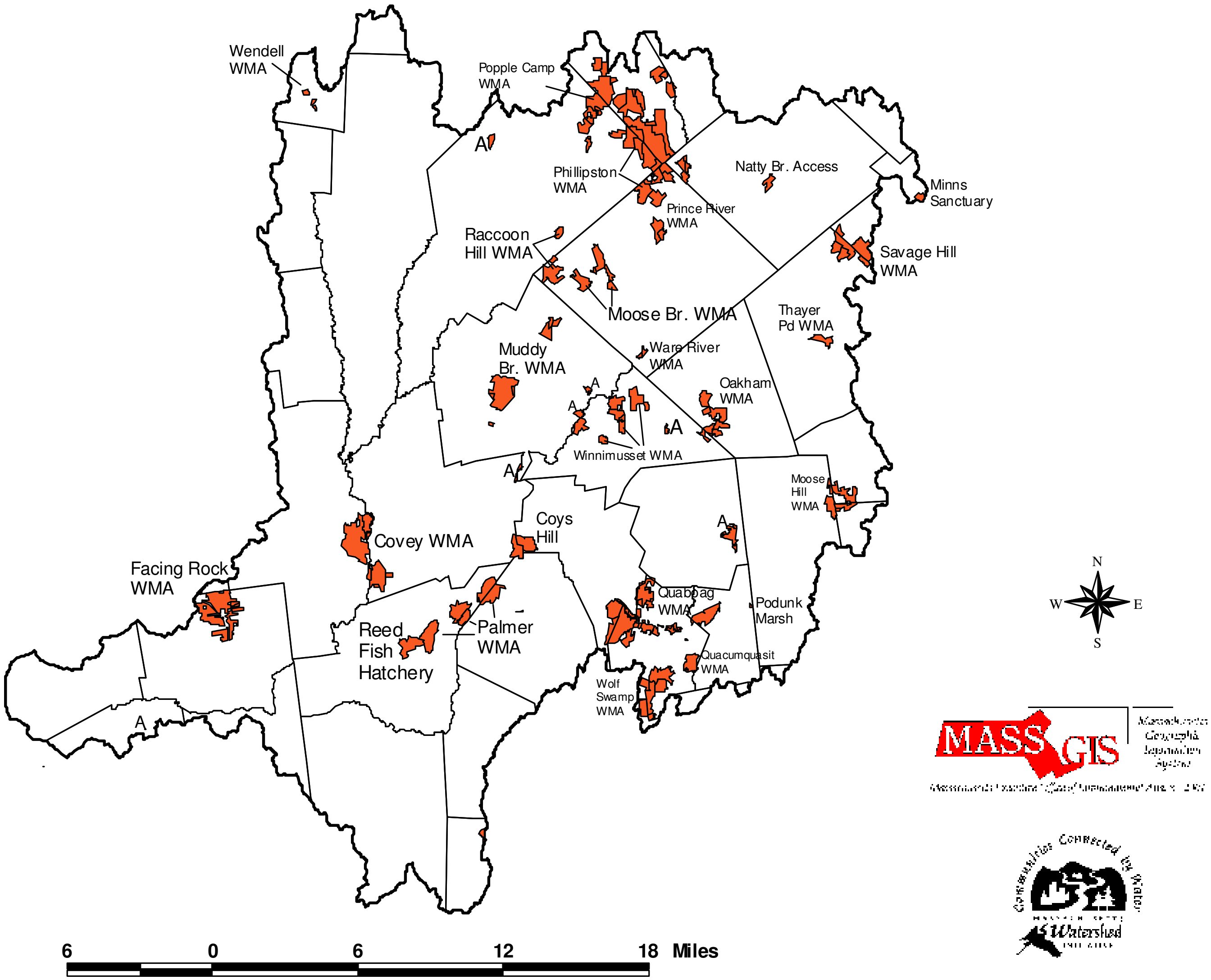


Figure 37. MDFW Lands in Chicopee River Basin.



10. Cultural, historic, and archeological resources: Information from the Massachusetts Historical Commission (through MassGIS) indicates that there are 31 Historic Districts and 47 Historic Places in the Chicopee River basin (Figure 38 and Tables 21 and 22). While these historic sites are found throughout the basin, local concentrations occur along state highway 9 through the Brookfields and Spencer, in Ware, and in the Chicopee/Springfield area. No data could be found on archeological resources in the basin.

11. Scenic resources: In 1981, a Massachusetts Landscape Inventory Project was completed by the former DEM. That inventory identified three "scenic landscapes" in the basin (Figure 39): the area around Quabbin Reservoir, Mt. Wachusetts State Reservation, and the southeast portion of the basin, along Rt. 31 in Spencer. However, much of the basin is considered scenic, in large part due to the presence of numerous small towns and villages, many of which are located along the major rivers and/or in the valleys of those rivers. Many of these small towns still retain much of their "old New England" character. As such, the basin is a major destination for tourists.

IV. Watershed Assessment

The previous section summarized many of the physical characteristics of the Chicopee River basin. In this section, an "assessment" of that information will be made, which will assist in identifying some of the main environmental issues in the basin, as well as some of the gaps in information that might be the focus of future data collection efforts.

The information addressed in this section comes from variety of sources, including data that has been collected over the years by DEP, MDC, other government agencies, municipalities, lake and watershed associations, and others. In addition, recent MWI (former) "priority projects" have served to fill in some of the data gaps that have been identified. For example, recent projects have provided information on water quality conditions, stormwater infrastructure, landuse-based modeling, etc.

In some instances, it was impossible to sort data by watershed boundaries, thus some topics (e.g., population projections and build-out results) are presented for whole communities, even though in some cases, only a small portion of a community may lie within the Chicopee River basin. In most cases however, data is basin-specific.

A. Population projections and build-out analyses

Environmental problems and challenges frequently stem from the needs of growing populations. Thus, an analysis of population levels and rates of growth is an important part of this watershed assessment. Data from several sources has been used for these analyses - U.S. Census data for 1990 and 2000 (see Table 6), population projections from the Massachusetts Institute for Social and Economic Research (MISER), and the results of town by town build-out analyses conducted by EOEA and regional planning agencies.

Census data shows that from 1990 to 2000, Chicopee River basin communities grew by an average of 8.4%. This compares to a statewide average of 9.2%. However, three basin communities experienced greater than 20% growth in population (Belchertown at 22.6%, Rutland at 28.7% and Hubbardston at 39.8%), which put them among the top 11% of growth rates in the state.

MISER projections (Figure 40 and Table 23) suggest that population change from 1990 to 2010 will range from 8.6% (Springfield) to 92.3% (Phillipston) in basin communities, with almost a third exceeding 30% growth, and 8 exceeding 50%. Many factors could affect the accuracy of those projections however, as evidenced from the degree to which the MISER predictions for the year 2000 differed from actual census data in some communities.

Build out analyses provide another measure of the potential for future growth. Such analyses were completed for all basin communities during 2000 and 2001. The results of those analyses again show substantial variability in the potential for growth in basin communities (Appendix D). For example, Springfield is essentially built out, while Petersham could experience more than a 1600% increase in population.

Figure 38. Historic Places and Districts in the Chicopee River Basin.

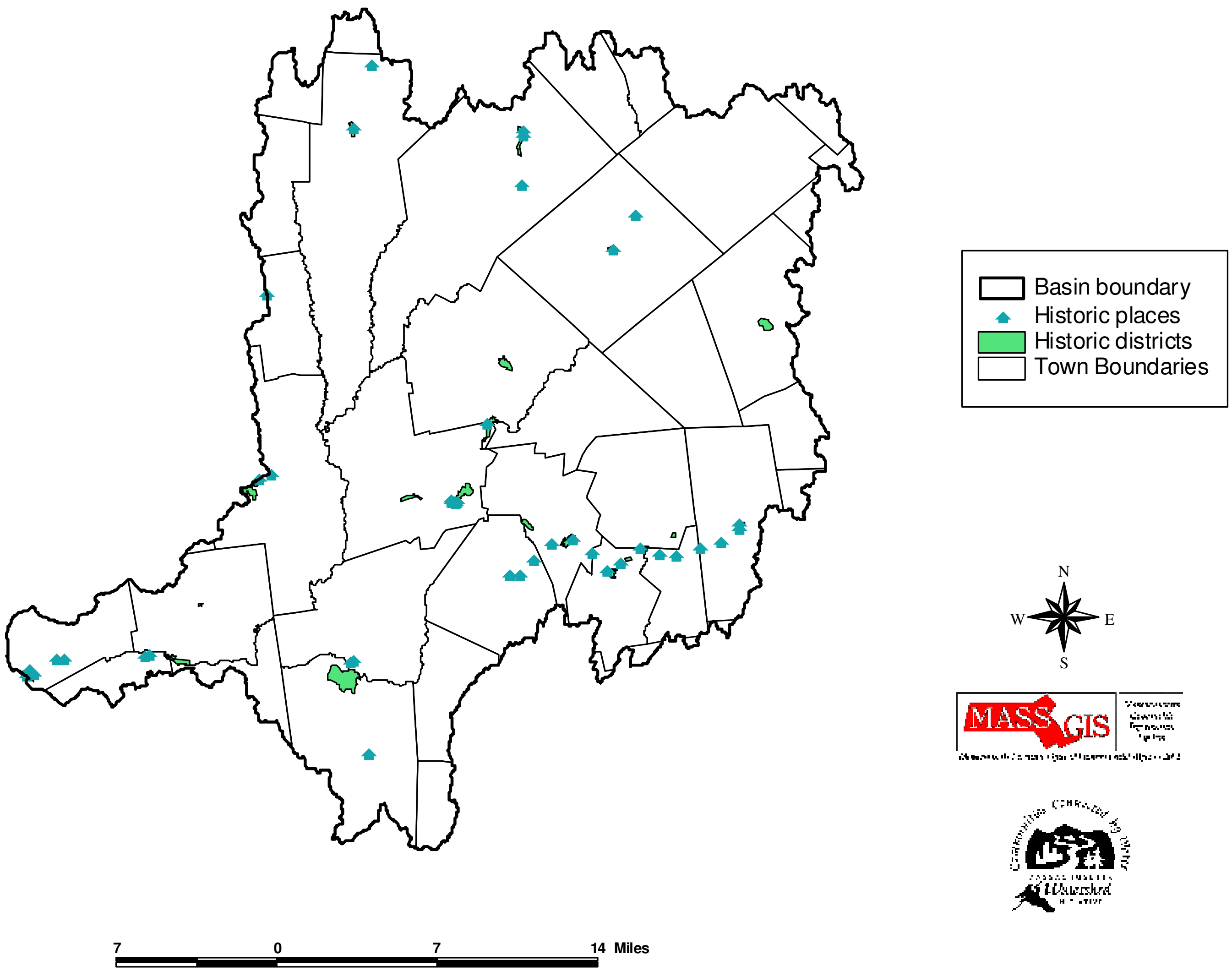


Table 21. Historic districts in the Chicopee River Basin (from MassGIS).

Town	District Name
Barre	Barre Common Historic District
Belchertown	Belchertown State School
Belchertown	Belchertown State School
Belchertown	Belchertown Center Historic District
Brookfield	Elm Hill Farm Historic District
Brookfield	Brookfield Common Historic District
Chicopee	Church Street Historic District
Chicopee	Dwight Manufacturing Company Housing District
Chicopee	Springfield Street Historic District
Hardwick	Hardwick Village Historic District
Hardwick	Gilbertville Historic District
Ludlow	Ludlow Center Historic District
Ludlow	Ludlow Village Historic District
Ludlow	Ludlow Village Historic District
Monson	Monson Developmental Center
Monson	Monson Center Historic District
N. Brookfield	Camp Atwater
New Salem	New Salem Common Historic District
Pelham	Pelham Town Hall Historic District
Petersham	Holland - Towne House
Petersham	Petersham Historic District
Rutland	Putnam
Spencer	Spencer Town Center Historic District
W. Brookfield	Salem Cross Inn
W. Brookfield	West Brookfield Center Historic District
Ware	Church Street Historic District
Ware	Ware Center Historic District
Ware	Ware Millyard Historic District
Wendell	Wendell Town Common Historic District
Wendell	Wendell Town Common Historic District
Wilbraham	Ludlow Village Historic District

Table 22. Historic places in the Chicopee River Basin (from MassGIS)		
Town	**Historic Place Name**	**Address**
Barre	Barre District #4 School House	Farrington Ave
Barre	Barre Town Hall	Exchange St
Belchertown	Walker - Collis House	1 Stadler St
Belchertown	Clapp Memorial Library	19 South Main St.
Brookfield	Milestone	Rt 9
Brookfield	Milestone	Elm Hill Rd
Brookfield	Milestone	Elm Hill Rd
Chicopee	Polish National Home	136-144 Cabot St.
Chicopee	Valentine School	91-103 Grape St.
Chicopee	Chicopee City Hall	Market Sq.
Chicopee	Page	105 East St.
Chicopee	Bellamy	91-93 Church St.
E. Brookfield	Milestone	Route 9
E. Brookfield	Milestone	North Brookfield Rd
Hardwick	Ware - Hardwick Covered Bridge	
Monson	Memorial Town Hall	Main St.
New Salem	Whitaker - Clary House	Elm St
New Salem	New Salem Academy	South Main St
Palmer	U. S. Post Office - Palmer Main Branch	Park St
Palmer	Union Station	Depot St
Pelham	Pelham Hill Church	
Petersham	Gay Farm	
Petersham	Prescott Town House	MA Route 32
Petersham	Petersham Craft Center	8 North St.
Spencer	Spencer Fire Station	155 Main St.
Spencer	Milestone	Rt. 9
Spencer	Milestone	Rt 9
Spencer	Milestone	Rt 9
Spencer	Spencer District #12 School	23 Grove St.
Springfield	Myrtle Street School	64 Myrtle St.
Springfield	Rieutord Block	146-152 Main St.
W. Brookfield	Milestone	East Main St.
W. Brookfield	Milestone	147 West Main St
W. Brookfield	Milestone	Foster Hill Rd
Ware	Ware - Hardwick Covered Bridge	Old Gilbertville Rd
Ware	Casino Theater	121 Main St.
Ware	Guild Block	66-80 Man St.
Ware	Kaplan Block	85-91 Main St.
Ware	Methodist Episcopal Church	13 Church St.
Ware	Otis Company Mill #1	East Main St
Ware	Otis Company Worker Housing	Otis Ave
Ware	Robinson - Hitchcock Block	112-114 Main St.
Ware	Ware Town Hall	Main St
Ware	Unitarian Church	Main St
Warren	Milestone	

Table 23. MISER population projections for Chicopee River Basin communities				
Municipality	**1990 Census**	**2010 Projection**	**%Change (20 Yr)**	**State Rank**
Athol	11,451	11,641	1.7%	294
Barre	4,546	5,584	22.8%	134
Belchertown	10,579	15,907	50.4%	47
Brimfield	3,001	3,917	30.5%	98
Brookfield	2,968	3,566	20.1%	159
Charlton	9,576	16,655	73.9%	25
Chicopee	56,632	57,041	0.7%	295
East Brookfield	2,033	2,198	8.1%	250
Granby	5,565	6,693	20.3%	157
Hampden	4,709	5,048	7.2%	257
Hardwick	2,385	2,736	14.7%	197
Hubbardston	2,797	5,290	89.1%	15
Leicester	10,191	12,012	17.9%	171
Ludlow	18,820	21,178	12.5%	223
Monson	7,776	8,198	5.4%	273
New Braintree	881	1,152	30.8%	97
New Salem	802	982	22.4%	136
North Brookfield	4,708	5,724	21.6%	144
Oakham	1,503	2,592	72.5%	26
Orange	7,312	8,129	11.2%	233
Palmer	12,054	13,612	12.9%	220
Paxton	4,047	5,026	24.2%	122
Pelham	1,373	1,726	25.7%	115
Petersham	1,131	1,401	23.9%	124
Phillipston	1,485	2,856	92.3%	14
Princeton	3,189	4,103	28.7%	107
Rutland	4,936	7,167	45.2%	60
Shutesbury	1,561	2,937	88.1%	16
Spencer	11,645	12,332	5.9%	270
Springfield	156,983	143,474	-8.6%	334
Sturbridge	7,775	9,091	16.9%	179
Templeton	6,438	7,156	11.2%	234
Wales	1,566	2,350	50.1%	48
Ware	9,808	12,138	23.8%	126
Warren	4,437	6,009	35.4%	76
Wendell	899	1,653	83.9%	20
West Brookfield	3,532	4,163	17.9%	172
Westminster	6,191	7,539	21.8%	141
Wilbraham	12,635	14,041	11.1%	236

Figure 39. Scenic Landscapes in the Chicopee River Basin.

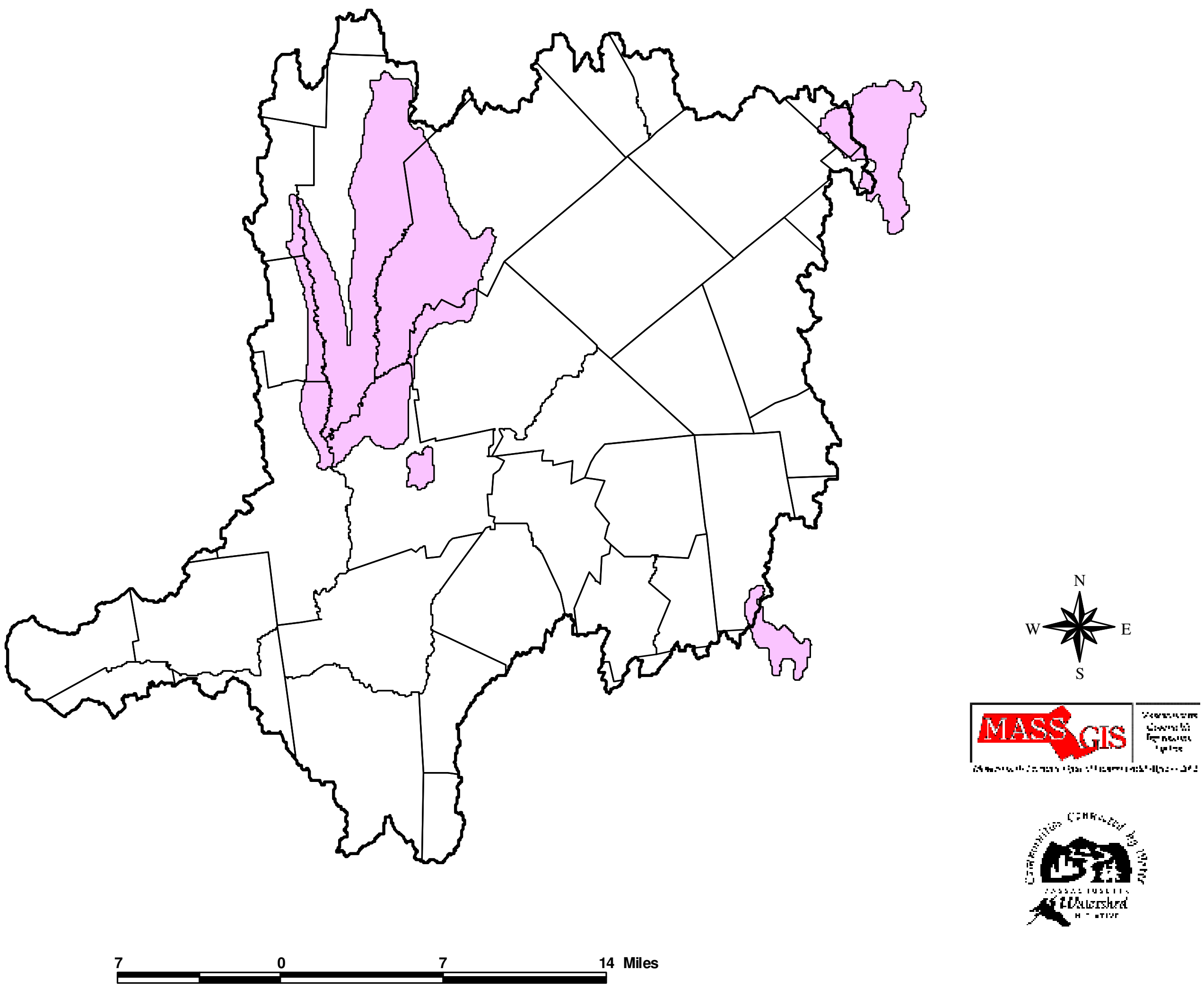
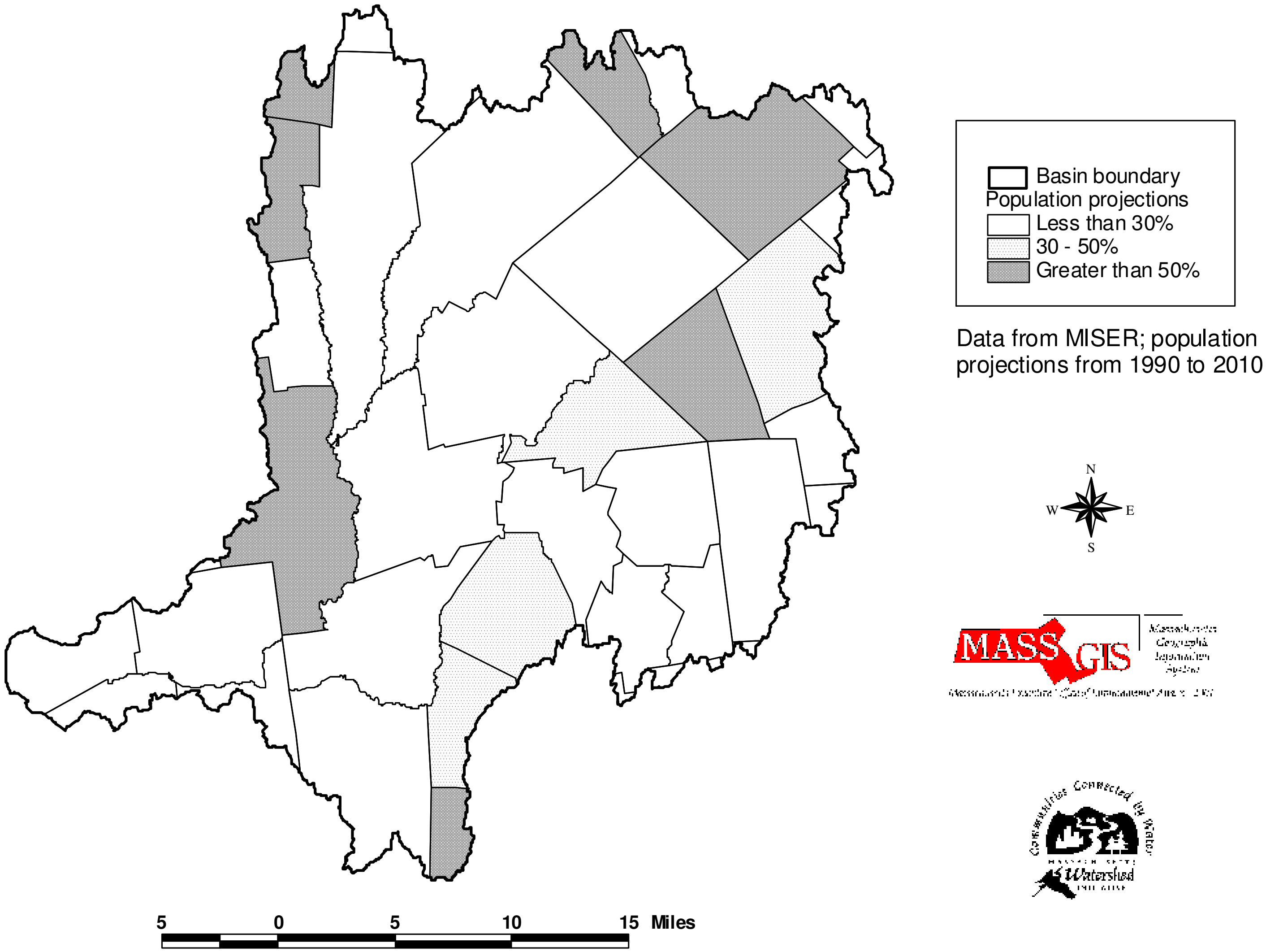


