# Wetlands and Potential Wetland Restoration Sites for the Mill Rivers and Manhan River Watersheds

A U.S. Fish and Wildlife Service National Wetlands Inventory Report

July 2000

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A U.S. Fish and Wildlife Service National Wetlands Inventory Report

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**ATTENTION**: The appendices are not included in this copy of the report. For these data and other information about the Massachusetts Wetlands Restoration Program (MWRP), visit the MWRP website at: http://www.state.ma.us/envir/mwrp/ or contact them via email at: wetlands.restoration@state.ma.us or by phone at 617-626-1177.

## Introduction

The U.S Army Corps of Engineers, New England District is working with the Massachusetts Wetlands Restoration & Banking Program to prepare watershed-based wetland restoration plans. The initial phase of this process is an inventory of wetlands and potential wetland restoration sites in the watershed. This is followed by an assessment of potential watershed deficits (problems due to flooding, poor water quality, fish and wildlife habitat degradation, etc.), preparation of a draft watershed plan for wetland restoration, public review and comment on the draft plan, and preparation of the final plan. The Corps requested technical assistance from the U.S. Fish and Wildlife Service's National Wetlands Inventory Program to perform the initial phase - the inventory phase - of this planning effort. Funds were provided to the Service to identify and map wetlands and potential wetland restoration sites following procedures used for other watersheds. The Natural Resources Assessment Group in the Department of Plant and Soil Sciences, University of Massachusetts-Amherst assisted with the project.

Subject Area

The study area consists largely of three small watersheds that are tributaries of the Connecticut River: Mill River (Deerfield to Hatfield), the Mill River (Williamburg to Northampton), and the Manhan River. Other notable streams include Broad Brook, Brewer Brook, Avery Brook, Bradford Brook, Wright Brook, and Norton Hollow. Large water bodies include Tighe Carmody Reservoir (Southampton), Northampton Reservoir (Whately), and Mountain Street Reservoir (Williamsburg/Hatfield). This study area represents a drainage area of about 184 square miles in western Massachusetts.

The watershed includes parts of three counties: Franklin (22% of the watershed), Hampden (5%), and Hampshire (73%). The Mill-Manhan watersheds encompass parts of 16 towns: Ashfield, Chesterfield, Conway, Deerfield, Easthampton, Goshen, Hatfield, Holyoke, Huntington, Montgomery, Northampton, Southampton, Westfield, Westhampton, Whately, and Williamsburg (Figure 1). The approximate acreage of each town within the study watersheds and the percent of the watersheds it represents are given in Table 1.

