AN ENVIRONMENTAL LAND USE PLAN FOR THE LAKE WISCONSIN WATERSHED WITHIN THE TOWN OF WEST POINT

COLUMBIA COUNTY, WISCONSIN

Prepared by:

Environmental Horizons, Incorporated

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The preparation of this publication was financed in part through a grant from the Wisconsin Department of Natural Resources Lake Management Planning Grant Program.

June 2006

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Chapter I

INTRODUCTION

BACKGROUND

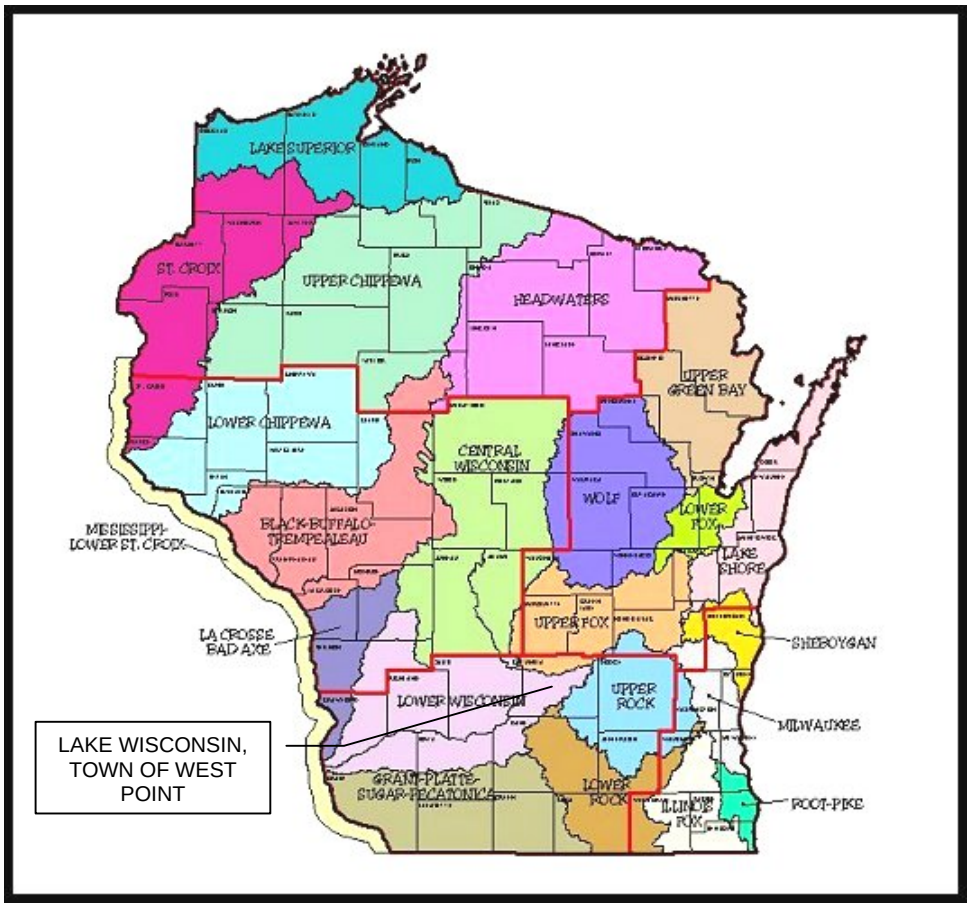
The Town of West Point is situated on the southern shore of Lake Wisconsin, an impounded portion of the Wisconsin River, as shown on Map 1. During the early 2000s, the Town determined that changing land use patterns within the Town were creating conditions that, if continued unabated, would change the character of the Town from a rural community to a more urbanized community serving as a “bedroom community” for the Madison metropolitan area. Wishing to manage any such transition in a rational manner, the Town has undertaken a review of its land uses and applicable ordinances to support development that is consistent with the unique environmental setting of the municipality and consistent with the protection of water quality in Lake Wisconsin. Funding for this project was provided, in part, through the Chapter NR 190 Lake Management Planning Grant Program administered by the Wisconsin Department of Natural Resources, and by the Town. The project was undertaken during 2005 and 2006 by Environmental Horizons, Incorporated, consultants to the Town of West Point, under the general guidance of the Town of West Point Town Board and the Town of West Point Lake Planning Grant Committee.

RATIONALE

Urbanization results in a change to the manner in which water and associated contaminants move across the land surface. New contaminants are introduced in urban settings, relative to historic forested lands and previous agricultural land uses. In this regard, agricultural lands are subjected to various soil amendments and practices that potentially mobilize plant nutrients, such as nitrogen and phosphorus, as well as sediments. Integrated nutrient and pest management practices can limit the available agro-chemicals subject to transport by runoff to water courses; however, agricultural land uses do mobilize significantly higher nutrient and sediment loads than occurs from natural, forested lands. As agricultural lands are converted to urban land uses, the levels of soil loss and nutrient transport can be reduced, while heavy metals such as copper and zinc become available and are transported to water courses.

Map 1

WISCONSIN WATERSHEDS: THE LOWER WISCONSIN RIVER BASIN



Source: Wisconsin Department of Natural Resources.

The levels and impacts of such contaminants can be managed through sound land use planning and management practices. Such practices are typically established through land use zoning and building-construction ordinances. For this reason, Environmental Horizons Inc was requested by the Town of West Point to review the current Town Code of Ordinances from the point of view of making recommendations that will ensure that future land use changes in the Town have minimal impacts on the water resources in and around the Town, focusing initially on the Lake Wisconsin drainage area within the Town of West Point. This review does not constitute legal advice.

As any potential land use changes have water quality impacts, the degree of water quality impact was assessed as a part of this planning project. This assessment focused initially on two major embayments of

Lake Wisconsin within the Town—embayments locally known as No-Name Bay and Sunset Bay, and utilized two simple mass-balance models; namely, the Wisconsin Department of Natural Resources Wisconsin Lake Model Spreadsheet model (WILMS version 3.0) and the Southeastern Wisconsin Regional Planning Commission unit area load (UAL) model. This approach provides a template for similar analyses that might be conducted as a subsequent phase of this phased land and water management planning project. Based upon the results of this model-based analysis, appropriate management measures for the protection of lake water quality can be defined.

One element of an appropriate lake water quality management strategy is sound land use planning within that portion of the Town of West Point draining to Lake Wisconsin. Appropriate land use planning within this drainage area is an essential element of such a strategy for protecting the integrity of both terrestrial and aquatic ecosystems. Data on the natural resource base of the Town was used to delineate potential environmental corridors, thereby identifying those elements of the natural resource base that should be protected in order to preserve the character and ambience of the Town, as well as provide for the protection of critical ecosystems. These resultant environmental corridors and isolated natural resource features provide a framework for the maintenance of not only the rural ambience for which the Town is known, but also for the water quality protections required for the maintenance of good water quality in Lake Wisconsin. This process adopted the methodology first employed by the Southeastern Wisconsin Regional Planning Commission in the delineation of environmental corridors and isolated natural resource features in the metropolitan Milwaukee area. An important element of this process was to establish connectivity between ecosystem elements, which continuity can be continued beyond the drainage area tributary to Lake Wisconsin and extend into other areas of the Town of West Point. Consequently, while this report focuses on the Lake Wisconsin drainage area, the methodologies utilized in generating the findings and recommendations set forth herein are readily transferable to other areas of the Town of West Point and beyond.

REPORT FORMAT

The findings and recommendations of this lake protection plan are set forth in this report. Following this introductory chapter, Chapter II presents information on the environmental corridors identified within the Town of West Point, including a description of the methodology employed in the delineation of the corridors and isolated natural resource features and the resultant corridors and natural resource features identified. Chapter III sets forth the potential water quality impacts of existing land uses on two bays that form a portion of the coast line of Lake Wisconsin within the Town. A component of this assessment is the delineation of the major subwatersheds draining to Lake Wisconsin from within the Town of West Point. These subwatersheds provide the basis for assessing the relative contributions of various land use

elements to the contaminant loading of the Lake. Chapter IV presents an overview of development impacts attendant to various types of land use, based upon the adopted land management plans of the Town of West Point, including a review of the applicable Town ordinances relating to development controls within the Town. Chapter IV also includes the results of a questionnaire survey conducted amongst Town residents riparian to Lake Wisconsin to determine their views on current and proposed land and water management actions. Chapter V presents an overview of those actions recommended for consideration by the Town of West Point Town Board, including actions to: refine the current ordinances relating to land and water management and in the Town by incorporating the environmental corridor concept into the Town land use plan and Code of Ordinances, initiate a process of citizen informational programming and monitoring to create a foundation for implementing sound lake management practices, and implement appropriate land and water management measures within the Town.

The scope of this report is limited primarily to consideration of the factors affecting the water quality of the nearshore waters of Lake Wisconsin adjacent to the Town of West Point. However, this plan forms an integral part of any future comprehensive lake management plan for the Lake. The preparation of a comprehensive lake management plan for Lake Wisconsin, however, will require additional water quality and biological data collection and analysis, and expansion of the scope of the work beyond the bounds of the Town.

This plan is intended to address the lake water quality goals and objectives of the Town of West Point community riparian to Lake Wisconsin. These goals and objectives are:

1. To protect and maintain public health, and to promote public comfort, convenience, necessity, and welfare, through the environmentally sound management of vegetation, fishery, and wildlife populations, in and around Lake Wisconsin;

2. To provide for high-quality, water-oriented recreational and aesthetic opportunities for residents and visitors to the Town of West Point, and manage the waters of Lake Wisconsin within the Town in an environmentally sound manner; and,

3. To effectively manage the water quality of Lake Wisconsin to the extent possible within the jurisdiction of the Town of West Point to maintain healthy aquatic and riparian wetland plant communities and, thereby, better facilitate the conduct of water-related recreation, improve the aesthetic value of the resource to the community, and enhance the resource value of the waterbody.

This inventory and plan element, which conforms to the requirements and standards set forth in the relevant *Wisconsin Administrative Codes*,[1] should serve as an initial step in achieving these objectives over time.

[1] *This plan has been prepared pursuant to the standards and requirements set forth,* inter alia*, in the* Wisconsin Administrative Code*: Chapter NR 1, "Public Access Policy for Waterways;" Chapter NR 103, "Water Quality Standards for Wetlands;" Chapter NR 107, "Aquatic Plant Management;" and Chapter NR 109, "Aquatic Plants Introduction, Manual Removal and Mechanical Control Regulations."*

Chapter II

ENVIRONMENTAL CORRIDOR DELINEATION

INTRODUCTION

The physical characteristics of a lake and its watershed are important factors in any evaluation of existing and likely future water quality conditions and lake uses, including recreational uses. Characteristics, such as watershed topography and local hydrology, ultimately influence water quality conditions and the composition of plant and fish communities within the lake. Therefore, these characteristics must be considered during the lake management planning process. Accordingly, this chapter provides pertinent information on the physical characteristics of the Lake Wisconsin watershed within the Town of West Point. These inventories are utilized in the delineation of “environmental corridors” within the Town. Environmental corridors are those areas having high concentrations of natural, recreational, historic, aesthetic, and scenic resources. Protection of these areas helps to maintain the overall quality of the environment and contributes to the ambience of the community. Subsequent chapters deal with the chemical and biological environments of the Lake and land uses within its drainage area.

ENVIRONMENTAL CORRIDORS

Environmental corridors include one or more of the following seven elements of the natural resource base which are essential to the maintenance of both the ecological balance and the natural beauty of the Region:

1) lakes, rivers, and streams and the associated undeveloped shorelands and floodlands;
2) wetlands;
3) woodlands;
4) prairies;
5) wildlife habitat areas;
6) wet, poorly drained, and organic soils; and,
7) rugged terrain and high-relief topography.

While the foregoing seven elements constitute integral parts of the natural resource base, there are five additional elements which, although not a part of the natural resource base *per se*, are closely related to or centered on that base and therefore are important considerations in identifying and delineating areas with

scenic, recreational, and educational value:

1) existing outdoor recreation sites;
2) potential outdoor recreation and related open space sites;
3) historic, archaeological, and other cultural sites;
4) significant scenic areas and vistas; and,
5) natural and scientific areas.

The delineation of these 12 natural resource and natural resource-related elements on a map results in an essentially linear pattern of relatively narrow, elongated areas, termed "environmental corridors" by the Southeastern Wisconsin Regional Planning Commission.1

It is important to point out that, because of the many interlocking and interacting relationships between living organisms and their environment, the destruction or deterioration of any one element of the total environment may lead to a chain reaction of deterioration and destruction among the others. The drainage of wetlands, for example, may have far-reaching effects, since such drainage may destroy fish spawning grounds, wildlife habitat, groundwater recharge areas, and natural filtration and floodwater storage areas of interconnecting lake and stream systems. The resulting deterioration of surface water quality may, in turn, lead to a deterioration of the quality of the groundwater. Groundwater serves as a source of domestic, municipal, and industrial water supply and provides a reservoir for low, or base, flows in rivers and streams. Similarly, the destruction of woodland cover, which may have taken a century or more to develop, may result in soil erosion and stream siltation and in more rapid runoff and increased flooding, as well as destruction of wildlife habitat. Although the effects of any one of these environmental changes may not in and of itself be overwhelming, the combined effects may lead eventually to the deterioration of the underlying and supporting natural resource base, and of the overall quality of the environment for life. The need to protect and preserve the remaining environmental corridors within the drainage area tributary to Lake Wisconsin thus becomes apparent. In the drainage area tributary to Lake Wisconsin, the riverbanks and lakeshores located within the environmental corridors should be candidates for immediate protection through proper zoning or through public ownership.

Primary Environmental Corridors

Primary environmental corridors generally lie along major stream valleys and around major lakes, and contain almost all of the remaining high-value woodlands, wetlands, and wildlife habitat areas. These corridors also contain all of the major bodies of surface water and related undeveloped floodlands and

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1 RUBIN, BRUCE P. & GERALD H. EMMERICH JR. (1981), Refining the Delineation of the Environmental Corridors in Southeastern Wisconsin, Southeastern Wisconsin Regional Planning Commission Technical Record*, Vol. 4 (2), pages 1-21.*

shorelands. These corridors frequently are subject to urban encroachment because of their desirable natural resource amenities. Unplanned or poorly planned intrusion of urban development into these corridors, however, not only tends to destroy the very resources and related amenities sought by the development, but tends to create severe environmental and development problems as well. The preservation of these corridors, thus, is one of the major ways in which the water quality of Lake Wisconsin can be maintained and perhaps improved. Primary environmental corridors include a wide variety of the abovementioned important resource and resource-related elements and are at least 400 acres in area, 2 miles in length, and 200 feet in width. Primary environmental corridors would be contiguous with environmental corridors and isolated natural areas lying outside the lake drainage area boundary.

Secondary Environmental Corridors

Secondary environmental corridors generally are located along intermittent streams or serve as links between segments of primary environmental corridor. These secondary environmental corridors contain a variety of resource elements, often remnant resources of primary environmental corridors that have been developed for intensive agricultural purposes and/or urban land uses. Secondary environmental corridors facilitate surface water drainage, maintain “pockets” of natural resource features, and provide for the movement of wildlife and dispersal of seeds for a variety of plant species. Such corridors should be preserved in essentially open, natural uses. As urban development proceeds, these areas should be incorporated into urban stormwater detention areas, associated drainageways, and neighborhood parks to the extent practicable.

Isolated Natural Resource Areas

In addition to the environmental corridors, other, smaller concentrations of natural resource base elements exist within the drainage area tributary to Lake Wisconsin. These elements are isolated from the environmental corridors by urban development and/or agricultural lands, but, although separated from the environmental corridor network, retain important natural values. Isolated natural resource areas may provide the only available wildlife habitat in an area, and are good locations for local parks and nature study areas contributing to the aesthetic character or natural diversity in a given area. Important isolated natural resource features may include isolated wetlands, woodlands, and wildlife habitat areas. These isolated natural resource features should also be protected and preserved in a natural state whenever possible.

NATURAL RESOURCE FEATURES

The natural resources of an area are important determinants of the ability of an area to provide a pleasant and habitable environment for all forms of life and to maintain its social and economic well being. The most

significant remaining aspects of the natural resource base should be preserved to help retain and maintain the ecological balance and natural beauty of the Town of West Point planning area. A description of the natural resource base, including surface water resources, wetlands, woodlands, and prime agricultural lands, is presented in this section.

Surface Water Resources

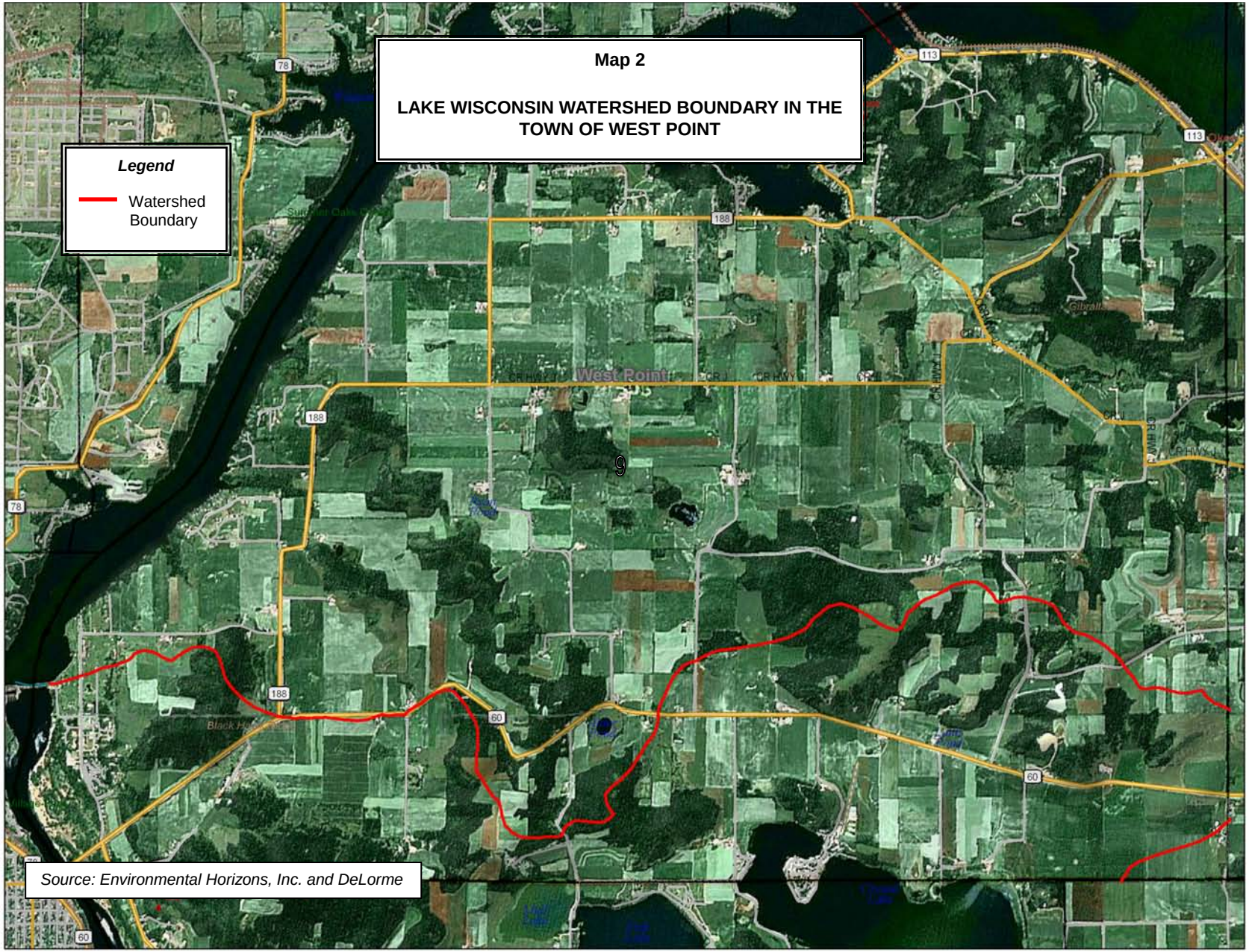
Surface water resources and associated floodplains form an important element of the natural resource base of the Town of West Point. The Town lies within a single drainage basin, in two watersheds, with the northern portion of the Town draining to Lake Wisconsin and the southern portion of the Town draining to the Wisconsin River. The watershed boundary is shown on Map 2. Perennial streams are defined as watercourses that maintain, at a minimum, a small continuous flow throughout the year except under unusual drought conditions, while intermittent streams are defined as watercourses that do not maintain a continuous flow throughout the year. Both are represented in the Town.

The floodplains of a river or stream are the wide, gently sloping areas contiguous to, and usually lying on both sides of, the river or stream channel. Rivers and streams occupy their channels most of the time. However, during even minor rainfall events, stream discharges are likely to increase markedly, and the channel may not be able to contain and convey all of the resultant flow. As a result of these stage increases, the river or stream spreads laterally over the floodplain. The periodic flows of a river or stream into the floodplain is a normal phenomenon and, in the absence of costly structural flood control works, will occur regardless of whether urban development exists on the floodplain or not.

For planning and regulatory purposes, floodplains are normally defined as the areas, excluding the channel, subject to inundation by the 100-year recurrence interval flood event. This is the event that would be reached or exceeded in severity, on average, once every 100 years. Stated another way, there is a 1 percent chance of this event being reached or exceeded in severity in any given year.

Floodplain areas are generally not well suited to urban development, not only because of the flood hazard, but also because of the presence of high water tables and soils poorly suited to urban uses. The floodplains, however, generally contain such important natural resource elements as woodlands, wetlands, and wildlife habitat areas. Therefore, floodplains can form prime locations for open space activities such as park and open space uses. Floodplains typically are delineated under the Federal Flood Insurance Program by County.

In addition, although not classified as streams, other natural and constructed drainageways may be located within agricultural areas in the planning area. The protection of these drainageways would serve to



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improve water quality, soil conditions, and wildlife habitat. Such drainageways can be protected through enrollment in the U. S. Department of Agriculture Conservation Reserve Enhancement Program (CREP) program and/or through zoning or other protective measures in the event that the abutting farmlands are developed in the future for urban uses.

Wetlands

For planning purposes, wetlands are commonly defined as areas in which the water table is at, near, or above the land surface and which are characterized by both hydric soils and the growth of sedges, cattails, or other wetland vegetation. Wetlands generally occur in depressions and near the bottom of slopes, particularly along lakeshores and stream banks, and on large land areas that are poorly drained. These wetlands perform an important set of natural functions, which include support of a wide variety of desirable, and sometimes unique, forms of plant and animal life; stabilization of lake levels and stream flows; entrapment and storage of plant nutrients in runoff, thus reducing the rate of enrichment of surface waters and noxious weed and algae growth; contribution to the atmospheric oxygen and water supplies; reduction of stormwater runoff by providing areas for floodwater impoundment and storage; protection of shorelines from erosion; entrapment of soil particles suspended in runoff and reduction of stream sedimentation; provision of groundwater recharge and discharge areas; and provision of opportunities for certain scientific, educational, and recreational pursuits. Wetlands within the Town of West Point planning area are shown on Map 3. As of 2000, wetlands and depressional areas covered about 308 acres, or about 2.5 percent of the planning area.

In some cases, wetland areas have been converted to cropland by clearing, draining, and/or filling. Such areas are not shown as wetlands on Map 3, but may be reclassified as wetlands in a future inventory, if the land is no longer farmed and the land reverts to wetland conditions.