Figure 40. Population Projections in Chicopee River Basin Communities.



Almost half of basin communities could see future population growth exceed 300% (Table 24).

Table 24. Growth potential in basin communities

Growth Potential	Number of Communities	Cumulative Number	Cumulative Percent
<100%	4	4	10.3%
100-200%	9	13	33.3%
200-300%	9	22	56.4%
300-400%	6	28	71.8%
400-500%	4	32	82.1%
500-600%	4	36	92.3%
600-700%	1	37	94.9%
>1000%	2	39	100.0%

For all 39 communities combined, buildout analyses indicate a future growth of more than 130%, with similar increases in student numbers (148%) and households (122%). In terms of infrastructure and space needs, these increases could result in an additional 393,572 acres being developed, almost 57 millions gallons per day of additional water demand, more than 283,000 additional tons/year of solid waste generation, and almost 3,800 miles of additional roadways to serve the 564,000 additional residents.

The rapid growth in some basin communities, plus the potential for significant future growth, means that substantial pressure will likely be put on the natural resources of the basin – particularly water resources – to meet the needs of expanding future populations. This will necessitate careful planning, including the protection of present and potential future water supplies and other significant natural resources.

The Pioneer Valley Planning Commission and the Central Massachusetts Regional Planning Commission have both developed long-range visions and plans for their respective portions of the basin that attempt to balance future population and economic growth in the region with protection of key environmental resources and assets.

B. Water quality

The recent history of water quality conditions in the Chicopee River basin has been typical of other major river systems in the state, which have generally shown substantial improvement over the past several decades as provisions of the federal Clean Water Act have been implemented. Most of the early industrial development and population growth in the basin occurred along the major rivers, especially the Chicopee, which provided the combination of greater flows and relatively steep hydrologic gradients that was so important for early water-powered industries. Further, the rapid growth of metropolitan Boston during the early 20th Century led to the development of the Quabbin Reservoir and the protection of more than 100,000 acres of adjacent watershed lands. As a result, the basin today generally consists of headwater areas with substantial protected land and/or small towns, with much more developed and heavily populated downstream areas. With some notable exceptions (e.g., WWTP discharges along the Ware and Quaboag Rivers), water quality conditions tend to follow the general trend of being good in the "upper" portions of the basin, and much more degraded in the lower portions. The following historical overview of conditions in the basin was taken from a report produced by Environmental Science Services, Inc. (ECS 1996).

Until circa 1974, the quality of water and sediments in the Chicopee River was severely degraded by uncontrolled discharges of municipal sewerage and industrial wastes. A river survey conducted by the U.S. Army Corps of Engineers in the mid-1950s found that the lower reaches of the river were so severely polluted that the river commonly constituted a public nuisance. Data gathered by the Massachusetts Division of Water Pollution Control during the 1960s and early 1970s confirmed this degradation, which was largely due to the discharges of two major industries along the river. Those studies found highly colored and toxic water and contaminated bottom sediments extending far downstream.

Although generally not as serious as the Chicopee River, conditions in the other three major rivers in the basin were also degraded during the mid 20th Century. Discharges from sewage treatment plants and riverside industries resulted in those waters often not meeting Class C criteria. By 1980 however, due to treatment plant upgrades and new limits on industrial discharges, Class B criteria were being met in most locations.

At present, most assessed portions of the basin continue to meet applicable water quality criteria, although the presence of CSOs in several Chicopee River communities still cause serious degradation of river water during storm events. Information on water quality in the Chicopee River basin derives from several sources: sampling data, classifications, and modeling results. Each is discussed in the following sections.

1. Sampling data

Data on water quality conditions in the Chicopee Basin comes from a variety of sources. DEP conducts water testing at 5 "SMART" monitoring stations in the Swift (1 station), Ware (2 stations) and Quaboag (2 stations) Watersheds. The results of that sampling, plus additional water quality testing, is summarized in DEP's 1998 Water Quality Assessment Report (DEP 2001). The Executive Summary of that report is included in Appendix E and available through DEP's web site at: www.state.ma.us/dep/brp/wm/wmpubs.htm.

The DEP assessment report summarizes current information on 37 river segments, totaling 194 river miles, plus 84 lakes, representing approximately 97% of the lake acreage in the basin. For the river segments, insufficient data was available to adequately assess about half of the segments for the four main "uses" evaluated in the report (i.e., aquatic life, primary, and secondary contact recreation, and aesthetics). Of those segments that were assessed, seven were considered to "not support" or only "partially support" one or more designated uses, or were considered to be "threatened" (Table 25).

Eight of the 9 segments in the Swift River Watershed supported all designated uses; insufficient data was available to assess any uses in the 9th segment. Three segments in the Swift River were placed on "Alert Status" for Aquatic Life or Contact Recreation uses, as a result of low dissolved oxygen (DO) or pH readings (in the 2 upper segments), or due to CSO impacts (in the lower segment).

At least one designated use was assessed in all 11 segments of the Ware River, although not all uses could be assessed in 4 segments. At least one use was either not supported, partially supported or threatened in 4 of the 11 segments; 4 others were put on "alert" status due to low DO or pH, high temperatures, low flows, or high bacteria related to CSOs. All together, 8 of the 11 segments in this watershed had issues related to designated use support or were put on alert status. Only one segment supported all designated uses. In the Quaboag River Watershed, lack of data completely precluded the assessment of 7 (of 12) segments. Only 2 segments could be assessed for all 4 uses, and neither of those fully supported all 4 uses. A total of 3 segments included uses that were not, or only partially supported, and one other segment was put on alert status due to CSO impacts.

None of the 5 segments of the Chicopee River were assessed for any designated uses due to lack of data. However, all 4 of the Chicopee River mainstem segments were put on alert status due to CSO impacts and/or hydromodification from the major dams on the river. DEP's river segment assessments also included recommendations, and these are summarized in Table 26. Many of these relate to the need for additional monitoring information to allow for more accurate and complete assessments of river segments in the future. Other recommendations include analysis of MDC's (now DCR) benthic macroinvertebrate data, implementation of DEP's Source Water Assessment Program (SWAP) recommendations, evaluation of flow impacts and issues in several segments, the re-issuance of a number of NPDES permits with updated limits and monitoring

Table 25. DEP Chicopee River Basin: 1998 Water Quality Assessment Report - River Segment Assessment Summary

Watershed	Segment #	River Name	Aquatic Life	1° Contact	2° Contact	Aesthetics
Swift River	MA36-29	Cadwell Creek	S	S	S	S
	MA36-30	Atherton Brook	S	S	S	S
	MA36-31	West Br. Swift R.	S	S	S	S
	MA36-32	Hop Brook	S	S	S	S
	MA36-33	Middle Br. Swift R.	S*	S	S	S
	MA36-34	West Br. Fever Br.	S*	S	S	S
	MA36-35	East Br. Swift R.	S	S	S	S
	MA36-09	Swift River	S	S	S	S
	MA36-10	Swift River	NA	NA*	NA*	NA
Ware River	MA36-01	East Br. Ware R.	PS	S	S	S
	MA36-02	West Br. Ware R.	S*	S	S	S
	MA36-36	Canesto Brook	S	S	S	S
	MA36-37	Burnshirt River	S*	S	S	S
	MA36-27	Ware River	PS(1.7)/S(2.9)*	S	S	S
	MA36-03	Ware River	S*	S	S	S
	MA36-04	Ware River	S	NA	NA	NA
	MA36-08	Prince River	NA	NA	NA	S
	MA36-05	Ware River	S(9.1)/T(2.0)	NA	NA	S
	MA36-06	Ware River	S(7.8)/T(1.0)	NS	S*	S
	MA36-07	Ware River	S	NA*	NA*	NA
Quaboag River	MA36-11	Sevenmile River	S	PS	S	S
	MA36-20	Cranberry River	NA	NA	NA	NA
	MA36-12	Sevenmile River	NA	NA	NA	NA
	MA36-13	East Brookfield R.	NA	NA	NA	NA
	MA36-14	Quaboag River	NA	NA	NA	NA
	MA36-18	Forget-Me-Not Br.	S*	NA	NA	S
	MA36-28	Forget-Me-Not Br.	NS	NA	NA	PS
	MA36-19	Dunn Brook	NA	NA	NA	NA
	MA36-15	Quaboag River	S	NA	NA	S
	MA36-16	Quaboag River	S*	NS(4.2)/PS(3.8)	NS(4.2)/S(3.8)	NS(4.2)/S(3.8)
	MA36-17	Quaboag River	NA	NA*	NA*	NA*
	MA36-21	Chicopee Brook	NA	NA	NA	NA
Chicopee River	MA36-22	Chicopee River	NA	NA*	NA*	NA*
	MA36-23	Chicopee River	NA*	NA	NA	NA
	MA36-26	Calkins Brook	NA	NA	NA	NA
	MA36-24	Chicopee River	NA*	NA*	NA*	NA*
	MA36-25	Chicopee River	NA*	NA*	NA*	NA*

Legend: S=Support; NS=Non-support; PS=Partial support; NA=Not assessed; T=Threatened
( ) numbers in parentheses indicate river miles meeting that condition

Table 26. DEP Chicopee River Basin: 1998 Water Quality Assessment Report - River Segment Assessment Recommendations

Watershed	Segment #	River Name	Recommendations
Swift River	MA36-29	Cadwell Creek	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations.
	MA36-30	Atherton Brook	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations.
	MA36-31	West Br. Swift R.	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Use DEP Biocriteria project data to confirm Aquatic Life Use status; Designate as Cold Water Fishery in next SWQS revision.
	MA36-32	Hop Brook	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Confirm that low DO is result of natural conditions.
	MA36-33	Middle Br. Swift R.	Analyze MDC BMI data and conduct additional biomonitoring to confirm Aquatic Life Use status; Implement SWAP recommendations; Evaluate DEP Biocriteria project data to confirm Aquatic Life Use status; Investigate low DO to determine if naturally occurring or from anthropogenic sources; Designate segment as Cold Water Fishery in next SWQS revision.
	MA36-34	West Br. Fever Br.	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Collect data to confirm low pH and DO as naturally occurring.
	MA36-35	East Br. Swift R.	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Designate segment as Cold Water Fishery in next SWQS revision.
	MA36-09	Swift River	Protect this valuable resource; Re-issue McLaughlin Fish Hatchery permit with appropriate limits and monitoring requirements; Expand instream monitoring activities to confirm Aquatic Life Use status; Establish "responsible party" to implement dam safety recommendations at Upper Bondsville Mill Dam.
	MA36-10	Swift River	Track and monitor Palmer CSO abatement activities, including fecal coliform data, which will also be used to assess primary and secondary contact uses; Establish "responsible party" to implement dam safety recommendations at Upper Bondsville Mill Dam; Determine need for instream monitoring to assess impacts from Old Bondsville Factory Hazardous Waste Site; Determine need for WMA permit for new Belchertown wells.

Ware River	MA36-01	East Br. Ware R.	Analyze MDC BMI data to confirm Aquatic Life Use status; Conduct habitat and biological assessments related to streamflow; Conduct continuous temperature monitoring at USGS gage; Review Fitchburg Water Dept's compliance with their WMA permit; Evaluate Mare Meadow and Bickford Pond reservoir operations regarding withdrawal practices and minimum flows; Collect additional data on flow, DO and temperature; Evaluate flow management practices at lakes, and relate to elevated in-stream temperatures; Implement SWAP recommendations.
Watershed	Segment #	River Name	Recommendations
	MA36-02	West Br. Ware R.	Analyze MDC BMI data to confirm Aquatic Life Use status; Collect data to confirm that low pH, DO and % saturation are naturally occurring; Evaluate flow management practices at lakes, and relate to elevated temperatures in segment; Implement SWAP recommendations.
	MA36-36	Canesto Brook	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations.
	MA36-37	Burnshirt River	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Evaluate flow management practices at Queen lake, Stone Bridge and Williamsville Ponds, related to elevated temperatures in Burnshirt River.
	MA36-27	Ware River	Conduct habitat assessment related to streamflow; Conduct BMI and fish population surveys; Conduct continuous temperature monitoring at USGS gage; Collect additional data on flow, DO and temperature; Implement SWAP recommendations.
	MA36-03	Ware River	Conduct habitat assessment related to streamflow; Conduct BMI and fish population surveys; Conduct continuous temperature monitoring at USGS gage; Collect additional data on flow, DO and temperature; Investigate elevated metal concentrations found in NAWQA study; Evaluate USA West Service compliance with stormwater permit at landfill.
	MA36-04	Ware River	Re-issue Barre WWTP permit with appropriate limits and monitoring requirements.
	MA36-08	Prince River	Work with Prince River Stream Team to implement their recommendations, including trash removal; Analyze DWM Biocriteria project data to assess Aquatic Life Use status.
	MA36-05	Ware River	Require Hardwick WPCF (Wheelwright and Gilbertville) to conduct toxicity identification and reduction evalution and reduce testing requirements to one organism; Gilbertville facility should be upgraded to provide adequate treatment of landfill leachate; Re-issue Quabbin Wire & Cable NPDES permit with appropriate limits and monitoring requirements, and screen their effluent for toxicity; Identify source of and reduce sediment inputs near Rt. 32 bridge.

	MA36-06	Ware River	Track progress of Palmer CSO abatement activities and collect bacteria data to evaluate effectiveness; Require Ware WWTP to conduct toxicity testing and reduction, and run Ware River water for dilution.
	MA36-07	Ware River	Track progress of Palmer CSO abatement activities and collect bacteria data to evaluate effectiveness; Use data to assess Primary and Seconday Contact Recreation status.
Quaboag River	MA36-11	Sevenmile River	Investigate sources of bacteria, including failing septic systems; Review Bond Construction Corp. compliance with WMA registration; Evaluate flow management practices of lakes.
	MA36-20	Cranberry River	Conduct upstream/downstream BMI evaluation to evaluate effectiveness of Spencer WWTP dechlorination system, and to assess Aquatic Life Use status; Require Spencer WWTP to run Cranberry River water as dilution water in toxicity tests.
	MA36-12	Sevenmile River	None
	MA36-13	East Brookfield R.	Evaluate East Brookfield Water Dept. compliance with their WMA registration.
Watershed	Segment #	River Name	Recommendations
	MA36-14	Quaboag River	Re-issue Brookfield Wire Co. NPDES permit with appropriate limits and monitoring requirements.
	MA36-18	Forget-Me-Not Br.	Require North Brookfield WWTP to continue to monitor this brook as part of their toxicity testing; Investigate potential for road runoff at multiple East Brookfield road crossings as contributors to instream sedimentation.
	MA36-28	Forget-Me-Not Br.	Make appropriate changes in North Brookfield WWTP NPDES permit; Investigate potential for road runoff at multiple East Brookfield road crossings as contributors to instream sedimentation; Conduct instream monitoring of nutrients and DO upstream and downstream of North Brookfield WWTP to isolate sources of organic enrichment.
	MA36-19	Dunn Brook	None
	MA36-15	Quaboag River	Re-issue Wm. E. Wright NPDES permit with appropriate limits and monitoring requirements; Monitor Warren Water Dept. compliance with their WMA registration.
	MA36-16	Quaboag River	Warren WWTP should implement changes necessary to ensure compliance with TRC and fecal coliform limits, and address color problem, including identifying the industrial user responsible; Remove the CSO designation for this segment in the next SWQS revision; Investigate sources of elevated fecal coliform levels during dry weather conditions.
	MA36-17	Quaboag River	Track progress of Palmer CSO abatement activities, and collect bacteria data to evaluate effectiveness, and to assess Primary and Secondary Contact Recreation status.
	MA36-21	Chicopee Brook	None
Chicopee River	MA36-22	Chicopee River	Track progress of Palmer CSO abatement activities, and collect bacteria data to evaluate effectiveness, and to assess Primary and Secondary Contact Recreation status.

	MA36-23	Chicopee River	Determine if CEEMI installed automated slide gate and if so, effects on flows; Collect data on effects of hydroelectric activities on streamflow and habitat; Address the lack of fish passage at hydropower dams.
	MA36-26	Calkins Brook	None
	MA36-24	Chicopee River	Track progress of Ludlow, Chicopee, and Springfield CSO abatement activities, and collect bacteria data to evaluate their effectiveness and to assess Recreational Uses status; Re-issue Solutia Inc. NPDES permit with appropriate limits and monitoring requirements; Make other appropriate changes to that permit, and to their water usage; Re-issue Chicopee WWTP permit with appropriate limits and monitoring requirements; Terminate the Westover ARB NPDES permit if they receive coverage under their multi-sector general stormwater permit; Issue Hanson Group an NPDES permit with appropriate limits and monitoring requirements; Collect data on effects of hydroelectric activities on streamflow and habitat; Address the lack of fish passage at hydropower dams.
	MA36-25	Chicopee River	Track progress of Chicopee CSO abatement activities, and collect bacteria data to evaluate their effectiveness and to assess Recreational Uses status; Collect data to evaluate effects of hydroelectric activities on streamflow and habitat; Address the lack of fish passage at hydropower dams; Support efforts to install an eel way at Dwight Dam; Determine need for additional instream monitoring to assess possible impacts of former Uniroyal Complex Hazardous Waste Site.

requirements, and the tracking of progress with CSO abatement activities in the lower portion of the basin. Many of these recommendations will guide decisions and actions made by EOEA during coming years.