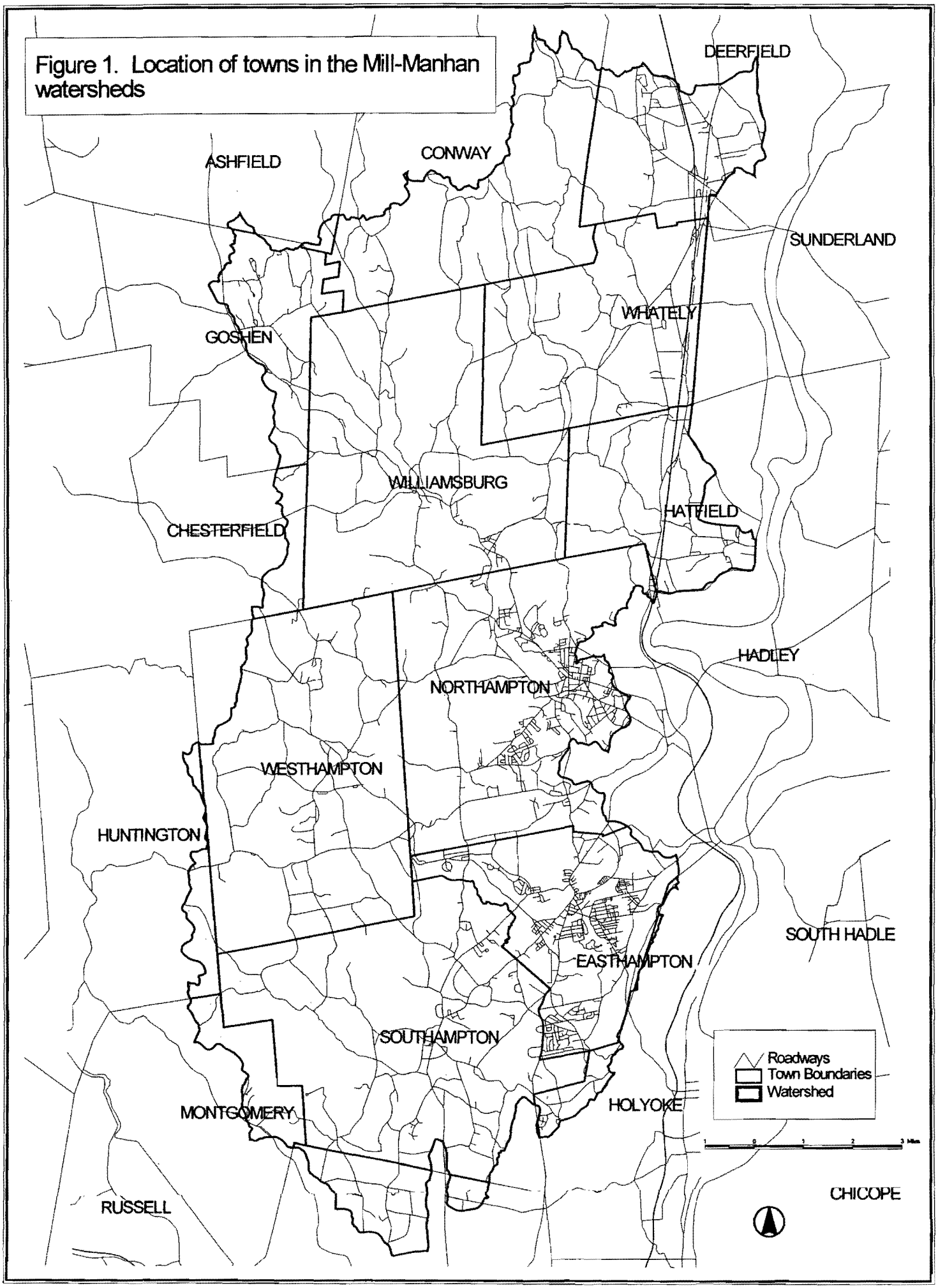



Figure 1. Location of towns in the Mill-Manhan watersheds

Table 1. Coverage of the Mill-Manhan watersheds by town.

| Town | Acreage | % of Watersheds |
|---|---|---|
| Ashfield | 257 | - |
| Chesterfield | 1198 | 1 |
| Conway | 9674 | 8 |
| Deerfield | 6012 | 5 |
| Easthampton | 8309 | 7 |
| Goshen | 4066 | 3 |
| Hatfield | 6051 | 5 |
| Holyoke | 917 | 1 |
| Huntington | 1148 | 1 |
| Montgomery | 1945 | 2 |
| Northampton | 15202 | 13 |
| Southampton | 17578 | 15 |
| Westfield | 2650 | 2 |
| Westhampton | 16166 | 14 |
| Whately | 10228 | 9 |
| Williamsburg | 16427 | 14 |

## Methods

Wetlands and deepwater habitats were mapped following the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) mapping procedures. These features were classified according to "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin et al. 1979), the official federal classification system for monitoring the status and trends of the nation's wetlands. Using this system, wetlands and deepwater habitats were classified to system, subsystem, class, subclass, water regime, and other modifiers (see Table 2 for common types). Identification and classification of wetlands and deepwater habitats were done through conventional wetland photointerpretation techniques by personnel at the University of Massachusetts' Natural Resources Assessment Group (NRAG) in the Department of Plant & Soil Sciences, Amherst and the U.S. Fish and Wildlife Service. The source imagery for this project was acquired from National Aerial Photography Program: 1:58,000 color infrared photography (April 1985 to May 1987) and 1:40,000 black and white (panchromatic) photography (April 1995 and April 1997). Both sets of photos were examined because the quality of the latter photos was spectrally inferior to that of the former. Field work was conducted to confirm results of photointerpretation.

NRAG staff also interpreted and delineated potential wetland restoration sites from this photography. Sites were first identified as either a Type 1 restoration site (former wetland no longer functioning as a wetland) or a Type 2 site (significantly impaired existing wetland). Potential wetland restoration sites were then characterized by the type of perturbation (adverse impact) such as diked/impounded, excavated, partly drained, or external influences (e.g., leachates, exposed soils, turf runoff, or sand/gravel operation). The former three categories were identified during the wetlands inventory phase of the project. External influences were detected later by re-examining the source imagery.

Upon completion of photointerpretation, overlays were made to match existing large-scale (1:25,000) U.S. Geological Survey topographic maps. NWI maps were prepared for the following quads: Greenfield, Easthampton, Mount Tom, Westhampton, and Williamsburg. Later, these maps and overlays for other quads containing small portions of the watersheds (Goshen, Greenfield, Mount Holyoke, Mount Toby, Shelburne Falls, and Woronoco) were digitized to create a data layer of the entire study area for geographic information system (GIS) analysis.

The U.S. Fish and Wildlife Service's NWI Program (Northeast Region) utilized the digital data to generate summary statistics on wetlands and potential wetland restoration sites for the watershed and to produce thematic maps for data analysis and presentation. The digital data represent the foundation of a potential wetland restoration site matrix to be expanded by the Corps for use in drafting a wetland restoration plan for the study area. NWI personnel analyzed the matrix results and aggregated potential sites into a manageable list due to their location and requirements for restoration. NWI personnel also supplemented the NRAG interpretations of potential Type 1 restoration sites. This was accomplished by evaluating a watershed-based wetland map and looking for suspected human-induced breaks (nonwetland areas) in wetlands along stream and

river corridors. For these unnatural "breaks", soil survey data was examined to verify the presence of hydric soil map units. Aerial photos were then reviewed to determine the current land use. When the land use was cropland, pasture, or other open land and the soils were mapped as hydric soil map units, the area was determined to be a potential Type 1 restoration site. This process added several more potential Type 1 restoration sites to the list.