Woodlands

Woodlands are defined as those upland areas one acre or more in size with 17 or more deciduous trees per acre, each measuring at least four inches in diameter at breast height, and having 50 percent or more tree canopy coverage. Coniferous tree plantations and reforestation projects also are identified as woodlands.

Woodlands provide an attractive natural resource of immeasurable value. Under good management, woodlands can serve a variety of beneficial functions, contributing to clean air and water, regulating surface water runoff, and contributing to the maintenance of a diversity of plant and animal life. Woodlands may require a century or more to develop. However, they can be destroyed through mismanagement within a comparatively short time. Deforestation can contribute to rapid stormwater runoff, siltation of lakes and

streams, and destruction of wildlife habitat, with concomitant human impacts. Consequently, woodlands should be maintained for their scenic, wildlife habitat, educational, and recreational value and for air and water quality protection.

Woodlands encompassed approximately 2875 acres, or about 22 percent of the planning area in 2000. As shown on Map 3, woodlands are scattered throughout the planning area.

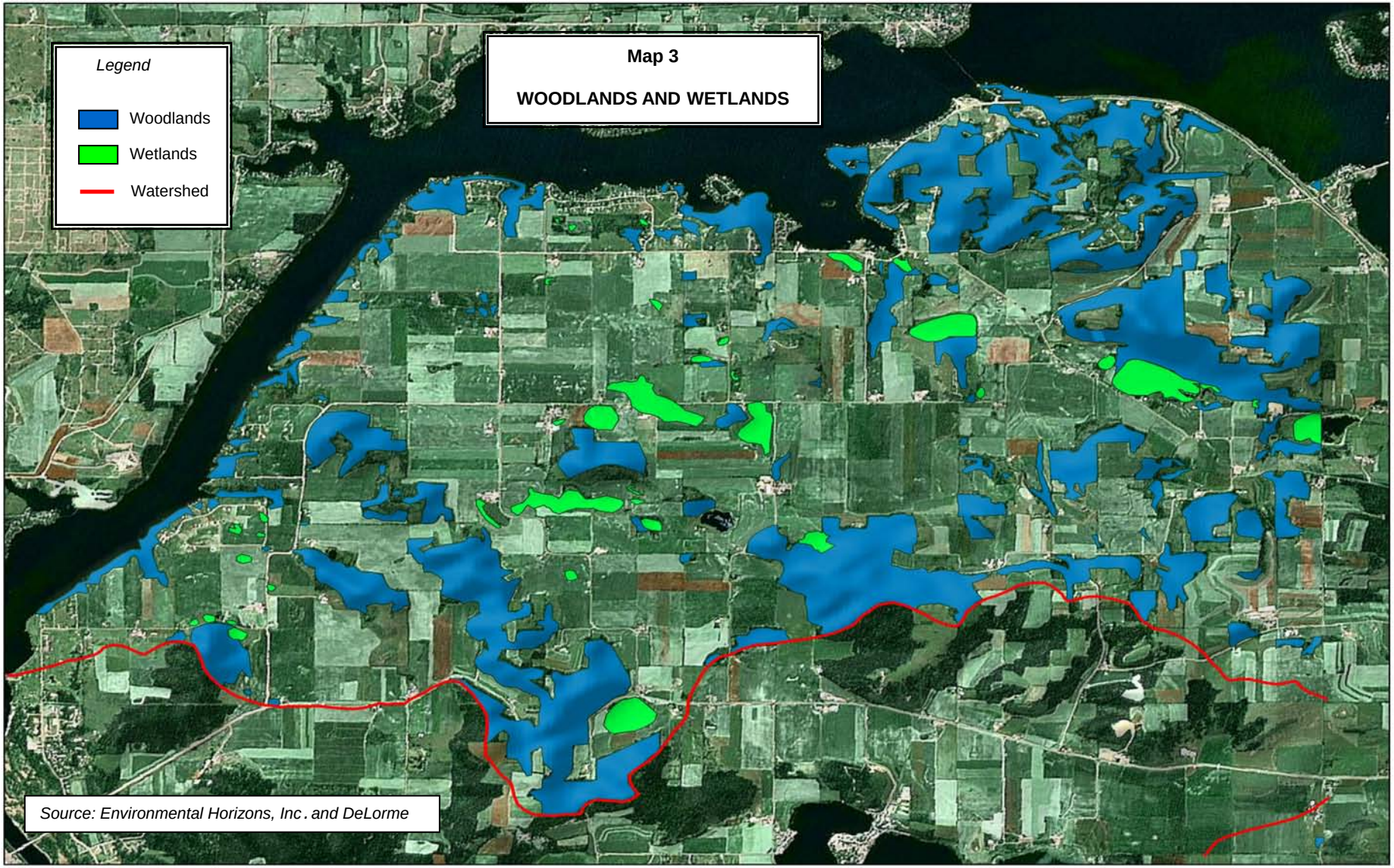
Soils

Soils and their management are one of the most important contributing factors to water quality within a given watershed. In 1978, the USDA, Soil Conservation Service completed a soil survey report for Columbia County. The report included comprehensive information on individual soil types within the county and aerial photographs and interpretations of those soils. The report is available in hard copy format or on CD Rom; however, it is also available online by accessing the USDA's website at http://websoilsurvey.nrcs.usda.gov/app/.

Each soil type has its own unique set of characteristics such as land slope, permeability or infiltration rate, chemical properties, vegetation, susceptibility to erosion, among others which all affect the suitability of a soil in terms of onsite sewage system suitability, agricultural productivity, and the volume of runoff generated.

Soil Erodibility

Soil erodibility is a function of many variables, some of the most important of which are soil slope and soil surface texture. Soil slope governs one of the most important physical characteristics of soil with regard to land management. In general, soils in excess of four percent slope should be highly managed to prevent soil erosion. Soil texture consists of the combination of soil grain sizes, of which silt sized particles are the most susceptible to eroding from the land surface. Map 4 illustrates soil erodibility characteristics within the Town of West Point. Approximately one third of the soils are considered highly erodible; just under two thirds are considered erodible; and the remainder are classified as unknown or undetermined. Highly erodible soils should be regarded as areas that require more intensive land management, especially when utilized for agricultural use or when being excavated for construction sites. These soils are very susceptible to erosion and preventative measures using conservation farming practices such as conservation tillage, no tillage, ridge tillage, contour farming, among others, or a multitude of construction site best management practices should be used.



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Onsite System Suitability

The majority of soils in the drainage area to Lake Wisconsin within the Town of West Point are unsuitable for onsite sewage disposal systems; this is illustrated on Map 5. The remaining soils are classified as limited or nonrated. The USDA – Natural Resources Conservation Service uses a variety of soil characteristics to evaluate whether a soil between the depths of 24 and 60 inches is suitable for effluent attenuation, installation, and functionality and maintenance of the system, and public health. These properties include but are not limited to proximity to groundwater, slope, permeability, presence of gravel and boulders, and depth to bedrock. The soils in the drainage area of Lake Wisconsin are predominately rated as very limited for septic tank absorption fields. From a management standpoint, septic systems installed in this area, especially those in close proximity to Lake Wisconsin should be evaluated on a frequent and regular basis to ensure that the system is functioning properly. Some of these systems may experience lateral flow due to the higher slopes surrounding the lake or the effluent may drain so rapidly through the absorption field, that there is not enough contact time to attenuate the contaminants before entering the lake.

Farmland Designation

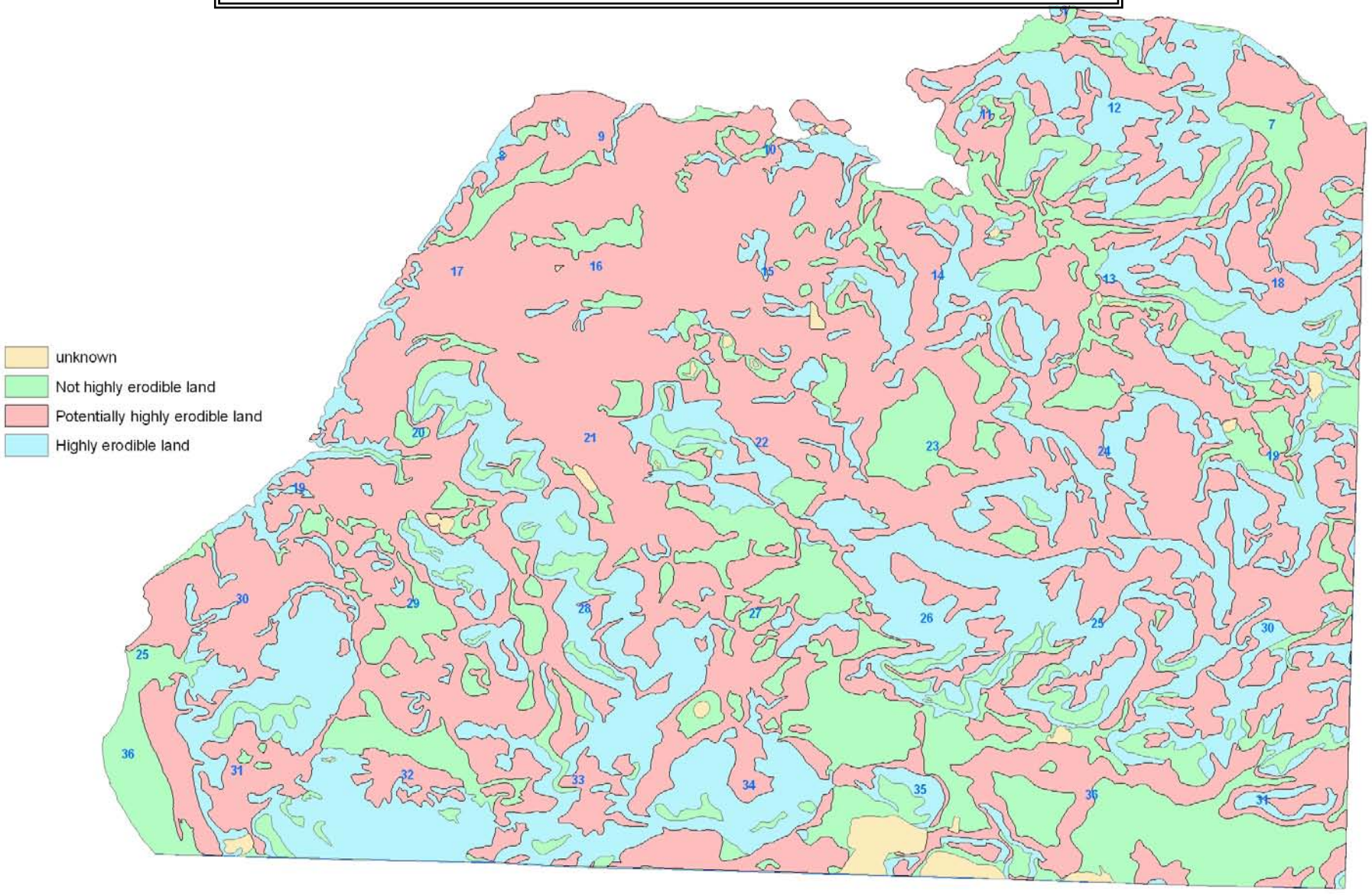
A soil's suitability for agricultural production is driven by a multitude of factors, chiefly of importance being soil slope, soil fertility, and drainage. The agricultural suitability of soils is illustrated on Map 6. Approximately 50 percent of the soils in the drainage area to Lake Wisconsin within the Town of West Point are considered Prime Farmland or Farmland of Statewide Importance. The remaining soils are considered to be average or low producing agricultural soils, with the latter considered not significant in terms of agricultural yield and production. Soils used for agricultural purposes should have a farm plan designed so that soil erosion is limited to every extent practical, and that soil amendments such as fertilizers and livestock manures are applied according to the needs of the crop.

Hydric Soils

Hydric soils are wet soils that have a high water table for long enough during the year that the soil's chemical properties are changed. Hydric soils are typified by gray or gleyed colors at or near the soil's surface. These colors are caused by the anaerobic conditions brought on by continued saturation. Hydric soils can be organic or mineral in nature and are commonly found in depressional areas, wetlands, or nearshore areas. Hydric soils do not have to be associated with a wetland identified in the State wetland inventory. Hydric soils are commonly found in isolated depressional areas. Areas containing hydric soils are not suitable for building purposes or for roads without significant alteration to the foundational base. Homes or buildings constructed on hydric soils will have ongoing foundation problems due to wetness and roads will be more subject to cracking and settling. Approximately 15 percent of soils within the Town are considered hydric.

Map 4

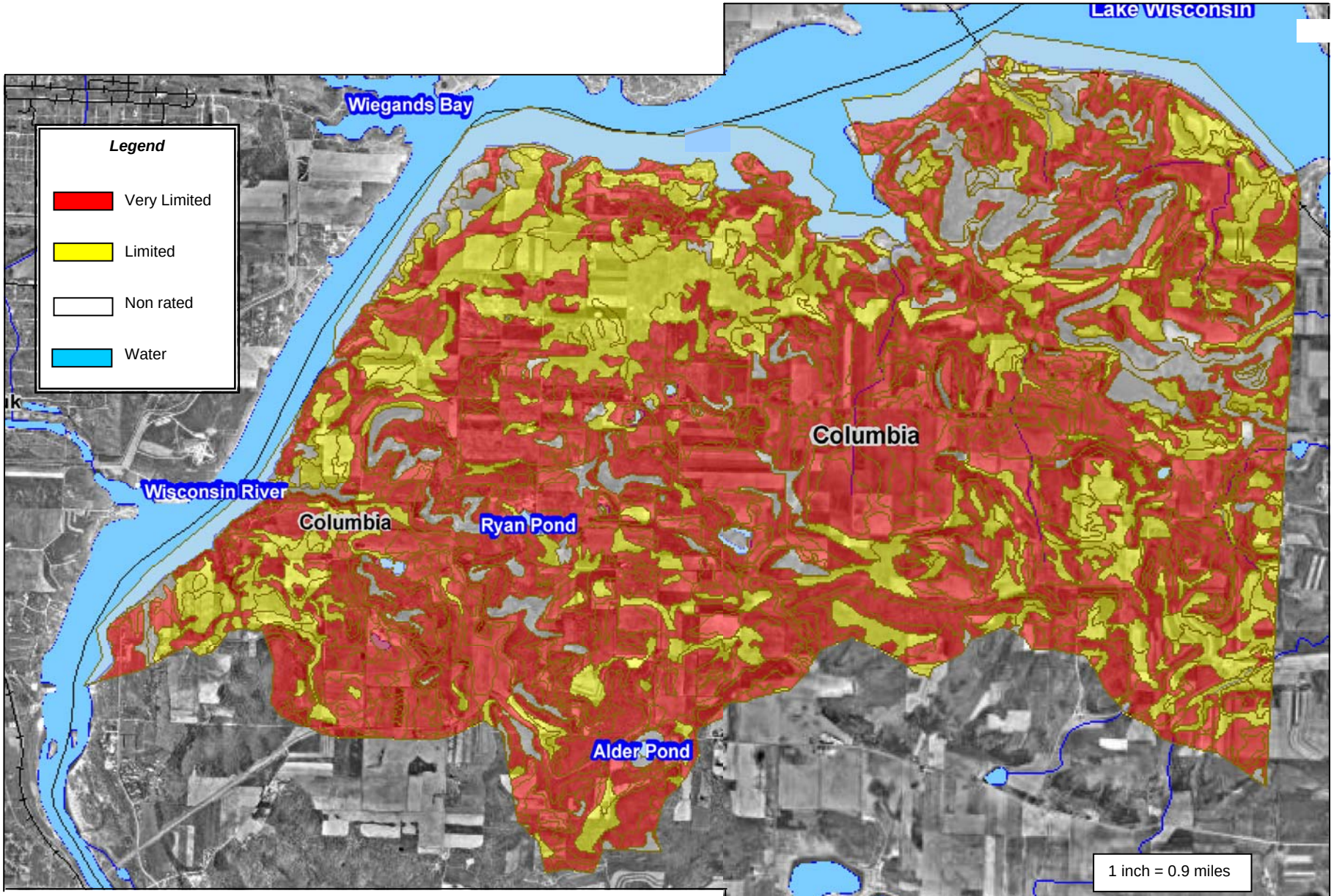
HIGHLY ERODIBLE LANDS IN THE TOWN OF WEST POINT, COLUMBIA COUNTY, WISCONSIN



Source: USDA – Natural Resources Conservation Service.

Map 5

Town of West Point Within the Lake Wisconsin Watershed – Onsite Septic System Soil Suitability

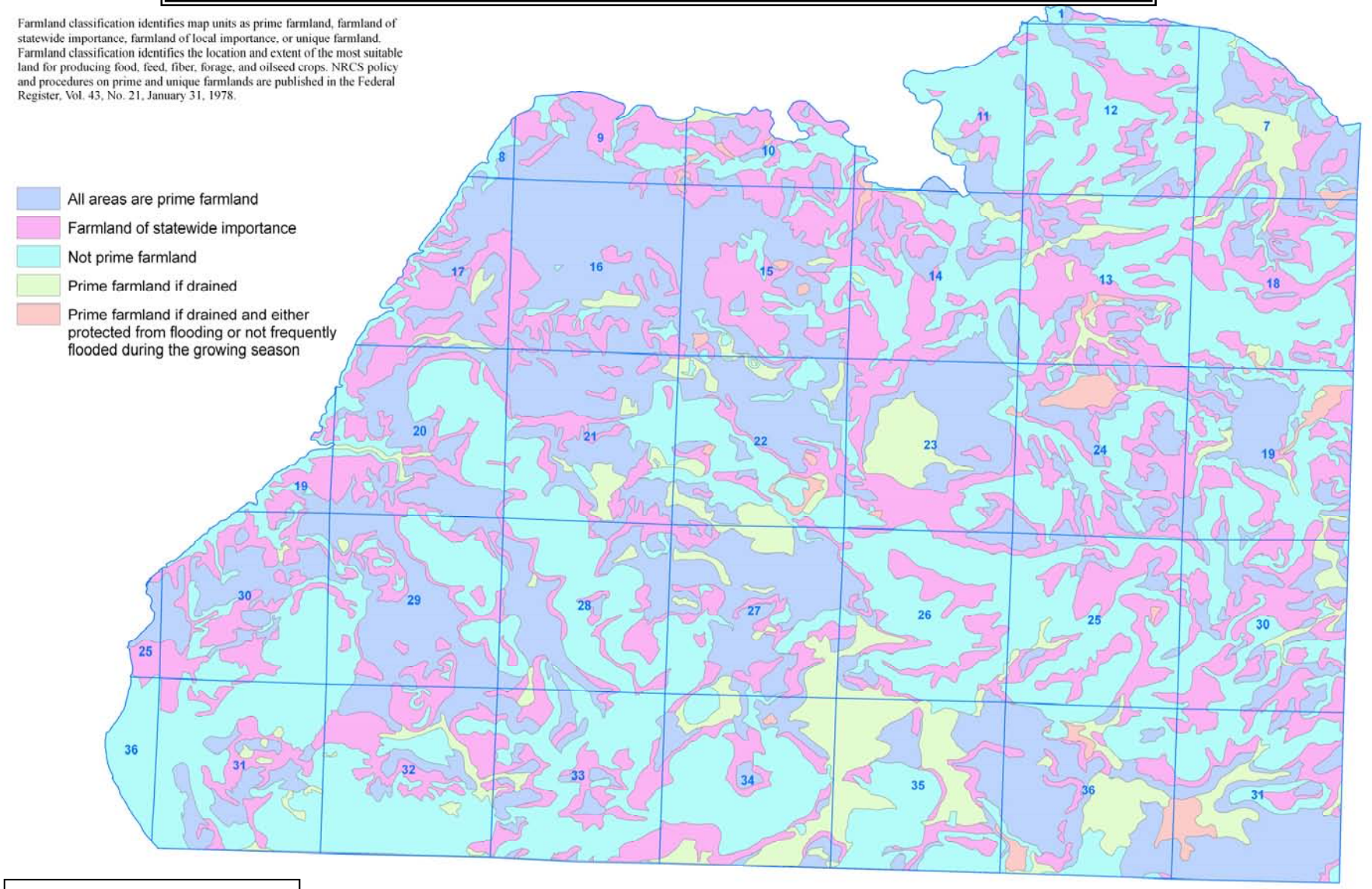


Source: USDA – Natural Resources Conservation Service

Map 6

FARMLAND CLASSIFICATION IN THE TOWN OF WEST POINT, COLUMBIA COUNTY, WISCONSIN

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. Farmland classification identifies the location and extent of the most suitable land for producing food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the Federal Register, Vol. 43, No. 21, January 31, 1978.



Source: USDA – Natural Resources Conservation Service.

These areas should be avoided for future development. Hydric soils in the Town of West Point are illustrated on Map 7.

Soil Drainage

Soil drainage is one of the most important characteristics of a soil governing its potential use in terms of the ability to grow crops, and for land development. The soils in the Town are predominately well to moderately well drained soils as shown on Map 8. However, a significant amount of soils are considered somewhat poorly drained, poorly drained, and very poorly drained. These soils provide challenges for agricultural production and must be drained in order to provide productive yields. In addition to being problematic for agricultural, building foundations and road foundations are poorly suited for these soil types and can be expected to have ongoing foundation problems due to wetness.

Topography

The Town of West Point is characterized by rolling relief. Prominent wooded ridges are common place within the Town, interspersed with areas of less relief that are dominated by agriculture. The topographical features of the Town are illustrated on Map 9. These ridges of which Gibraltar Rock is a part were not created glacially. Rather they are remnants of an eroded landscape and are comprised of Ordovician St. Peter's sandstone[1]. Underlying the St. Peter's sandstone are older sandstone deposits. These sandstones were deposited during a time in which much of Wisconsin was covered by shallow inland seas.

FISH AND WILDLIFE

An inventory of fish and wildlife resources in the vicinity of Lake Wisconsin was prepared as part of the relicensing requirements for the hydroelectric plant for which Lake Wisconsin serves as the water reservoir[2]. A recommended protocol for citizen based monitoring of Lake Wisconsin fish species is set forth in Appendix A.