Lake assessments are summarized in Table 27. Here again, lack of data precluded the assessment of many lakes and ponds, and additional data collection will be an important area of focus for future team actions. Trophic status was assessed for 76 lakes, although it could not be determined definitively for 42 (55.3%) of them. Of the remaining 34, 26 were considered eutrophic, 3 were hypereutrophic, 2 dystrophic, 2 mesotrophic and 1 (Quabbin Reservoir) oligotrophic. Forty-eight lakes were considered impaired for one or more uses. Causes of impairment included non-native and noxious plants, turbidity, mercury, and flow alteration. With the exception of mercury, the causes of impairment may be indicative of enrichment, especially from nutrients resulting from stormwater runoff, failing or substandard sewage disposal systems, and/or agricultural runoff.

Recommendations for lakes in the basin include: additional quality-assured data collection, review and implementation of SWAP recommendations for those lakes that serve as drinking water supplies, “spot treatments” of isolated nuisance plant occurrences as well as programs to handle the more extensive plant infestations, prevention programs to check the future spread of nuisance plants, and investigations of the spread of specific nuisance plants in a number of specific waterbodies.

The MDC (now DCR) conducts extensive water quality monitoring at more than 25 sites in the Quabbin and Ware River drainages, involving both tributary and reservoir sampling. Their data represents the most extensive and intensive assessment of water quality conditions in the basin. As expected, given the high degree of protection afforded the Quabbin watershed, the MDC monitoring results confirm the high quality of the water entering and leaving the reservoir.

Water quality data is also collected by various other agencies and groups in the basin. A number of lake or pond associations sample water quality conditions in their respective waterbodies, and sometimes in their tributaries. Other sampling is, or has been, done by the Chicopee River Watershed Council, the U.S. Army Corps of Engineers (at their Barre Falls and Conant Brook facilities), local schools, conservation commissions, and boards of health. Although these combined activities represents a substantial amount of water quality sampling, most of this sampling is conducted in specific locations, or on irregular schedules. There is no standardization of protocols or coordination of efforts with this sampling.

DEP's SMART represents the best dataset of water quality that is collected at strategic locations on a regular basis. However, at present that program only monitors 5 sites in the entire basin, and all five are located along mainstem sections of major rivers. While such sampling provides useful information, those factors limit the utility of the data for such uses as characterizing conditions throughout the basin, or identifying potential sources of water quality degradation.

In summary, a fair amount of information is available on water quality at various locations in the basin. However, no systematic, basin-wide monitoring program is currently in place in the Chicopee River Watershed.

2. Classifications

Several classifications of water quality in the Chicopee River Basin are available from EPA and DEP. The EPA "Index of Watershed Indicators" web site gives the Chicopee a "score" of 6, which indicates "More Serious Problems; High Vulnerability". This score is based on evaluations of: designated use attainment (less than 20% of all assessed segments support all designated uses); fish consumption advisories (6 advisories in 1998); high levels of population change (1980 to 1990); degree of hydrologic modifications; high numbers of aquatic species at risk; and moderate levels of wetland loss, nitrogen deposition, and both agricultural and urban runoff potential. It should be noted, however, that some of this data may not be basin-specific (e.g., wetland loss figures are statewide) or up to date.

Table 27. Chicopee River Basin Lake Assessments (from DEP Chicopee River Basin 1998 Water Quality Assessment Report)

LAKE, LOCATION	ID #	SIZE (Acres)	TROPHIC STATE	USE ASSESSMENT	CAUSES
Adams Pond, Oakham	MA36001	30	D	1° Contact- P(30) 2° Contact- P(30) Aesthetics- P(30)	Turbidity
Asnacomet Pond,* Hubbardston	MA36005	127	U	2° Contact- S(127) Aesthetics- S(127)	
Beaver Lake, Ware	MA36010	150	U	ALUS- P(150) 2° Contact- S(150) Aesthetics- S(150)	Non-native plants (Mh, Ms)
Bennett Street Pond, Palmer	MA36014	6	E	1° Contact- N(6) 2° Contact- N(6) Aesthetics- N(6)	Noxious plants
Bickford Pond,* Hubbardston/Princeton	MA36015	163	U	2° Contact- S(163) Aesthetics- S(163)	
Brigham Pond*, Hubbardston	MA36020	45	U	2° Contact- S(45) Aesthetics- S(45)	
Brookhaven Lake, West Brookfield	MA36021	34	E	1° Contact- P(34) 2° Contact- P(34) Aesthetics- P(34)	Turbidity
Brooks Pond,* Petersham	MA36022	86	E	1° Contact- N(86) 2° Contact- N(86) Aesthetics- N(86)	Noxious plants
Brooks Pond, North Brookfield/New Braintree/Oakham/Spencer	MA36023	190	U	ALUS- P(190) 2° Contact- S(165); U(25) Aesthetics- S(165); U(25)	Non-native plants (Mh)
Browning Pond, Oakham/Spencer	MA36025	106	E	ALUS- P(106) 1° Contact- N(25); U(81) 2° Contact- S(81); N(25) Aesthetics- S(81); N(25)	Non-native plants (Mh) Noxious plants
Carter Pond,*,Petersham	MA36029	44	U	1° Contact- N(22); U(22) 2° Contact- S(22); N(22) Aesthetics- S(22); N(22)	Noxious plants
Chicopee Brook Pond, Monson	MA36031	9	E	1° Contact-N(7); U(2) 2° Contact- S(2); N(7) Aesthetics- S(2); N(7)	Noxious plants
Chicopee Reservoir, Chicopee	MA36033	22	U	2° Contact- S(22) Aesthetics- S(22)	
Cloverdale Street Pond, Rutland	MA36036	19	E	1° Contact- N(19) 2° Contact- N(19) Aesthetics- N(19)	Noxious plants
Conant Brook Reservoir, Monson	MA36038	4	U	2° Contact- S(4) Aesthetics- S(4)	
Connor Pond,* Petersham	MA36039	22	U	2° Contact- S(22) Aesthetics- S(22)	
Crystal Lake, Palmer	MA36043	16	U	2° Contact- S(16) Aesthetics- S(16)	
Cunningham Pond,* Hubbardston	MA36044	27	E	1° Contact- N(27) 2° Contact- N(27) Aesthetics- N(27)	Noxious plants
Cusky Pond, New Braintree	MA36045	33	E	1° Contact- N(33) 2° Contact- N(33) Aesthetics- N(33)	Noxious plants
Dean Pond, Oakham	MA36050	64	E	1° Contact- P(64) 2° Contact- P(64) Aesthetics- P(64)	Noxious plants Turbidity
Dean Pond, Monson/Brimfield	MA36049	12	U	2° Contact- S(12) Aesthetics- S(12)	
Demond Pond,* Rutland	MA36051	120	M	2° Contact- S(120)	

				Aesthetics- S(120)	
Dimmock Pond, Springfield	MA36053	9.5	E	2° Contact- S(9.5) Aesthetics- S(9.5)	
Doane Pond,* North Brookfield	MA36054	28	H	1° Contact- N(17); U(11) 2° Contact- S(11); N(17) Aesthetics- S(11); N(17)	Noxious plants
Edson Pond,* Rutland	MA36180	36	E	1° Contact- P(7); N(29) 2° Contact- P(7); N(29) Aesthetics- P(7); N(29)	Noxious plants Turbidity
Fivemile Pond, Springfield	MA36061	35.3	U	2° Contact- S(35.3) Aesthetics- S(35.3)	
Fivemile Pond South, Springfield	MA36182	4	E	1° Contact- N(4) 2° Contact- N(4) Aesthetics- N(4)	Noxious plants
Forest Lake, Palmer	MA36063	45	U	ALUS- P(45) 1° Contact- N(11); U(34) 2° Contact- S(34); N(11) Aesthetics- S(34); N(11)	Non-native plants (Ms) Noxious plants
Gaston Pond,* Barre	MA36065	15	U	1° Contact- N(3); U(12) 2° Contact- S(12); N(3) Aesthetics- S(12); N(3)	Noxious plants
Hardwick Pond, Hardwick	MA36066	66	U	ALUS- P(66) 1° Contact- P(66) 2° Contact- P(66) Aesthetics- P(66)	Non-native plants (Cc, Mh) Turbidity
Harris Pond, Ludlow	MA36067	12	E	1° Contact- N(7); U(5) 2° Contact- S(5); N(7) Aesthetics- S(5); N(7)	Noxious plants
Haviland Pond, Ludlow	MA36069	25	U	2° Contact- S(25) Aesthetics- S(25)	
Horse Pond,* North Brookfield	MA36072	63	E	2° Contact- S(63) Aesthetics- S(63)	
Knights Pond,* Belchertown	MA36077	36	U	2° Contact- S(36) Aesthetics- S(36)	
Lake Lashaway, North Brookfield/East Brookfield	MA36079	270	E	ALUS- P(270) 2° Contact- S(270) Aesthetics- S(270)	Non-native plants (Cc)
Lake Lorraine, Springfield	MA36084	28.5	U	ALUS- P(28.5) 2° Contact- S(28.5) Aesthetics- S(28.5)	Non-native plants (Ms)
Lake Whittemore, Spencer	MA36165	52	E	1° Contact- P(52) 2° Contact- P(52) Aesthetics- P(52)	Turbidity
Long Pond,* Rutland	MA36082	168	H	ALUS- P(168) 1° Contact- P(84); N(84) 2° Contact- P(84); N(84) Aesthetics- P(84); N(84)	Non-native plants (Mh) Noxious plants Turbidity
Long Pond, Springfield	MA36083	18	E	1° Contact- N(18) 2° Contact- N(18) Aesthetics- N(18)	Noxious plants
Lovewell Pond,* Hubbardston	MA36085	82	U	1° Contact- N(9); U(73) 2° Contact- S(73); N(9) Aesthetics- S(73); N(9)	Noxious plants
Mare Meadow Reservoir,* Westminister/Hubbardston	MA36090	240	U	2° Contact- S(240) Aesthetics- S(240)	
Mare Meadow Reservoir North,* Westminster	MA36178	38	U	2° Contact- S(38) Aesthetics- S(38)	
Minechoag Pond, Ludlow	MA36093	21	E	1° Contact- N(10); U(11) 2° Contact- S(11); N(10) Aesthetics- S(11); N(10)	Noxious plants
Mona Lake, Springfield	MA36094	11	E	1° Contact- N(7); U(4) 2° Contact- S(4); N(7) Aesthetics- S(4); N(7)	Noxious plants

Moose Hill Reservoir, Spencer/Leicester	MA36179	51	D	1° Contact- P(51) 2° Contact- P(51) Aesthetics- P(51)	Turbidity
Moosehorn Pond,* Hubbardston	MA36097	67	E	ALUS- P(67) 2° Contact- S(67) Aesthetics- S(67)	Non-native plants (Mh)
Muddy Pond,* Oakham/Rutland	MA36102	23	U	1° Contact- P(8); N(15) 2° Contact- P(8); N(15) Aesthetics- P(8); N(15)	Noxious plants Turbidity
Nine Mile Pond, Wilbraham	MA36107	30	U	2° Contact- S(30) Aesthetics- S(30)	
Old Reservoir, Barre	MA36114	37	U	ALUS- N(10); U(27) 1° Contact- P(27); N(10) 2° Contact- P(27); N(10) Aesthetics- P(27); N(10)	Flow alteration Turbidity
Palmer Reservoir,* Palmer	MA36115	8	U	2° Contact- S(8) Aesthetics- S(8)	
Paradise Lake, Monson	MA36116	17	U	2° Contact- S(17) Aesthetics- S(17)	
Pattaquattic Pond, Palmer	MA36117	18	U	2° Contact- S(18) Aesthetics- S(18)	
Peppers Mill Pond, Ware	MA36121	11	U	1° Contact- N(6); U(5) 2° Contact- S(5); N(6) Aesthetics- S(5); N(6)	Noxious plants
Perry Hill Pond, Hubbardston	MA36122	23	U	2° Contact- S(23) Aesthetics- S(23)	
Pottapaug Pond Basin,* (northeast basin Quabbin Reservoir) Petersham/Hardwick	MA36125	568	U	Fish consumption- N(568) 2° Contact- S(40); U(528) Aesthetics- S(40); U(528)	Metals (Hg)
Powder Mill Pond, Barre	MA36126	18	U	Fish consumption- N(18) 2° Contact- S(18) Aesthetics- S(18)	Metals (Hg)
Quabbin Reservoir,* New Salem Shutesbury/Pelham/Hardwick/ Ware /Petersham/Belchertown	MA36129	25000	O	Fish consumption- N(25,000) 2° Contact- S(25,000) Aesthetics- S(25,000)	Metals (Hg)
Quaboag Pond, Brookfield/East Brookfield	MA36130	537	H	ALUS- P(537) Fish consumption- N(537)	Non-native plants (Cc, Mh, Ms) Metals (Hg)
Quacumquasit Pond (South Pond), Brookfield/East Brookfield/ Sturbridge	MA36131	218	U	ALUS- P(218) Fish consumption- N(218) 2° Contact- S(218) Aesthetics- S(218)	Non-native plants (Cc, Ms, Mh) Metals (Hg)
Queen Lake,* Phillipston	MA36132	134	U	2° Contact- S(134) Aesthetics- S(134)	
Red Bridge Impoundment, Ludlow/Wilbraham	MA36171	83	U	2° Contact- S(83) Aesthetics- S(83)	
Shaw Pond,* Leicester	MA36138	64	M	2° Contact- S(64) Aesthetics- S(64)	
South Barre Reservoir, Barre	MA36141	21	U	1° Contact- P(21) 2° Contact- P(21) Aesthetics- P(21)	Turbidity
Spectacle Pond, Wilbraham	MA36142	16	U	1° Contact- N(5); U(11) 2° Contact- S(11); N(5) Aesthetics- S(11); N(5)	Noxious plants
Springfield Reservoir,* Ludlow	MA36145	393	U	2° Contact- S(393) Aesthetics- S(393)	
Stone Bridge Pond,* Templeton	MA36148	32	E	1° Contact- P(4); N(28) 2° Contact- P(4); N(28) Aesthetics- P(4); N(28)	Noxious plants Turbidity
Sugden Reservoir, Spencer	MA36150	83	U	1° Contact- P(83) 2° Contact- P(83) Aesthetics- P(83)	Turbidity
Thayer Pond,* Rutland	MA36181	46	E	1° Contact- N(46)	Noxious plants

				2° Contact- N(46) Aesthetics- N(46)	
Thompson Lake, Palmer	MA36154	32	U	2° Contact- S(32) Aesthetics- S(32)	
Thompsons Pond, Spencer	MA36155	117	U	ALUS- P(117) 1° Contact- P(82); N(35) 2° Contact- P(82); N(35) Aesthetics- P(82); N(35)	Non-native plants (Ms) Noxious plants Turbidity
Town Barn Beaver Pond, Petersham	MA36156	6	E	1° Contact- N(6) 2° Contact- N(6) Aesthetics- N(6)	Noxious plants
Turkey Hill Pond, Rutland/Paxton	MA36157	90	U	ALUS- P(90)	Non-native plants (Mh)
Waite Pond,* Hubbardston	MA36161	34	U	2° Contact- S(34) Aesthetics- S(34)	
Wickaboag Pond, West Brookfield	MA36166	320	E	2° Contact- S(320) Aesthetics- S(320)	
Williamsville Pond,* Hubbardston	MA36167	57	E	1° Contact- N(20); U(37) 2° Contact- N(20); U(37) Aesthetics- N(20); U(37)	Noxious plants

* Indicates Class A (water supply) waterbody; all others are Class B. (Bold indicates 1998 303(d) listed lakes). ID # – Waterbody Identification Code
Trophic State: D = dystrophic, E = eutrophic, H = hypereutrophic, M = mesotrophic, O = oligotrophic, U = undetermined.
Non-native Aquatic Plants: Cc = *Cabomba caroliniana,* Mh = *Myriophyllum heterophyllum,* Ms = *Myriophyllum spicatum*
Use Assessment: Uses (Aquatic Life - ALUS, Fish Consumption, Primary Contact Recreational - 1° Contact, Secondary Contact Recreational - 2° Contact, Aesthetics), Status (S = support, T = threatened, P = partial support, N = non-support, U = undetermined/not assessed)

The Massachusetts Surface Water Quality Standards (SWQS) provide a classification scheme for 24 river segments and drinking water reservoirs in the basin (Table 28). These include 10 Class A Public Water Supplies, 5 Class B Cold Water segments, 7 Class B Warm Water segments, and 2 Class B Warm Water CSO segments. The latter includes all 17.9 miles of the Chicopee River, and one segment of the Quaboag River (which no longer has CSO discharges, and thus should be reclassified when the SWQS are revised). The other main classification of waters in the Chicopee basin is DEP's 303d list of impaired waterbodies. This list, produced under the requirements of section 303d of the federal Clean Water Act, includes 4 rivers and 11 lakes or ponds. Pathogens are the primary cause of impairment for the rivers, and the presence of noxious aquatic plants is the most commonly identified impairment cause for the lakes and ponds (Table 29).

Total Maximum Daily Load (TMDL) analyses were produced for 7 of the waterbodies on the 303d list during 2001. The focus of those TMDLs was phosphorus enrichment, resulting in excessive aquatic plant growth. Two public meetings were held to present and discuss the results of the TMDL models, and to provide recommendations on remedial measures that could be taken to improve the condition of the waterbodies. Several projects are now underway, or in the planning stages, to start addressing those recommendations. The 303d classification process has resulted in a list of waterbodies that may not reflect the true status and remediation needs of the waterbodies in the basin. Thus, it is likely that there will be substantial interest in modifying the list (involving both the removal of presently listed waterbodies, and the addition of new ones) when the opportunity arises.

3. Modeling Results

A number of models are currently available for predicting water quality conditions within specified drainage areas. Two such models have been used in the Chicopee basin to date. Under a former MWI contract administered by the DEP, Environmental Science Services, Inc. (ESS) used the "Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds" (i.e., the "P8" model) to produce estimates of total phosphorus (TP), total Kjeldahl nitrogen (TKN) and total suspended solids (TSS) in 30 drainage areas in the Quaboag sub-basin. Separate analyses were conducted for 1985 conditions (based on the most recent land use data available at the time of the analyses), and for year 2010 conditions (based on projections of population levels and associated land use changes).

Table 28. Water quality classifications of waterbodies in the Chicopee River Basin

Watershed	Name/Location	River Miles	Class	Comments/Restrictions
Swift River	*Swift River* – confluence with Ware River to Winsor Dam	0.0 – 9.8	B	Cold Water
	Swift River – upstream of Winsor Dam	above 9.8	A	Public Water Supply
Ware River	*Ware River* – confluence with Quaboag River to South Barre	0.0 – 27.3	B	Warm Water
	Ware River - South Barre to MDC intake	27.3 – 29.1	B	Cold Water; High Quality water
	Ware River - MDC intake to source	29.1 – 34.0	A	Public Water Supply
	Barre Town Reservoir – source to outlet in Barre, plus tributaries thereto	--	A	Public Water Supply
	Mare Meadow Reservoir – source to outlet in Hubbardston, plus tributaries thereto	--	A	Public Water Supply
	Bickford Pond – source to outlet in Hubbardston, plus tributaries thereto	--	A	Public Water Supply
	Prince River, entire length		B	Cold Water; High Quality water
Quaboag River	*Quaboag River* - confluence with Ware River to Warren POTW	0.0 – 13.1	B	Warm Water; CSO
	Quaboag River - Warren POTW to Rt. 67	13.1 – 19.2	B	Warm Water
	Quaboag River - Rt. 67 to source	19.2 – 24.9	B	Warm Water
	Seven Mile River – confluence with E. Brookfield River to Spencer WWTP	0.0 – 2.4	B	Warm Water
	Seven Mile River – Spencer WWTP to source	2.4 – 8.6	B	Warm Water; High Quality water
	East Brookfield River – entire length	0.0 – 2.2	B	Warm Water
	Dunn Brook – confluence with Quaboag River to N. Brookfield WWTP	0.0 – 3.3	B	Warm Water
	Dunn Brook – N. Brookfield WWTP to source	3.3 – 4.9	B	Cold Water; High Quality water
	Chicopee Brook – entire length	0.0 – 7.0	B	Cold Water
	Doane Pond and Horse Pond – source to outlet in N. Brookfield, plus tributaries thereto	--	A	Public Water Supply
	Palmer Reservoir – source to outlet in Palmer, plus tributaries thereto	--	A	Public Water Supply
	Shaw Pond – source to outlet in Leicester, plus tributaries thereto	--	A	Public Water Supply
Chicopee River	*Chicopee River* – confluence with CT River to confluence with Ware and Quaboag Rivers	0.0 – 17.9	B	Warm Water; CSO
	Springfield Reservoir – source to outlet in Ludlow, plus tributaries thereto	--	A	Public Water Supply
	Nash Hill Reservoir – source to outlet, plus tributaries thereto to Ludlow	--	A	Public Water Supply

Table 29. 1998 303(d) List of Waters, Chicopee River Basin (from DEP 2001)

1998 303(d) Listed Waterbody		Cause of Impairment
Chicopee River	Source to confluence with Connecticut River, Chicopee	Pathogens (fecal coliform bacteria)
Quaboag River	Rte 32 bridge to confluence with Ware River, Palmer	Pathogens (fecal coliform bacteria)
Seven mile River	Confluence with Cranberry River, Spencer to confluence with East Brookfield River, East Brookfield	Pathogens (fecal coliform bacteria)
Cranberry River	Source to confluence with Seven mile River, Spencer	Chlorine
Bemis Pond	Chicopee	Suspended solids
Browning Pond	Oakham/Spencer	Organic enrichment/ low DO, noxious aquatic plants
Dimmock Pond	Springfield	Noxious aquatic plants
Eames Pond	Paxton	Organic enrichment/ low DO, noxious aquatic plants
Long Pond	Springfield	Noxious aquatic plants
Minechoag Pond	Ludlow	Noxious aquatic plants
Mona Lake	Springfield	Noxious aquatic plants
Spectacle Pond	Wilbraham	Noxious aquatic plants
Sugden Reservoir	Spencer	Nutrients, organic enrichment/ low DO
Wickaboag Pond	West Brookfield	Noxious aquatic plants, turbidity
Alden Pond *	Ludlow	Nutrients, noxious aquatic plants

Just over 1/3 of the drainage areas modeled were determined to have unacceptable water quality (using 1985 data), with that fraction predicted to rise to ½ by 2010 (ESS 2001). In addition to the future increase in the number of impacted drainage areas, the modeling also predicted an increase in the degree of impairment in those areas currently considered impacted.