Various GIS-generated maps were produced and distributed to the Corps and are not included in this report. These maps included watershed-based maps and town-based maps showing: 1) distribution of wetlands and deepwater habitats by type and 2) location and type of potential wetland restoration sites. A watershed-scale map was also prepared that showed the center points of adjacent land uses that may be adversely affecting wetland quality.

Table 2. Wetland types for the Mill-Manhan watersheds and their classification (following Cowardin et al. 1979) and corresponding map codes. (Note: The map codes are not complete since water regime and other modifiers appear in the digital database and on the NWI maps; water regime modifiers: A - temporarily flooded, B - saturated, C- seasonally flooded, E- seasonally flooded/saturated, F - semipermanently flooded, and H - permanently flooded; other modifiers: x - excavated, d - partly drained, h - diked/impounded, and b - beaver-modified.)

| Common Name | Technical Classification (Map Code) |
|---|---|
| Wooded Swamp | Palustrine Forested Wetland (PFO)<br>Broad-leaved Deciduous (PFO1)<br>Needle-leaved Evergreen (PFO4)<br>Mixed (PFO1/4; PFO4/1)<br>Dead (PFO5) |
| Shrub Swamp | Palustrine Scrub-Shrub Wetland (PSS)<br>Broad-leaved Deciduous (PSS1)<br>Broad-leaved Evergreen (PSS3) |
| Marsh | Palustrine Emergent Wetland (PEM)<br>Semipermanently Flooded (PEM1F)<br>Seasonally Flooded/Saturated (PEM1E) |
| Wet Meadow | Palustrine Emergent Wetland (PEM)<br>Saturated (PEM1B)<br>Temporarily Flooded (PEM1A) |
| Pond | Palustrine Unconsolidated Bottom (PUB)<br>Palustrine Unconsolidated Shore (PUS) |
| Mixed Wetlands | Palustrine Emergent/Scrub-Shrub Wetland (PEM/SS; PSS/EM)<br>Palustrine Emergent/Forested Wetland (PEM/FO; PSS/EM)<br>Palustrine Scrub-Shrub/Forested Wetland (PSS/FO; PFO/SS) |
| Lake Shore (nonvegetated) | Lacustrine Unconsolidated Shore (L2US) |
| River Shore (nonvegetated) | Riverine Unconsolidated Shore (R2US; R3US) |

## Interpretation of Study Results

The study is based on remote sensing techniques with limited field work. It is a screening process which attempts to identify existing wetlands that are or may be significantly altered in various ways and former wetlands that may be suitable for restoration. In the future, these potential sites will be evaluated by others on the ground and with input from individuals with local knowledge of wetland resources in the watersheds. The identification of potential wetland restoration sites by remote sensing, therefore, does not supplant the need for field evaluation, but rather it is a first-step in the evaluation process. Sites identified as potential wetland restoration sites need to be examined on the ground to see if restoration is truly warranted or even possible. Moreover, all restoration work on private lands requires landowner approval. This study provides a good starting point for considering possible wetland restoration opportunities in the watershed and, therefore, provides a framework for initiating the process of restoration.

There are limitations inherent in the techniques used to identify potential wetland restoration sites that readers of this report should be made aware of. All partly drained vegetated wetlands (with "d"-modifier applied) were identified as potential candidates for restoration. The magnitude and effect of such drainage needs to be considered on a case-by-case basis when determining whether such sites really need restoration. In general, wetlands mapped with the "d"-modifier and with drier water regimes, especially temporarily flooded ("A"-modifier, e.g., PFO1Ad), seasonally flooded ("C"-modifier, e.g., PEM1Cd), and saturated ("B"-modifier, e.g., PSS1Bd), are more likely to have experienced significant alterations due to modified hydrology. They could be considered higher priority sites for restoration than partly drained, seasonally flooded/saturated wetlands (e.g. PFO1Ed) which should still have an abundance of water. Also, all vegetated wetlands subject to excavation (with the "x"-modifier) and open water excavations in existing wetlands were identified as potential restoration sites. Vegetated wetlands associated with impoundments, except those associated with reservoirs and dammed lakes, were identified as potential wetland restoration sites. When considering whether restoration is desirable, one first needs to consider the purpose of the impoundment and whether such function is more beneficial than restoration of a vegetated wetland. Remember that open water is an important feature of many wetland ecosystems and one that is particularly important to a host of fish and wildlife species.

The presence of a naturally vegetated buffer has a positive effect on the quality of wetlands and water bodies. Consequently, the study identifies locations of buffer areas where such vegetation is lacking due to some form of development (urban, suburban, impervious surface, or agriculture). These are likely sources of nonpoint source pollution when such breaks occur along water bodies and they may also be sources of adverse environmental impacts (e.g., degradation of water quality and sedimentation) for wetlands. Although not the focus of the state's wetland restoration program, individuals interested in restoring the biological integrity of wetlands may want to initiate efforts to restore naturally vegetated buffers around impacted wetlands as well as along streams and other water bodies.