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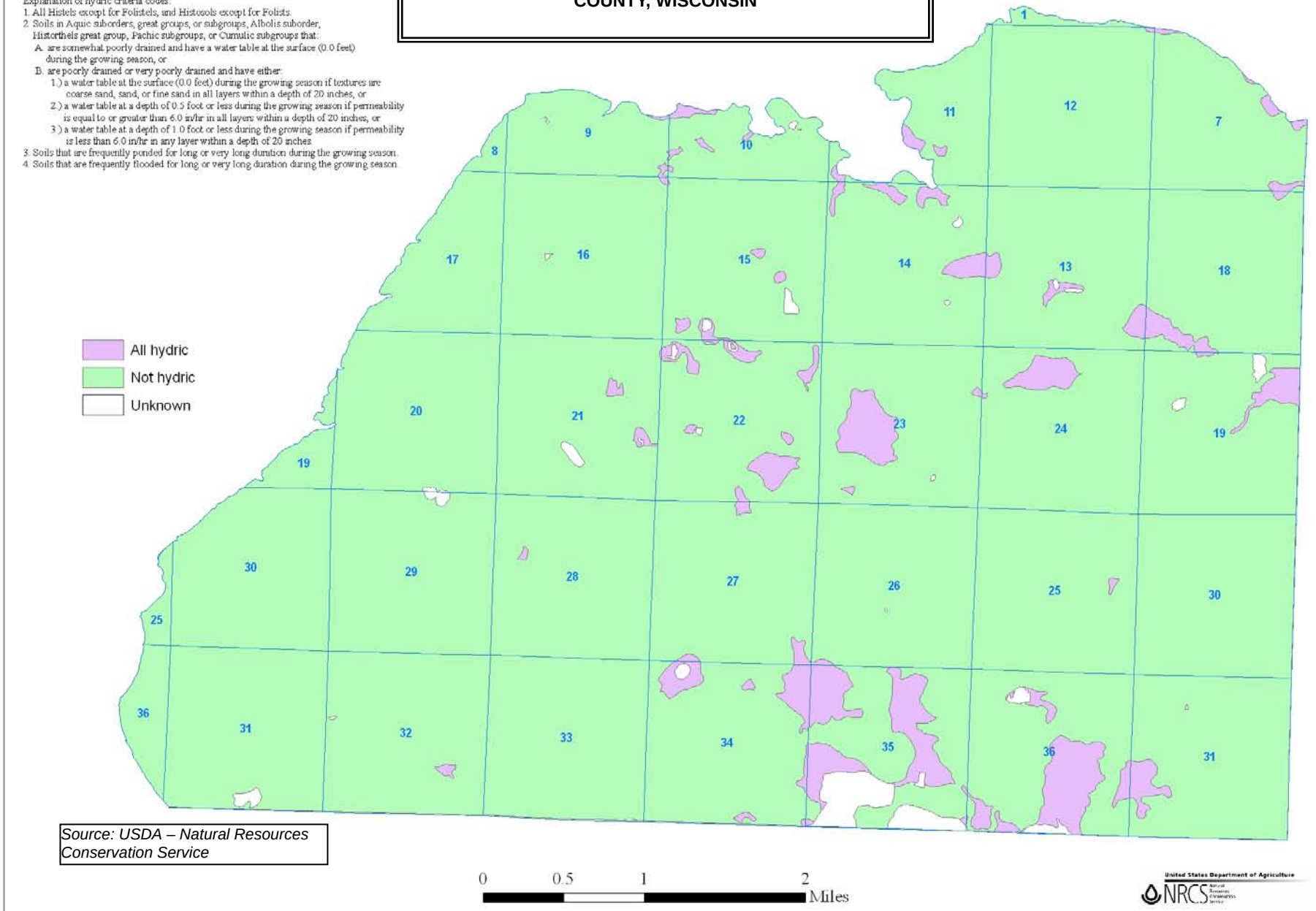
[1] *Dott, Robert H., and Attig, John W.,* Roadside Geology of Wisconsin, *2004, Mountain Press Publishing Company, Missoula, MT.*

[2] *Wisconsin Power & Light Company and Mead and Hunt,* Prairie du Sac Hydroelectric Project FERC Project No. 11162-000, Wisconsin River Sauk & Columbia Counties, Volume 1, *1993.*

Map 7

HYDRIC SOILS IN THE TOWN OF WEST POINT, COLUMBIA COUNTY, WISCONSIN

Explanation of hydric criteria codes:
1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Pachic subgroups, or Cumulic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      1.) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      2.) a water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      3.) a water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for long or very long duration during the growing season.
4. Soils that are frequently flooded for long or very long duration during the growing season.



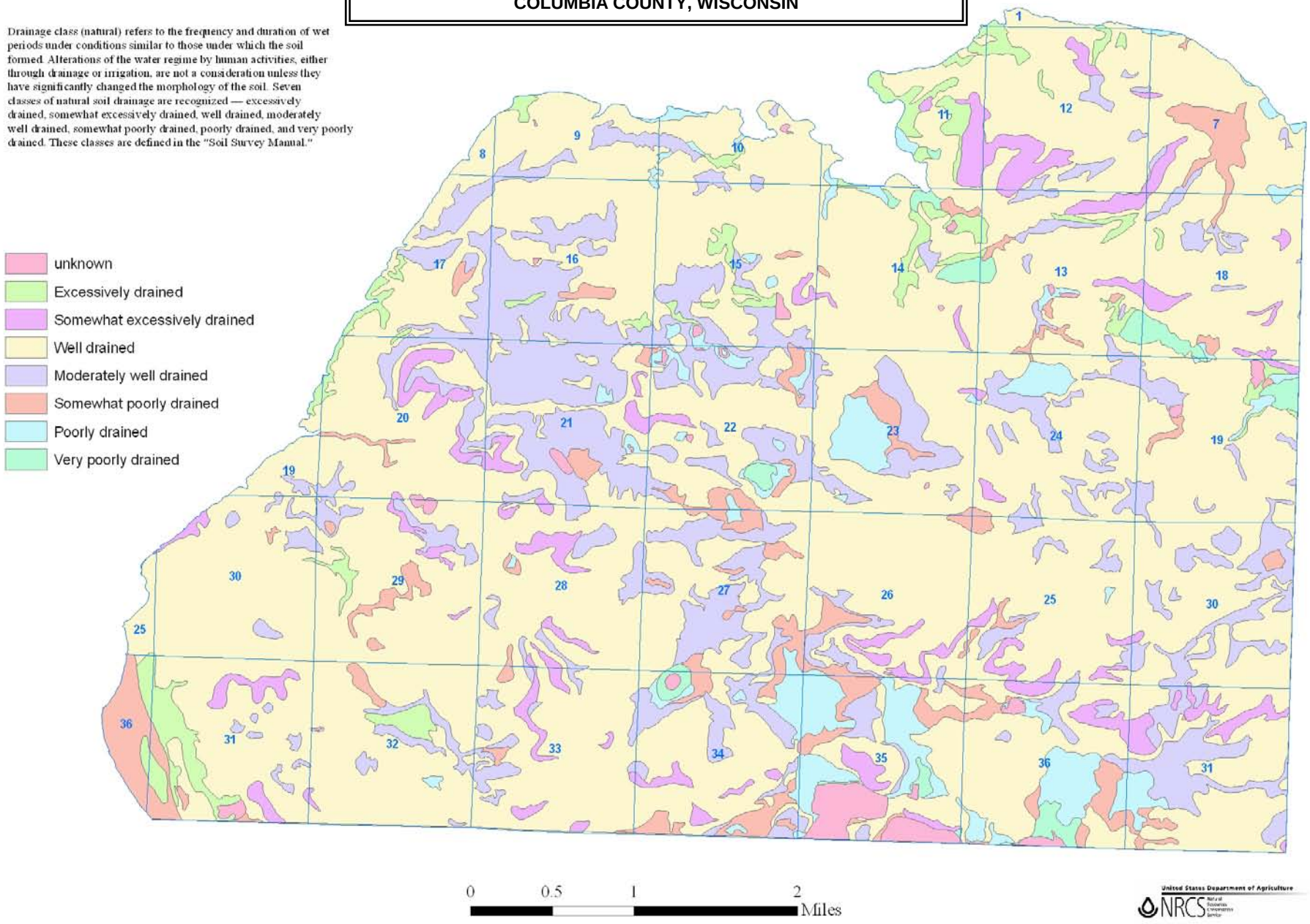
Source: USDA – Natural Resources Conservation Service

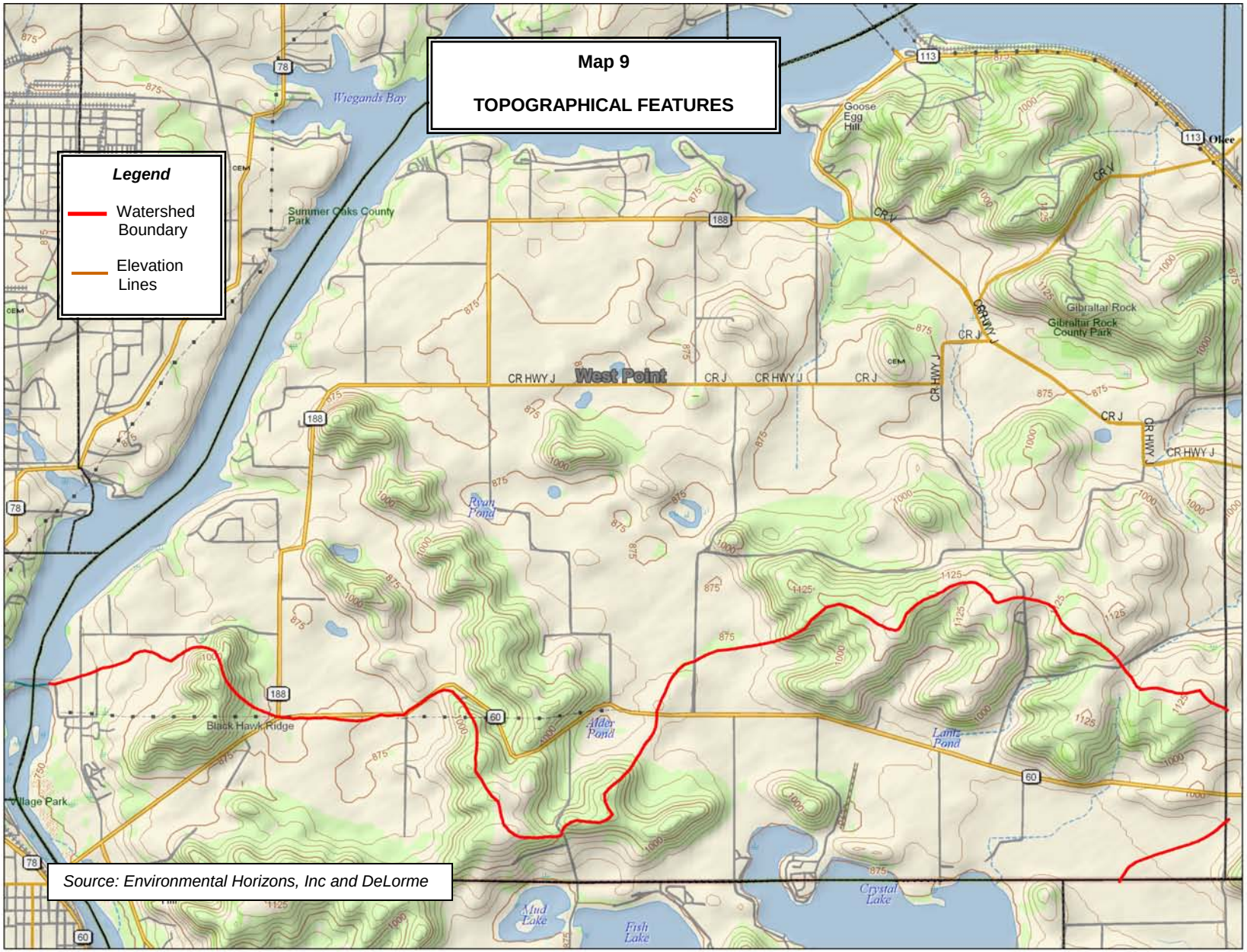
United States Department of Agriculture
NRCS

Map 8

SOIL DRAINAGE CLASSIFICATIONS IN THE TOWN OF WEST POINT, COLUMBIA COUNTY, WISCONSIN

Drainage class (natural) refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized — excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."





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Lake Wisconsin Fishery

In 1992 and 1993, Mead and Hunt, Inc. conducted a fisheries survey in the main body of Lake Wisconsin as a part of the Prairie du Sac dam relicensing requirements. At this time, they recorded 33 different species of fish. These data along with existing fisheries information collected by the Wisconsin Department of Natural Resources are presented in Table 1. During this survey, Mead and Hunt, Inc. noted that walleye in the 10 to 13 inch size range were the dominant game species present in Lake Wisconsin, and that most of the fish species, as compared to nearby river and lake systems in which the same species were found, exhibited above average growth rates compared to their counterparts. The downstream area from the Prairie du Sac was also noted for its Paddlefish population. This area is believed to contain the largest Paddlefish population in Wisconsin.

Table 1

FISH SPECIES PRESENT IN LAKE WISCONSIN

Fish Species Common Name	Scientific Name
Chestnut lamprey	Ichthyomyzon castaneus
Lake sturgeon[a]	Acipenser fulvescens
Bowfin[a]	Amia calva
Mooneye	Hiodon tergisus
Gizzard shad[a]	Dorosoma cepedianum
Brook trout	Salvelinus fontinalis
Brown trout	Salmo trutta
Northern pike[a]	Esoc lucius
Muskellunge[a]	Esox musquinongy
Tiger muskellunge	E. masquinongy x E. lucius
Stonerollers	Campostoma spp.
Common carp[a]	Cyprinus carpio
Brassy minnow	Hybognathus hankinsoni
Golden shiner[a]	Notemigonus crysoleucas
Emerald shiner[a]	Notropis atherinoides
Weed shiner	Notropis texanus
River shiner	Notropis blennius
Pugnose minnow	Notropis emiliae
Spotfin shiner	Cyprinella spiloptera
Bluntnose minnow	Pimephales notatus
Bullhead minnow	Pimephales vigilax
River carpsucker[a]	Carpiodes carpio
Quillback[a]	Carpiodes cyprinus
Highfin carpsucker[a]	Carpiodes velifer
Spotted sucker[a]	Minytrema melanops
Speckled chub	Hybopsis aestivalis
White sucker[a]	Catostomus commersoni
Smallmouth buffalo	Ictiobus bubalus
Bigmouth buffalo[a]	Ictiobus cyprinellus
Black buffalo	Ictiobus niger
Silver redhorse	Moxostoma anisurum
Golden redhorse	Mixostoma erythurum
Shorthead redhorse[a]	Moxostoma macrolepidotum
Flathead catfish[a]	Pylodictis olivaris
Channel catfish[a]	Ictalurus punctatus

Fish Species Common Name	Scientific Name
Yellow bullhead[a]	Ictalurus natalis
Black bullhead	Ictalurus melas
Brown bullhead[a]	Ictalurus nebulosus
Brook silverside	Labidesthes sicculus
White bass[a]	Morone chrysops
Yellow bass[a]	Morone mississippiensis
Rock bass[a]	Ambloplites rupestris
Pumkinseed[a]	Lepomis gibbosus
Smallmouth bass[a]	Micropterus dolomieui
Largemouth bass[a]	Micropterus salmoides
Bluegill[a]	Lepomis macrochirus
Black crappie[a]	Pomoxis nigromaculatus
White crappie[a]	Pomoxis annularis
Johnny darter	Etheostoma nigrum
Yellow perch[a]	Perca flabescens
Pirate perch	Aphredoderus sayanus
Log perch[a]	Percina caprodes
Blackside darter	Percina maculata
Walleye[a]	Stizostedion vitreum vitreum
Sauger[a]	Stizostedion canadense
Freshwater drum[a]	Aplodinotus grunniens

[a]*Species recorded by Mead and Hunt, Inc. during the 1992 and 1993 survey.*
Source: Mead and Hunt, Inc. and Wisconsin Department of Natural Resources.

Wildlife

Mammals

The Town of West Point is habitat to a large variety of wildlife species. Mammals found in the Lake Wisconsin watershed include the white tail deer (*Odocolieus virginianus*), eastern gray squirrel (*Sciurus carolinensis*), cottontail rabbit (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), red fox (*Vulpes fulva*), coyote (*Canis latrans*), beaver (*Castor Canadensis*), muskrat (*Ondontra zibethica*), mink (*Mustela vison*), and river otter (*Lutra canadensis*).

Birds

As a part of the relicensing requirements for the Prairie du Sac dam, Mead and Hunt, Inc., did a survey in 1992 and 1993 of the birdlife within the Lake Wisconsin region. During their survey, they recorded 62 species of different birds. Mead and Hunt, Inc. noted that the lake was used heavily as a stopping point for migratory birds during the spring and fall migration. The Lake Wisconsin region particularly the downstream portion of the Prairie du Sac dam is noted for its large American bald eagle (*Haliaeetus leucocephalus*) population. Many of the birds observed during this survey are summarized in Table 2.

Table 2

Selected Bird Species Within the Lake Wisconsin Watershed

Bird Species Common Name	Scientific Name
Ruffled grouse	Bonasa umbellus
American woodcock	Philohela minor
Wild turkey	Meleagris gallopavo
Ring-necked pheasant	Phasianus colchicus
Mallard ducks	Anas platyrhynochos
Wood ducks	Aix sponsa
Blue winged teal	Ana discors
Common merganser	Mergus merganser
Canada goose	Branta Canadensis
Pied-billed grebe	Podilymbus podiceps
Double-crested cormorant	Phalacrocorax auritus
American coot	Fulica americana
Great blue heron	Ardea herodias
Green heron	Butorides straitus
Great egret	Casmerodious albus
Belted kingisher	Megaceryle alcyon
Osprey	Pandion haliaetus
American bald eagle	Haliaeetus leucocephalus
American white pelicans	Pelecanus erythrorhynchos
Red-tailed hawk	Buteo jamaicensis
Great horned owl	Bubo virginiasus
Screech owl	Otus asio

Source: Mead and Hunt, Inc.

In addition to the species of birds noted in Table 2, Mead and Hunt, Inc also noted a large variety of gulls, terns, and shorebirds, as well as a variety of songbirds and woodpeckers.

Amphibians and Reptiles

During the course of the survey in 1992 and 1993, Mead and Hunt, Inc. also recorded species of amphibians and reptiles. Specifically, Mead and Hunt, Inc. reported six species of frogs and toads, which included the leopard frog (*Rana pipiens*), spring peeper (*Hyla crucifer*), chorus frog (*Pseudacris triserata*), green frog (*Rana clamitans*), Eastern gray tree frog (*Hyla versicolor*), and the American toad (*Bufo americanus*). Mead and Hunt, Inc. also recorded six species of turtles, which included the snapping turtle (*Chelydra serpentina*), painted turtle (*Chrysemys picta*), stinkpot turtle (*Sternotherus odorantus*), spiney softshell turtle (*Trionyx feroxspiniferus*), map turtle (*Graptemys geographica*), and the false map turtle (*Graptemys pseudographica*).

Endangered, Threatened, or Special Concern (ETS) Species

As part of the FERC relicensing requirements[1] endangered, threatened and special concern species were identified within 90 miles downstream of the Prairie du Sac dam and 45 miles upstream from the dam.

[1] *Op. Cit.*

Consequently, there is a distinct possibility of their existence within the watershed in the Town of West Point.

Fish and Other Aquatic Species

The United States Fish and Wildlife Service has indicated that the following listed species may be present in the Lake Wisconsin waters and its nearshore areas. These species include:

- Lake sturgeon (*Acipenser fulvescens*) – Category 2
- Crystal darter (*Ammocrypta asprella*) – Category 2
- Blue sucker (*Cycleptus elongates*) – Category 2
- Paddlefish (*Polyodon spathula*) – Category 3C
- Higgins eye mussel (*Lampsilis higginsi*) – Endangered
- Winged mapleleaf mussel (*Quadrula fragosa*) – Endangered
- Salamander mussel (*Simpsonaias ambigua*) – Category 2
- Pecatonica river mayfly (*Acanthametropus pecatonica*) – Category 2
- Elusive clubtail dragonfly (*Stylurus notatus*) – Category 2

Category 2 species include those species which are endangered or threatened, while Category 3 species include those species which have increased in population, but could be relisted as endangered or threatened if population levels begin to decline.

The Wisconsin Department of Natural Resources maintains a list of state threatened or state endangered species. The following includes a list of those species that may be found within Lake Wisconsin waters or the nearshore areas. These species include:

- Goldeye (*Hiodon alosoides*) – state endangered
- Paddlefish (*Polyodon spathula*) – state endangered
- Speckled chub (*Hybopsis aestivalis*) – state threatened
- Black buffalo (*Ictiobus niger*) – state threatened
- Pirate perch (*Aphtedoderus savanus*) – state watch
- Western sand darter (*Ammocrypta clara*) – state watch
- Mud darter (*Etheostoma aspringene*) – state watch
- Pugnose minnow (*Notripis emiliea*) – state watch
- Weed shine (*Notropis texanus*) – state watch
- Bullhead mussel (*Plethobasus cyphyus*) – state endangered
- Rock pocketbook mussel (*Arcidens confragosus*) – state threatened

- Paper pond shell mussel (*Anodonta imbecillis*) – state watch
- Creek heel splitter mussel (*Lasmigona compressa*) – state watch

During the 1992 and 1993 fisheries survey of Lake Wisconsin, Mead and Hunt, Inc. documented the presence of Lake sturgeon; however, no Paddlefish were found in Lake Wisconsin.

Wildlife

The United States Fish and Wildlife Service has indicated that the following listed species may be present in the Lake Wisconsin watershed. These species include:

- Peregrine falcon (*Falco peregrinus*) – endangered
- American bald eagle (*Haliaeetus leuciciphalus*) – threatened
- Eastern massasauga rattlesnake (*Sistrurus catenatus*) – Category 2

The Wisconsin Department of Natural Resources maintains a list of state threatened or state endangered species. The following includes a list of those species that may be found within Lake Wisconsin watershed These species include:

- Peregrine falcon (*Falco peregrinus*) – state endangered
- American bald eagle (*Haliaeetus leuciciphalus*) – state threatened
- Cooper's hawk (*Accipiter cooperii*) – state watch
- Henslow's sparrow (*Ammodramus henslowii*) – state watch
- Red-shouldered hawk (*Buteo lineatus*) – state watch
- Wood turtle (*Clemmys insculpta*) – state threatened
- Western box turtle (*Tenapene ornate*) – state endangered
- Blanding's turtle (*Emydoidea blandingii*) – state threatened
- Black rat snake (*Elaphe obosoleta*) – state special concern
- Bullsnake (*Pituophis melanoleucus*) – state specieal concern
- Western ribbon snake (*Thamnophis sauritus*) – state endangered
- Eastern massasauga rattlesnake (*Sistrurus catenatus*) – state endangered
- Western slender lass lizard (*Ophisaurus attenuatus*) – state endangered
- Blanchard's cricket frog (*Acris crepitans blanchardi*) – state endangered
- Bullfrog (*Rana catesbeiana*) – state special concern

During the 1992 and 1993 survey, Mead and Hunt documented only three species that were on these lists: the American bald eagle, the osprey, and the great egret.

PARK AND OPEN SPACE SITES

An inventory of existing park and open space sites in the Town of West Point was conducted in 2004. There were three park and open space sites in the planning area. Two of these sites were smaller, “pocket” parks located adjacent to the Town of West Point Town Hall and adjacent to the Merrimac Ferry docking site. One major county facility was also located in the Town, that park being the Gibraltar Rock County Park.

ENVIRONMENTAL CORRIDORS IN THE TOWN OF WEST POINT

In the drainage area tributary to Lake Wisconsin within the Town of West Point, the riverbanks and lakeshores, and the steeply sloped lands that characterize the drainage area tributary to Lake Wisconsin, comprise the environmental corridors. These lands should be candidates for immediate protection through proper zoning or, possibly, through public ownership in certain cases. Of the areas not publicly owned, the remaining areas of natural shoreline, riparian wetlands and steeply sloped hillsides are perhaps the most sensitive areas in need of greatest protection.

Primary Environmental Corridors

The primary environmental corridors generally lie along the major ridgelines creating the stream valleys draining to Lake Wisconsin, and contain almost all of the remaining high-value woodlands, wetlands, and wildlife habitat areas. The delineated primary environmental corridors in the study area tributary to Lake Wisconsin encompassed about 2280 acres, or about 17 percent of the study area, as quantified in Table 3 and shown on Map 9. These corridors are subject to urban encroachment because of their desirable natural resource amenities. Unplanned or poorly planned intrusion of urban development into these corridors, however, not only tends to destroy the very resources and related amenities sought by the development, but tends to create severe environmental and development problems as well. The preservation of these corridors, thus, is one of the major ways in which the water quality of Lake Wisconsin can be maintained and perhaps improved.