Limited field sampling was also conducted as part of this project. That sampling documented substantial increases in TP and TSS in response to storm events, indicating that NPS pollution is likely to be a major contributor to water quality impairment within the Quaboag sub-basin. Areas suspected of generating significant NPS pollution in the project area include moderate-density residential areas, agricultural lands, urban and commercial areas, golf courses and areas with ongoing construction activities.

The second modeling effort was conducted by the former Chicopee River Watershed Team Leader, using the Watershed Analyst tools available through MassGIS. Those tools provide summaries, estimates, and predictions of land use, percent imperviousness, and annual pollutant loadings (for nitrogen, phosphorus, and TSS) for discrete subwatersheds. This methodology is based on published accounts of the correlations between various land use types and their contributions to imperviousness and pollutant loads.

To facilitate the use of the Watershed Analyst tools, the basin was divided into 44 subwatersheds, ranging in size from approximately one to almost 25 square miles in size (Figure 41). Since it is largely protected and undeveloped, and since the MDC (now DCR) closely monitors the area, the Quabbin Reservoir drainage area was left intact, and not sub-divided for this analysis. The remaining 43 subwatersheds are all direct tributaries to the Chicopee, Swift, Ware, or Quaboag Rivers. In each of those four major watersheds, additional land area that drains directly into the rivers was included in a catch-all "mainstem" category.

Results of the Watershed Analyst modeling showed wide variability in both predicted pollutant loads and imperviousness (Table 30 and Appendix F). Most subwatersheds (38 of 44, or 86%) had estimated imperviousness of less than 5%. Only 4 had greater than 10% imperviousness, although 3 of these exceeded 30%, which is indicative of severely-degraded stream systems.

Pollutant load estimates were converted to pounds per year per square mile to allow for easier comparisons. While no "standards" for pollutants per square mile of drainage area exist, comparisons among subwatersheds are still informative. For example, phosphorus estimates ranged from a low of 74.5 lbs/mi^2/yr in the Parkers Brook subwatershed to 998.3 lbs/mi^2/yr for Abbey Brook. Similarly, nitrogen estimates ranged

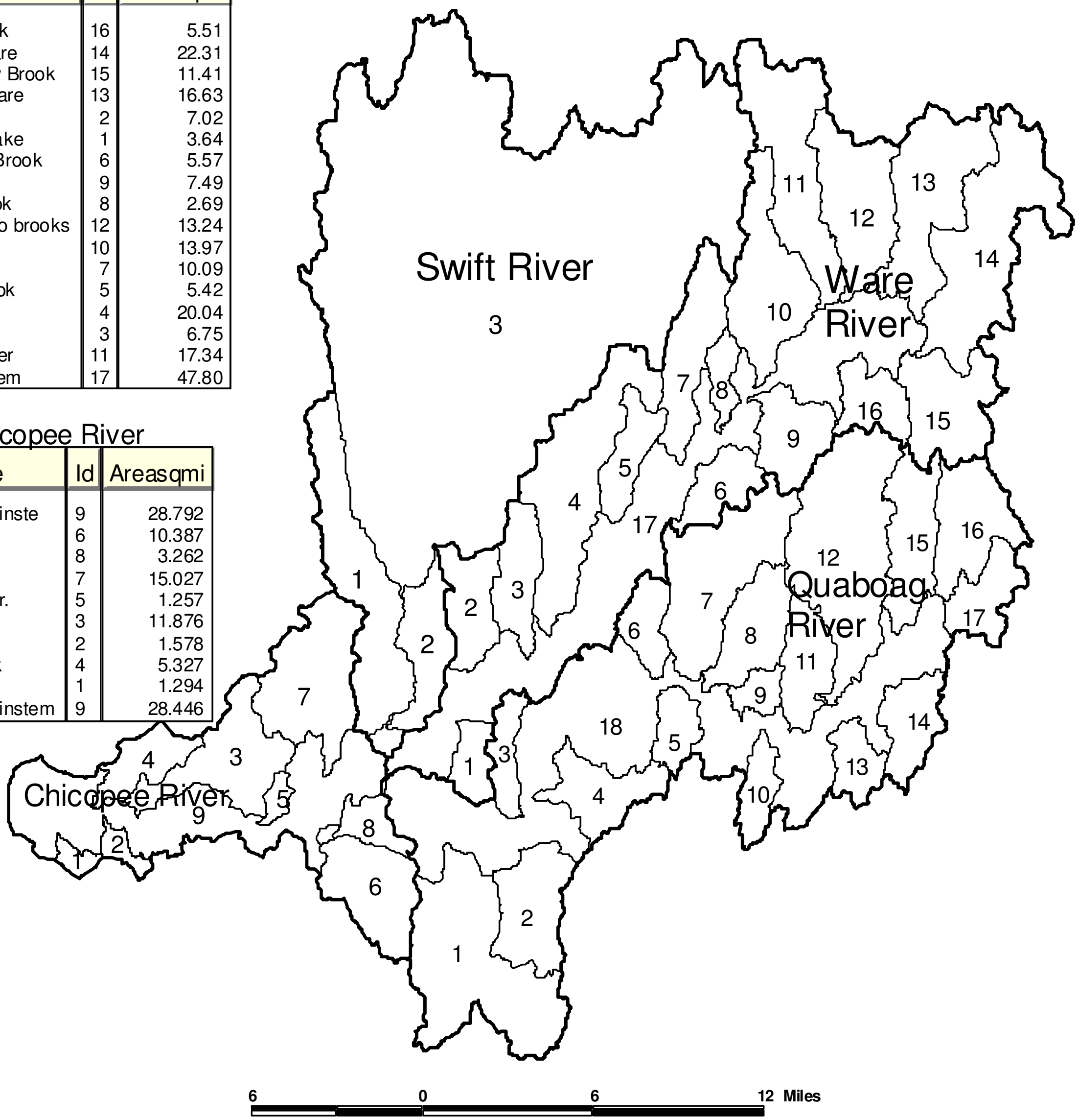
Figure 41. Chicopee River Basin Subwatersheds.

Ware River

Name	Id	Areasqmi
Parkers Brook	16	5.51
E Branch Ware	14	22.31
Longmeadow Brook	15	11.41
W Branch Ware	13	16.63
Penny Brook	2	7.02
Thompson Lake	1	3.64
Winimusset Brook	6	5.57
Pratt Brook	9	7.49
Pine Hill Brook	8	2.69
Natty Canesto brooks	12	13.24
Prince River	10	13.97
Moose Brook	7	10.09
Danforth Brook	5	5.42
Muddy Brook	4	20.04
Flat Brook	3	6.75
Burnshirt River	11	17.34
Ware Mainstem	17	47.80

Chicopee River

Name	Id	Areasqmi
Chicopee Mainste	9	28.792
Twelve Mile	6	10.387
Calkins	8	3.262
Broad Brook	7	15.027
Minechoag Br.	5	1.257
Fuller Brook	3	11.876
Poor Brook	2	1.578
Cooley Brook	4	5.327
Abbey Brook	1	1.294
Chicopee Mainstem	9	28.446



Quaboag River

Name	Id	Areasqmi
Shaw Brook	17	6.033
Turkey Hill Brook	16	10.205
Seven Mile River	15	9.469
Cranberry River	14	6.493
Five Mile River	12	24.883
Great Brook	13	4.193
Dunn Brook	11	6.779
Trout Brook	10	3.968
Willow Brook	9	2.377
Coys Brook	8	8.336
Lake Wickaboag	7	17.728
Naultaug Brook	5	3.891
Lamberton Brook	6	4.542
Kings Brook	3	4.046
Blodgett Mill Br	4	7.712
Foskett Mill Brook	2	9.783
Chicopee Brook	1	24.027
Quaboag Mainstem	18	57.460

Swift River

Name	Id	Areasqmi
Swift below Quabbin	2	7.951
Quabbin Watershed	3	187.516
Jabish Brook	1	18.585
Swift River Mainstem	4	0.960

Table 30 – Estimated pollution loads and imperviousness by subwatershed

Watershed	Subwatershed	Acres	Sq.Miles	% Imp.	Estimated gross loads			Estimated loads per sq mi		
					N	P	SS	N	P	SS
Chicopee	12-mile Brook	6647.8	10.4	1.7	20077.3	1573.0	366585.6	1932.9	151.4	35292.1
	Broad Brook	9616.9	15.0	2.3	30523.5	3151.0	903567.8	2031.3	209.7	60132.0
	Calkins Brook	2087.3	3.3	4.4	7167.4	737.1	194178.9	2197.6	226.0	59538.4
	Fuller Brook	7600.4	11.9	6.4	34146.3	4811.5	1313600.1	2875.3	405.2	110613.1
	Minechoag Brook	804.3	1.3	11.3	3990.4	604.0	153672.2	3175.3	480.6	122280.5
	Cooley Brook	3409.0	5.3	31.9	23006.8	4594.5	1421421.8	4319.3	862.6	266855.4
	Abbey Brook	828.2	1.3	35.0	7313.3	1291.8	332281.7	5651.4	998.3	256774.1
	Poor Brook	1009.7	1.6	47.2	8667.5	1569.9	447733.5	5493.9	995.1	283796.6
Swift	Jabish Brook	11894.0	18.6	2.4	37648.2	3573.2	935069.1	2025.8	192.3	50314.8
	Quabbin Res	120002.2	187.5	1.2	321857.6	29052.2	5727611.2	1716.5	154.9	30546.7
	Swift below QR	5087.7	7.9	2.4	16213.6	1560.5	373620.8	2039.6	196.3	46999.1
Ware	Parkers Brook	3525.6	5.5	1.0	9225.0	410.3	90182.0	1674.6	74.5	16370.7
	E. Br. Ware River	14279.9	22.3	1.6	41461.2	3169.5	771005.7	1858.2	142.1	34555.1
	Longmeadow Br.	7304.6	11.4	2.0	22950.9	2073.4	573016.0	2010.9	181.7	50205.4
	W. Br. Ware River	10644.7	16.6	1.7	30441.9	2120.7	485225.1	1830.3	127.5	29173.6
	Penny Brook	4490.8	7.0	2.0	13593.7	1108.7	274889.1	1937.3	158.0	39175.4
	Thompson Lake	2330.5	3.6	3.4	8179.2	896.2	227872.7	2246.2	246.1	62578.2
	Winimusset Brook	3566.7	5.6	1.2	9826.8	940.1	385826.8	1763.3	168.7	69231.8
	Pratt Brook	4794.0	7.5	1.4	13941.0	1211.5	412065.1	1861.1	161.7	55010.8
	Pine Hill Brook	1722.5	2.7	1.2	4896.3	412.6	176285.9	1819.2	153.3	65499.6
	Natty/Canesto	8474.4	13.2	1.9	25286.9	1985.1	530794.3	1909.7	149.9	40086.4
	Prince River	8940.6	14.0	2.0	27391.7	2507.0	846360.9	1960.8	179.5	60585.5
	Moose Brook	6454.4	10.1	1.1	17945.3	1435.9	475563.5	1779.4	142.4	47155.5
	Danforth Brook	3470.7	5.4	1.8	10683.0	1109.9	363318.3	1970.0	204.7	66996.2
	Muddy Brook	12825.7	20.0	1.8	38164.0	3019.6	841253.8	1904.4	150.7	41978.4
	Flat Brook	4318.0	6.7	1.9	13246.3	1193.0	351796.5	1963.3	176.8	52142.1
	Burnshirt River	11099.4	17.3	1.5	31741.2	2123.3	512875.1	1830.2	122.4	29572.8
Quaboag	Shaw Brook	3861.1	6.0	2.0	11937.0	1177.6	338505.7	1978.6	195.2	56109.3
	Turkey Hill Brook	6530.9	10.2	2.7	21931.5	2336.8	638533.7	2149.2	229.0	62573.5

Table 30. (Cont).

Watershed	Subwatershed	Acres	Sq.Miles	% Imp.	Estimated gross loads			Estimated loads per sq mi		
					N	P	SS	N	P	SS
	Seven Mile River	6060.1	9.5	1.6	18123.5	1677.6	505098.9	1914.0	177.2	53342.9
	Cranberry River	4155.4	6.5	2.0	13330.4	1306.8	393123.9	2053.1	201.3	60547.6
	Five Mile River	15924.9	24.9	1.9	47550.9	4619.6	1507681.3	1911.0	185.7	60591.7
Quaboag	Great Brook	2683.6	4.2	1.3	7812.8	577.7	170941.4	1863.2	137.8	40767.1
(cont.)	Dunn Brook	4337.7	6.8	3.2	14176.8	1560.7	472395.8	2091.7	230.3	69699.0
	Trout Brook	2539.3	4.0	2.0	7461.0	583.8	162117.5	1880.5	147.1	40859.8
	Willow Brook	1521.2	2.4	5.2	5420.4	587.2	172779.1	2280.5	247.0	72691.7
	Coys Brook	5334.6	8.3	3.4	19075.4	2397.2	792810.0	2288.5	287.6	95114.6
	Lake Wickaboag	11345.8	17.7	2.1	35138.4	3724.7	1210074.8	1982.1	210.1	68258.6
	Naultaug Brook	2490.3	3.9	1.3	7010.6	548.8	197335.9	1801.7	141.0	50714.8
	Lamberton Brook	2906.9	4.5	1.5	8459.6	714.9	211213.1	1862.5	157.4	46501.9
	Kings Brook	2589.0	4.0	2.1	7238.3	471.3	134777.4	1789.3	116.5	33316.9
	Blodgett Mill Br.	4935.5	7.7	2.6	14777.4	1251.8	358297.9	1916.2	162.3	46461.5
	Foskett Mill Br.	6260.8	9.8	2.2	18324.5	1344.8	340537.7	1873.2	137.5	34810.9
	Chicopee Brook	15376.8	24.0	2.9	51147.3	5139.9	1403862.9	2128.8	213.9	58430.4
OVERALL:		376083.9	587.6		1138502.1	108256.7	28497760.5	1937.4	184.2	48496.0
Mean				4.9				2216.9	240.7	68960.3
Median				2.0				1949.0	178.3	54176.8

from 1674.6 to 5651.4 lbs/mi^2/yr. TSS estimates varied from 16370.7 to 283796.6 lbs/mi^2/yr. As with the estimates of imperviousness, pollutant loads for the majority of subwatersheds were relatively comparable, except for a small number of "outlier" subwatersheds (Figure 42a), especially when graphed against the percent imperviousness of the subwatershed (Figure 42b).

In order to interpret the results of the pollutant loading analyses, and to prioritize subwatersheds for remedial attention, the subwatersheds were "ranked" for each of the 4 main analyses (i.e., % imperviousness, phosphorus, nitrogen & suspended solids) and a cumulative "score" developed for each. The individual rankings (1-44) reflect the pollutant load or % imperviousness estimates, ordered from lowest to highest. The individual rankings were then summed to derive a total "score" for each subwatershed. Thus, a low rank and/or score indicates that a subwatershed had low estimates of pollutant loads and/or imperviousness. As shown in Table 31, the subwatersheds with the highest 5 scores (i.e., most degraded) are all tributaries to the Chicopee. Two subwatersheds in the Quaboag Watershed (i.e. Coys & Willow) also scored high, although the actual pollutant load estimates for those subwatersheds were generally much lower than for the 5 Chicopee tributaries.

The results of both the ESS and the MassGIS modeling will help guide follow-up sampling and/or remediation action in the basin. Specific focus areas for this work will include 5 tributaries of the Chicopee River, and the 2 tributaries of the Quaboag River with the highest scores (see Table 31).

C. Water quantity

Water quantity issues in the Chicopee primarily relate to water withdrawals and transfers in the basin, and the impacts of dams on local flow conditions. The Chicopee has a wealth of surface water bodies, with a total of 174 recognized lakes, ponds, or impoundments covering more than 32,000 acres. Many of these have dams associated with them, and thus have the potential to alter river or stream flows. U.S. Fish & Wildlife Service (USFWS) data indicates that 111 dams that are considered to be barriers to fish movements occur in the basin. In addition, the Chicopee River basin is home to the largest interbasin transfer of drinking water in the state – i.e., the Quabbin Reservoir/Ware River Watershed portion of the MWRA system. Thus, flow issues are of concern in the Chicopee.

Dams occur throughout the basin (see Figure 33), although many of these are small and impound relatively little water. The larger dams in the basin are generally associated with public water supply reservoirs or hydroelectric facilities, and these can have substantial influence on local flow conditions. DEP's 1998 water quality assessment report for the basin (DEP 2001) identified two portions of the basin where dams and/or their associated water withdrawals may have adverse impacts on downstream conditions: 1) the upper Ware River Watershed, where a number of impoundments may be causing alterations in flow, temperature and DO; and 2) the Chicopee River, where large hydroelectric dams may be adversely affecting flow and habitat conditions.

Six hydroelectric dams occur along the Chicopee River, in Wilbraham, Ludlow, Chicopee, and Springfield. Four of these include canal structures (up to 3000 feet long) that divert portions of the river flow to the power stations, and thus reduce flows in the bypass reaches of the river channel.

All 6 hydroelectric facilities along the Chicopee River have exemptions from regular FERC licensing since their power generation levels fall below the thresholds for FERC licensing. However, this does not exempt them from meeting certain operating conditions, including for minimum flows and drawdown limits. Thus, the 4 facilities that deliver water to the powerhouses via canals or tunnels have minimum flows ranging from 237 to 258 cfs, and drawdown limits of 1 or 2 feet (depending on time of year). The 2 run-of-the-river facilities have minimum flow requirements of 332 and 357 cfs. These operating conditions provide some mitigation of the potential impacts of the hydro operations on flow and habitat conditions in the river. Still, USGS gauging station records from the Chicopee River at Indian Orchard show a regular pattern of fluctuation in river stage (Figure 43). Further, the bypass reaches immediately below several of these dams are largely dewatered during dry periods of the year.