## Results

Watershed Statistics[1]

*Aquatic Resources*

Approximately 6 percent of the Mill-Manhan watersheds was represented by wetlands and deepwater habitats (excluding acreage of linear streams and wetlands). Wetlands were more abundant than deepwater habitats, with 6387 acres of the former vs. 950 acres of the latter (Figure 2). Forested wetlands were the most abundant wetland type in the watershed, accounting for 61 percent of the wetlands (excluding mixed stands of forested wetlands and other wetland types). Emergent wetlands were second-ranked, representing about 11 percent of the wetlands. Shrub wetlands were next in abundance, comprising 9 percent of the wetlands. Nonvegetated wetlands represented 7 percent of the wetlands in the study area. A total of 319 acres were beaver-influenced, affecting 5 percent of the wetlands. The extent of individual wetland types (classified to the subclass level) and deepwater habitats is summarized below (see Appendix A for detailed statistics).

| Wetland Type | Acreage |
|---|---|
| Palustrine Emergent Wetland | 706.5 |
| Palustrine Emergent Wetland - Phragmites | 4.8 |
| Palustrine Forested Wetland | 3875.8 |
| Deciduous | (2517.5) |
| Evergreen | (264.2) |
| Mixed | (1081.8) |
| Dead | (12.3) |
| Palustrine Emergent/Shrub Wetland | 313.7 |
| Palustrine Emergent/Forested Wetland | 77.1 |
| Palustrine Forested/Shrub Wetland | 401.8 |
| w/Deciduous Forested | (331.6) |
| w/Evergreen Forested | (70.2) |
| Palustrine Scrub-Shrub Wetland | 553.2 |
| Deciduous | (491.2) |
| Evergreen | (37.4) |
| Mixed | (15.8) |
| Dead | (8.8) |
| Palustrine Unconsolidated Bottom/Emergent | 4.2 |
| Palustrine Unconsolidated Bottom | 347.2 |

[1]Please note that there may be minor differences in totals between watershed-based statistics and town-based statistics. This is due to rounding-off of decimals.

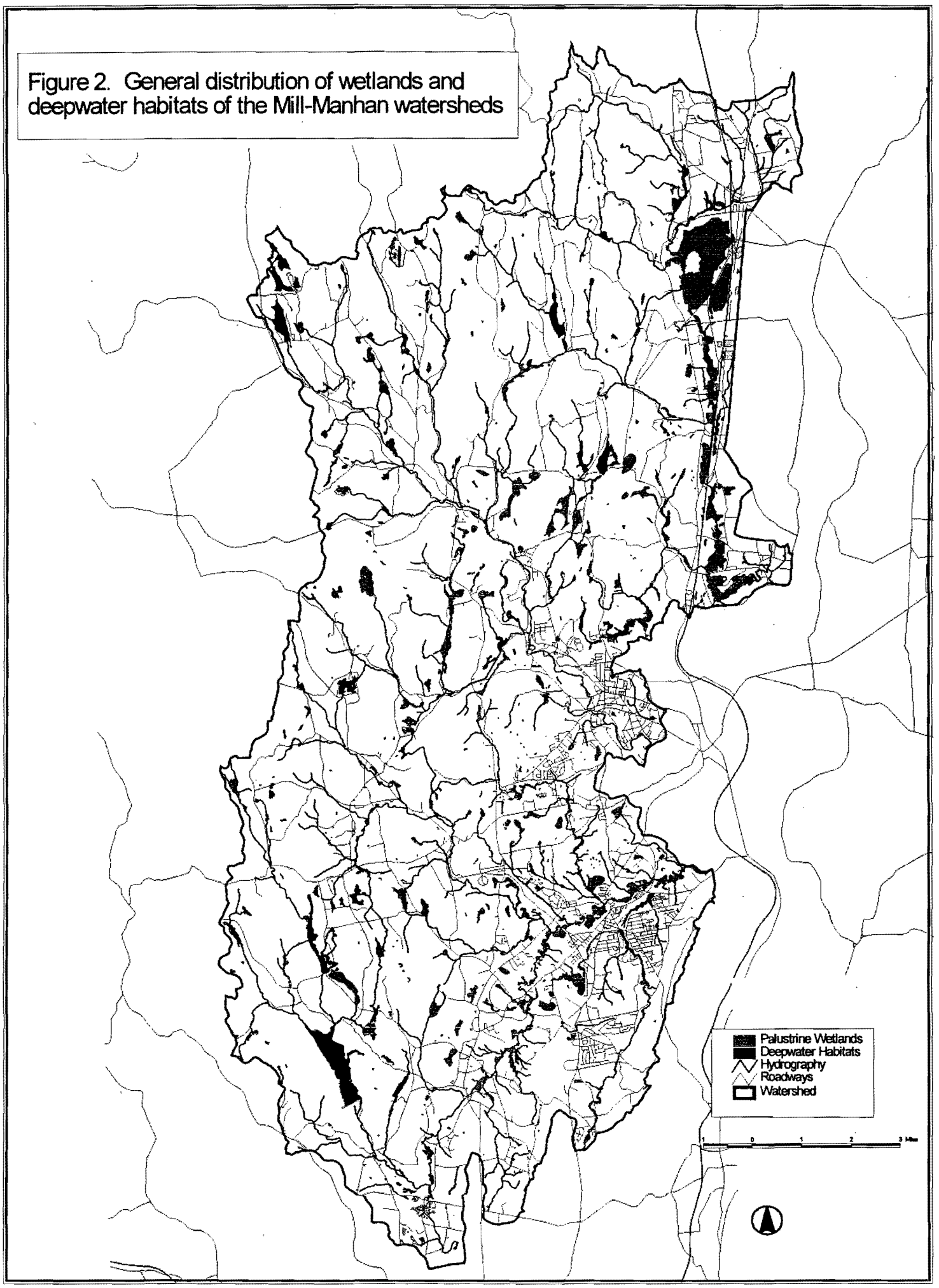
| | |
|---|---|
| Palustrine Unconsolidated Shore | 3.6 |
| *Total Palustrine Wetlands* | ***6287.9*** *(excluding linear wetlands)* |
| Lacustrine Unconsolidated Shore | 89.9 |
| Riverine Unconsolidated Shore | 9.6 |
| Total Other Wetlands | 99.5 |
| **Total All Wetlands** | **6387.4** (excluding linear wetlands) |