Table 3

PROPOSED ENVIRONMENTAL CORRIDORS WITHIN THE DRAINAGE AREA TRIBUTARY TO LAKE WISCONSIN IN THE TOWN OF WEST POINT, COLUMBIA COUNTY, WISCONSIN

Category	Acres	Percent
Primary	2283.5	17.7
Secondary	582.4	4.4
Isolated	497.2	3.8
Non-Corridor Lands	9628.9	74.1
Total	12992.0	100.0

Source: Environmental Horizons, Inc.

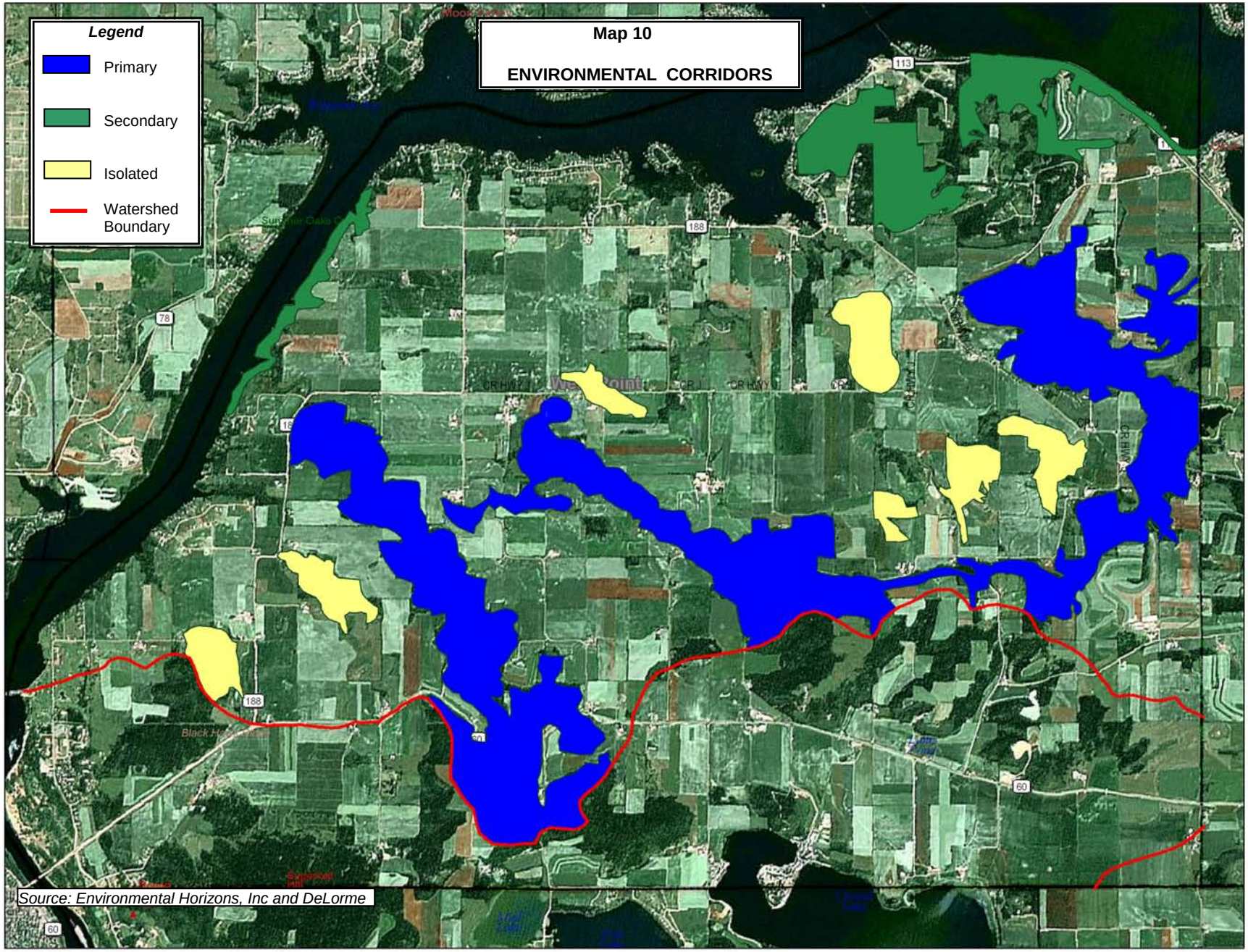
Secondary Environmental Corridors

The secondary environmental corridors within the drainage area tributary to Lake Wisconsin in the Town of West Point are located generally along intermittent streams or serve as links between segments of primary environmental corridors. These secondary environmental corridors contain a variety of resource elements, often remnant resources from primary environmental corridors, which have been developed for intensive agricultural purposes or urban land uses. Secondary environmental corridors facilitate surface water drainage, maintain “pockets” of natural resource features, and provide for the movement of wildlife, as well as for the movement and dispersal of seeds for a variety of plant species. Such corridors, while not as important as the primary environmental corridors, should be preserved in essentially open, natural uses as urban development proceeds within the direct drainage area, particularly when the opportunity is presented to incorporate the corridors into urban stormwater detention areas, associated drainageways, and neighborhood parks. The delineated secondary environmental corridors encompassed approximately 582 acres, or about 4.5 percent of the study area, as illustrated on Map 10.

Isolated Natural Resource Areas

In addition to the environmental corridors, other, small concentrations of natural resource base elements exist within the drainage area tributary to Lake Wisconsin in the Town of West Point. These resource base elements are isolated from the environmental corridors by urban development or agricultural uses and, although separated from the environmental corridor network, have important natural values. Isolated natural resource areas may provide the only available wildlife habitat in an area, provide good locations for local parks and nature study areas, and lend an aesthetic character or natural diversity to an area. Important isolated natural resource features include a geographically well-distributed variety of isolated wetlands, woodlands, and wildlife habitat. These isolated natural resource features should also be protected and preserved in a natural state whenever possible. Such isolated areas, five or more acres in areal extent, delineated within the study area totaled about 497 acres, or 4 percent of the study area, as shown on Map 10.

The relationship between the environmental corridors and isolated natural resource areas delineated above is discussed in Chapter IV relative to their relationship with the Town of West Point Code of Ordinances. Recommended measures to implement the incorporation of the environmental corridor concept within the Town are set forth in Chapter V.



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Chapter III

WATER QUALITY IMPACTS

INTRODUCTION

Water pollution problems, recreational use conflicts, and deterioration of the natural environment are all primarily a function of the human activities within the drainage area of a waterbody, as are the ultimate solutions to these problems. This is especially true with respect to lakes, which are highly susceptible to deterioration from human activities because of relatively long pollutant retention times, and because of the variety of often conflicting uses to which lakes are subjected. Furthermore, urban development is often concentrated in the direct drainage areas, around the shorelines of lakes, where there are no intermediate stream segments to attenuate pollutant runoff and loadings. This type of lake degradation is more likely to interfere with desired water uses and is often more difficult and costly to correct than degradation arising from clearly identifiable point sources of pollution in the watershed. Accordingly, the land uses and attendant population levels in the drainage area directly tributary to a lake must be important considerations in any lake management planning effort.

In the case of Lake Wisconsin, the tenth largest Lake in the State, the importance of nonpoint-sourced pollutants in determining lake water quality is paramount. Being an impounded portion of the Wisconsin River, the Lake has an extremely large drainage area to surface area ratio, leading to significant contaminant loads being generated from this watershed.[1] For this reason, land usage and population distributions are summarized in this Chapter, together with a review of jurisdictional issues relevant to water quality and lake management.

SUBWATERSHED DELINEATIONS

The Town of West Point forms a substantial portion of the southern shoreline of Lake Wisconsin, with approximately the northern two-thirds of the Town draining to the Lake either directly or through tributary

[1] *RAST, W. & J. A. THORNTON (1998) Reservoirs: Environmental processes, management and policy. In: B.H. Kay,* Water Resources: Health, Environment and Development*. E & FN Spon, London. pp. 1-12. ISBN 0-419-22290-1.*

stream systems, the majority of which are intermittent in character. Because of these drainageways, surface runoff to the Lake follows preferred routes, with various portions of the Town having distinct drainage routes. These routes form the central features of the subwatersheds, the locations of which influence their relative impacts on the Lake. These impacts are comprised of the combined effects of runoff quantity and runoff quality, and are related to land usage. Consequently, the delineation of the major subwatersheds draining to Lake Wisconsin within the northern portions of the Town of West Point provides an important tool for assessing the likely and potential impacts of the human occupation of the land surface on the Lake and its component ecosystems.

The subwatersheds within the Town of West Point were delineated using the U.S. Geological Survey one inch equals 24,000 feet scale topographic maps with 10-feet contour intervals. Approximately 30 such basins were identified, as shown on Map 11. Not all of the subbasins identified drain directly to Lake Wisconsin; some drain through other subbasins, or to other surface water features, with a few being internally drained or terminal basins through which water reaches Lake Wisconsin in the form of groundwater rather than direct runoff. Much of the lakeshore, drains directly to the Lake without passing through any upstream basin.

Each of the subbasins thus delineated will have a distinctive combination of land slopes, land uses, and related attributes, such as soil types and compositions, which have bearing on the discharge of water and contaminants. Two of these subbasins were selected for further analysis, using the Wisconsin Lake Model Spreadsheet (WILMS version 3.0),[2] and unit area load-based models developed for use within the Southeastern Wisconsin Region.[3] These embayments are locally known as No-Name Bay and Sunset Bay, and are also shown on Map 11. These embayments were selected based upon concerns expressed by the

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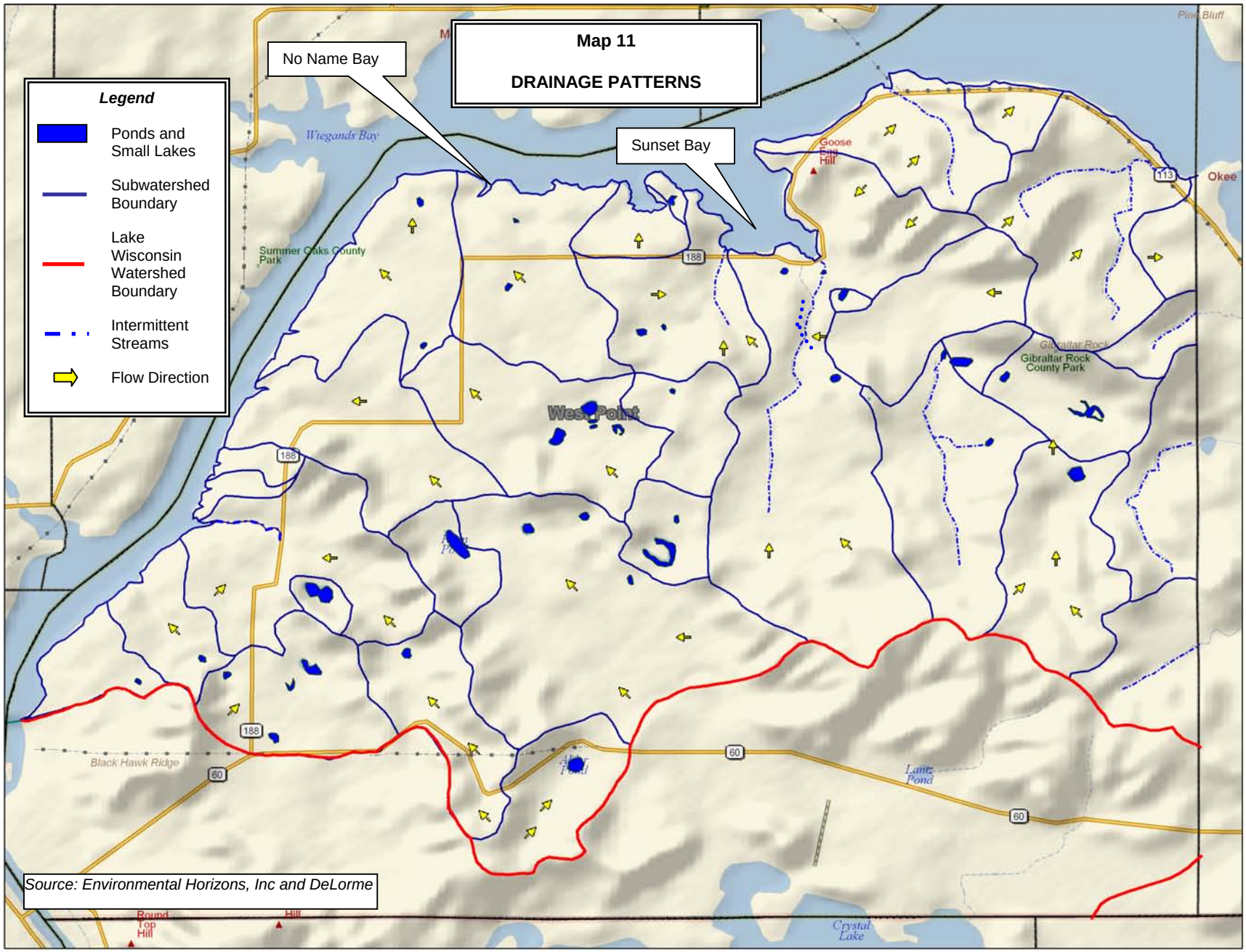
[2] *Wisconsin Department of Natural Resources Publication No. PUBL-WR-363-96 REV,* Wisconsin Lake Model Spreadsheet, Version 3.00, User's Manual*, June 1994.*

[3] *RYDING, S.-O. & W. RAST (1989).* The Control of Eutrophication of Lakes and Reservoirs*, Unesco Man and the Biosphere Series, Volume 1, Parthenon Press, Carnforth;THORNTON, J. A., W. RAST, M. M. HOLLAND, G. JOLANKAI, and S.-O. RYDING (1999).* The Assessment and Control of Nonpoint Source Pollution of Aquatic Ecosystems*, Unesco Man and the Biosphere Series, Volume 23, Parthenon Press, Carnforth.*



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Town of West Point residents who noted changes to nearshore water depths in these bays during their period of residence in the Town. Similar analyses could be performed for other nearshore areas of Lake Wisconsin, in future, should the need or similar concerns arise.

ESTIMATION OF CONTAMINANT LOADS

Contaminant loads, or pollutant loads, to a lake are generated by various natural processes and human activities that take place in the drainage area tributary to a lake.[4] These loads are transported to the lake through the atmosphere, across the land surface, and by way of inflowing streams. Potential pollutants transported by the atmosphere are deposited onto the surface of the lake as dry fallout and direct precipitation. Pollutants transported across the land surface enter the lake as direct runoff and, indirectly, as groundwater inflows, including drainage from onsite wastewater treatment systems. Potential pollutants transported by streams enter a lake as surface water inflows. In drainage lakes, like Lake Wisconsin, pollutant loadings transported into the lake through the inflowing stream system, in the absence of identifiable or point source discharges from industries or wastewater treatment facilities, comprise the principal route by which contaminants enter a waterbody. Contaminants transported across the land surface directly tributary to a lake, likewise in the absence of identifiable or point source discharges from industries or wastewater treatment facilities, comprise a secondary route although such direct inputs of contaminants into bays or other confined waters can have a significant impact of local water quality. For these reasons, the discussion that follows is based upon nonpoint source pollutant loadings to Lake Wisconsin from within the Town of West Point, with an emphasis on No-Name and Sunset Bays. For purposes of this analysis, these bays were assumed to have no exchange with the main lake basin of Lake Wisconsin.

Currently, there are no known point source discharges of pollutants to Lake or to the surface waters tributary to Lake Wisconsin within the Town of West Point. However, known sources of water pollution include such nonpoint or diffuse sources as urban sources, such as runoff from residential, commercial, transportation, construction, and recreational activities, and rural sources, such as runoff from agricultural lands and onsite sewage disposal systems.

Phosphorus has been identified as the factor generally limiting aquatic plant growth in Wisconsin lakes.[5] Thus, excessive levels of phosphorus in the lake are likely to result in conditions that interfere with the

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[4] Ibid.

[5] *LILLIE, R. A. & J.W. MASON (1983). Wisconsin Department of Natural Resources Technical Bulletin No. 138,* Limnological Characteristics of Wisconsin Lakes*.*

desired use of the lake. Phosphorus from the watershed is typically retained within lakes, and can accumulate in lake sediments from which it can be released under conditions of oxygen depletion during periods of lake stratification such as typically occur during summer and winter months. This phenomenon—known as “internal loading”—may contribute phosphorus to the waters of a lake and spur the growths of algae and other aquatic plants. However, in the case of the two Bays, this loading was assumed to be negligible.

In addition, urbanization brings with it increased use of metals and other materials that contribute pollutants to aquatic systems. Copper, zinc, and cadmium are typical contaminants likely to be contributed from urban development. The majority of these metals become associated with sediment particles and are likely to be encapsulated in the bottom sediments of the receiving waterbody.

Contaminant Loadings to No-Name Bay

The tributary drainage area to No-Name Bay in Lake Wisconsin is about 603 acres in areal extent. Nonpoint-sourced phosphorus, suspended solids, and urban-derived metals inputs to the Bay were estimated using the Wisconsin Lake Model Spreadsheet (WILMS version 3.0), and unit area load-based models developed for use within the Southeastern Wisconsin Region.

Phosphorus Loadings

Table 4 sets forth the estimated phosphorus loads to No-Name Bay under year-2000 land use conditions. A total annual phosphorus loading of between about 131 and 612 pounds, with a most likely total phosphorus loading of about 359 pounds, estimated to be contributed to the Bay. Of the most likely annual total phosphorus load, it was estimated that 348 pounds per year, or about 97 percent of the total loading, was contributed by runoff from rural land; 9 pounds per year, or 2.5 percent, was contributed by runoff from urban land; and about 2 pounds, or about 0.5 percent, was contributed by runoff from woodlands.

Table 4

Annual Phosphorus Loading for No-Name Bay

Source	Acres	Phosphorus, lbs/year	Percent From Each Land Use
Residential	94.63	8.8	2.5
Woodlands	9.51	1.9	0.2
Agriculture and Open Space	499.63	348.4	97.3
Total	603.77	359.1	100.0

Source: Environmental Horizons, Inc.

Sediment Loadings

The estimated sediment budget for No-Name Bay under year-2000 land use conditions is shown in Table 5.

A total annual sediment loading of approximately 111 tons of sediment was estimated to be contributed to the Bay. Of the likely annual sediment load, it was estimated that 110 tons per year, or 99 percent of the total loading, was contributed by runoff from rural land; approximately 1930 pounds per year, or just under 1 percent of the total loading, was contributed by runoff from urban lands; and about 30 pounds per year, or just about 0.1 percent of the total loading, was contributed from woodlands.

Table 5

Annual Sediment and Metals Loading for No-Name Bay

Source	Acres	Sediment, lbs/year	Percent	Copper, lbs/year	Percent	Zinc, lbs/year	Percent From Each Land Use
Residential	94.63	1930	0.9	0	100.0	1.2	100.0
Woodlands	9.51	30	<0.1	- -	- -	- -	- -
Agriculture and Open Space	499.63	220050	99.1	- -	- -	- -	- -
Total	603.77	222010	100.0	0	100.0	1.2	100.0

Source: Environmental Horizons, Inc.

Urban Heavy Metals Loadings

Table 3 also sets forth the estimated loadings of copper and zinc likely to be contributed to No-Name Bay from urban development surrounding the Bay. The estimated heavy metal budget for the Bay under year-2000 land use conditions was about 0 pounds of copper, and 1.2 pounds of zinc.

In-Lake Sinks

Of the annual sediment load entering No-Name Bay, it was estimated that the entire load was retained within the Bay for planning purposes. While this is unlikely to be the case in reality, this assumption provides a “worst case” scenario from which the greatest potential accumulation can be estimated. This accumulation was estimated based upon an average density, or mass per unit volume, of sediment under in-lake conditions derived from the literature. In actuality, it is likely that a portion of this load will be transported out of the Bay and into the main basin of Lake Wisconsin, with only a portion of the load being deposited within the Bay. Based upon this assumption, however, it is estimated that the 111 tons of sediment being delivered from the land surface would result in approximately 18 inches of deposition annually.

Contaminant Loadings to Sunset Bay

The tributary drainage area to Sunset Bay in Lake Wisconsin is about 2,597 acres in areal extent. Nonpoint-sourced phosphorus, suspended solids, and urban-derived metals inputs to the Bay were estimated using the Wisconsin Lake Model Spreadsheet (WILMS version 3.0), and unit area load-based models developed for use within the Southeastern Wisconsin Region.

Phosphorus Loadings

Table 6 sets forth the estimated phosphorus loads to Sunset Bay under year-2000 land use conditions. A total annual phosphorus loading of between about 500 and 2300 pounds, with a most likely total phosphorus loading of about 1300 pounds, was estimated to be contributed to the Bay. Of the most likely annual total phosphorus load, it was estimated that 1230 pounds per year, or about 95 percent of the total loading, was contributed by runoff from rural land; 22 pounds per year, or about 2 percent, was contributed by runoff from urban land; 44 pounds per year, or about 3 percent was contributed by runoff from woodlands; approximately 4 pounds per year, or about 0.5 percent was contributed by runoff from wetlands; and about 2 pounds per year, or less than 0.5 percent, by direct precipitation onto the water surface.

Table 6

Annual Phosphorus Loading for Sunset Bay

Source	Acres	Phosphorus, lbs/year	Percent From Each Land Use
Residential	252.93	22.1	1.7
Woodlands	556.17	44.1	3.4
Water	3.9	2.0	0.1
Wetlands	41.37	4.4	0.3
Agriculture and Open Space	1742.61	1230.4	94.5
Total	2596.98	1303.0	100.0

Source: Environmental Horizons, Inc.

Sediment Loadings

The estimated sediment budget for Sunset Bay under year-2000 land use conditions is shown in Table 7. A total annual sediment loading of between about 391 tons of sediment was estimated to be contributed to the Bay. Of the likely annual sediment load, it was estimated that about 388 tons per year, or 99 percent of the total loading, was contributed by runoff from rural land; 2.5 tons per year, or about 0.6 percent, was contributed by runoff from urban land; one ton per year, or about 0.3 percent was contributed by runoff from woodlands; and approximately 153 pounds per year, or less than 0.1 percent was contributed by runoff from wetlands.

Urban Heavy Metals Loadings

Table 5 also sets forth the estimated loadings of copper, zinc, and cadmium likely to be contributed to Sunset Bay from urban development surrounding the Bay. The estimated heavy metal budget for the Bay under year-2000 land use conditions was about 0 pounds of copper, and 3 pounds of zinc.

In-Lake Sinks

Of the annual sediment load entering Sunset Bay, it was estimated that the entire load was retained within the Bay for planning purposes. While this is unlikely to be the case in reality, this assumption

Table 7

Annual Sediment and Metals Loading for Sunset Bay

Source	Acres	Sediment, lbs/year	Percent	Copper, lbs/year	Percent	Zinc, lbs/year	Percent
Residential	252.93	4932	0.6	0	100.0	3.0	100.0
Woodlands	556.17	2016	0.3	- -	- -	- -	- -
Water	3.9	0	0	- -	- -	- -	- -
Wetlands	41.37	153	<0.1	- -	- -	- -	- -
Agriculture and Open Space	1742.61	775575	99.1	- -	- -	- -	- -
Total	2596.98	782676	100.0	0	100.0	3.0	100.0

Source: Environmental Horizons, Inc.

provides a “worst case” scenario from which the greatest potential accumulation can be estimated. This accumulation was estimated based upon an average density, or mass per unit volume, of sediment under in-lake conditions derived from the literature. In actuality, it is likely that a portion of this load will be transported out of the Bay and into the main basin of Lake Wisconsin, with only a portion of the load being deposited within the Bay. Based upon this assumption, however, it is estimated that the 391 tons of sediment being delivered from the land surface would result in approximately 0.6 inches of deposition annaully.