Figure 42a. Frequency distributions of pollutant load estimates for the Chicopee River Basin subwatersheds

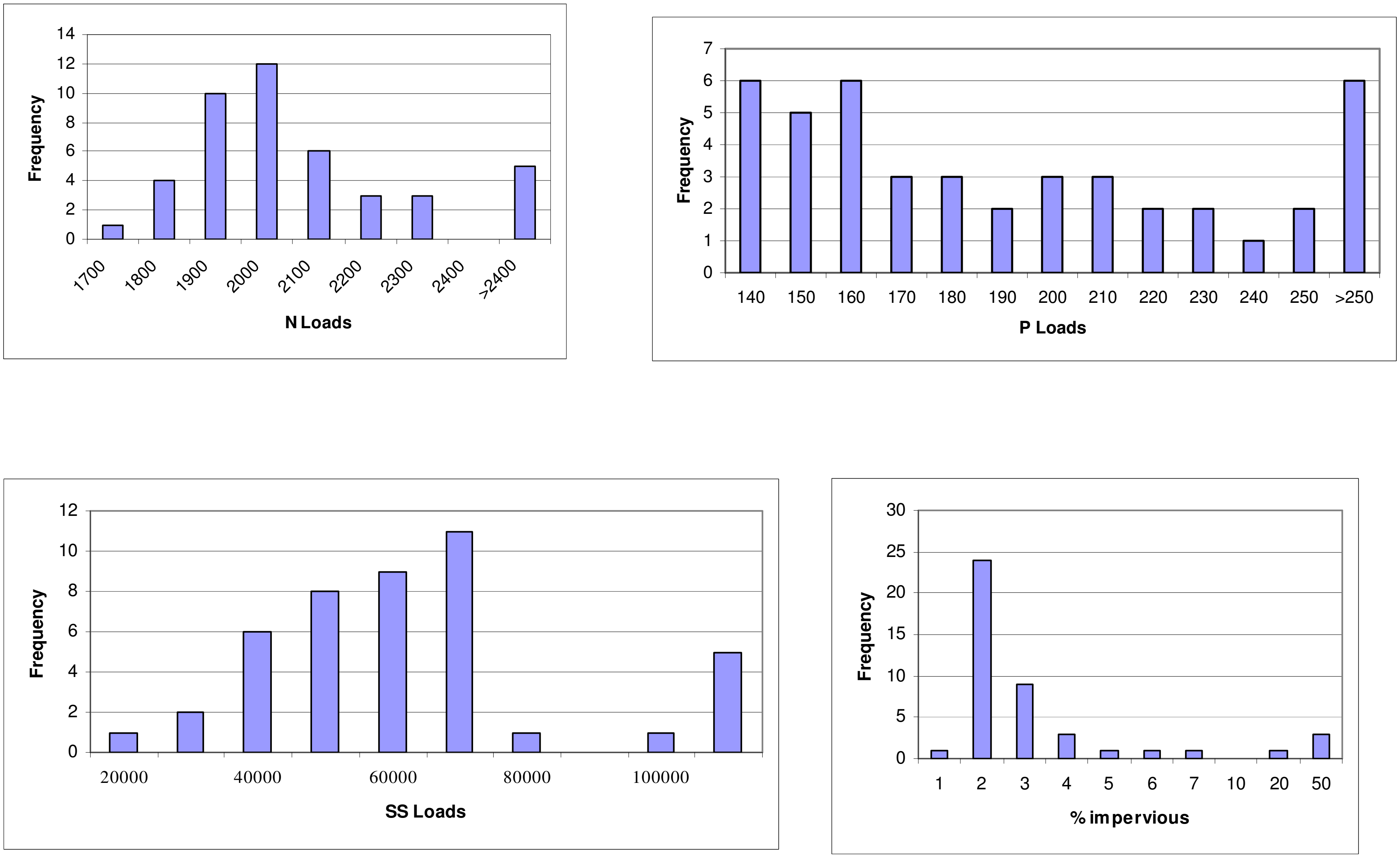


Figure 42b. Estimated subwatershed pollutant loads graphed against percent imperviousness

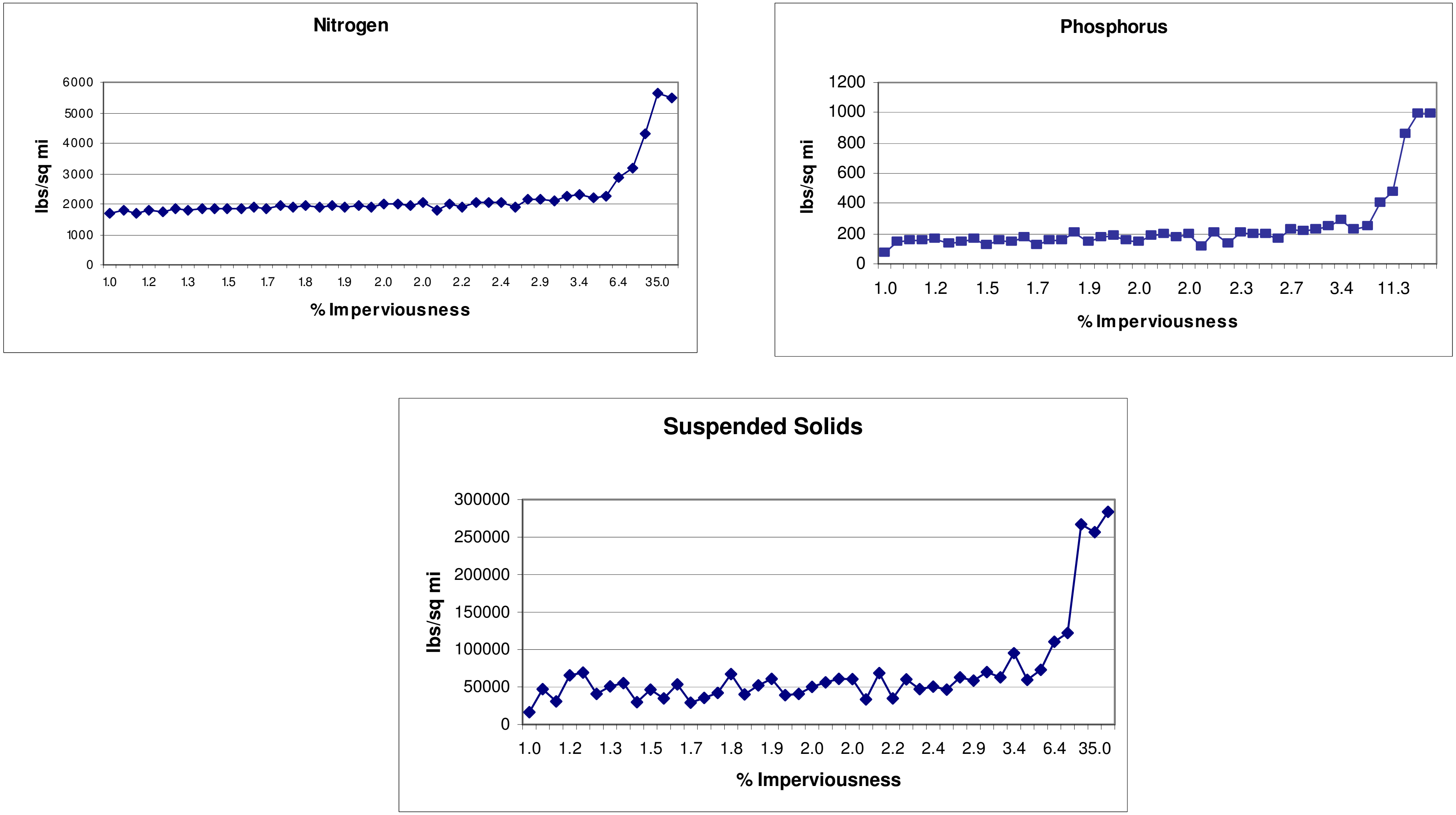
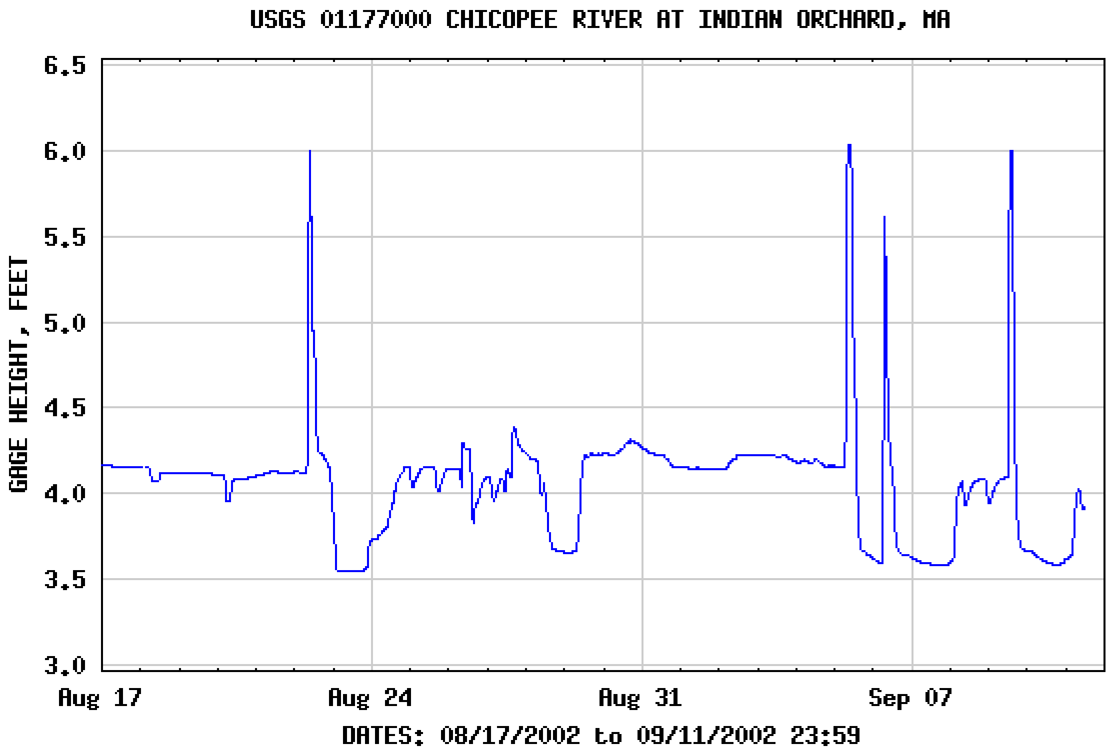
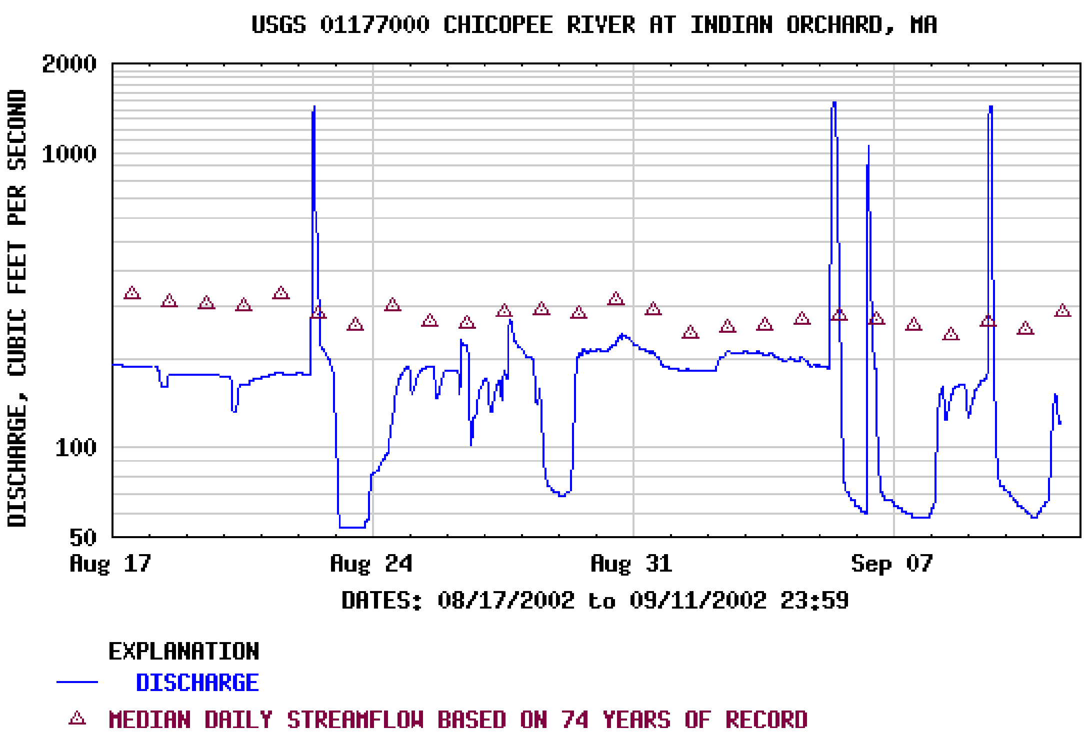


Table 31. Ranking of subwatersheds based on estimated pollution loads
(1=lowest loads or imperviousness; 44=highest)

Subwatershed	Watershed	N	P	TSS	% Imp	Sum of ranks
Parkers Brook	Ware	1	1	1	1	4
Burnshirt River	Ware	8	3	3	9	23
Quabbin Res	Swift	2	15	4	3	24
W. Br. Ware River	Ware	9	4	2	13	28
Moose Brook	Ware	4	9	17	2	32
E. Br. Ware River	Ware	10	8	6	11	35
Great Brook	Quaboag	13	6	11	6	36
Kings Brook	Quaboag	5	2	5	26	38
Naultaug Brook	Quaboag	6	7	20	7	40
Lamberton Brook	Quaboag	12	16	15	10	53
Foskett Mill Br.	Quaboag	14	5	7	28	54
Natty/Canesto	Ware	17	11	10	17	55
12-mile Brook	Chicopee	21	13	8	14	56
Muddy Brook	Ware	16	12	13	15	56
Pine Hill Brook	Ware	7	14	33	4	58
Trout Brook	Quaboag	15	10	12	21	58
Pratt Brook	Ware	11	18	23	8	60
Winimusset Brook	Ware	3	20	36	5	64
Penny Brook	Ware	22	17	9	20	68
Seven Mile River	Quaboag	19	22	22	12	75
Flat Brook	Ware	24	21	21	18	84
Blodgett Mill Br.	Quaboag	20	19	14	32	85
Five Mile River	Quaboag	18	25	30	19	92
Longmeadow Br.	Ware	28	24	18	22	92
Prince River	Ware	23	23	29	25	100
Shaw Brook	Quaboag	26	27	24	23	100
Danforth Brook	Ware	25	30	34	16	105
Jabish Brook	Swift	29	26	19	31	105
Swift below QR	Swift	31	28	16	30	105
Cranberry River	Quaboag	32	29	28	24	113
Broad Brook	Chicopee	30	31	27	29	117
Lake Wickaboag	Quaboag	27	32	35	27	121
Chicopee Brook	Quaboag	34	33	25	34	126
Calkins Brook	Chicopee	36	34	26	38	134
Turkey Hill Brook	Quaboag	35	35	31	33	134
Dunn Brook	Quaboag	33	36	37	35	141
Thompson Lake	Ware	37	37	32	36	142
Willow Brook	Quaboag	38	38	38	39	153
Coys Brook	Quaboag	39	39	39	37	154
Fuller Brook	Chicopee	40	40	40	40	160
Minechoag Brook	Chicopee	41	41	41	41	164
Cooley Brook	Chicopee	42	42	43	42	169
Abbey Brook	Chicopee	44	44	42	43	173
Poor Brook	Chicopee	43	43	44	44	174

Figure 43. Fluctuations in stage and flow of the Chicopee River, as recorded at the USGS gage at Indian Orchard





River profiles, showing the influence of dams along the major rivers in the basin, are presented in Figure 44 and Table 32. The Ware and Chicopee Rivers are the "steepest", with drops of approximately 14 ft/mi. The Quaboag River has an average drop of less than 12 ft/mi; and Swift River (below Quabbin Reservoir) drops just 9 ft/mi.

Table 32. River profile data

River	Length (miles)	Elevation		Total Drop (feet)	Drop (feet/mi.)
		Beginning	End		
Swift (below Quabbin)	8.7	380'	300'	80	9.21
Ware	34.0	742.5'	300'	442.5	13.03
Quaboag	24.8	594'	300'	294	11.83
Chicopee	17.7	300'	50'	250	14.05

The other main sources of variations in flow within the Chicopee River basin are withdrawals and diversions. The DEP lists almost 2-dozen Water Management Act (WMA) registrations in the basin, totaling more than 200 MGD (Table 33). However, the MWRA withdrawal from Quabbin Reservoir and the Ware River accounts for over 92% (187 MGD) of the total. The only other withdrawal greater than 2 MGD is the combined permit for the Palmer and the McLaughlin fish hatcheries operated by MDFW, which is registered at 6.43 MGD.

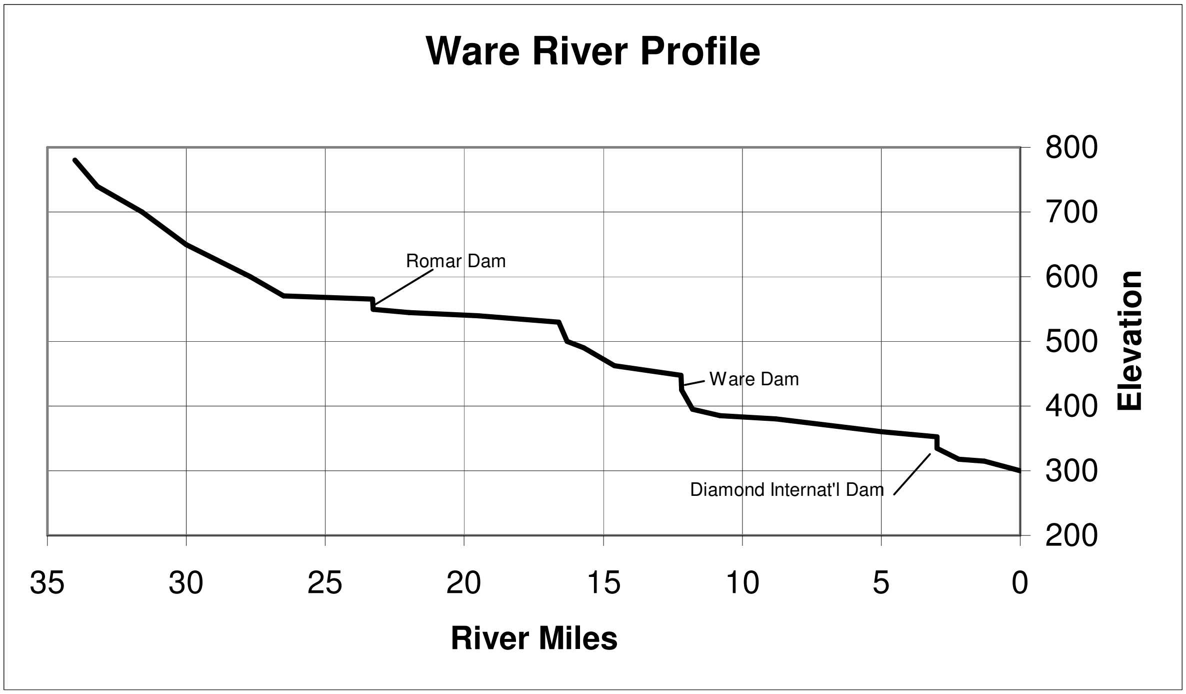
The MWRA withdrawal at Quabbin Reservoir represents a significant interbasin transfer of water. On average, almost 150 MGD is sent from Quabbin (in the Swift River Watershed) eastward into the Nashua River basin. Another 10.6 MGD is transferred from the Swift to the Connecticut River basin through the communities of Chicopee, South Hadley and Wilbraham. Fully ¾ of the water flowing into the Quabbin Reservoir is diverted out-of-basin (approximately 70% to the Nashua through the Quabbin Aqueduct and 5% to the Connecticut via the Chicopee Valley Aqueduct). As discussed previously, these diversions have resulted in significant alterations in the flow regimes of the Swift, Ware, and Chicopee Rivers (see Figures 7 through 10).

As part of the operating requirements for the Quabbin Reservoir, the MWRA is required to release a minimum of 20 MGD to the Swift River on a daily basis. Further, when flows in the Connecticut River drop below certain thresholds, additional releases into the Swift River are required. Since this water originates well below the surface of the reservoir, it remains cool year-round. The net effect is that the Swift River has a relatively constant flow of cool clear water throughout the year – an uncommon condition that is prized by local fishermen. Thus, the potential adverse impacts resulting from the transfer of substantial quantities of water out of basin are somewhat mitigated by the regular, controlled releases into the Swift River, and the beneficial impacts those releases have on the local fishery.

Several other transfers of water or wastewater occur within the basin (i.e., between subwatersheds), or between the Chicopee and other basins (including the Connecticut, Nashua, Blackstone and Millers). Figure 45 shows the approximate locations of these transfers. Most of these are relatively minor, and unlikely to result in significant local impacts. The one possible exception is in the upper reaches of the East Branch of the Ware River, where the Fitchburg Water Department transfers up to 2.26 MGD from the basin via Bickford and Mare Meadow Reservoirs on an annual basis (note: daily withdrawals in 1999 were 3.8 MGD for 145 days from Bickford, and 10.4 MGD for 31 days from Mare Meadow). DEP's Water Quality Assessment Report for the Chicopee identified possible water quality impacts in this region that may be related to these withdrawals (DEP 2001).

Overall, the Chicopee River basin is relatively "water-rich", and water quantity or low flows are generally not of basin-wide concern. However, as described above, impacts of dams, withdrawals and/or diversions have resulted in several significant local concerns.