| Deepwater Habitat Type | Acreage |
|---|---|
| Lacustrine Unconsolidated Bottom | 930.8 |
| Riverine Unconsolidated Bottom | 19.2 |
| **Total Deepwater Habitats** | **950.0** *(excluding linear rivers/streams)* |

Nearly all of the deepwater habitats were lakes and reservoirs associated with the lacustrine system. Only 19 acres of riverine waters were mapped (excluding linear acreage). Of the lacustrine deepwater habitats, about 92 percent were impounded water bodies, either artificially created by damming up narrow river or stream valleys or by modifying an existing lake. Seventy-four acres of lakes (presumably unaltered) were inventoried.

Linear wetlands and streams inventoried totaled about 262 miles. Streams alone accounted for 237 miles or 92 percent of these linear features (48 miles of lower perennial, 125 miles of upper perennial, and 64 miles of intermittent streams). The remainder were 9 miles of emergent wetlands, 13 miles of forested wetlands, 1 mile of scrub-shrub wetlands, and 1 mile of narrow ponds.

Figure 2. General distribution of wetlands and deepwater habitats of the Mill-Manhan watersheds



*Human-Altered Wetlands*

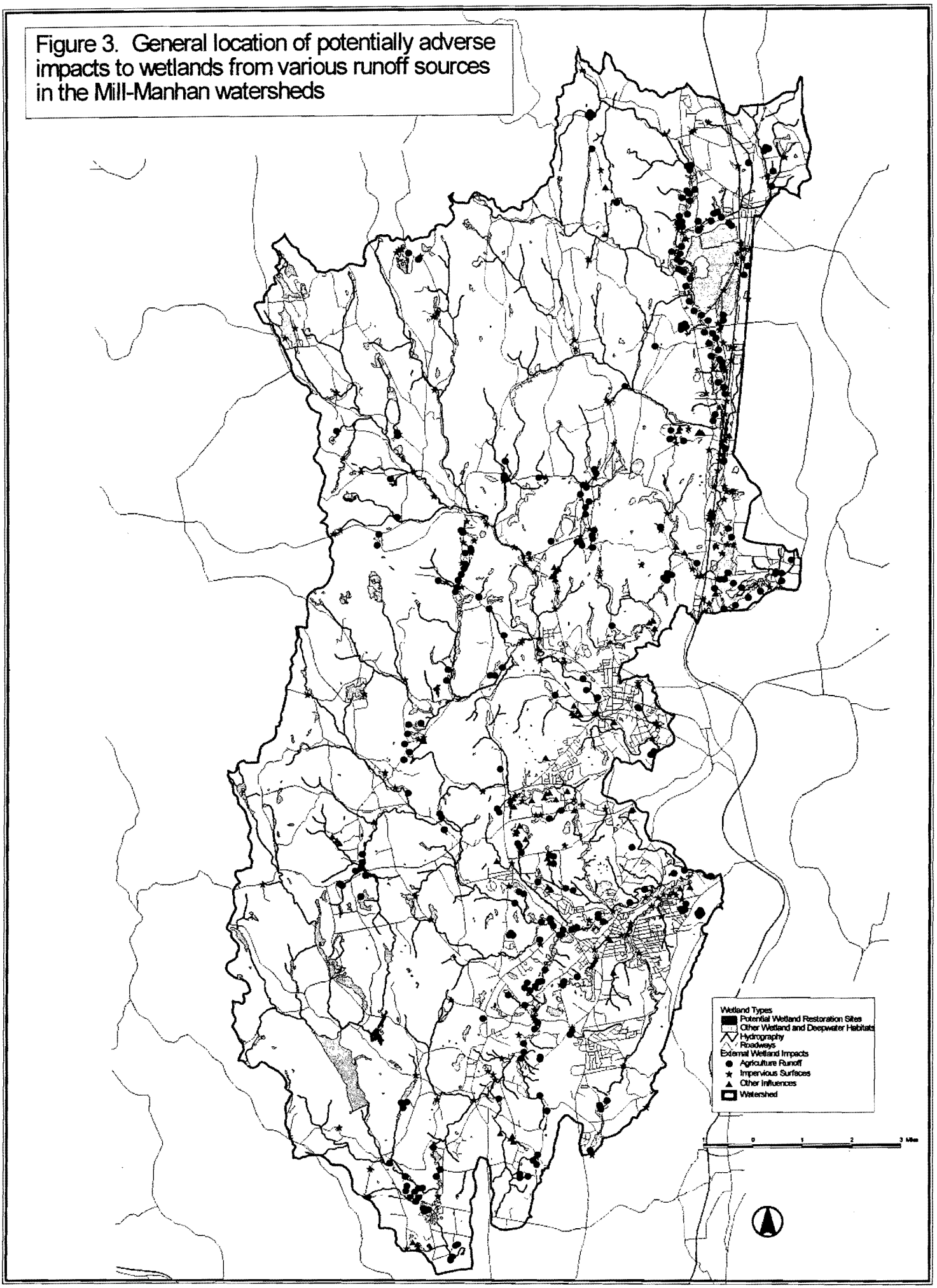
Major alterations to wetlands in the Mill-Manhan watersheds include: 1) partial drainage through ditching, 2) excavation, and 3) impoundment. About 9 percent of the existing wetlands in the watershed have been significantly modified. Most (82%) of the partly drained wetlands are emergent wetlands (50 acres). All but 1 percent of the excavated wetlands are ponds (173.8 acres of palustrine unconsolidated bottoms and shores). Approximately 42 percent of the diked/impounded wetlands are vegetated wetlands, while the majority are nonvegetated shallow water wetlands (either ponds - 110.0 acres or shallow water zone of lakes and reservoirs - 89.9 acres).