Management measures to address the loss of materials from the land surface are indicated in the following Chapters.

Chapter IV

LAND DEVELOPMENT IMPACTS

INTRODUCTION

The Town of West Point is situated on the southern shore of Lake Wisconsin, an impounded portion of the Wisconsin River. During the early 2000s, the Town determined that changing land use patterns within the Town were creating conditions that, if continued unabated, would change the character of the Town from a rural community to a more urbanized community serving as a “bedroom community” for the Madison metropolitan area. Wishing to manage any such transition in a rational manner, the Town has undertaken a review of its land uses and supporting ordinances to support development that is consistent with the unique environmental setting of the municipality and having limited negative consequences for Lake Wisconsin. To help further support this endeavor, the Town developed a questionnaire survey instrument to gage the opinions and thoughts of residents within the nearshore area of Lake Wisconsin with regards to land use, zoning regulations, and lake use issues.

Urbanization results in a change to the manner in which water and associated contaminants move across the land surface. New contaminants are introduced in urban settings, relative to historic forested lands and previous agricultural land uses. In this regard, agricultural lands are subjected to various soil amendments and practices that potentially mobilize plant nutrients, such as nitrogen and phosphorus, as well as sediments. Integrated nutrient and pest management practices can limit the available agro-chemicals subject to transport by runoff to water courses; however, agricultural land uses do mobilize significantly higher nutrient and sediment loads than occurs from natural, forested lands. As agricultural lands are converted to urban land uses, the levels of soil loss and nutrient transport can be reduced, while heavy metals such as copper and zinc become available and are transported to water courses.

The levels and impacts of such contaminants can be managed through sound land use planning and management practices. Such practices are typically established through land use zoning and building-construction ordinances. For this reason, Environmental Horizons Inc was requested by the Town of West Point to review the current Town Code of Ordinances from the point of view of making recommendations that will ensure that future land use changes in the Town will have minimal impact on the water resources in

and around the Town, focusing initially on the Lake Wisconsin drainage area within the Town of West Point.

This Chapter sets forth observations and recommendations relative to the Town of West Point Code of Ordinances as the Code existed during late 2005. At the time of writing, land divisions within the Town were subject to a temporary moratorium enacted pursuant to Chapter 9-20-02A of the Town of West Point Code of Ordinances so as to allow the Town to review development alternatives.

CIVIL DIVISIONS

The geographic extent and functional responsibilities of civil divisions and special-purpose units of government are important factors related to land use and management, since these local units of government provide the basic structure of the decision-making framework within which land use development and redevelopment must be addressed.

Map IV-1 shows the extent of the Wisconsin River watershed upstream of Lake Wisconsin. Map IV-2 shows the portion of Lake Wisconsin and the Wisconsin River within Columbia County. The Town of West Point is situated in the northwestern portion of Columbia County, south of the Wisconsin River and Lake Wisconsin.

RESIDENT POPULATION

Resident population levels are an important consideration in any natural resource planning effort. Data on the historical and existing resident population of the Town of West Point are presented in Table 8. The resident population of the Town increased between 1990 and 2000. The resident population level in1990, based on U.S. Census data, was 1,285 persons. By 2000, the resident population had increased to 1,534 persons. This represents an increase of 249 persons, or about 20 percent, over 1990. This increase suggests a possible trend for future continued population growth in this community with concomitant demands for community services and recreational opportunities.

The 1990 population was housed in 777 housing units, of which 426 were owner-occupied and 273 were unoccupied. Seasonal housing units accounted for 253 dwellings. The population increase noted between 1990 and 2000 resulted in a further 130 housing units being added to the housing stock of the Town as summarized in Table 6. There were a total of 907 housing units as of the year 2000, of which 600 were owner-occupied and 247 were unoccupied at the time of the 2000 Census. Seasonal housing units accounted for 224 dwellings, suggesting the conversion of previously seasonally occupied dwelling units to year-round occupancy. Of the owner-occupied structures, 350 were single family dwellings at the time of the 2000 Census.

LAND USE BASE

The type, intensity, and spatial distribution of the various land uses within the drainage area tributary to Lake Wisconsin are important determinants of lake water quality and recreational use demands. The current and planned land use patterns placed in the context of the historical development of the area are, therefore, important considerations in any lake management planning effort for the Lake.

Table 8

CENSUS CHARACTERISITCS FOR 1990 AND 2000, TOWN OF WEST POINT, COLUMBIA COUNTY, WISCONSIN

Census Data	1990	2000	Percent Change (%)
Population	1285	1634	21
Housing Information			
Total Housing Units	777	907	14
Owner Occupied Units	504	660	24
Unoccupied Units	20	23	13
Seasonal Units	253	224	(13)

Source: Environmental Horizons, Inc. and the United States Census Bureau.

The land area of the Town of West Point is estimated to encompass about 18,960 acres, or about 29.5 square miles.1 Of this area, about 13,000 acres or about 20.5 square miles are within the drainage area directly tributary to Lake Wisconsin. In 2000, residential uses within the drainage area of the Town tributary to Lake Wisconsin occupied about 940 acres, or about 7 percent of the total area, within the Town, as summarized in Table 9. Other urban lands, such as parklands, industrial and commercial lands, governmental and institutional lands, and transportation corridors, combined to encompass approximately a further 55 acres, or less than 1 percent of the drainage area. Agricultural and other open lands formed the largest land use within the Town during the year 2000, accounting for about 8,740 acres, or about 67 percent of the drainage area tributary to Lake Wisconsin. Other rural land uses, including woodlands, wetlands, and surface water, together encompassed about 3,260 acres, or approximately 25 percent of the drainage area. Current land use is illustrated on Map 12.

The Town of West Point planning area is served by several well-developed highways that support the planning area on a daily basis. The important highways serving the Town are STH 188, STH 60, STH 113, CTH J, and CTH V. In addition, the Chicago and North Western Railroad right-of-way traverses the northeastern portion of the planning area from east to west, crossing Lake Wisconsin near the ferry landing.

1 A portion of the Town is comprised of the water surface of Lake Wisconsin, adding about another 3,900 acres to the Town surface area, totaling to 22,900 acres.

Table 9

LAND USE IN THE TOWN OF WEST POINT WITHIN THE LAKE WISCONSIN WATERSHED

LAND USE CATEGORY	ACRES	PERCENT
Woodlands	2875.6	22.1
Wetlands and Depressional Areas	308.3	2.4
Residential	936.3	7.2
Water[a]	76.5	0.6
Parks	54.0	0.4
Agriculture and Open Space	8741.3	67.3
Total	12992.0	100.0

[a]*Exclusive of Lake Wisconsin.*
Source: Environmental Horizons, Inc.

LAND USE REGULATIONS

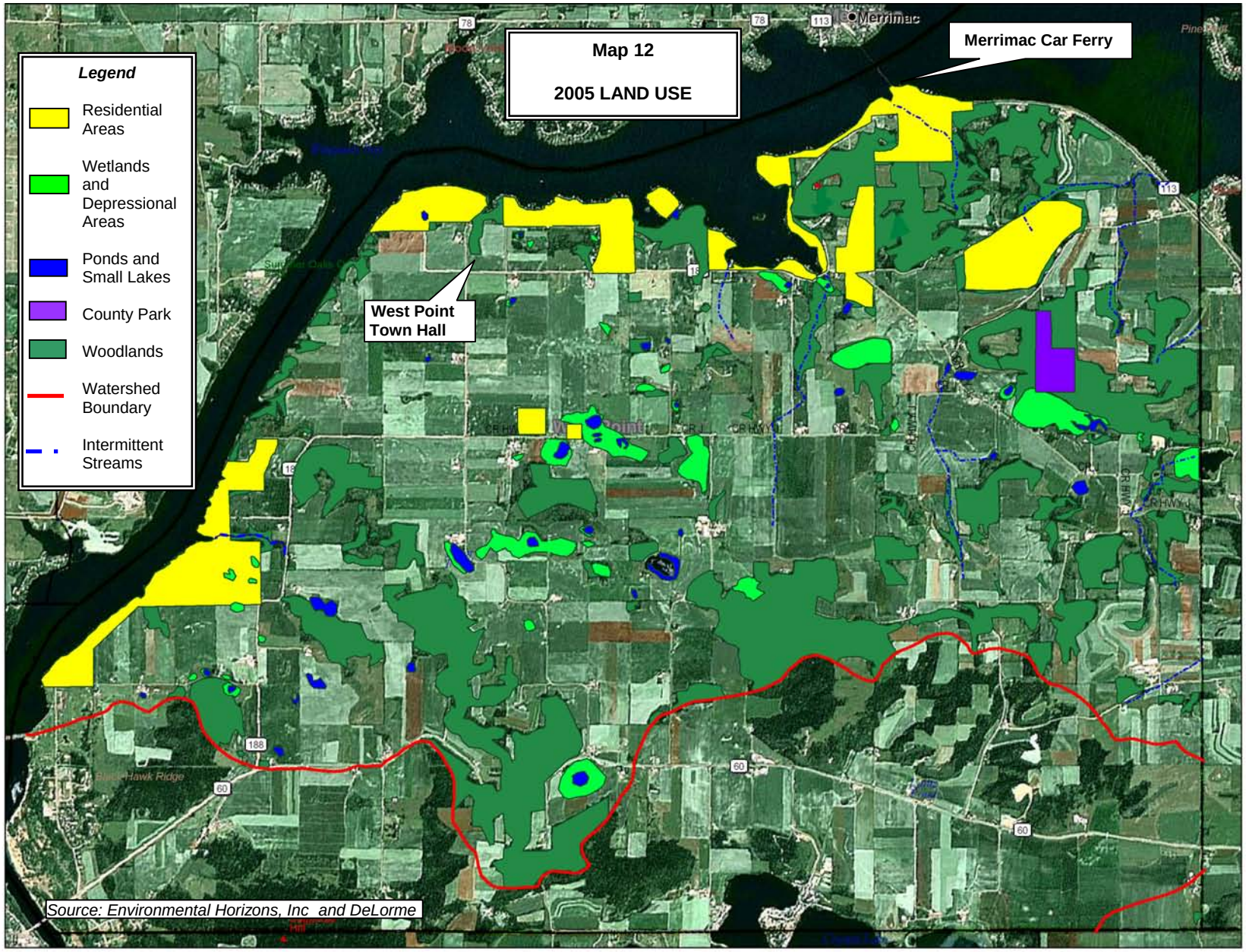
The comprehensive zoning ordinance represents one of the most important and significant tools available to local units of government in directing the proper use of lands within their area of jurisdiction. Local zoning regulations include general, or comprehensive, zoning regulations and special-purpose regulations governing floodland and shoreland areas. General zoning and special-purpose zoning regulations may be adopted as a single ordinance or as separate ordinances; they may or may not be contained in the same document. Any analysis of locally proposed land uses must take into consideration the provisions of both general and special-purpose zoning. The ordinances administered by the units of government with jurisdiction over lands within the Town of West Point tributary to Lake Wisconsin are summarized in Table 10.

Table 10

LAND USE REGULATIONS WITHIN THE DRAINAGE AREA TRIBUTARY TO LAKE WISCONSIN IN THE TOWN OF WEST POINT: 2005

Community	TYPE OF ORDINANCE				
	General Zoning	Floodland Zoning	Shoreland or Shoreland-Wetland Zoning	Subdivision Control	Erosion Control and Stormwater Management
Columbia County	Adopted	Adopted	Adopted and Wisconsin Department of Natural Resources approved	Adopted	Adopted
Town of West Point	County ordinance	County ordinance	County ordinance	Adopted	Adopted

Source: Environmental Horizons, Inc.



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MN (1.6° W)

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Data Zoom 12-0

General Zoning

Cities in Wisconsin are granted comprehensive, or general, zoning powers under Section 62.23 of the *Wisconsin Statutes*. The same powers are granted to villages under Section 61.35, *Wisconsin Statutes*. Counties are granted general zoning powers within their unincorporated areas under Section 59.69 of the *Statutes*. However, a county zoning ordinance becomes effective only in those towns that ratify the county ordinance. Towns that have not adopted a county zoning ordinance may adopt village powers, and subsequently utilize the city and village zoning authority conferred in Section 62.23, subject, however, to county board approval where a general-purpose county zoning ordinance exists. Alternatively, a town may adopt a zoning ordinance under Section 60.61 of the *Wisconsin Statutes* where a general-purpose county zoning ordinance has not been adopted, but only after the county board fails to adopt a county ordinance at the petition of the governing body of the town concerned.

Floodland Zoning

Section 87.30 of the *Wisconsin Statutes* requires that cities, villages, and counties, with respect to their unincorporated areas, adopt floodland zoning to preserve the floodwater conveyance and storage capacity of floodplain areas and to prevent the location of new flood damage-prone development in flood hazard areas. The minimum standards which such ordinances must meet are set forth in Chapter NR 116 of the *Wisconsin Administrative Code*. The required regulations govern filling and development within a regulatory floodplain, which is defined as the area subject to inundation by the 100-year recurrence interval flood event, the event which has a 1 percent probability of occurring in any given year. Under Chapter NR 116, local floodland zoning regulations must prohibit nearly all forms of development within the floodway, which is that portion of the floodplain required to convey the 100-year recurrence peak flood flow. Local regulations must also restrict filling and development within the flood fringe, which is that portion of the floodplain located outside the floodway that would be covered by floodwater during the 100-year recurrence flood. Permitting the filling and development of the flood fringe area, however, reduces the floodwater storage capacity of the natural floodplain, and may thereby increase downstream flood flows and stages. It should be noted that towns may enact floodland zoning regulations which may be more restrictive than those in the County Shoreland and Floodland Protection Zoning Ordinance. However, the Town of West Point currently is regulated only by the county ordinance for floodplain zoning.

Shoreland Zoning

Under Section 59.692 of the *Wisconsin Statutes*, counties in Wisconsin are required to adopt zoning regulations within statutorily defined shoreland areas, those lands within 1,000 feet of a navigable lake, pond, or flowage, or 300 feet of a navigable stream, or to the landward side of the floodplain, whichever

distance is greater, within their unincorporated areas. Minimum standards for county shoreland zoning ordinances are set forth in Chapter NR 115 of the *Wisconsin Administrative Code*. Chapter NR 115 sets forth minimum requirements regarding lot sizes and building setbacks; restrictions on cutting of trees and shrubbery; and restrictions on filling, grading, lagooning, dredging, ditching, and excavating that must be incorporated into county shoreland zoning regulations. In addition, Chapter NR 115 requires that counties place all wetlands five acres or larger and within the statutory shoreland zoning jurisdiction area into a wetland conservancy zoning district to ensure their preservation after completion of appropriate wetland inventories by the Wisconsin Department of Natural Resources.

In 1982, the State Legislature extended shoreland-wetland zoning requirements to cities and villages in Wisconsin. Under Sections 62.231 and 61.351, respectively, of the *Wisconsin Statutes*, cities and villages in Wisconsin are required to place wetlands five acres or larger and located in statutory shorelands into a shoreland-wetland conservancy zoning district to ensure their preservation. Minimum standards for city and village shoreland-wetland zoning ordinances are set forth in Chapter NR 117 of the *Wisconsin Administrative Code*.

It should be noted that the basis for identification of wetlands to be protected under Chapters NR 115 and NR 117 is the Wisconsin Wetlands Inventory. Mandated by the State Legislature in 1978, the Wisconsin Wetlands Inventory resulted in the preparation of wetland maps covering each U.S. Public Land Survey township in the State. A County shoreland zoning ordinance is in effect in the Town of West Point.

Subdivision Regulations

Chapter 236 of the *Wisconsin Statutes* requires the preparation of a subdivision plat whenever five or more lots of 1.5 acres or less in area are created either at one time or by successive divisions within a period of five years. The *Statutes* set forth requirements for surveying lots and streets, for plat review and approval by State and local agencies, and for recording approved plats. Section 236.45 of the *Statutes* allows any city, village, town, or county that has established a planning agency to adopt a land division ordinance, provided the local ordinance is at least as restrictive as the State platting requirements. Local land division ordinances may include the review of other land divisions not defined as “subdivisions” under Chapter 236, such as when fewer than five lots are created or when lots larger than 1.5 acres are created.

The subdivision regulatory powers of towns and counties are confined to unincorporated areas. City and village subdivision control ordinances may be applied to extraterritorial areas, as well as to the incorporated areas. It is possible for both a county and a town to have concurrent jurisdiction over land divisions in

unincorporated areas, or for a city or village to have concurrent jurisdiction with a town or county in the city or village extraterritorial plat approval area. In the case of overlapping jurisdiction, the most restrictive requirements apply. The Town of West Point has adopted its own subdivision ordinance. The subdivision control ordinance adopted and administered by Columbia County applies only to the unincorporated statutory shoreland areas of the County.

Construction Site Erosion Control and Stormwater Management Regulations

Section 62.23 of the *Wisconsin Statutes* grants authority to cities and villages in Wisconsin to adopt ordinances for the prevention of erosion from construction sites and the management of stormwater runoff from lands within their jurisdictions. Towns may adopt village powers and subsequently utilize the authority conferred on cities and villages under Section 62.23 to adopt their own erosion control and stormwater management ordinances, subject, however, to county board approval where a county ordinance exists. Construction site erosion control and stormwater management ordinances were in effect in the Town of West Point. The Town has adopted both construction site erosion control and stormwater management ordinances.

Columbia County has adopted construction erosion control and stormwater management ordinances. These ordinances apply to the unincorporated town lands in the county. These ordinances require persons engaging in land disturbing activities to employ soil erosion control practices on affected sites that are consistent with those set forth in the *Wisconsin Construction Site Best Management Practice Handbook*, or equivalent practices. In general, these practices are designed to minimize soil loss from disturbed sites through prior planning and phasing of land disturbing activities and use of appropriate onsite erosion control measures.

LAND USE PLANNING

The Town of West Point has adopted a land use plan for the Town during June 1996 that recognizes the unique situation of the Town within the metropolitan Madison area. Within this plan, two types of designated district stand out; namely, the Agricultural and Woodland Preservation District, and the Lake Shore Development District. The former prohibits subdivisions and land divisions of less than 35 acres in areal extent, and limits “spot zoning,” or the application of specific zoning changes to limited land areas within larger geographic areas having a different zoning—an example of which would be the location of an industrial enterprise within a residential neighborhood. The Lake Shore Development District is focused on residential lands riparian to Lake Wisconsin and promotes the clustering of non-farm development.

The goals of these planning districts are to:

- Preserve farm operations by protecting prime agricultural lands and woodlands
- Discourage the proliferation of subdivisions by maintaining the rural character of the Town
- Prohibit development in floodlands and wetlands
- Protect surface and ground water quality and encourage good soil conservation practices.

Implementation of this land use plan, pursuant to the foregoing goals, is embodied within the zoning scheme adopted by the Town. Objectives such as those that underlie the Town land use plan are consistent with the maintenance of good water quality both within Lake Wisconsin and the other surface waters of the Town.

For the purposes of lake protection, and in order to give effect to the land use planning objectives for the Town as summarized above, two chapters of the Town of West Point Code of Ordinances have specific relevance; namely, Chapter 6, *Land Division and Subdivision Regulations*, and Chapter 7, *Erosion Control and Storm Water Runoff Regulations*. Both Chapters reflect current practice relative to environmental and lake protection, and have been updated as recently as the year 2005. Notwithstanding, certain refinements to these ordinances could be considered in the light of emerging land management practices being adopted elsewhere in Wisconsin. These further refinements are noted below.

Land Divisions

Chapter 6 of the Town of West Point Code of Ordinances regulates land divisions within the Town. Further land divisions within the Town were placed under a moratorium during 2005 to allow the town residents to develop and articulate a Vision for their community, and to limit the piecemeal urbanization of the community. Emerging practice in Wisconsin would suggest further refinement of this Chapter should be considered. Alternative practices being adopted by other communities within the State include two emerging techniques for preserving open space and rural character:

- Purchase of development rights
- Clustering.

The purchasing of development rights continues to recognize the right of individual land owners to dispose of private property for development. Central to these rights is the philosophy that urban land uses are the best and highest use of lands. Consequently, certain communities, including the Town of Dunn in Dane County, Wisconsin, have recognized this right by purchasing a severable element of an owner's title in the land; namely, the right of the individual to transform rural lands to urban lands. This program determines the incremental value of the land as the difference in value between the land maintained as agricultural or other

open land and the value of the land as urban land. This determination utilizes standard appraisal practices to determine this increment. That portion of the urban land value that exceeds the value of the agricultural and open land value then forms the purchase price, such that a third party can own the rights to place urban-type development upon the land. As the purchaser is generally a land trust or conservancy, the purpose of such an acquisition is to prevent the urbanization of the lands, preserving the lands as open space.

In practice, the purchase of development rights invokes a cost to the community of approximately 75 to 85 percent of the cost of an outright land purchase. Consequently, while such an approach has been utilized to preserve open space, it is not a popular option. In this case, ownership of the land remains vested in the land owners, while the land trust or conservancy only owns the use of the land surface. Landowners in such cases may continue to engage in practices that are considered rural in character, and which are agreed by the purchaser of the development rights and landowner. Such practices typically include operation of woodlots, pasturing of livestock, and various cropping practices. Ownership of the development rights is commonly in perpetuity, but could also be for a contracted period of time. Lands subject to such agreements can be bought and sold, but the purchaser remains subject to the land use controls.

An alternative approach recognizes that land divisions are likely to continue to occur, but encourages more appropriate utilization of the land area subject to such divisions. Experience throughout Wisconsin has shown that limitations of land divisions, such as is contained within the Town of West Point ordinances, frequently results in farm lands being broken up into 35-acre parcels, which, subsequently, are developed such that the homestead site in located in the center of the parcel. This type of development results in the “cookie-cutter” development patterns seen throughout much of Wisconsin. Negative impacts of such development, in addition to the large land areas consumed by such practices, include significantly increased lengths of roadway that need to be maintained; inefficiencies in traffic patterns especially affecting emergency response and provision of services such as public transportation (including those related to public school systems), and loss of natural resource features (e.g., prime agricultural lands) and the aesthetic character of the community.

Consequently, to minimize these inefficiencies and maintain intact tracts of prime agricultural land, some communities, including Jefferson County, have developed an alternative approach to land division that maintains the landowner’s right to utilize and sell lands, but protects the public interest by limiting the size of the lots that can be created and divided from a larger lot. Under such a system, larger areas or numbers

of lots can be created on lands that are not designated as prime agricultural land. This places an incentive on the development of lands other than prime agricultural land. Under the Jefferson County system, prime farm lands can be divided into no more than three parcels, with each parcel not to exceed approximately 5-acres in areal extent, while non-prime farm lands can be divided into no more than five parcels, with each parcel not to exceed approximately 5-acres in areal extent. Such a system leaves the larger portion of a typical 40-acre farm as an intact unit, preserving the rural character of the community.

The foregoing system could also be applied to lands designated as falling within environmental corridors or as natural features, thereby preserving the vistas and views within the local jurisdiction.

Consideration of such a land management-agricultural preservation system by the Town of West Point such as that adopted by Jefferson County is recommended as best meeting the goals outlined in the Town land use plan.