Figure 44. Profiles of the four major rivers in the Chicopee River Basin (elevations in feet)



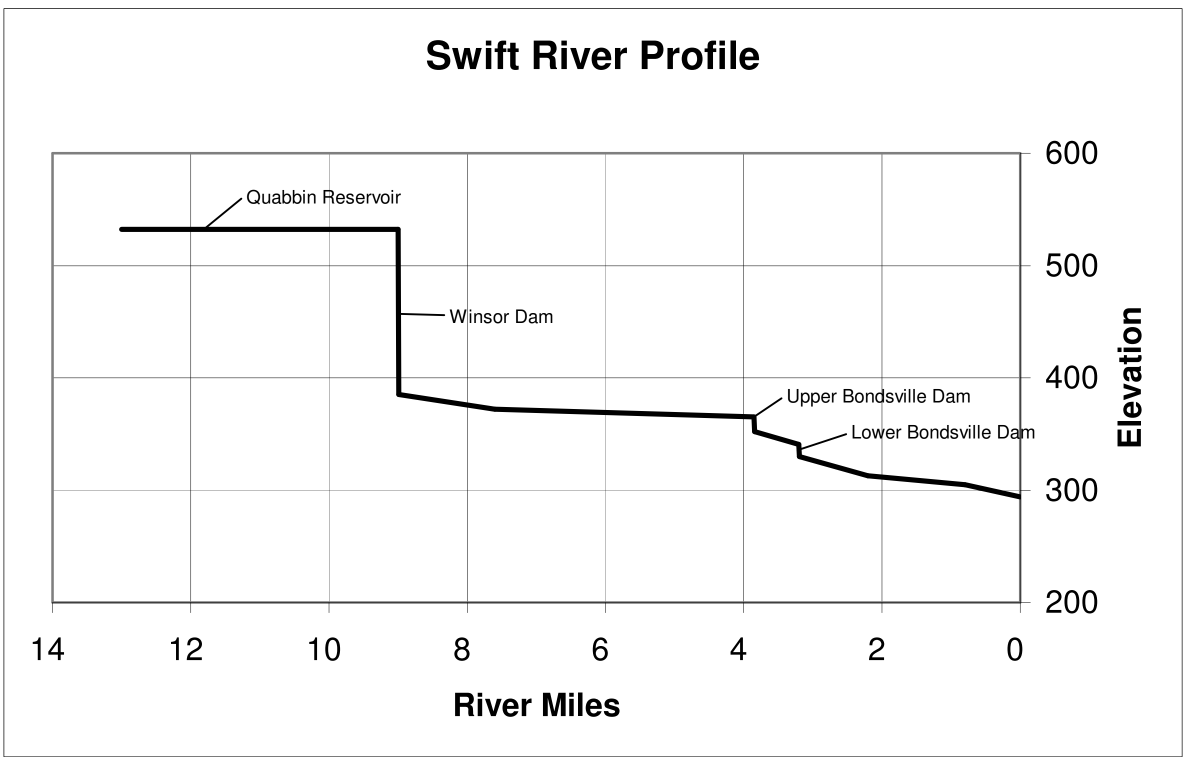
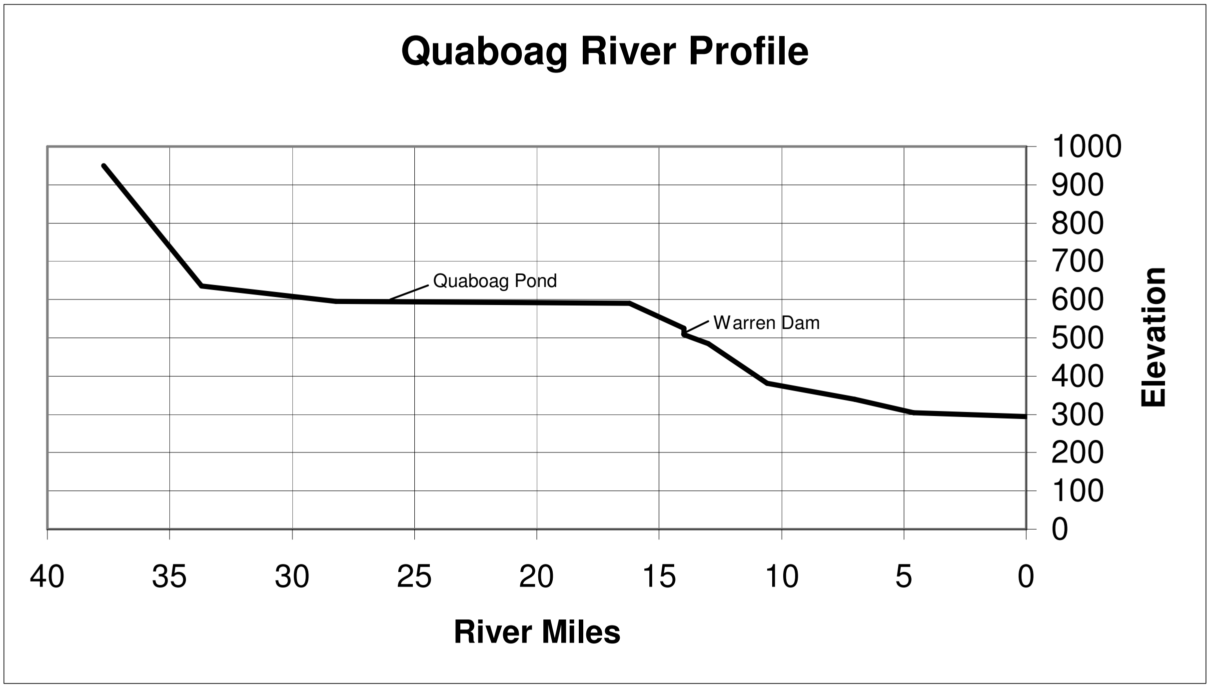


Figure 44 (continued)



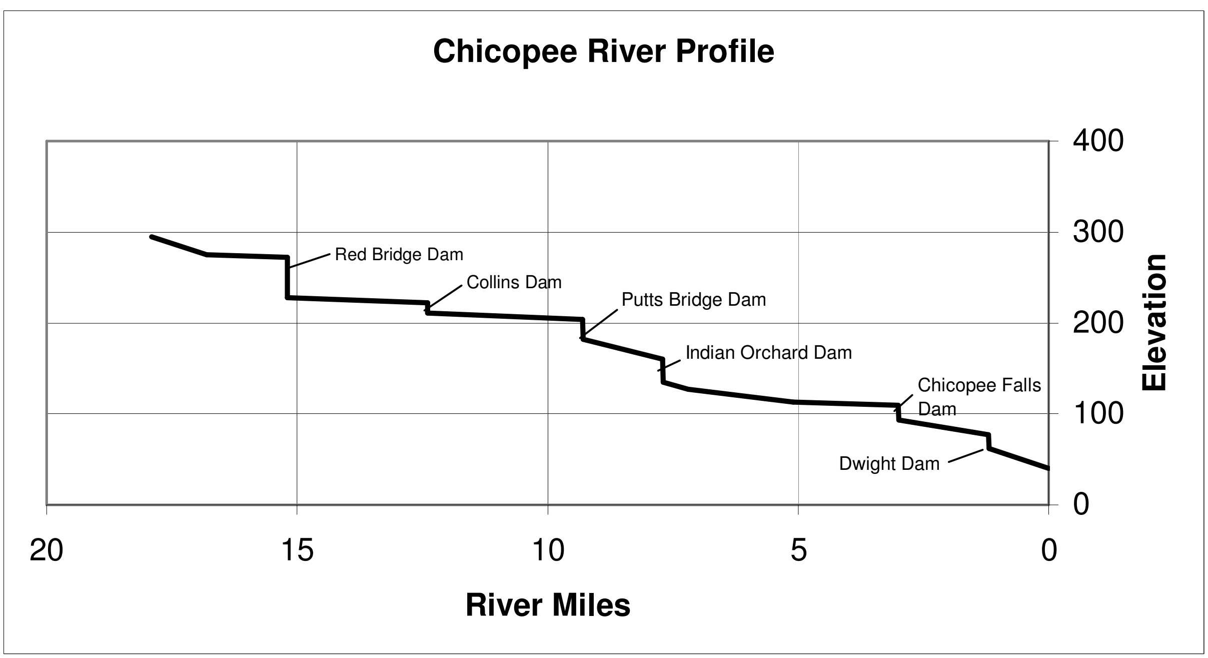


Table 33. List of Water Management Act registered and permitted average annual water withdrawals in the Chicopee River Basin (from DEP 2001)

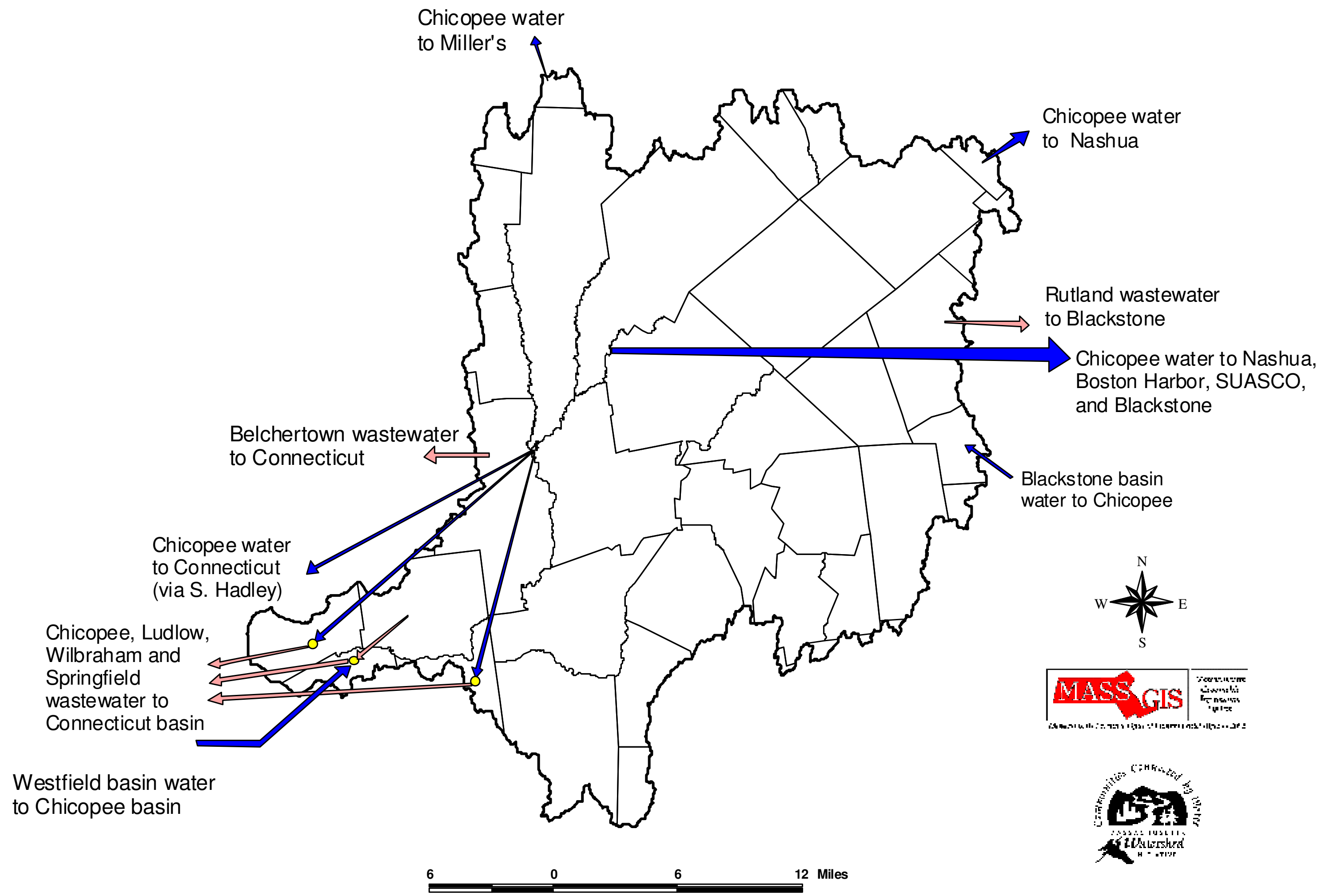
Permit #	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	G or S	Well/Source Name	Withdrawal location
	10802401	1024000	Belchertown Water District	0.19		024-01G	G	Tubular Wells Tap	Belchertown
	10802401	1024000	Belchertown Water District	0.19		024-05G	G	PS-1 (Daigle)	Belchertown
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-01G	G	Well #2	Ware
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-01G	G	Well #1	Ware
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-01G	G	Well #3	Ware
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-03G	G	Dismal Swamp Well	Ware
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-02G	G	Well #4	Ware
	10819101	1191000	Monson Water & Sewer Department	0.92		191-02S	S	Conant Pond	Monson
	10819101	1191000	Monson Water & Sewer Department	0.92		191-05G	G	Bunyan Road Well	Monson
	10819101	1191000	Monson Water & Sewer Department	0.92		191-03G	G	Bethany Road Well	Monson
	10819101	1191000	Monson Water & Sewer Department	0.92		191-04G	G	Palmer Road Well	Monson
9P210822701**	10822701	1227003	Three Rivers Fire District	0.4	0	1227003-03G	G	Well #3	Three Rivers
9P210822701**	10822701	1227003	Three Rivers Fire District	0.4	0	1227003-01G	G	Well #1	Three Rivers
	10828101	1161000	Springfield Water&Sewer Commission	1.82		161-01S	S	Ludlow Reservoir	Ludlow
	10822702	1227000	Palmer Water Department	0.65		227-01S	S	Upper Graves Brook Res.	Palmer
	10822702	1227000	Palmer Water Department	0.65		227-02G	G	Gravel Pack Well #2	Palmer
	10822702	1227000	Palmer Water Department	0.65		227-02S	S	Lower Graves Brook Res.	Palmer
	10822704	1227002	Bondsville Water District	0.36		1227002-02G	G	Well #2	S. Belchertown
	10822704	1227002	Bondsville Water District	0.36		1227002-03G	G	Well #3	S. Belchertown
	10822704	1227002	Bondsville Water District	0.36		1227002-01G	G	Well #1	S. Belchertown
	10833901		Dauphinais & Son, Inc*.	0.34					
	20802101	2021000	Barre Water Department	0.26		2021000-01G	G	Well #1	South Barre
	20802101	2021000	Barre Water Department	0.26		2021000-03G	G	South Barre Well	South Barre
	20802101	2021000	Barre Water Department	0.26		2021000-01S	S	Town Reservoir	Barre
	20802101	2021000	Barre Water Department	0.26		2021000-02G	G	Well #2	Barre
	20804501	2045000	Brookfield Water Department	0.09		2045000-02G	G	Quaboag St. Pumping Sta.	East Brookfield
	20808401	2084000	East Brookfield Water Department	0.11		2084000-01G	G	West Street Well	East Brookfield

Table 33. (Cont.)

Permit	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	G or S	Well/Source Name	Withdrawal location
	20821201	2212000	North Brookfield Water Department	0.43		2212000-02S	S	North Pond	North Brookfield
	20828002		Bond Construction Corporation*	0.27					
9P20828001	20828001	2280000	Spencer Water Department	0.48	0.49	280-02G	G	Meadow Rd. Well	Spencer
9P20828001	20828001	2280000	Spencer Water Department	0.48	0.49	280-01G	G	Cranberry Brook Well	Spencer
9P20828001	20828001	2280000	Spencer Water Department	0.48	0.49	280-01S	S	Shaw Pond	Leicester
9P220831101	20831101		Hardwick Knitted Fabrics, Inc	0.23	0.5				
	20832301	2323000	West Brookfield Water Department	0.26		2323000-01G	G	#1 Well	West Brookfield
	20832301	2323000	West Brookfield Water Department	0.26		2323000-02G	G	#2 Well	West Brookfield
	10822705		Cascades Diamond Inc	1.17					
	20831102	2311000	Warren Water District	0.2		311-01G	G	Tub Wells, Comins Pond	Warren
	10830901	MWRA	MDC/MWRA	186.7			S	Ware River Intake	Barre
	10830901	MWRA	MDC/MWRA	186.7			S	Chicopee Valley Aqueduct	Ware
	10830901	MWRA	MDC/MWRA	186.7			S	Quabbin Aqueduct	Hardwick
9P20809701	20809701	2097000	Fitchburg Water Department	0.67	0.11	2097000-06S	S	Mare Meadow Reservoir	Hubbardston
9P20809701		2097000	Fitchburg Water Department		0.11	2097000-09S	S	Bickford Reservoir	Hubbardston
	10802402		DFW	6.43			G	Palmer Hatchery-Well #2	Palmer
	10802402		DFW	6.43			S	McLaughlin Hatchery	Belchertown
	10802402		DFW	6.43			G	McLaughlin Hatchery #3	Ware
	10802402		DFW	6.43			G	McLaughlin Hatchery #2	Belchertown
	10802402		DFW	6.43			S	Palmer Hatchery-Reservoir	Palmer
	10802402		DFW	6.43			G	Palmer Hatchery-Well 1	Palmer
	10802402		DFW	6.43			G	McLaughlin Hatchery #1	Belchertown
9P10802401			DFW	0	1.03		G	McLaughlin Hatchery #4	Belchertown
9P10830901			Ware Fiber Recovery Associates		0.5				
9P210802402		1024013	Coldspring Golf Course, Inc.		0.16		G	PW-1	Belchertown
9P210802402		1024013	Coldspring Golf Course, Inc.		0.16		G	PW-2	Belchertown
9P210802402		1024013	Coldspring Golf Course, Inc.		0.16	1024013-01G	G	PW-3	Belchertown
9P210802402		1024013	Coldspring Golf Course, Inc.		0.16	1024013-02G	G	PW-4	Belchertown

* indicates average withdrawal over less than 365 days, ** permit for new source no change in withdrawal volume, G – ground water, S – surface water, PWS – Public Water Supply

Figure 45. Interbasin transfers in the Chicopee River Basin.



D. Biological resources

The wide variety of habitat types found in the Chicopee River basin, plus the large blocks of undeveloped, mostly-forested habitat and protection provided by the extensive MDC (now DCR) watershed lands, has resulted in substantial richness in the biological resources of the basin. Almost 70% of the basin is classified as forested, with more than 10,000 acres of wetlands and almost 33,000 acres of water. These land cover types provide habitat for a wide variety of both terrestrial and aquatic wildlife species. Further, more than 33,000 acres of agricultural land provides additional habitat for "early-successional" wildlife.

Several efforts to map the state's biological resources have occurred in recent years (e.g., MRIP, GAP, and more recently, BioMap). These programs have used various sources of existing data to identify areas that deserve special attention in land conservation efforts.

The MRIP (Massachusetts Resource Identification Project) was a collaborative effort between MassGIS and the EPA, and was designed to *identify natural resource areas important to the quality of life and promotion of an ecosystem approach to natural resource management* in the state. One of the products of the MRIP was a "co-occurrence" map, showing locations where up to 6 important resources overlapped (e.g., estimated rare habitat, outstanding resource water, contiguous natural lands greater than 500 acres, etc.). In theory, areas of multiple resource occurrence should have higher conservation value, and thus be priorities for land protection efforts. The results of the MRIP analysis for the Chicopee River basin (Figure 46) again shows the ecological value of the MDC (now DCR) watershed lands, along with Quaboag Pond and the upper Quaboag River, and several other river valleys in the basin.

The GAP project represents a different approach to assessing the relative condition of biological resources. This method maps natural communities and predicted species distributions (based on current land cover conditions) and compares that information against the existing network of conservation areas, thus showing which species or habitats are not well represented in the network (i.e., where the "gaps" are). For southern New England, the gap identification process has not been completed, although maps of predicted species occurrences for frogs, salamanders, snakes and turtles have been compiled. The dark bands running north-south through the middle part of the state (Figure 47) show the high species richness of these groups of animals that occur in the Chicopee River basin.

Finally, the BioMap project that was recently completed by the Natural Heritage and Endangered Species Program identified and mapped the areas most crucial to protecting the state's biodiversity. These maps were created through a systematic evaluation of over 7,000 site-specific records of rare plants, animals, and natural communities collected over a 22-year period (NHESP 2001). The maps include the most viable rare species habitats and natural communities (i.e., the "core habitat") and large minimally-fragmented "supporting natural landscapes" that safeguard the core habitats. In so doing, *BioMap identifies those areas of Massachusetts most in need of protection to conserve biodiversity for generations to come* (NHESP 2001). Significant concentrations of core habitats and supporting natural landscapes in the Chicopee River basin (Figure 48) occur in the Quabbin Reservoir and Ware River Watershed areas, and also near Westover Air Base in Chicopee, near the Springfield Reservoir in Ludlow, around the Norcross Wildlife Sanctuary in Monson, Wales and Brimfield, around Quaboag and Quacumquaset Ponds and the Quaboag River in the southeast portion of the basin, and along the Meadow, Mill and Sucker brooks in New Braintree, North Brookfield and West Brookfield. Additional, smaller (but still significant) core habitat areas occur in other portions of the basin.

In future years, the "AquaMap" project will provide a companion evaluation of aquatic habitats in the state. Further, MDFW will be conducting aquatic habitat surveys in the Chicopee River basin during the 2003 "research" year. Those surveys will provide additional information that will help identify areas of high conservation value in the basin, and prioritize their protection.

Figure 46. Resource co-occurrence in the Chicopee River Basin (MRIP analysis).