| Altered Wetland Type | Acreage in Watershed | % of Wetlands |
|---|---|---|
| Partly Drained Wetland | 60.8 | 1.0 |
| Excavated Wetland | 175.1 | 2.7 |
| Diked/Impounded Wetland | 345.4 | 5.4 |
| --- | --- | --- |
| Total | 581.3 | 9.1 |

*Wetlands Possibly Adversely Affected By Runoff from Adjacent Uplands*

Many Mill-Manhan wetlands are located adjacent to land uses where runoff may adversely affect the quality of the wetland. Examples include wetlands where surface water runoff from agricultural fields, impervious surface (e.g., road runoff from storm drains or parking lot runoff), exposed soils, or turf (e.g., residential lawns and golf courses) where such runoff may be degrading the water quality. For the Mill-Manhan watersheds, runoff from farmland appears to have the greatest potential for adversely affecting wetland quality. Sedimentation of wetland basins from eroding cropland may also be negatively affecting wetland quality. Figure 3 shows the general locations (center points) of areas bordering wetlands that may be adversely affecting their quality.

Figure 3. General location of potentially adverse impacts to wetlands from various runoff sources in the Mill-Manhan watersheds



*Potential Wetland Restoration Sites*

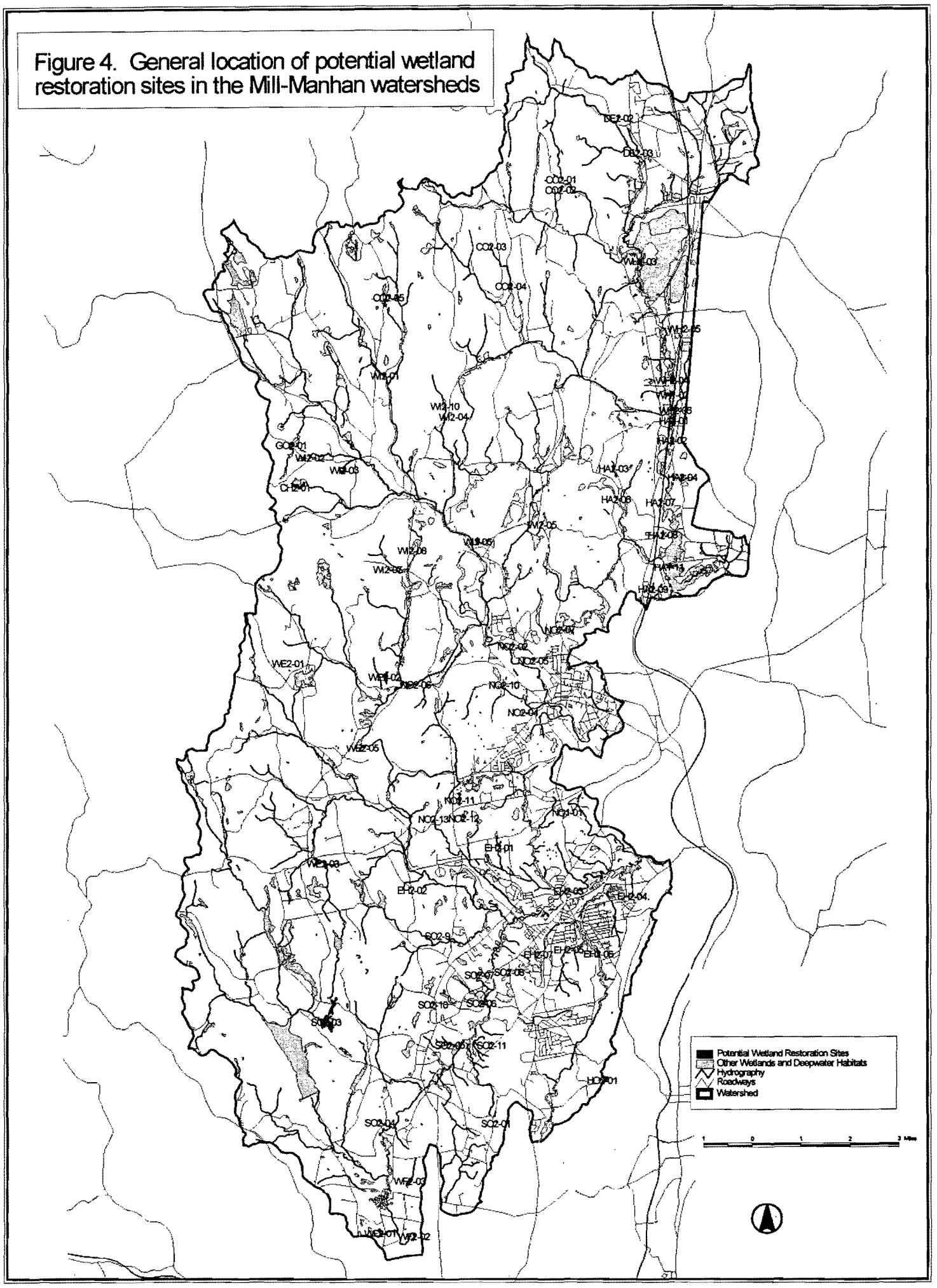
The wetlands of the Mill-Manhan watersheds are subjected to a multitude of human-induced stressors due to the agricultural history and current level of farming in the watersheds. In considering potential wetland restoration sites, this study attempted to emphasize former wetlands that may be restorable (called Type 1 restoration sites) and existing wetlands that were likely to be functionally impaired and that may be restorable (Type 2 sites). Type 1 sites may contain former wetlands that have been filled or effectively drained. The Type 2 sites may encompass existing wetlands that have been diked, ditched, and excavated where restoration of vegetated wetlands may be possible.