Stormwater Management

Chapter 7 of the Town of West Point Code of Ordinances regulates stormwater management and erosion control practices within the Town. This ordinance embodies the principles set forth in Chapter NR 151 of the Wisconsin Administrative Code. It requires use of erosion control practices when individuals engage in land disturbing practices in urban and urbanizing areas of the Town, including the use of construction site erosion controls and urban stormwater management practices. The use of a curb-and-gutter drainage system, as required pursuant to Chapter 6 of the Code of Ordinances, is consequently refined so as to maintain runoff volume at near-predevelopment rates with concomitant water quality. To this end, as development proceeds and impervious surfaces increase in area, larger volumes of stormwater will have to be infiltrated. In this regard, note must be taken of “karst features.” Such features refer to a specific geologic formation which may or may not be present within the Town; namely, underground cavities created by the dissolution of limestone by rainfall percolating and infiltrating into such geologic units. Rather, and more correctly, the reference to “karst features” should be replaced by a reference to “direct conduits to groundwater such as fractured bedrock at the surface.” Such a change in definition reflects more accurately the underlying geology of the Town and creates a more robust definition of terms in keeping with current State guidance.

With the promulgation of Chapters NR 153 and NR 154 of the *Wisconsin Administrative Code*, which become effective during October 2003, cost-share funding may be available to encourage installation of appropriate land management measures.

Ordinance Refinements

Emerging land use management practice in land-oriented communities in Wisconsin suggest that the Town of West Point consider two further ordinances; namely, an onsite sewage system inspection and maintenance ordinance, and an urban turf management ordinance.

Recent studies of the potential impact of riparian landscaping activities on the nutrient loadings to waterways in Wisconsin have suggested that urban residential lands can contribute up to twice the mass of phosphorus to a lake when subjected to an active program of urban lawn care than similar lands managed in a more natural fashion. The application of agrochemicals to such lands, in excess of the plant requirements, therefore, results in enhanced nutrient loading directly to the adjacent waterbodies. To address these concerns, a number of communities are debating the enactment of fertilizer control ordinances—in addition to the public informational programming discussed below. Some communities, such as the Big Cedar Lake Protection and Rehabilitation District in Washington County, have purchased bulk lots of phosphorus-free lawn and garden fertilizers for resale to riparian landowners. Given the increasing importance of urban land uses within the riparian areas of the Town of West Point, consideration of a comprehensive program to regulate urban agricultural practices appears to be warranted.

It should be noted that communities adopting lawn care ordinances frequently consider such ordinance to be tutorial, rather than enforceable, although the enforcement of the ordinance can require a homeowner or applicator to have a sample of fertilizer tested at a recognized laboratory should the use of a product containing phosphorus be suspected. In such cases, the ordinance provide for penalties for violation involving fines and forfeitures. In addition, such ordinance span the gamut from an outright prohibition on the application of phosphorus-rich fertilizer the urban lawns to allowing the use of compost-based fertilizer products containing up to 3 percent phosphorus by mass. Further, some communities allow exemptions from these requirements if homeowners can demonstrate by soil test results that phosphorus is required for a healthy turf, or if homeowners are establishing a new lawn, where added phosphorus may be required to achieve optimal growth of the turf. In every case, agricultural operations are exempted in recognition of the fact that crop harvesting exports phosphorus from the land surface. Similar approaches to managing nitrogen are yet to be proposed.

Where onsite sewage disposal systems remain the primary wastewater treatment method, it is recommended that an onsite sewage disposal system management program be carried out, including the conduct of an ongoing informational and educational effort. Homeowners in areas served by onsite systems

should be advised of the rules, regulations, and system limitations governing onsite sewage disposal systems, and should be encouraged to undertake preventive maintenance programs. Columbia County currently has such a program in place, pursuant to Chapter Comm 83 of the *Wisconsin Administrative Code* for onsite sewage disposal systems installed after 1983—consideration is currently being given by the Wisconsin Legislature to extending this inspection program to all onsite sewage disposal systems.

Notwithstanding, several communities have adopted additional requirements for onsite system inspection and maintenance that include all onsite systems in areas adjacent to waterways. Such an ordinance was first adopted by the Lauderdale Lakes Lake Management District in Walworth County. This local ordinance requires that all onsite sewage disposal systems within the jurisdiction be inspected on a four-yearly basis—with one-quarter of the systems being inspected each year during the four-year period. Other communities have adopted similar ordinances but with different rotations as better served those communities. Such a system would serve until such time as the Wisconsin Legislature acts to make such requirements applicable Statewide.

As for those systems installed after 1983, such ordinances require that onsite sewage treatment systems be inspected by licensed haulers, the choice of provider generally being left to the individual homeowners. Notwithstanding, in the case of the Lauderdale Lakes Lake Management District, the District contracts with a specific hauler every four years, with concomitant cost savings for District residents. The costs of such inspections are levied on homeowners as an element of the District's property tax levy. In this case, however, residents having long term relationships with other providers may continue to use their service provider of choice, but at their own cost. Adoption of this system entails a cost for record keeping and sending of notices to homeowners and delinquent individuals. Within the Town of Mukwonago, the Phantom Lakes Management District, which has a similar ordinance to the Lauderdale Lakes Lake Management District, but contracts with Waukesha County for this service rather than individually undertaking this record keeping activity.

As development within the Town of West Point continues, and because such development is focused on the shorelands of Lake Wisconsin as described in the Town land use plan, consideration of an onsite sewage disposal system inspection ordinance and program is recommended.

Public Informational and Educational Programming

Educational and informational brochures and pamphlets, of interest to homeowners and supportive of the recreational use and shoreland zoning regulations, are available from the University of Wisconsin-

Extension Service, and the Wisconsin Department of Natural Resources. These latter cover topics, such as beneficial lawn care practices and household chemical use guidelines. These brochures could be provided to homeowners through local media, direct distribution, or targeted school or public library displays. Elsewhere, lake organizations and municipalities, in cooperation with the County, school district or civic organizations, have compiled and distributed information packets to landowners on water quality protection measures and residential "good housekeeping" practices. Many of these ideas can be integrated into ongoing, larger-scale municipal activities such as anti-littering campaigns, recycling drives, and similar pro-environment activities.

In addition to public informational programming, or informal educational programming, discussed above, there are a number of school-based educational opportunities that the community can utilize. Programs and curricula such as Project WET and Adopt-A-Lake, are available from and supported by the University of Wisconsin-Extension. Through these programs, youth have an opportunity to experience "hands on" the aquatic environment and become better informed about current and future lake issues and concerns.

Finally, the participation in the Wisconsin Department of Natural Resources Self-Help Monitoring Program should be continued. Volunteer monitoring under the auspices of the WDNR "Self-Help Monitoring Program" involves citizens in taking Secchi-disc transparency readings in the Lake at regular intervals. The Lake Coordinator of the Wisconsin Department of Natural Resources-Southeast Region can assist in enlisting volunteers in this program. The information gained at first hand by the public during participation in this program increases the credibility of the proposed changes in the nature and intensity of use to which the Lake is subjected. While much of the work involved in these programs is undertaken by a group of volunteers, their actions can be supported by the Town through encouraging the volunteer monitors to share their results with the community on a regular basis, perhaps at Town meetings or other appropriate public meeting.

PUBLIC PERCEPTIONS OF LAKE AND LAND USE

To further elucidate the concerns and opinions of lakeshore residents with respect to land and water resources issues, the Town of West Point developed and despatched about 675 mail drop questionnaire surveys to residents within the Town that were identified as living on or near Lake Wisconsin during spring of 2006. The questionnaire survey is presented in Appendix B. Of these survey instruments, 288 (about 45 percent) were completed and returned.[2] The surveys were intended to explore the relationship of the

2 One further survey was returned, but was so severely damaged in transit that the data could not be accessed.

respondents to both the Lake and the Town, by ascertaining public perceptions with respect to land use and water use and quality issues of concern.

The majority of respondents (63 percent) were year-round residents, and most were long term residents, having lived in the community for five to fifteen years. Notwithstanding, a plurality of respondents (25 percent) was new to the community, having live in the Town for less than five years. Almost 90 percent of these respondents had purchased their properties from non-family members, and about 95 percent had a structure located on the property. The average length of time that the title had been in a family was approximately 13.25 years. A minority of respondents (about 5 percent) reported that they were life-long residents of the Town, with an equal number of respondents reporting that they had lived in the Town off and on for a similar period.

Of the properties owned by the respondents, almost all were residential properties. The majority were occupied by either three- or four-season homes. At the time of purchase, respondents noted that about one-half of the properties were occupied by four-season, year round homes. About one-fifth of properties had three-season homes at the time of purchase, with a further one-third of properties having no structure present. Currently, as of spring 2006, new construction or conversion of properties had increased the percentage of year round homes to about 85 percent of properties, the majority of these being through new construction on properties that lacked a permanent structure at the time of purchase. About one tenth of the properties were reported as currently being occupied by three-season structures, while only 5 percent remained without a dwelling structure. One half of the homes were less than 2,000 square feet, these homes being equally divided between those of under 1,500 square feet and those of between 1,500 and 2,000 square feet. About one quarter of properties had homes of between 2,000 square feet and 3,000 square feet in area.

On average, these homes were occupied by two-person families having an average of two children per household. About 85 percent of respondents were employed either full- or part-time. The majority of respondents were employed in a professional capacity. Of the balance, about one-quarter of respondents indicated that they were retired, although a number of these respondents did engage in part time work, contributing to the numbers of respondents that reported being employed. About two-fifths of respondents worked in the local area, in the Sauk Prairie-West Point-Lodi area, with a similar number working in the Madison metropolitan area.

About one-half of the respondents owned lakefront property. Of the remainder, the majority of respondents

did not own lakefront property, although about 10 percent of respondents did own off-lake properties with deeded lake access. The average length of shoreline owned by lakefront property owners was about 180 feet, within a range from a minimum of 25 feet to a maximum of 3,350 feet.

Swimming was the favored active recreational pursuit, with bird watching and picnicking being the favored passive recreational activities, reported by respondents. Other active summer watersports favored by respondents included power boating, waterskiing, canoeing, operating personal watercraft, and sailing. Active winter sports included snowmobiling and snowshoeing. Ratings of importance of these activities followed the pattern of participation in such activities, with waterskiing, power boating, and waterskiing being rated as the most important active recreational uses. Likewise, bird watching, walking and picnicking were the most important passive recreational uses.

Respondents reported that they, collectively, owned 90 “ski-boats”, about 80 pontoon boats, 100 “fishing boats”, 60 personal watercraft, and about 100 other types of nonmotorized vessels. The average horsepower rating of powered watercraft was about 40 hp for “ski-boats” and 20 hp for both pontoon and “fishing boats”. The majority of motors were the traditional two-stroke variety, with a minority of four-stroke engines being reported.

Lake use was rated as "light" during the week and "heavy" during the week end, by a majority of respondents.

From a regulatory point of view, the majority of folk were satisfied with the current regulatory framework. With respect to land use and zoning, respondents were agreed that local land use planning formed an important tool for local control of development issues. Consequently, respondents indicated agreement with the need for both town-level land use planning and cooperation in land use planning between neighboring jurisdictions. Respondents were neutral, however, on the issue of whether the use of private land should be governed by zoning rather than by the desires of the landowner, suggesting that behaviors may differ from perceptions on this issue. This potential difference between perception—what people believe in an intellectual sense—and behavior—what people actually do—is not unusual and highlights the tension between what people believe and how people act when it comes to issues such as land use. Notwithstanding, respondents noted their agreement with the need for development controls, and their general desire that the Town maintain its rural character by ensuring that viable farms continue to be a feature of the Town. This is consistent with the further desire of the majority of respondents that the Town should work with willing landowners to preserve the natural character of the landscape, particularly along

the lakeshore.

With respect to lake access, the majority of respondents felt that there was adequate public access to Lake Wisconsin, although a majority also suggested that a park and picnic area near the ferry landing in the Town would be desirable. A number of respondents noted their desire for a playground.

Respondents were satisfied with law enforcement activity on the lake, although the majority of respondents were neutral with respect to the operation of personal watercraft and noise levels on the Lake. This general level of satisfaction with respect to law enforcement activities included both summer and winter lake uses as well as with the level of enforcement of fish and game regulations on the lake.

About one-half of respondents indicated that they fished Lake Wisconsin, with an average level of effort devoted to angling being 15 days per year. Fewer respondents engaged in ice fishing, consistent with the reduced level of lake use during the winter months. Slightly more respondents utilized the Lake for angling during the weekend (about 45 percent) that during the week, with weekly angling effort being approximately equally split between use during the day and evening hours. Similarly, angling effort was fairly equally split between angling from the shoreline or from a pier and angling from a boat.

The majority of anglers (one-half) reported that they fished for panfish, with about a third of respondents reporting that they also fished for walleyed pike and smallmouth bass. About one-quarter of respondents reported fishing for largemouth bass. Lesser numbers of anglers (less than 15 percent) reported fishing for northern pike or other species, including, *inter alia*, carp, sauger, and perch. As might be expected, respondents provided a full range of opinions as to whether specific species of fish were increasing or decreasing in abundance or whether numbers remained stable; however, in contrast to the full range of responses for most species, there was fair agreement among respondents that northern pike abundances were declining or, at best, stable. Based on the majority of responses presented, panfish populations in Lake Wisconsin would seem to be stable; walleyed pike and muskellunge populations possibly declining; and large- and small-mouth bass populations remaining stable or possibly increasing in the case of smallmouth bass, in the opinion of the anglers responding to the survey. The majority of respondents rated the quality of the fishing on Lake Wisconsin as good to excellent.

In terms of water quality, respondents were neutral with respect to sanitary regulations governing the disposal of soil and liquid wastes. However, the majority of respondents were of the opinion that private sewerage systems in the Lake Wisconsin watershed were functioning correctly, which opinion is consistent

with the indications that most systems are of recent vintage—the majority of these systems were installed during the late 1980s—and subject to the regular inspection requirements set forth by Wisconsin Administrative Code—the majority of these systems were inspected in about 2003. The oldest onsite sewage treatment system was reported to have been installed in 1948, with the most recent systems being installed during 2006. Three-quarters of the onsite sewage treatment systems were septic tanks, with the remainder of systems being comprised of about equal numbers of community-based systems, holding tanks, and mound systems.

Respondents also indicated a general level of satisfaction with stormwater regulations and erosion control requirements in the Town. Notwithstanding, a majority of respondents indicated that they agreed with the statement that the bays on Lake Wisconsin within the Town of West Point were filling with sediment. This opinion is consistent with the opinion expressed by a majority of respondents that water clarity was an issue of concern. Respondents also expressed concern about algae and invasive or nonnative species, with the level of concern over algae being somewhat stronger than the concern over nonnative species. This may reflect the prominence given to the possible public health impacts of toxic forms of blue-green algae known to occur in the metropolitan Madison area.

The top five concerns reported by respondents were: 1) general water quality, 2) development around the lake, 3) farm runoff, 4) stormwater runoff, and 5) boat speeds, this latter being closely followed by concerns over the size of boats and the number of personal watercraft operating on the Lake, excessive noise, and numbers of boats, generally. The concern about the density and speeds of watercraft is consistent with the perception that the Lake is heavily used on weekends.

Respondents raised numerous other issues relating to their experiences in the Town of West Point. However, there were few consistencies within this range of responses, suggesting that there are no significant concerns of a general nature among the respondents. On the other hand, the large number of responses provided to this survey suggests a level of concern among the community with respect to the future of the Town that should be considered in planning for future development along the shores of Lake Wisconsin. Recommended actions in this regard are set forth in Chapter V.

Chapter V

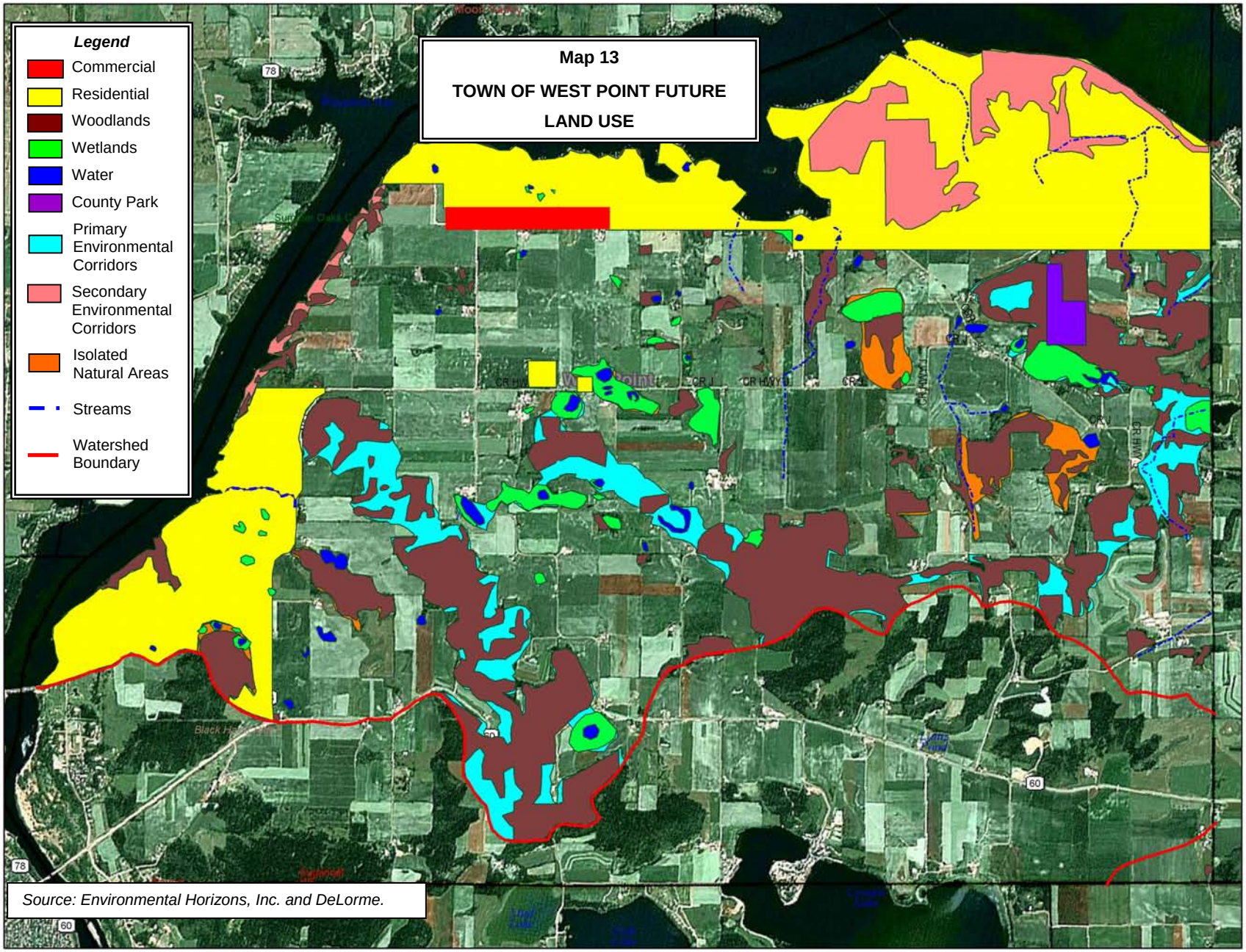
ALTERNATIVE AND RECOMMENDED LAND AND WATER RESOURCE MANAGEMENT MEASURES

INTRODUCTION

This chapter presents a recommended lake protection and management plan for the portion of the Lake Wisconsin tributary drainage area located within the Town of West Point, Columbia County. The plan is based upon inventories and analyses of land use and land and water management practices, pollution sources, recreational use and population forecasts, and an evaluation of alternative land-based lake management measures. The recommended plan sets forth means for: 1) providing water quality conditions suitable for full-body contact recreational use and the maintenance of healthy communities of warmwater fish and other aquatic life, 2) reducing the severity of existing or perceived problems which constrain or preclude desired water uses, 3) improving opportunities for water-based recreational activities, and 4) protecting environmentally sensitive areas.

Analyses of water quality conditions in the Lake indicate that the general condition of the water in Lake Wisconsin is very good. There appear to be few impediments to water-based recreation, although access by recreational watercraft is limited in some portions of the Lake by water depths and growths of aquatic macrophytes. Nevertheless, based upon a review of the inventory findings and consideration of planned developments within the area tributary to the Lake, as set forth in the adopted Town of West Point land use plan, measures will be required to continue to protect and maintain the high quality of the Lake for future lake users. Therefore, this plan sets forth alternatives and recommendations for: land use and water quality management, including protection of environmentally sensitive lands, in the area directly tributary to Lake Wisconsin, and informational programming.

The recommended management measures for Lake Wisconsin are summarized graphically on Map 13, and are listed in Table 11. The recommended plan measures are more fully described


Legend
Commercial
Residential
Woodlands
Wetlands
Water
County Park
Primary Environmental Corridors
Secondary Environmental Corridors
Isolated Natural Areas
Streams
Watershed Boundary
Map 13
TOWN OF WEST POINT FUTURE LAND USE
Source: Environmental Horizons, Inc. and DeLorme.
Data use subject to license.
© 2004 DeLorme. XMap®/GIS Editor.
www.delorme.com
MN (1.7° W)
0 ¼ ½ ¾ 1 1¼ mi
Data Zoom 12-0

below. It should be noted that recreational use management and institutional development measures were also considered in developing this management plan, and are presented as ancillary management measures for the protection of Lake Wisconsin. The recommended management agency responsibilities for tributary area land management also are set forth in Table 11.

Table 11

RECOMMENDED PROTECTION PLAN ELEMENTS FOR LAKE WISCONSIN IN THE TOWN OF WEST POINT, COLUMBIA COUNTY

Issue	Plan Element	Subelement	Location	Management Measures[a]	Management Responsibility
Land Use	Land use management	Land use plan implementation	Entire watershed	Support implementation of the town land use plan	Town of West Point and Columbia County
		Environmentally sensitive lands protection	Entire watershed	Develop environmental corridors and Support preservation of environmental corridor lands and critical species habitat	Town of West Point and Columbia County
			Town of West Point	Create performance standards within the Town land use plan and County zoning code to give legal status to environmental corridor lands	Town of West Point and Columbia County
Nonpoint Source Pollution and Water Quality	Watershed land management	Urban nonpoint source controls	Entire watershed	Implement and maintain recommended good urban housekeeping practices, and maintenance of grassed swales	Town of West Point and Columbia County
		Construction site erosion control	Entire watershed	Continue to enforce existing erosion control and water quality protection ordinances; refine ordinances where necessary	Town of West Point and Columbia County
		Rural nonpoint source controls	Entire watershed	Implement and maintain rural land best management practices, and integrated nutrient and pest management practices	Town of West Point and Columbia County
	Water quality management	Water quality control	Entire lake	Incorporate specific actions within the stormwater management plan for the protection of the surface water quality of Lake Wisconsin	Town of West Point and Columbia County
		Water quality monitoring	Entire lake	Participate in the DNR Self-Help Monitoring Program; consider creation and implementation of a citizen-based creel census program	Volunteer monitors
		Water quality protection	Entire watershed	Implement and maintain recommended good urban housekeeping practices	Town of West Point and Columbia County ; individual property owners
Point Source Pollution and Wastewater	Water quality management	Sewage treatment	Urban areas of the Lake Wisconsin shorelands	Consider extension of public sanitary sewerage services from neighboring regional wastewater treatment facilities	Town of West Point
		Onsite sewage management	Urban areas of the Lake Wisconsin shorelands	Encourage proper on-site sanitary sewage system maintenance	Town of West Point and Columbia County ; individual property owners

Table 11 (continued)

Informational and Educational Programming	Public informational programming	- -	Entire watershed	Continue public awareness and information programming Encourage householders to adopt environmentally sustainable land management practices Participate in soil testing program offered by UW-Extension	Town of West Point; Columbia County; Wisconsin Department of Natural Resources; and University of Wisconsin-Extension
Lake organization development	Lake Association/Town Sanitary District creation	- -	Town of West Point	Consider formation of a lake sanitary district to serve the urban lands draining to Lake Wisconsin; Consider creation of a lake association serving the drainage area directly tributary to Lake Wisconsin	Town of West Point Individual citizens with assistance from University of Wisconsin-Extension

[a]*Costs to be determined.*

Source: Environmental Horizons, Inc.