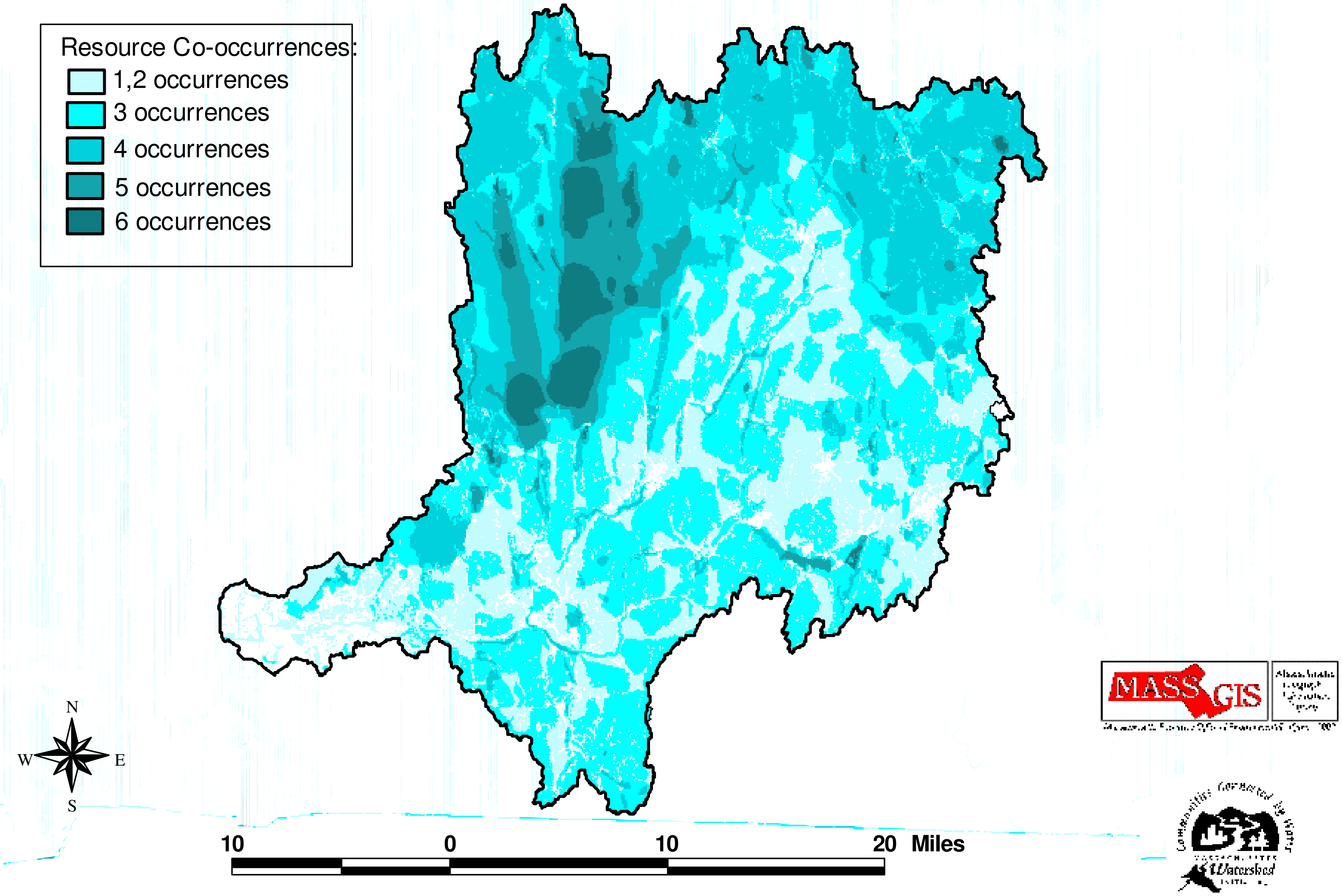


Figure 47. Gap Analysis maps of species richness.

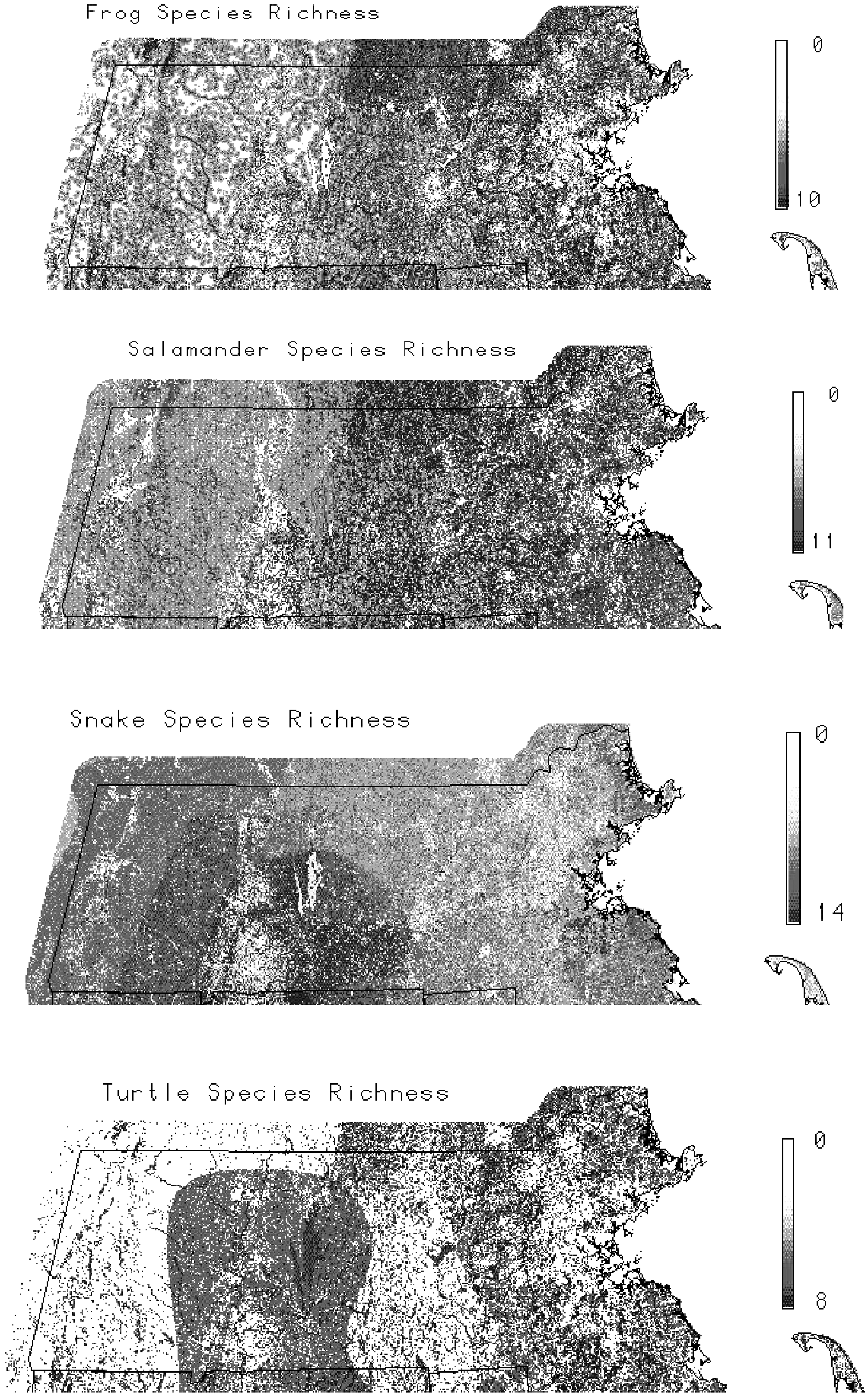
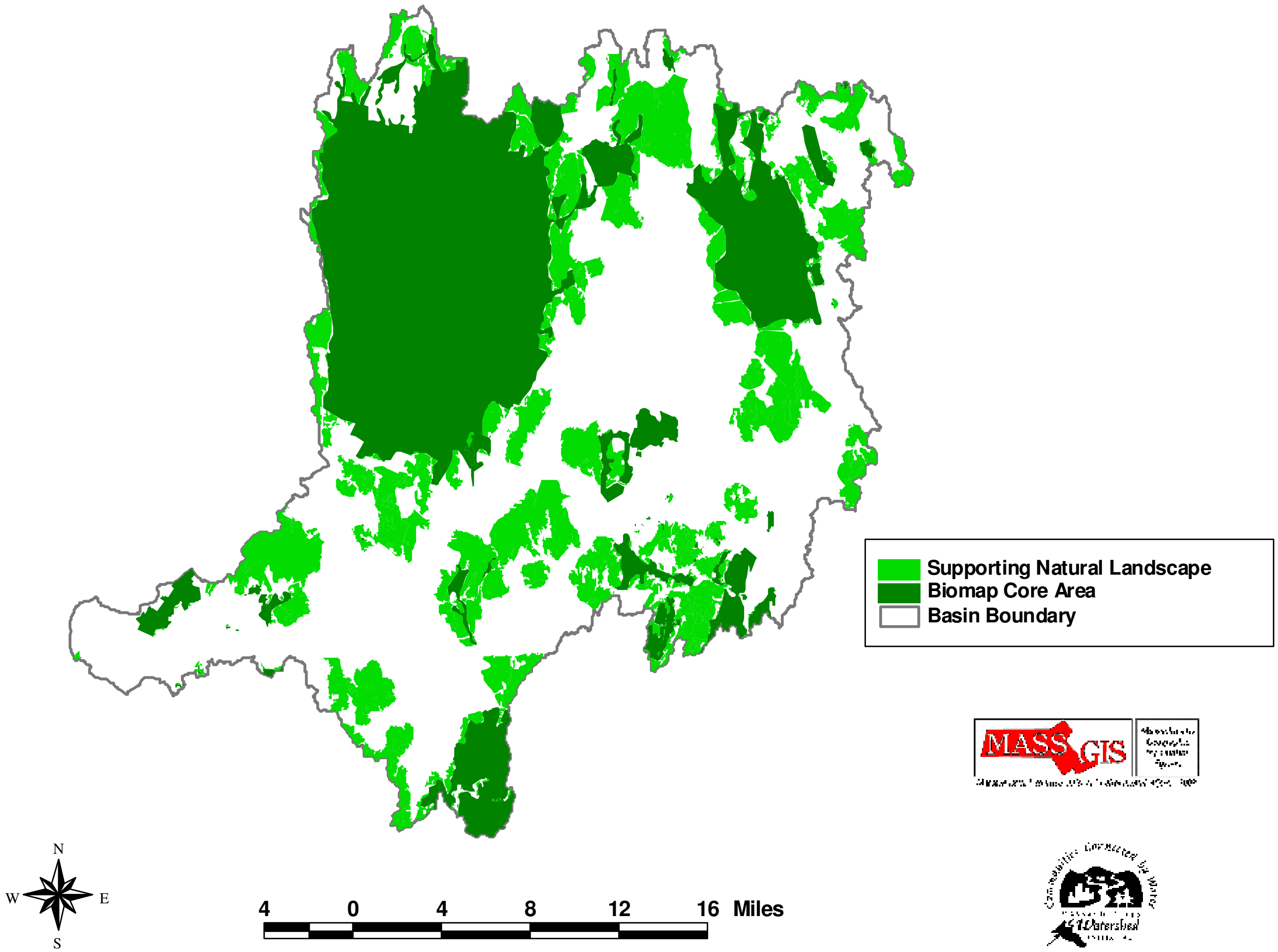


Figure 48. Biomap Core Areas and Supporting Natural Landscapes.



E. Open Space/Growth planning

Efforts to plan for future growth, including protection of open space, have occurred, or are occurring in a number of basin communities. In addition, efforts by government agencies and private conservation organizations have resulted in a substantial amount of protected open space in the basin (Figure 49). Further, land protected by municipalities and private organizations (e.g., sportsmen's clubs, Boy Scouts, etc.), along with Chapter 61 lands account for a substantial amount of additional acreage (Figure 50), although many of these lands are not permanently protected. Overall, almost 289 square miles of the basin are considered "protected open space" (Table 34), representing approximately 40% of the basin.

Table 34. Open space in the Chicopee River basin

Category	Acres	Sq.Miles	% of Total
CH61	9011.2	14.1	4.9%
CH61A	13387.2	20.9	7.2%
CH61B	4727.0	7.4	2.6%
DEM	14183.0	22.2	7.7%
DFWELE	19736.6	30.8	10.7%
MDC	80264.5	125.4	43.4%
FEDERAL	583.5	0.9	0.3%
NON-PROFIT	13693.5	21.4	7.4%
MUNICIPAL	12478.6	19.5	6.7%
PRIVATE	12386.2	19.4	6.7%
MISC. STATE	3320.5	5.2	1.8%
MISC OTHER	1103.0	1.7	0.6%
TOTAL	184874.6	288.9	100.0%

Despite the relatively large percentage of the basin that is considered open space, much of this (more than 43% of the total) is in the large blocks of MDC-controlled (now DCR) watershed lands in the Quabbin and Ware River Watersheds. While there is great value in having such large blocks of protected land, it nonetheless gives a somewhat false impression of the status of open space protection in the basin. As shown in Figure 49, large areas of the basin, including almost all of some basin communities, have little, permanently-protected open space.

In an attempt to remedy this situation, the former watershed team worked to enhance the ability of local communities to protect land by providing assistance in developing or updating their Recreation and Open Space Plans. In 1998, only 28% of the Chicopee basin communities had approved open space plans on file with the state Division of Conservation Services. By spring of 2002, that percentage had increased to 51%, with several other communities in the process of completing their plans (Table 35 and Figure 51). In conjunction with the Massachusetts Watershed Coalition, and The Trustees of Reservations, new plans were developed for Barre, Spencer, Rutland, Hubbardston, and West Brookfield in late 2001 and early 2002. Efforts will continue to encourage additional communities to prepare open space plans, and to assist those communities with approved plans to implement those plans.

Another major effort aimed at assisting communities with growth planning is Executive Order 418 (EO 418), which provides all municipalities in the state with local buildout analyses, and access to up to $30,000 in planning services. This assistance is intended to help cities and towns plan and prepare for future growth through the preparation of a "Community Development Plan" which address such issues as economic development, affordable housing, open space and natural resource protection, and transportation. Presentations

Figure 49. Permanently-protected open space in the Chicopee River Basin.

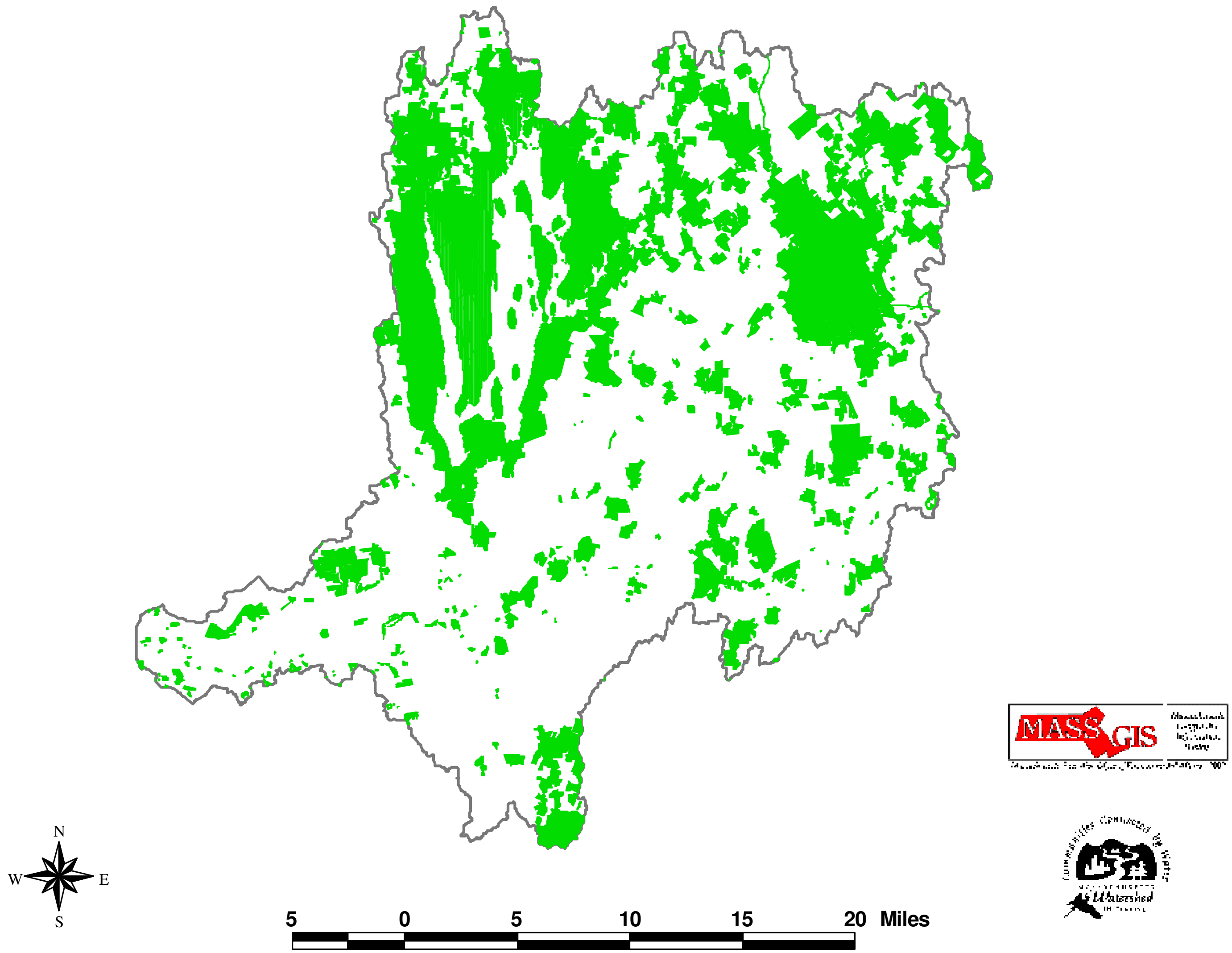


Figure 50. Non-permanent land protection in the Chicopee River Basin.
(Note: Chapter 61 lands not shown for all communities)