A total of 79 wetland complexes were identified as some type of potential wetland restoration site. Figure 4 shows the location of these numbered potential wetland restoration complexes in the watersheds, while data are summarized below and in Appendix B (detailed breakdowns of each site by town are presented in Appendix D). A digital database containing baseline information for use in preparing a more detailed restoration site matrix was prepared and given to the Corps, but is not included in this report.

Six Type 1 sites were detected in the study watersheds. Nearly 9 acres of these sites were found: four in Whately (5.1 acres), one in Hatfield (3.2 acres), and one in Northampton (0.5 acres). Most of these sites are cropland on former hydric soils.

A total of 73 Type 2 wetland restoration sites were inventoried, totaling 218.2 acres. Most (60%) of this acreage was represented by diked/impounded sites (129.9 acres). Ditched/partly drained wetlands accounted for 28 percent of the Type 2 sites (48.0 acres of emergent wetland, 6.3 acres of scrub-shrub wetland, and 6.5 acres of mixed emergent/shrub wetlands). Excavated wetlands that may have potential for restoration totaled 27.5 acres and most (95%) of this acreage consists of ponds dug out of vegetated wetlands.

Figure 4. General location of potential wetland restoration sites in the Mill-Manhan watersheds



Townwide Statistics

*Aquatic Resources*

A summary of wetlands and deepwater habitats in the Mill-Manhan watersheds by town is provided below. Most of the wetlands occurred in the towns of Whately, Williamsburg, Southampton, Hatfield, Northampton, and Easthampton. These towns each had more than 500 acres of wetlands and collectively they contained 4864 acres or 76 percent of the study area's wetlands. Whately was top-ranked in wetland abundance. Its wetlands represented 20 percent of the wetlands. Williamsburg was next ranked, having almost 14 percent of the area's wetlands. Nearly half (43%) of the area's deepwater habitats were located in Southampton. Goshen had about 150 acres of deepwater habitats, accounting for 16 percent of the study area's water body acreage. More detailed summaries for each town are provided in Appendix C.

| Town | Deepwater Habitat Acreage* | Wetland Acreage* | Town Acres in Watershed |
|---|---|---|---|
| Ashfield | - | 3.8 | 258 |
| Chesterfield | - | 59.0 | 1198 |
| Conway | 19.8 | 239.4 | 9674 |
| Deerfield | - | 376.4 | 6012 |
| Easthampton | 57.7 | 599.1 | 8309 |
| Goshen | 150.6 | 121.7 | 4066 |
| Hatfield | 46.0 | 728.9 | 6036 |
| Holyoke | - | 35.0 | 917 |
| Huntington | - | 76.3 | 1148 |
| Montgomery | - | 30.3 | 1945 |
| Northampton | 66.0 | 681.2 | 15202 |
| Southampton | 405.5 | 740.7 | 17578 |
| Westfield | - | 102.9 | 2650 |
| Westhampton | 55.3 | 478.9 | 16166 |
| Whately | 91.3 | 1247.8 | 10228 |
| Williamsburg | 58.0 | 865.8 | 16427 |

*Excludes linear stream and wetland acreages; any difference in the cumulative town total vs. the watershed total acreage is due to round-off.