Based upon review of the inventories and analyses set forth in Chapters II through IV, issues were identified that required consideration in the formulation of alternative and recommended lake management measures. These issues are related to: 1) land use, 2) pollution abatement, and 3) water quality. The management measures considered herein are focused primarily on those measures which are applicable to the Lake Wisconsin and to the Town of West Point.

TRIBUTARY AREA MANAGEMENT

Land Use Management and Zoning

A basic element of any lake management planning effort is the promotion of sound land use development and management in the tributary drainage area to the lake. The type and location of future urban and rural land uses in the tributary area to Lake Wisconsin will determine, to a large degree, the character, magnitude, and distribution of nonpoint sources of pollution; the practicality of, as well as the need for, stormwater management; and, to some degree, the water quality of the Lake.

The level of development envisioned in the Town of West Point land use plan for the area tributary to Lake Wisconsin indicates continuing urban development, generally on large suburban-density lots. Careful review of applicable County and Town zoning ordinances to incorporate levels and patterns of development consistent with the plan within the area tributary to Lake Wisconsin is recommended. Changes in the zoning ordinances could be considered to better reflect the land use patterns recommended in the Town land use plan; namely, the

preservation of farming operations, the maintenance of the rural character of the Town, and the protection of wetlands, floodlands, and water resources.

To this end, it is recommended that the Town and/or County seek to preserve land areas in acreages adequate for agricultural use, or, if fallow, to preserve areas that maintain the current scenic vistas provided by the open landscape within the Town, by limiting land divisions and locations of urban density development to specific locations, generally contiguous to existing urban density development. A generalized pattern of land development consistent with these guidelines is shown on Map 13. Consideration should be given to minimizing the areal extent of development by providing specific provisions and incentives to cluster residential development on smaller lots while preserving portions of the open space on each property or group of properties considered for development, utilizing the principles of conservation development. Further, it is recommended that the Town consider the adoption of a land division ordinance similar to that adopted by Jefferson County, which seeks to preserve larger land units, while allowing landowners to subdivide lands for residential use.

The Town land use plan envisions that urban land use development within the area tributary to Lake Wisconsin will occur primarily at low densities and only in areas which are covered by soils suitable for the intended use; which are not subject to special hazards such as flooding, and which are not environmentally sensitive, that is, not encompassed within the environmental corridors described in Chapter II. Given that significant areas of the Town are covered by soils that have limitations or severe limitations for residential development utilizing onsite sewage disposal systems, consideration should be given to use of communal or public sanitary sewerage systems in order to ensure minimal impacts on lake water quality. These alternatives are discussed further below.

Development in the Shoreland Zone

Existing year 2000 land use patterns and zoning regulations in the drainage area in the Town of West Point tributary to Lake Wisconsin have been described in Chapter II. If the recommendations set forth in the adopted Town of West Point land use plan are followed, some additional urban residential development within the area tributary to Lake Wisconsin would occur. Much of this residential development is likely to occur on agricultural lands. Infilling of existing platted lots and some backlot development, as well as the redevelopment and reconstruction of existing single-family homes and commercial structures on lakefront

properties, also may be expected to occur. Recent surveillance indicates that this type of development is currently occurring, with the result, as documented in Chapter IV, that the decade between 1990 and 2000 saw an increase in both population and numbers of housing units in the Town of about 20 percent over 1990 levels. In addition, respondents to the questionnaire survey indicated that one-half of the homes that had been purchased as three-season dwellings had been converted to year-round accommodation.

Accordingly, given the potential impact of lakeshore development on the lake resources, land use development or redevelopment proposals around the shoreline of Lake Wisconsin and within the area tributary to the Lake should be evaluated for potential impacts on the Lake, as such proposals are advanced. These impacts include the direct impacts of soil loss and contaminant mobilization as a result of construction activities, and the indirect impacts as a result of subsequent land management practices.

A land use issue which has the potential to affect the Lake is the development for urban uses of the agricultural and other open space lands in the tributary area. As previously noted, large-lot residential development is occurring in areas of the Lake tributary area in which such development may not have been envisioned in the adopted land use plan. If this trend continues, much of the open space areas remaining in the tributary area will be replaced over time with large-lot urban development. This may significantly increase the pollutant loadings to the Lake and increase the pressures for recreational use of the Lake. A significant portion of the undeveloped lands of the Town could potentially be developed for low-density urban uses.

A major land use issue which has the potential to affect Lake Wisconsin is the redevelopment of existing lakefront properties, replacing lower-density uses with higher-density dwellings with potential for increased roof areas, parking areas, and other areas of impervious surfaces. As observed in other lakefront communities in Wisconsin, respondents noted that dwellings constructed or converted to year-round usage in recent years tended to have larger floor areas than older dwellings. Replacement of a pervious land surface with an impervious surface will increase the rate of stormwater runoff to the Lake, increase pollutant loadings on the Lake, and will reduce groundwater recharge. While these effects can be moderated to some extent through structural stormwater management measures, there is likely to be an adverse impact on the Lake from significant redevelopment in the area tributary to the Lake involving conversion to higher-density land uses. For this reason, maintenance of the historic low- and medium-density

residential character of the shoreline of Lake Wisconsin to the maximum extent practical is recommended.

The existing zoning in the tributary drainage basin generally permits development on large suburban-density lots on much of the remaining open lands. Control of shoreland redevelopment, and the related intensification of use, is not specifically addressed in the existing zoning codes. It is recommended that the impact of future land use development on Lake Wisconsin be minimized through review and modification of the applicable zoning ordinance regulations and zoning district maps to address the concerns noted. Changes in zoning ordinances are recommended to minimize the areal extent of development by providing specific provisions and incentives for the clustering of residential development on smaller lots within conservation subdivisions, thus preserving significant portions of the open space within each property or group of properties considered for development. Likewise, protection of lands within the delineated environmental corridors is recommended.

It is further recommended that lakefront developments, as well as setback and landscaping provisions, be carefully reviewed. Such review would address specific shoreland zoning requirements, and could consider the stormwater and urban nonpoint source pollution abatement practices proposed to be included in shoreland development activities, as required pursuant to Chapters NR 151 and NR 153 of the *Wisconsin Administrative Code*. Provision for shoreland buffers, use of appropriate and environmentally friendly landscaping practices, and inclusion of stormwater management measures that provide water quality benefits are practices to be encouraged.

Recent studies of the potential impact of riparian landscaping activities on the nutrient loadings to lakes in Southeastern Wisconsin have suggested that urban residential lands can contribute up to twice the mass of phosphorus to a lake when subjected to an active program of urban lawn care than similar lands managed in a more natural fashion. The application of agrochemicals to such lands, in excess of the plant requirements, therefore, results in enhanced nutrient loading directly to the adjacent waterbodies. To address these concerns, a number of communities are debating the enactment of turf management ordinances in addition to the public informational programming discussed below. Some communities, such as the Big Cedar Lake Protection and Rehabilitation District, near West Bend, Wisconsin, also have purchased bulk lots of phosphorus-free lawn and garden fertilizers for resale to riparian landowners. Given

the increasing importance of urban land uses within the riparian area of Lake Wisconsin, and within its tributary area, consideration of a comprehensive program to regulate urban agricultural practices appears to be warranted.

Stormwater Management on Development Sites

With respect to stormwater management on development sites, the Town of West Point had adopted stormwater management ordinances. These ordinances reflect current best practices insofar as the determination of stormwater flows, mitigation of flooding potential, and the control of contaminants from land use activities are concerned. Periodic review of these ordinances and their provisions for consistency with best management practices, and to ensure their currency with the state-of-the-art, should be undertaken on a regular basis to facilitate control of urban-source contaminants that would likely be delivered to the Lake.

It is recommended that the Town of West Point take an active role in promoting urban nonpoint source pollution abatement. Actions to promote urban nonpoint source pollution abatement would include the conduct of specific stormwater management planning projects within specific portions of the tributary drainage area located where future urban development or redevelopment is anticipated. Such a planning program should include a review of the stormwater management ordinances, to ensure that the ordinance provisions reflect state-of-the-art runoff and water quality management requirements. It also is recommended that similar reviews be conducted by each riparian municipality to ensure that there is harmony between the ordinances governing urban density development in each of the municipalities draining to Lake Wisconsin. Adoption by all riparian municipalities of common stormwater management ordinance provisions is strongly recommended. This recommendation is consistent with the top three issues identified by respondents to the questionnaire survey, as documented in Chapter IV, who noted that water quality, development, and runoff from urban and agricultural operations within the Town were the most serious issues facing the Town and Lake.

Protection of Environmentally Sensitive Lands

Environmentally sensitive lands within the area tributary to Lake Wisconsin in the Town of West Point include wetlands, woodlands, and wildlife habitat areas. Nearly all of these areas have been included in the environmental corridors and isolated natural resource features delineated in Chapter II. Upland areas, woodlands, and wildlife habitat areas are recommended to be

protected primarily through local land use regulation, while wetlands enjoy a wider range of protections set forth in State and Federal legislation.

Wetland protection can be accomplished through land use regulation and, in cases where land use regulations may not offer an adequate degree of protection, through public acquisition of sensitive sites. These wetland areas are currently protected to a degree by current zoning and regulatory programs administered by the U.S. Army Corps of Engineers, Wisconsin Department of Natural Resources (WDNR), and County and municipal authorities under one or more of the Federal, State, County, and local regulations.

Wetland, woodland, and groundwater recharge area protection can be accomplished through land use regulation and public land acquisition of critical lands. Both measures are recommended for the area tributary to Lake Wisconsin. The wetland areas within the area tributary to the Lake are currently largely protected through the existing regulatory framework provided by the U.S. Army Corps of Engineers permitting program, State shoreland zoning requirements, and local zoning ordinances. The major wetland areas in the Lake Wisconsin tributary drainage area in the Town of West Point have been included in the environmental corridors delineated in this plan. Establishment, and consistent and effective application, of regulations to create and protect these areas is recommended. Where practicable, inclusion of such areas within parklands or other public lands should be considered. Such actions may be applicable adjacent to the Gibraltar Rock County Park, for example.

A key area for protection is the northwestern portion of the Town which forms the breeding and roosting habitat for bald eagles. Development activities within and adjacent to this area should be limited, especially during the breeding season, to minimize disturbance of these birds. Consideration of public acquisition of these lands is recommended to ensure the long term preservation of this critical habitat.

Anticipated Land Use Changes in No Name and Sunset Bays

Based upon the foregoing recommendations regarding the future development of urban density residential lands, a future land use condition was elaborated for each of the two embayments that were considered for water quality modeling purposes. Tables 12 and 13 set forth the current and anticipated future land use conditions in each subwatershed.

Table 12

Acres for No-Name Bay Current and Future

Source	Current Acres	Future Acres
Residential	94.63	188.17
Woodlands	9.51	- -
Commercial	- -	59.83
Agriculture and Open Space	499.63	355.77
Total	603.77	603.77

Source: Environmental Horizons, Inc.

Table 13

Acres for Sunset Bay Current and Future

Source	Current Acres	Future Acres
Residential	252.93	646.40
Woodlands	556.17	545.63
Water	3.90	3.90
Wetlands	41.37	41.37
Agriculture and Open Space	1742.61	1359.68
Total	2596.98	2596.98

Source: Environmental Horizons, Inc.

POLLUTION ABATEMENT AND STORMWATER MANAGEMENT

All human activities upon the land surface result in some degree of mobilization of contaminants and modification of surface runoff patterns that can affect lakes and streams, their quality, and biotic condition. Many human activities can be mitigated to a large extent by the implementation of sound planning, appropriate nonpoint source pollution abatement measures, and the actions of an informed public. In the first instance, sound land use development and management in the tributary area, and protection of environmentally sensitive lands, are the fundamental building blocks for protecting lake and stream water quality and habitat, and preserving human use opportunities that will support a broadly-based recreational and residential community. In addition, specific nonpoint source pollution control and abatement measures should be integrated into land use regulations and promoted by a far-reaching informational and educational program within the area tributary to individual lakes and streams.

Nonpoint Source Pollution Abatement

Tributary area management measures may be used to minimize nonpoint source pollutant loadings from the tributary area by locating development within a tributary basin in accordance

with sound planning. Beyond such actions, specific interventions may be required to control the mass of contaminants, generated by various types of land use activities, that are transported to the Lake. Rural sources of contaminants arise as pollutants transported by runoff from cropland and pastureland; urban sources include contaminants transported by runoff from residential, commercial, industrial, transportation, and recreational land uses, and from construction activities.

As described in Chapter III, the most readily controllable loadings are associated primarily with runoff from urban and agricultural lands within the area tributary to the Lake and from urbanizing lands throughout the area tributary to the Lake within the Town that are linked to the Lake by way of streams and stormwater drainage systems. These loadings, combined, constituted more than 90 percent of the total phosphorus and sediment loadings to Lake Wisconsin, and 100 percent of the heavy metals loadings, based upon 2000 land uses. Phosphorus loadings from the remainder of the tributary area, and from direct deposition onto the Lake surface, contributed the balance of the total loadings. The contributions of phosphorus, sediment and heavy metals from urban lands are expected to increase as agricultural lands are progressively converted to urban uses.

While some proportion of these contaminant loads may be attenuated as a consequence of the extensive wetland areas, the ability of these wetlands to assimilate pollutants is wholly dependent upon the maintenance of their structure and function within their ecosystems. These features can be overwhelmed by inappropriate land uses that result in the degradation of the wetlands, diminishing their ability to capture contaminants, or creating contaminant loads of such magnitude that the wetlands are overloaded. Thus, the control of nonpoint sources of water pollution at their sources is an important consideration. Properly applied, such controls can reduce the pollutant loadings to a lake by about 25 percent or more.

Appendix C presents a list of alternative nonpoint source pollution management measures that could be considered for use in the Lake Wisconsin area to reduce loadings from nonpoint sources of pollution. Information on the cost and effectivity of the measures is also presented in Appendix C. It should be noted that appropriate public informational programming, described below, provides a means of disseminating information on various nonpoint source control measures that can be targeted to specific sectors of the community. Many of the measures are

low-cost or no-cost measures that can be implemented by individual landowners. Selected measures are discussed below.

The recommended tributary area land management measures are specifically aimed at reducing the water quality impacts on Lake Wisconsin of nonpoint sources of pollution within the tributary area. Nonpoint source control measures should be considered for all areas tributary to Lake Wisconsin. Nonpoint source pollution abatement controls in the tributary area are recommended to be achieved through a combination of rural agricultural nonpoint controls, urban stormwater management, and construction erosion controls. The implementation of the land management practices described below may be expected to result in a reduction in nonpoint-source pollutants that is considered to be the maximum practicable given the findings of the inventories and analyses compiled during the planning effort.

Rural Nonpoint Source Controls

Upland erosion from agricultural and other rural lands is a contributor of sediment to streams and lakes. Estimated phosphorus and sediment loadings from croplands, woodlots, pastures, and grasslands in the area tributary to Lake Wisconsin were presented in Chapter III. These data were utilized in determining the pollutant load reduction that could be achieved, the types of practices needed, and the extent of the areas to which the practices need to be applied within the area tributary to Lake Wisconsin.

Based upon the pollutant loading analysis set forth in Chapter III, more than 90 percent of the total loadings of sediment and phosphorus to No Name and Sunset Bays in Lake Wisconsin riparian to the Town of West Point were contributed by runoff from rural lands. While agricultural land uses are anticipated to be a declining form of land usage within portions of the area tributary to Lake Wisconsin in the Town, the agricultural operations that remain within the tributary area are likely to continue to contribute a significant proportion of the sediment load to the waterbody. Thus, detailed farm conservation plans are likely to continue to be required to adapt and refine erosion control and nutrient and pest management practices for individual farm units. Generally prepared with the assistance of staff from the U.S. Natural Resources Conservation Service or County Land Conservation Department, such plans identify desirable tillage practices, cropping patterns, and rotation cycles. The plans also consider the specific topography, hydrology, and soil characteristics of the farm; identify the specific resources of the farm operator; and articulate the operator objectives of the owners and managers of the land.

The implementation of nonpoint source pollution controls in rural areas also requires the cooperative efforts of the Town of West Point, Columbia County, and private landowners. Technical assistance can be provided by the U.S. Department of Agriculture Natural Resources Conservation Service; the Wisconsin Department of Agriculture, Trade and Consumer Protection; and the Columbia County Land Conservation Department. As discussed previously, it is recommended that the Town of West Point, in coordination with the WDNR and Columbia County, develop a strategy to address nonpoint source pollution. State and Federal soil erosion control and water quality management programs, individually or in combination, can be used to achieve pollutant reduction goals. Such programs include the U.S. Department of Agriculture Environmental Quality Incentive Program (EQIP), the Wisconsin Department of Natural Resources runoff management and lake protection programs, and various local land acquisition initiatives.

Highly localized, detailed, and site-specific measures are required to effectively reduce soil loss and contaminant runoff in rural areas. These measures are best defined and implemented at the local level through the preparation of detailed farm conservation plans. Practices which are considered most applicable within the area tributary to Lake Wisconsin include conservation tillage, integrated nutrient and pesticide management, and pasture management. In addition, it is recommended consideration be given to cropping patterns and crop rotation cycles, with attention to the specific topography, hydrology, and soil characteristics for each farm. A reduction of about 25 percent in the nonpoint source loading from rural lands could provide significant reductions in total phosphorus loadings to Lake Wisconsin.

The cost of the needed measures will vary depending upon the details of the recommended farm conservation plans. These costs may be expected to be incurred to a large extent for purposes of agricultural land erosion control in any case. As noted above, with the promulgation of Chapters NR 153 and NR 154 of the *Wisconsin Administrative Code*, which became effective during October 2003, cost-share funding may be available to encourage installation of appropriate land management measures. Likewise, cost-share funding may be available under the Chapter NR 120 nonpoint source pollution abatement program for the repair and maintenance of those management measures installed pursuant to the priority watershed plan.

Urban Nonpoint Source Controls

As of 2000, established urban land uses contributed about 2 percent of the phosphorus loads to Non Name and Sunset Bays in Lake Wisconsin within the Town of West Point. This is anticipated to increase under future land use conditions. Those urban-source pollutant loadings that are most controllable include runoff from the residential lands adjacent to the Lake, and urban runoff from areas with a high proportion of impervious surface. The potential also exists within the Lake Wisconsin tributary area for significant construction site erosion impacts if development continues in the tributary area as has been the recent trend.

Potentially applicable urban nonpoint source control measures include stormwater management measures, wet detention basins, grassed swales, and good urban “housekeeping” practices. Generally, the application of low-cost urban housekeeping practices may be expected to reduce nonpoint source loadings from urban lands by about 25 percent.

Public educational programs can be developed to encourage good urban housekeeping practices, to promote the selection of building and construction materials which reduce the runoff contribution of metals and other toxic pollutants, and to promote the acceptance and understanding of the proposed pollution abatement measures and the importance of lake water quality protection. Urban housekeeping practices and source controls include restricted use of fertilizers and pesticides, improved pet waste and litter control, the substitution of plastic for galvanized steel and copper roofing materials and gutters, proper disposal of motor vehicle fluids, increased leaf collection, and continued use of reduced quantities of street deicing salt.

Particular attention also should be given to reducing pollutant loadings from high pollutant loading areas, such as commercial sites and parking lots. To the extent practicable, parking lot stormwater runoff should be diverted to areas covered by pervious soils and appropriate vegetation, rather than being directly discharged to surface waters. Material storage areas may be enclosed or periodically cleaned, and diversion of stormwater away from these sites may further reduce pollutant loadings. Street sweeping, catch basin installation and cleaning, stream protection, leaf litter and vegetation debris collection, and stormwater storage and infiltration measures can enhance the control of nonpoint-source pollutants from urban and urbanizing areas, and reduce urban nonpoint source pollution loads by up to about 50 percent.

As has been noted in Chapter IV, the Town of West Point has adopted stringent stormwater management ordinances applicable to new development within the areas under their jurisdiction. While these measures limit the potential impacts of new development, they do not address impacts from existing land uses nor do they address the cumulative impacts of past development. Therefore, additional measures to reduce nonpoint source pollution from existing development would appear to be warranted. Proper design and application of structural urban nonpoint source control measures, such as grassed swales and detention basins, requires the preparation of a detailed stormwater management system plan that addresses stormwater drainage problems and controls nonpoint sources of pollution.

The development of urban nonpoint source pollution abatement measures for the Lake Wisconsin areas should be the primary responsibility of the riparian municipalities. In addition to the adoption of stormwater management ordinances, the most viable measures to control urban nonpoint sources of pollution appear to be good urban land management and urban housekeeping practices. Such practices consist of fertilizer and pesticide use management, litter and pet waste controls, and management of leaf litter and yard waste. The promotion of these measures requires an ongoing public informational program. It is recommended that the Town of West Point take the lead in sponsoring such programming in the Town through regular public informational meetings and mailings. The Town should also ensure that relevant literature, available through the University of Wisconsin-Extension Service and the WDNR, is made available at these meetings and at the local government offices.

As an initial step in carrying out the recommended urban practices, it is recommended that a fact sheet identifying specific residential land management measures beneficial to the water quality of Lake Wisconsin be prepared and distributed to property owners. This fact sheet could be distributed by the Town, with the assistance of the University of Wisconsin-Extension Service and Columbia County Department of Land Conservation offices. The recommended measures may be expected to provide about a 25 percent reduction in urban nonpoint source pollution runoff.

Developing Area Nonpoint Source Controls

Developing areas can generate significantly higher pollutant loadings than established areas of similar size. Developing areas include a wide array of activities, including urban renewal projects, individual site development within the existing urban area, and new land subdivision

development. The regional land use and county development plans envision only limited new urban development within the tributary area. However, as previously noted, some large-lot suburban-density development is currently taking place in the area of the Town of West Point tributary to Lake Wisconsin, together with the redevelopment of existing, platted lakefront lots.

Construction sites, especially, may be expected to produce suspended solids and phosphorus loadings at rates several times higher than established urban land uses. Control of sediment loss from construction sites can be provided by measures set forth in the model ordinance developed by the WDNR in cooperation with the Wisconsin League of Municipalities. These controls are temporary measures taken to reduce pollutant loadings from construction sites during stormwater runoff events. Construction erosion controls may be expected to reduce pollutant loadings from construction sites by about 75 percent. Such practices are expected to have only a minimal impact on the total pollutant loading to the Lake due to the relatively small amount of time during which lands are being developed. However, such controls are important pollution control measures that can abate localized short-term loadings of phosphorus and sediment from the tributary area and the upstream tributary area.

At the present time, Columbia County has adopted construction site erosion control ordinances which are administered and enforced by the County, in both the shoreland and nonshoreland areas of the unincorporated areas of the lands tributary to Lake Wisconsin. The provisions of these ordinances apply to all development except single- and two-family residential construction. Single- and two-family construction erosion control measures are to be specified as part of the building permit process. Because of the potential for development, some of it albeit unplanned, in the area tributary to Lake Wisconsin, it is important that adequate construction erosion control programs, including enforcement, be in place.