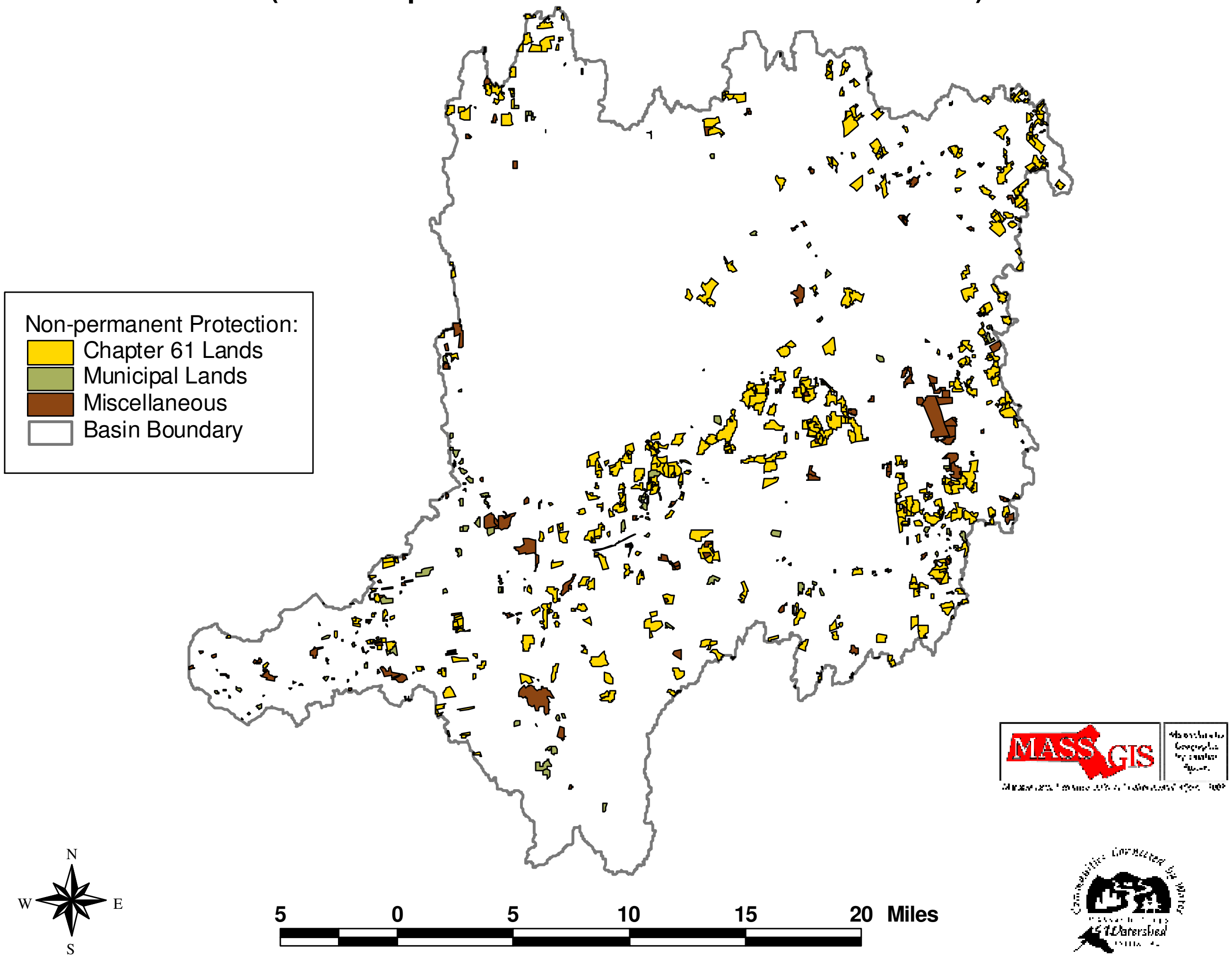
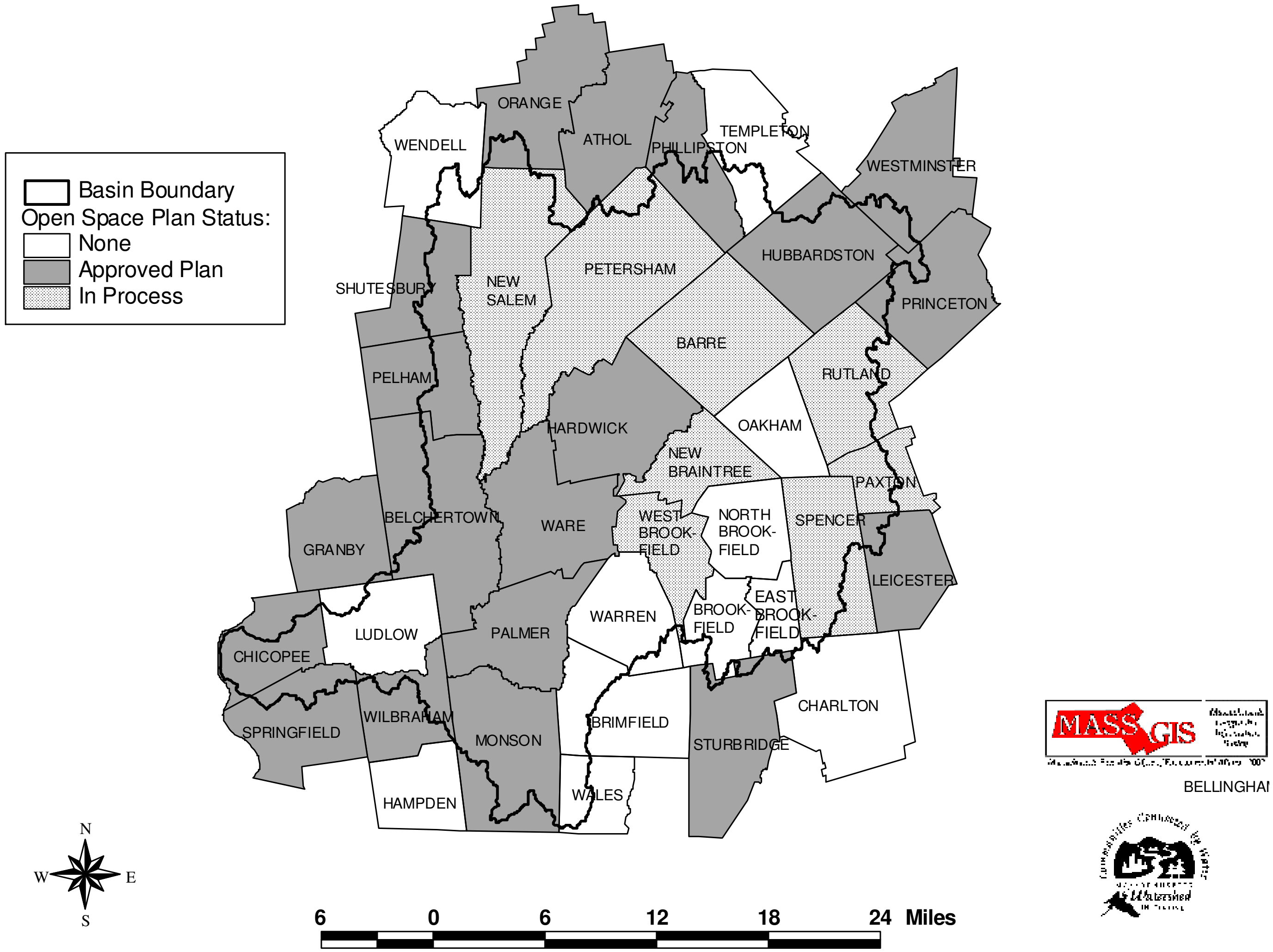


Table 35. Status of open space plans in Chicopee River basin communities (as of 2/02). (20 of 39 (51%) with approved plans or recent drafts)

TOWN	PLAN STATUS	COMMENTS
Athol	Aug-05	
Barre	Expired Plan	updating ?
Belchertown	Jul-06	COND ADA, maps..
Brimfield	Expired Plan	exp 1/95
Brookfield	Expired Plan	no plan
Charlton	Expired Plan	expired 12/01
Chicopee	Jul-2005	COND ADA, inv, maps
E. Brookfield	Expired Plan	no plan
Granby	Jun-02	strong draft 10/24/01
Hampden	Expired Plan	draft 8/00
Hardwick	Feb-02	
Hubbardston	Apr-06	COND ADA, ltrs
Leicester	Aug-2004	
Ludlow	Expired Plan	exp 11/01
Monson	april 2004	
New Braintree	Expired Plan	no plan
New Salem	Expired Plan	exp jun-93
North Brookfield	Expired Plan	expired mar-00
Oakham	Expired Plan	no plan
Orange	Apr-06	
Palmer	Sept-04	
Paxton	Expired Plan	no plan
Pelham	Jun-02	U/R 1/2/02
Petersham	Expired Plan	working?
Phillipston	Mar-2006	
Princeton	Aug-05	
Rutland	Expired Plan	exp 11/01
Shutesbury	May-05	great plan
Spencer	Expired Plan	draft 6/98
Springfield	Oct-02	
Sturbridge	Jul-2004	
Templeton	Expired Plan	exp. may-92
Wales	Expired Plan	no plan
Ware	May-2003	COND
Warren	Expired Plan	no plan
Wendell	Expired Plan	Update in process
West Brookfield	Jun-02	U/R 1/4/02
Westminster	Apr-2004	COND
Wilbraham	Aug-2004	

KEY to PLAN STATUS:
Expired Plan - plans are approved for a 5 year period which has expired
Draft - plan not yet approved; only in draft stage
COND - plan is substantially complete and will be finally approved once outstanding documents are submitted
Date Given - plan expires on the last day of that month

Figure 51. Status of Open Space Plans in Chicopee River Basin communities (as of 2/02).



on the buildout results were delivered during spring and summer of 2001. By January of 2002, 12 communities in the Chicopee River basin had completed the necessary agreements and paperwork to take advantage of the $30,000 in planning services (Belchertown, Brimfield, Granby, Ludlow, Orange, Palmer, Shutesbury, Spencer, Templeton, Wendell, West Brookfield, and Westminster).

Other communities already had current master plans in place, or were in the process of developing or updating them when EO 418 was announced. Those communities were eligible to use the planning resources for implementation of their master plans.

In addition to the above forms of assistance provided for planning in basin communities, the MDC (now DCR) also provides Technical Assistance Grants (TAGs) to municipalities within the Quabbin or Ware River Watersheds for planning. Communities that have received TAGs in recent years include Rutland, Shutesbury, Petersham, Wendell, New Salem, and Paxton. These grants have been used for the development of comprehensive or master plans, open space plans, wastewater planning, and in one case, for the hiring of a planning agent for the town. These grants provide much-needed planning assistance, especially to the smaller communities in the basin, which often lack the staff or resources to develop those plans on their own.

F. Outreach

Outreach to basin communities and residents regarding environmental and watershed issues is presently accomplished in various ways. Former watershed team members and their respective agencies or organizations collectively accomplished much of this outreach, in the form of presentations, displays, newsletters, brochures, websites, field trips, etc. Agencies and organizations that are particularly active with outreach and education include the former MDC, DEP, DFW, and the former DEM as well as the Chicopee River Watershed Council, The Trustees of Reservations, Massachusetts Audubon Society, Norcross Wildlife Sanctuary, the Upper Ware River Watershed Association, and others. The former WTL was also very active with outreach and education in the basin, often meeting with local environmental groups, municipal boards, school groups, and others.

Several recent (former) team activities had enhanced outreach and education in the basin. In FY 01, several thousand dollars worth of outreach materials were purchased, including a portable display board, and various promotional products (e.g., pens, water bottles, litter bags, etc., all with the MWI logo and contact information printed on them). More recently, a former team project has resulted in the purchase of a touch-screen computer monitor that is currently being set up to display the MassGIS watershed analyst tools. This will enable local residents to locate their "place" in the basin, and then follow the path of water flow through the basin from any starting point (e.g., their home).

Another former team project, being done in conjunction with the 4 other former greater Connecticut River WTLs has established a network of middle and high school classes that are interested in environmental monitoring. Training workshops, a project website, an equipment loan program, and a means of data sharing have all been (or are in the process of being) established. That project will greatly enhance outreach and education by providing information, training, and coordination of school-based monitoring of water quality, macroinvertebrates, and invasive species.

Much remains to be done in regards to outreach and education in the basin. For example, contacts and relationships with school groups, local chambers of commerce, businesses, and additional town boards and commissions need to be established and/or strengthened. There is also a need for greater coordination among the various agencies and organizations involved in environmental education in the basin. To facilitate the latter, efforts are currently underway to establish Regional Environmental Education Alliances (REEAs) throughout the state, including one in the eastern portion of the Chicopee basin. The former WTL also met and communicated with existing REEA that serves the western portion of the basin. One possible project that may emerge from that association is the establishment of an environmental education center in the Chicopee River Business Park.

G. Local Capacity Building

Since the inception of the former MWI in the Chicopee River basin in 1998, the need for capacity building among the watershed organizations and municipal boards and commissions in the basin has been clearly articulated. Of the 3 watershed associations that operate in the basin, none has paid staff. All 3 depend on volunteers to run field trips, produce newsletters, maintain mailing lists, and perform the other duties of the organizations. All 3 also operate out of the homes of their directors; none has an office space in which to keep organization records or have a telephone or answering machine.

An analogous situation exists with many municipal boards and commissions in the basin. Almost ¾ of basin communities have fewer than 10,000 residents, and more than half of those have fewer than 5,000 residents. As is the case with many small towns in western and central Massachusetts, town boards and commissions are staffed entirely by volunteers. Few communities in the basin have paid staff to assist with the very important environmental protection work performed by conservation commissions, boards of health, or planning boards.

Capacity-building among the environmental organizations and municipal boards in the basin continues to be a challengey.

H. Recreation

Outdoor recreation is an important part of watershed education and stewardship since it holds the potential for “connecting” people with the outdoor world. Such connections can play an important role in developing a sense of understanding and concern about environmental conditions. A number of outdoor recreational opportunities, as well as needs, have been identified in the Chicopee River Basin.

The abundance of lakes, ponds and waterways in the Chicopee provide for some excellent water-based outdoor recreation opportunities. Further, the large blocks of protected open space, much of which is open to passive recreation, provides additional opportunities. The exceptional fishing, hiking, and wildlife viewing available at the Quabbin Reservation make it one of the most popular outdoor destinations in southern New England. However, many other parts of the basin, including many small local gems of protected open space, also offer superb outdoor recreational opportunities.

Given the large acreages of undeveloped land and the variety of habitat conditions, hunting is a very popular activity in the basin. This activity is greatly enhanced by the numerous wildlife management areas managed by DFW (see Figure 37) and the state forestlands managed by DEM (now DCR) (see Figure 35). The former also provides additional recreational opportunities such as wildlife viewing, hiking, and field trials for hunting dogs. The latter are also popular for hiking, cross-country skiing, and other outdoor activities.

Fishing is also very popular in the Chicopee River Watershed, given the variety of aquatic habitats available (e.g., Quabbin Reservoir reaches depths of 150 feet and has produced landlocked salmon in excess of 20 pounds; the Swift River below the Quabbin Reservoir provides a relatively constant flow of clear cold water year-round, and is thus well-known and well-used as a trout fishery; a number of shallower waterbodies provide excellent warmwater fishing opportunities). Still, fish consumption advisories for Powder Mill Pond, Quabbin Reservoir, Quaboag Pond, and Quacumquasit Pond (in addition to the statewide advisory for mercury) are of concern.

River and lake-based recreation (boating, swimming, etc.) are also popular in the basin, and the 15 public boat launches in the basin (see Figure 34 and Table 20) are well used. These launch areas are mostly on lakes, ponds, or impoundments; however, only 2 provide access to rivers. Although there are many more private or informal access points to the basin's waterways, public access would be greatly enhanced by providing additional developed boat launch sites, especially along rivers and larger streams and brooks.

Swimming occurs in a number of the basin's waterbodies, although the number of state-owned swimming areas is somewhat limited. DEM (now DCR) operates swimming areas at Chicopee State Park, Lake Lorraine State Park and Rutland State Park (in addition to 2 pools), and MDC (now DCR) maintains a swimming beach at Comet Pond in Hubbardston. Most other public swimming occurs at town beaches.

Camping in the basin occurs mainly at private campgrounds. Only one public camping area is located in the basin, and that occurs at an unstaffed site (i.e., the Federated Women's Club State Forest in Petersham). Additional public camping opportunities are desirable.

V. Data Gaps and Assessment of Data Quality

The availability and quality of data used to assess conditions in the Chicopee River basin are variable. In general, and with some exceptions, information on physical and social characteristics is relatively abundant and fairly reliable. Notable exceptions include soils and hydrology data, both of which are lacking somewhat. Soils data for most of the four counties in which the Chicopee is located is available from the Natural Resources Conservation Service (NRCS), but is not yet available through MassGIS (which would allow it to be characterized and summarized for the basin). Good hydrologic data is available for the main rivers in the basin, and for some of their tributaries. However, only limited hydrology data is available for most of the subwatersheds in the basin.

In some cases (e.g., for cultural/historic resources, or for local infrastructure) the information is available, but just needs to be compiled. Much of this data collection and compilation will occur during the next 5-year basin cycle.

Data gaps are most pronounced for certain ecological characteristics, including animal and habitat data, and water quality conditions. The latter is of particular concern since the quality of the water flowing through and out of the basin is often considered to be a reflection of its overall environmental condition or health. Water quality data is collected by a number of organizations and agencies in the Chicopee River basin, but not in a basin-wide coordinated way. Further, no standard sampling protocols are followed by the various entities involved in data collection. Thus, even when data is collected, it cannot always be used for assessment or comparison purposes. As a result, our ability to characterize water quality conditions throughout the basin is limited.

VI. Summary of Priorities, Conclusions, and Next Steps

This report represents the first time that a comprehensive watershed assessment has been conducted for the Chicopee River basin. In addition to compiling significant amounts of information from a variety of sources, it also serves to identify the areas in which additional data collection is necessary. Further, it forms the basis for the 5-year "Watershed Action Plan" (WAP) that will soon be developed for the basin. That WAP constitutes the main "next step" that will follow the release of this assessment report.

Two main conclusions arise from this assessment. First, it is clear that *additional data collection and assessment work are needed in the basin*. However, limitations in state resources that are available to do this additional data collection leads to the second conclusion – i.e., *local organizations and municipal boards must play a greater role in assessing watershed conditions and needs, and ways must be found to increase their capacity to do so*.

Despite the substantial amount of information that is available (and summarized in this report) about the basin, much of it is simply <u>descriptive</u> information about physical or social conditions. Relatively little reliable information is available that allows for a comprehensive <u>assessment</u>, especially of environmental conditions. This is true both basin-wide, and, even more so, for individual subwatersheds. Much of the water quality and hydrology data that is presently collected in the basin is done so along the major rivers (e.g., DEP's SMART monitoring sites are located near USGS gaging stations on the Ware, Swift, and Quaboag Rivers). While this allows for general assessments of conditions in those major drainage areas, they generally do not allow for the assessments of particular problem areas or hot spots.

The subwatershed modeling approach used in this report (see Section IV.B.3) is a first step in providing a "finer resolution" to watershed assessment. However, there are limitations to this method, since it relies on the use of land cover conditions, and generalized relationships between specific land uses and associated water quality produced by those uses. Such analyses are useful in providing a general overview of conditions in the basin, but they should be followed up with actual field data collection, both to verify the model predictions and to help identify the sources of any water quality degradation that is either predicted or documented.

Some of this field data collection is already occurring in the basin, as a result of several priority projects that have been funded by EOEA in the past few years. For example, the University of Massachusetts has been collecting water quality data from 9 sites, along with additional GIS modeling aimed at characterizing the hydrologic processes and the relative influence of various sub-drainages on water quality conditions in the basin. ESS is now conducting their third project in the basin, all of which have, or will, provide water quality data from various locations in the basin. Such data collection will continue to be a priority in future priority project proposals as well.

Efforts must also continue to identify sources of environmental degradation in the basin. The land use based modeling described earlier identified a handful of subwatersheds that are predicted to have high imperviousness and/or pollutant loads. Future fieldwork will focus on these subwatersheds and attempt to identify pollutant sources as well as opportunities for mitigation. Other subwatersheds may not have ranked very high in imperviousness or pollutant loads in the modeling but might still have water quality problems. Thus, data collection efforts should continue throughout the basin.

Stream teams provide a great means of doing initial assessments of subwatersheds as well as promoting local involvement and stewardship.

Additional data collection and assessment work should also be focused on the biological resources of the basin. This work should begin in 2003, when the basin will be in Year 2 of the 5-year basin cycle, and thus DFW will be conducting fish habitat assessments in the Chicopee. Funding is needed for rare species surveys, initially concentrating on rare mussels. The survey work should continue in the future, expanding to other parts of the basin and to other species or groups of organisms. The "AquaMap" project should also provide useful information on the biological resources of the basin.

The second conclusion identified above relates to capacity building among the various environmental groups, organizations, and municipal boards in the basin. Success in moving environmental protection in the basin to the next level will largely depend on the active involvement of those stakeholders in assessment, mitigation, and protection efforts. However, many of these groups do not presently have the resources, training, or other capacity to be active and effective partners in the watershed. New ways of building the capacity of these stakeholders is crucial.

Capacity-building of watershed stakeholders can take various forms. While the ideal goal would be to have strong, well-trained, staffed, and funded organizations and boards, this is unlikely to occur in the foreseeable future. Recent budget cutbacks on the state level have eliminated capacity-building grant programs that were previously available. Also, personnel cutbacks will result in the loss of "circuit rider" positions that are presently providing assistance to conservation commissions in the basin. Thus, it will be important to find other, more creative ways to support and build capacity among watershed partners.

Many watershed organizations successfully operate on a volunteer basis because of the dedication and commitment of their members. The most successful often have one or more leaders who are particularly dedicated and knowledgeable, and possess enough "people skills" to build and maintain a high level of motivation and output from other members. Oftentimes, the best way to build capacity in volunteer organizations is to find and recruit such leaders.

Access to resources is also important for environmental groups, and those resources can take many forms. Sometimes "access to information" is of great value in itself. Such information might be related to grant opportunities, training sessions, technical assistance, or even contact information for people who have been successful in building other organizations, and thus can provide guidance and encouragement. By their very nature, representatives on the former watershed teams represent a wealth of potentially useful information that can be shared, both among former team members and with other watershed stakeholders.

To a limited extent, the former Chicopee team members can provide some basic organizational support to some watershed groups. For example, assistance has been provided to several organizations with newsletter production, mailing lists, map production, and other support services. These options hold particular potential for capacity building since they typically involve outreach and/or education, which can result in greater involvement of existing, or recruitment of new members. The GIS capabilities available to EOEA could be of particular value to certain organizations, and especially to municipal boards and commissions in the basin.

The need for additional data collection and for capacity-building discussed above also represents 2 of the main priorities in the Chicopee River basin. Data collection and assessment should be organized on a subwatershed basis, and focus on water quality conditions, identification of the sources of environmental degradation, and water use and movements in and out of the subwatersheds. Assessments of both the present and long-term infrastructure needs in basin communities should also be a priority. Capacity-building should focus on both environmental organizations (e.g., watershed associations, and lake and pond groups) and municipal boards and commissions (e.g., conservation, health, and planning).

A third priority relates to outreach and education. In general, there should be a continued effort to "*do more outreach, more frequently, and to more people*". One way to do this is through establishment of watershed newsletters and regular articles in local media. Many of the decisions that affect the quality of the watershed environment are made by the local people. The best decisions are those that are made with the benefit of good information, and providing that information to decision makers in the basin should always be a high priority.

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