*Potential Wetland Restoration Sites*

Listed below are sites that may have some potential for wetland restoration by town. Six Type 1 sites totaling 8.8 acres were detected in the study watersheds: 1 site in Hatfield (3.2 acres), 1 site in Northampton (0.5 acres), and 4 sites in Whately (5.1 acres). Most of these sites were agricultural lands on former hydric soils. These sites would require regrading (restoration of microrelief) and restoration of wetland hydrology.

A total of 218 acres of Type 2 sites were identified. This total amounted to roughly 5 percent of the wetlands in the Mill-Manhan watersheds. Over half of the potential Type 2 acreage was located in three towns: Southampton (26%), Hatfield (15%) and Westhampton (14%). More detailed summaries for wetland restoration sites by town are given in Appendix D.

| Town | # of Type 1 Sites/Acreage | # of Type 2 Sites/Acreage | Total Acreage of Restoration Sites |
|---|---|---|---|
| Ashfield | - | - | - |
| Chesterfield | - | 1/7.3 | 7.3 |
| Conway | - | 6/3.7 | 3.7 |
| Deerfield | - | 3/1.9 | 1.9 |
| Easthampton | - | 7/8.1 | 8.1 |
| Goshen | - | 1/1.7 | 1.7 |
| Hatfield | 1/3.2 | 10/33.7 | 36.9 |
| Holyoke | - | 1/1.4 | 1.4 |
| Huntington | - | - | - |
| Montgomery | - | - | - |
| Northampton | 1/0.5 | 12/23.4 | 23.9 |
| Southampton | - | 11/57.1 | 57.1 |
| Westfield | - | 3/15.9 | 15.9 |
| Westhampton | - | 5/30.6 | 30.6 |
| Whately | 4/5.1 | 3/13.5 | 18.6 |
| Williamsburg | - | 10/19.9 | 19.9 |

## General Comments on Restoration Opportunities

Wetland restoration in the Mill-Manhan watersheds may involve several approaches depending on the impact type. For partly drained wetlands, evaluation of the effects of drainage is required and then dig plugging, weir construction, or other hydrologic reconstruction may be done where restoration is deemed appropriate. The objective would be to hold water in the wetlands more than they currently do because of the drainage ditch. For excavated wetlands that are nonvegetated (e.g., palustrine unconsolidated bottoms = dug-out ponds), it may be worth considering establishing vegetated wetland in the shallow water zone. This may be accomplished by depositing clean fill or dredged material along the edge of the pond to raise elevations sufficient to support the establishment of wetland plants. The elevation and its effect on surface water depth and frequency and duration of flooding will dictate the types of plants that the area will be able to support. Particular attention must therefore be paid to the type of plants desired and their ecological requirements when planning the target elevation. A fringe of emergent wetland along a pond provides habitat suitable for wetland wildlife. Contact a wetland ecologist/wildlife management biologist for details. For impounded sites, the intended use of the impoundment must be considered as well as its current use by fish and wildlife. Many such sites may not be desirable for restoration of vegetated wetlands and may be best left alone. Some impounded sites, however, may be viewed as suitable for such restoration, especially those that lack shoreline wetlands.

In addition to the wetland sites identified as Type 1 or Type 2 restoration sites, there are numerous other wetlands in the Mill-Manhan watersheds that may be adversely affected by adjacent land use. Land use practices around these wetlands may be having a negative effect on the wetland by reducing its value to wildlife, by increasing sedimentation, or by introducing chemicals (pesticides, herbicides, and fertilizers) into them. In these situations, establishing a vegetated buffer of 100 or more feet could produce significant water quality benefits and some benefits to wildlife, while buffers of 200-300 feet would greatly increase wildlife habitat values.

**Acknowledgments**

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Photointerpretation for this effort was performed by John Swords of the U.S. Fish and Wildlife Service's National Wetlands Inventory Program (FWS-NWI), and Irene Huber and Todd Nuerminger of the Natural Resources Assessment Group in the Department of Plant and Soil Sciences, University of Massachusetts-Amherst. Map preparation and the baseline wetlands digital data were done mainly by the U.S. Fish and Wildlife Service's National Wetlands Inventory Center in St. Petersburg, Florida. Field work was performed by John Swords, Gabe DeAlessio (FWS-NWI), Claire Tebbs (FWS-NWI volunteer), Chris Hatfield, Judy Johnson (Corps), Ralph Tiner, Matt Starr (FWS-NWI), and Herb Bergquist (FWS-NWI). Construction of the digital database for the Mill-Manhan watersheds, data analysis, and preparation of maps and statistics for this report were done by Matt Starr. Ralph Tiner prepared the draft and final reports.

The draft report was reviewed by the U.S. Army Corps of Engineers and the Massachusetts Wetlands Restoration & Banking Program (MWRBP). Comments from Chris Hatfield and Hunt Durey (MWRBP) were most helpful in providing focus on certain wetland conditions and in finalizing this report.

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