It is recommended that Columbia County and the Town of West Point continue efforts to control soil erosion attendant to construction activities in accordance with existing ordinances. As noted in Chapter IV, Columbia County has adopted construction erosion control ordinances. Enforcement of the ordinances by the County is generally considered effective. The provisions of these ordinances apply to all development except single- and two-family residential construction. The single- and two-family construction erosion control is to be carried out as part of the building permit process.

Construction site erosion controls may include the use of silt fences, sedimentation basins, rapid revegetation of disturbed areas; the control of “tracking” from the site; and careful planning of the construction sequence to minimize the areas disturbed. Construction site erosion control is particularly important in minimizing the more severe localized short-term nutrient and sediment loadings to Lake Wisconsin that can result from uncontrolled construction sites. Consideration should be given to incorporating construction site erosion control measures into a formal stormwater management system serving larger developments following construction.

Construction site erosion control measures may be expected to reduce the phosphorus loading from that source by about 75 percent. Because of the potential for development in the tributary area to Lake Wisconsin in the Town of West Point, it is important that adequate construction erosion control programs be in place.

The cost for construction site erosion control will vary depending upon the amount of land under construction at any given time. Typical costs are $250 to $500 per acre under development.

Anticipated Changes in Contaminant Loadings to No Name and Sunset Bays

Contaminant Loadings to No-Name Bay

The tributary drainage area to No-Name Bay in Lake Wisconsin is about 600 acres in areal extent. Nonpoint-sourced phosphorus inputs to the Bay were estimated using the Wisconsin Lake Model Spreadsheet (WILMS version 3.0).

Table 14 sets forth the estimated phosphorus loads to No-Name Bay under future land use conditions. A total annual phosphorus loading of between about 160 and 595 pounds, with a most likely total phosphorus loading of about 400 pounds, is estimated to be contributed to the Bay. This represents an estimated increase in loading of about 40 pounds of phosphorus per year from current conditions—see Chapter III—as a result of the conversion of agricultural lands to urban residential uses. Of the most likely future annual total phosphorus load, it was estimated that 254 pounds per year, or about 63 percent of the total loading, was contributed by runoff from rural land, while a further approximately 150 pounds per year, or 37 percent, was contributed by runoff from urban land. This assumes that there would be some additional commercial development in the vicinity of the Town Hall, which accounts for the major portion of the predicted increase in phosphorus loadings. Application of urban nonpoint source pollution

control measures to parking areas and commercial buildings is indicated should such development be contemplated.

Table 14

Estimated Future Annual Phosphorus Loading for No-Name Bay

Source	Acres	Phosphorus, lbs/year	Percent from Each Land Use	Percent Change from 2000
Residential	188.17	17.6	4.4	+100.0
Commercial	59.83	132.0	32.7	- -
Woodlands	- -	- -	0.0	- -
Agriculture and Open Space	499.93	253.6	62.9	-27.2
Total	597.51	403.2	100.0	+12.3

Source: Environmental Horizons, Inc.

Contaminant Loadings to Sunset Bay

The tributary drainage area to Sunset Bay in Lake Wisconsin is about 2,600 acres in areal extent. Nonpoint-sourced phosphorus inputs to the Bay were estimated using the Wisconsin Lake Model Spreadsheet (WILMS version 3.0).

Table 15 sets forth the estimated phosphorus loads to Sunset Bay under future land use conditions. A total annual phosphorus loading of between about 420 and 1950 pounds, with a most likely total phosphorus loading of about 1077 pounds, was estimated to be contributed to the Bay. This represents an estimated decrease in loading of about 227 pounds of phosphorus per year from current conditions—see Chapter III—as a result of the conversion of agricultural lands to urban residential uses. Of the most likely annual total phosphorus load, it was estimated that 980 pounds per year, or about 95 percent of the total loading, was contributed by runoff from rural land, while about 60 pounds per year, or about 5 percent, was contributed by runoff from urban land. In terms of this embayment, the conversion of agricultural lands to residential lands is expected to moderate phosphorus flows from the land surface. Notwithstanding, application of urban residential nonpoint source pollution abatement measures is warranted, and could result in further benefit to the Lake as a result of reductions in phosphorus loads. Such measures would include provision for onsite stormwater detention as required pursuant to Chapter NR 153 of the *Wisconsin Administrative Code*.

Table 15

Estimated Future Annual Phosphorus Loading for Sunset Bay

Source	Acres	Phosphorus, lbs/year	Percent from Each Land Use	Percent Change from 2000
Residential	252.93	57.3	5.3	+59.2
Woodlands	544.92	44.0	4.1	0.0
Water	3.9	1.0	<0.1	0.0
Wetlands	41.37	4.4	0.4	0.0
Agriculture and Open Space	1722.4	970.2	90.1	-21.1
Total	2565.5	1076.9	100.0	- -

Source: Environmental Horizons, Inc.

WASTEWATER MANAGEMENT

Public Sanitary Sewerage System Management

Some concentrations of urban development located along the shoreline of Lake Wisconsin have been included within public sanitary sewer service areas. However, these areas have not been extended into the Town of West Point. Consequently, Town lands identified as having a density of development equivalent to an urban concentration would continue to be provided with sewage disposal through the use of onsite sewage disposal systems. Notwithstanding, it is recommended that the sewerage needs of such areas be periodically reevaluated in light of changing conditions.

Based upon the recommended land use pattern identified in Map 13, the development and use of public or community-based sanitary sewerage systems could be possible, given that development of urban density residential areas is proposed to be limited to those areas contiguous to existing urban density development. This would increase the practicability of extending sewerage services to urban lands located along the western boundary of the Town from the Sauk City, and to the urban lands located along the northern boundary of the Town from Harmony Grove.

Under the former alternative, it is proposed to provide public sanitary sewerage services to the western shorelands of the Town of West Point by extending a force main from Sauk City along STH 60 and STH 188 to the intersection with CTH J. Provision of a force main along this route would entail installation of at least one pumping station and approximately 20,500 linear feet of sewer. This does not include provision of local sewers serving urban density residential development along this route, the cost of individual laterals serving households, or the

incremental cost of wastewater treatment at the wastewater treatment facilities. Nevertheless, based upon the standardized costs of sewer construction, it is estimated that the cost of providing the opportunity for public sewerage treatment would be approximately $675,000—comprised of $615,000 in force main cost plus $60,000 in pump station cost. Based upon current land uses, a further investment of approximately $1,415,000 would be required for provision of local sewerage networks located along the year 2000 town road system, with about the same magnitude of cost—about $1,225,000—for providing lateral connections to individual households. Consequently, the estimated cost of providing public waterborne sewerage services to the western shorelands of Lake Wisconsin in the Town of West Point would be on the order of about $3,255,000, excluding the incremental cost of wastewater treatment.

Under this alternative, it is proposed to provide public sanitary sewerage services to the northern shorelands of the Town by extended a force main from Okee along STH 113 and STH 188 to the vicinity of the Town of West Point Town Hall at the intersection of CTH J. Provision of a force main along this route would entail installation of at least one pumping station and approximately 31,250 linear feet of sewer. This does not include provision of local sewers serving urban density residential development along this route, the cost of individual laterals serving households, or the incremental cost of wastewater treatment at the wastewater treatment facilities. Nevertheless, based upon the standardized costs of sewer construction, it is estimated that the cost of providing the opportunity for public sewerage treatment would be approximately $1,000,000—comprised of $940,000 in force main cost plus $60,000 in pump station cost. Based upon current land uses, a further investment of approximately $1,350,000 would be required for provision of local sewerage networks located along the year 2000 town road system, with about the same magnitude of cost—about $1,225,000—for providing lateral connections to individual households. Consequently, the estimated cost of providing public waterborne sewerage services to the northern shorelands of Lake Wisconsin in the Town of West Point would be on the order of about $2,360,000, excluding the incremental cost of wastewater treatment.

Given the magnitudes of these estimated costs, totaling in excess of $5,500,000, consideration of community level and individual onsite sewage disposal systems would appear to be warranted.

Onsite Sewage Disposal System Management

At the time of the initial report, the population residing in the area tributary to Lake Wisconsin in the Town of West Point utilized onsite systems for treatment of sanitary and household wastewaters. Two basic alternatives are available for abatement of pollution from onsite sewage disposal systems: continued reliance on, and management of, the onsite sewage disposal systems, and, alternatively, the implementation of community-based collection systems.

Where onsite sewage disposal systems remain the primary wastewater treatment method, it is recommended that an onsite sewage disposal system management program be carried out, including the conduct of an ongoing informational and educational effort. Homeowners in areas served by onsite systems should be advised of the rules, regulations, and system limitations governing onsite sewage disposal systems, and should be encouraged to undertake preventive maintenance programs. Columbia County currently has such a program in place, pursuant to Chapter Comm 83 of the *Wisconsin Administrative Code* for onsite sewage disposal systems installed after 1983—consideration is currently being given by the Wisconsin Legislature to extending this inspection program to all onsite sewage disposal systems. The current County ordinance provisions requiring the regular inspection and maintenance of onsite sewage disposal systems should be enforced to minimize potential phosphorus loadings from this source.

It also is recommended that Columbia County, in cooperation with the Town of West Point, assume the lead in providing the public informational and educational programs to encourage affected property owners to have existing onsite systems inspected and any needed remedial measures undertaken, as appropriate. Homeowners should be advised of the rules and regulations governing, and the limitations of onsite sewage disposal systems, and should be encouraged to undertake preventive maintenance programs, especially of those older systems not yet subject to the inspection requirements of the County ordinance. Based upon the responses offered by respondents to the questionnaire survey conducted under the auspices of this planning program, the majority of onsite sewage disposal systems in the portions of the Town riparian to Lake Wisconsin were installed since the 1980s, with inspections having been conducted on most of these systems between 2003 and 2006.

Typical costs for a basic inspection and maintenance service range from about $100 to $200 per year, although more extensive programs could be more expensive. The costs of the informational programming typically have been included within the operating budget of the County. Costs of replacement systems are estimated at about $5,000 for conventional onsite sewage disposal systems, about $12,000 for mound systems, and about $7,500 for holding tanks systems, the latter requiring more frequent pumping ranging from monthly to quarterly.

ANCILLARY PLAN RECOMMENDATIONS

Institutional Development

While lake management activities fall under the general powers of municipalities, other public and private organizational alternatives for the management of lakes in the State of Wisconsin exist. Private lake organizations have the option to be incorporated, generally as nonstock, not-for-profit corporations under Chapter 181, *Wisconsin Statutes*. Public lake organizations include special-purpose units of government that are created as public inland lake protection and rehabilitation districts under Chapter 33, *Wisconsin Statutes*, utility districts created pursuant to the municipal statutes, and town sanitary districts created under Chapter 60, *Wisconsin Statutes*. The specific type (or types) of organization created is based upon the decision of the community. In the case of Lake Wisconsin, general oversight of lake management activities within the Town of West Point currently is provided by the Town of West Point.

Private Lake Organizations

Private lake organizations are voluntary. Such organizations have the advantage that there are few restrictions imposed upon the types of activities in which they engage, subject to relevant permits and laws. Incorporated associations generally have a somewhat greater number of restrictions imposed upon them, but may be considered qualified associations for purposes of obtained State cost-share grants. Because of their voluntary nature, membership levels, and, therefore, income levels, of associations often fluctuate from year-to-year. Even so, a number of property owner associations exist around Lake Wisconsin. Membership in these organizations may be required under deed covenants as these organizations are generally associated with subdivisions. Thus, while these organizations tend to be geographically confined, many have broader mandates than solely lake issues, although these issues may be important to the association memberships.

In the Town of West Point, such an organization would be well suited to providing general informational programming to the community. Extension of membership in this organization to folk in other riparian communities would increase the scope of activities of the organization and potentially provide a sustainable base of membership and volunteers.

Public Lake Organizations

Public inland lake protection and rehabilitation districts, or lake management districts, are public governmental units formed for the specific purpose of managing and protecting lake water quality. Inclusion in the district, once the district is created, is mandatory, and registered voters and persons owning property within the district become the electors of the district for purposes of governance. Lake management districts have the capability of raising public funds subject to majority approval of the district budget at the annual meeting of the district. For this reason, lake management districts can provide a more stable financial base from which to undertake lake management activities. Often, lake associations and lake districts operate in harmony around lakes throughout Wisconsin.

Sanitary districts with a lake focus are know as lake sanitary districts and perform many or all of the same functions as a lake protection and rehabilitation or management district as well as providing solid and liquid waste management services. Should public sanitary sewerage be considered for implementation in the Town of West Point, creation of a Town Sanitary District would be recommended. Lake sanitary districts can provide informational programming as well as commission and execute water quality improvement projects within their jurisdiction.

SUMMARY

This plan, which documents the findings and recommendations of a lake management planning study requested by the Town of West Point, examines existing and anticipated land use conditions within the portion of the Town draining to Lake Wisconsin, and potential management problems in two embayments of Lake Wisconsin in the Town, and presents a recommended plan for the resolution of these concerns.

The Lake Wisconsin watershed within Town of West Point was found to be at risk from developmental pressures arising from the close proximity of the Town to the Madison metropolitan area and adjacent to a progressively urbanizing part of Dane County. Surveys

indicated that the Lake and the tributary drainage area contain significant areas of ecological value, including numerous wetlands and high-quality wildlife habitat.

The Lake Wisconsin protection and recreational use plan, summarized on Map 13 and in Table 11, recommends actions be taken to limit further human impacts on the Lake water quality and reduce human impacts on the ecologically valuable areas adjacent to the Lake and in its watershed. The plan recommends consideration of community-based onsite sewage treatment systems and/or public water-borne wastewater treatment as a consequence of the limited suitability of the soils in the Town for onsite sewage disposal.

The plan recommends maintenance of the rural ambience of the Town through protection of prime agricultural lands as commercially viable units. Land development activities are recommended to be carried out in areas contiguous to existing residential development along the western and northern portions of the Town, riparian to Lake Wisconsin, excluding the critical species habitat area adjacent to the bald eagle habitat areas in the northwestern portions of the Town. Creation of ordinances to protect these habitat areas and to implement an environmental corridor system within the Town is recommended.

The recommended plan includes continuation of an ongoing program of public information and education provided to riparian residents and lake users. For example, additional options regarding household chemical usage, lawn and garden care, shoreland protection and maintenance, and recreational usage of the Lake should be made available to riparian householders, thereby providing riparian residents with alternatives to traditional alternatives and activities.

This recommended plan seeks to balance the demand for high-quality residential and recreational opportunities at Lake Wisconsin in the Town of West Point with the requirements for environmental protection of the Lake.

APPENDIX A

PROTOCOL FOR THE CONDUCT OF A CITIZEN-BASED CREEL CENSUS OF LAKE WISCONSIN

INTRODUCTION

Creel surveys are records of the types and conditions of fishes caught in a lake, and may include records of fishes kept or released back into the lake.[1] Such records are compiled from anglers, and generally include information on the species of fishes caught, their length, weight, and condition. Location information may also be collected as part of such a census. These records provide fisheries managers with data on the abundance, angling pressures, and condition of fishes in a lake. A group of records from a waterbody comprise a census and serve a similar purpose to the federal census conducted on a decadal basis by the U.S. Census Bureau in that fisheries managers can determine the essential characteristics of a fishery and develop management plans based upon these specific characteristics. For example, using these data, fisheries managers can create and/or modify stocking and harvesting programs to best reflect prevailing conditions at a specific lake.

DATA ACQUISITION AND REPORTING

Data are typically gathered and entered onto a form by either the individual angler or a volunteer monitor who interviews individual anglers, say, at the recreational boating access site or along the lakeshore. A typical data entry form that could be used in the conduct of a creel census on Lake Wisconsin is shown in Figure A-1. The data form provides space for the monitor or angler to enter a variety of information about the Lake and its fishery. The initial data to be entered describe the type of fishing experience and weather conditions at the time of the fishing experience. The date and times of the fishing experience are entered onto the form, together with the type of fishing, boat fishing, shore fishing, open-ice fishing, ice shanty fishing, or wading fishing, and the numbers of persons in the fishing party. The time data allow calculation of the rate of catch per unit of effort, or time, devoted to the catch. If known, the air and water temperatures, and the water clarity based upon a Secchi disc measurement, are also entered on the form. These data provide insights into light conditions and other water quality conditions that may be influencing the fishery at the time of the survey.

The body of the form, shown in Figure A-1, provides space for recording data on individual fishes caught during the angling experience. The major fish species present in Lake Wisconsin are listed in

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[1] *Bradley T. Eggold and Matthew Coffaro,* A Manual for Creel Clerks and Contest Monitors*, Wisconsin Department of Natural Resources, undated.*

Figure A-1

CREEL SURVEY FORM

Lake Name: Lake Wisconsin
Date: _____
(Month/Day/Year)
Weather: _____
Air Temperature (°F): _____
Water Temperature (°F): _____
Secchi Depth (ft): _____

Person submitting report: _____
Type of Fishing: (1) Boat Fishing (2) Shore Fishing
(3) Open – ice fishing (4) Ice Shanty
(5) Fly Fishing
Number in Party: _____
Start Fish Time: _____ : _____ am/pm
End Fish Time: _____ : _____ am/pm
Total Fish Time (hour): _____ hrs. _____ min.

SPECIES	Code	% of Time Fished For	# Caught	# Kept
Channel Catfish	1			
Yellow Bullhead	2			
White Bass	3			
Yellow Bass	4			
Rock Bass	5			
Pumpkinseed Sunfish	6			
Smallmouth Bass	7			
Largemouth Bass	8			
Northern Pike	9			
Walleye	10			
Muskellenge	11			
Sturgeon	12			
Bluegill	13			
Black Crappie	14			
White Crappie	15			
Yellow Perch	16			
Sauger	17			
	18			
	19			
	20			
	21			

Species Code	Total Length (in)	Weight (lbs)

Species Code	Deformities	Eroded Fins	Lesions/Tumors	Parasistes
	Yes/No	Yes/No	Yes/No	Yes/No
	Yes/No	Yes/No	Yes/No	Yes/No
	Yes/No	Yes/No	Yes/No	Yes/No
	Yes/No	Yes/No	Yes/No	Yes/No

CREEL SURVEY FORM
Continued

Show location of area fished on map below:

Lake Wisconsin Above Dam (West)

Lake Wisconsin (Central and East)

Source: Environmental Horizons and DeLorme

Figure A-2

PICTORIAL IDENTIFICATION FOR SUNFISHES

Green Sunfish

Adult

Mouth reaches to or beyond the middle of the eye

2 dorsal fins that appear as one

Light blue to whitish streaks emanating from the head

No tooth patch on the tongue

Relatively elongated gill rakers

Adult

Breeding male

Similar Species

Bluegill
The bluegill is somewhat similar to the green sunfish. The green sunfish has a somewhat larger mouth reaching the middle of the eye), a more elongated body,a rounded pectoral fin, and an opercular tab fringed with white. The bluegill has a smaller mouth (reaching the front of the eye), a more rounded body, an elongated and pointed pectoral fin, and a solid dark blue opercular tab.

Pumpkinseed
The pumpkinseed is somewhat similar to the green sunfish. The pumpkinseed has a red dot at the back of its dorsal tab, and it has short and knobby gill rakers. The green sunfish has an opercular tan fringed with white, and its gill rakers are relatively elongated.

Orangespotted sunfish
The orangespotted sunfish is somewhat similar to the green sunfish. The orangespotted sunfish has 8 or 9 soft rays in its anal fin, conspicuous orange spots, and an overall lighter body color. The green sunfish has 10-12 soft rays in its anal fin, lacks orange spots, and has an overall darker body color.

Warmouth
The warmouth is somewhat similar to the green sunfish. The warmouth has a tooth patch on its tongue; the green sunfish does not.

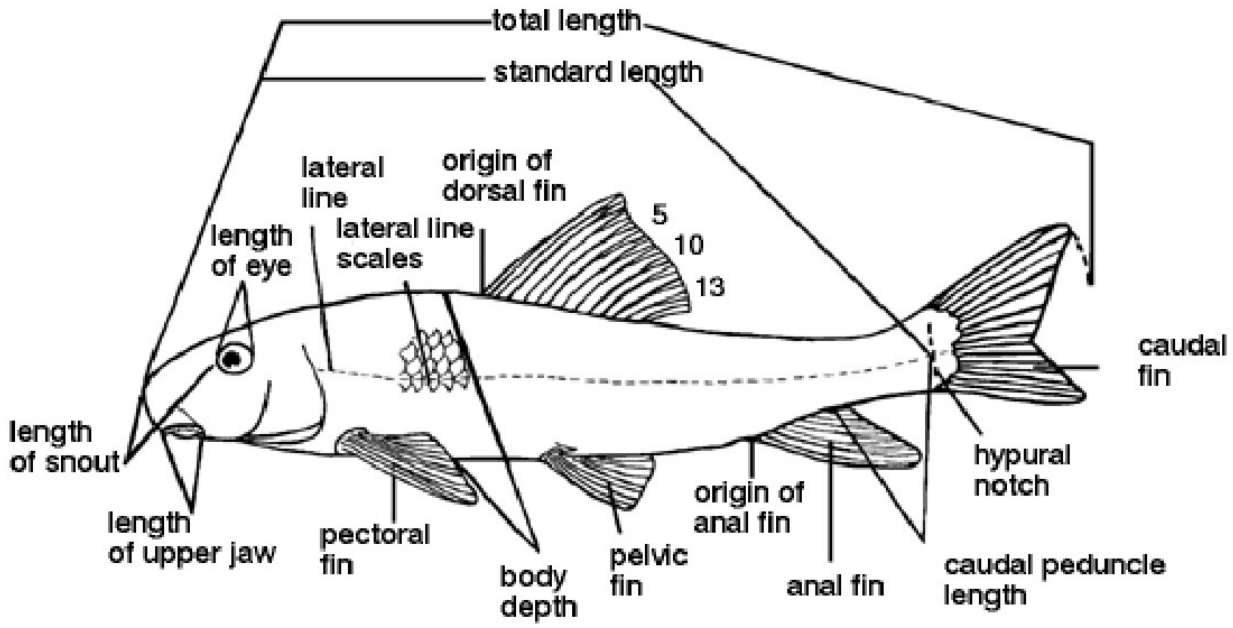
Longear sunfish
The longear sunfish is somewhat similar to the green sunfish. The longear sunfish has a reddish margin around its opercular tab (which is elongated in large specimens but not in small ones) and 34-38 lateral line scales. The green sunfish has a white to yellow margin around its opercular tab and 44-51 lateral line scales.

NOTE: The above information can be found at http://limnology.wisc.edu/research/newresearch.htm

Source: Wisconsin Department of Natural Resources, University of Wisconsin Center for Limnology and Sea Grant Institute.

Figure A-3

EXTERIOR ANATOMY FEATURES OF WHITE SUCKERS GENERALLY USED IN IDENTIFICATION OF FISHES



Source: Wisconsin Department of Natural Resources, University of Wisconsin Center for Limnology and Sea Grant Institute.

the right hand column, together with a numeric code that represents that fish species. Not all fish species reported from the Lake are listed, however. Fishes not listed can be added in the blank spaces provided. Some species, such as the bullheads, have a number of variants, e.g., yellow bullheads, brown bullheads, and black bullheads, that have been reported in the Lake as documented in Chapter II. There are specific taxonomic difficulties in distinguishing these varietals, and, from a fisheries management point of view, little difference between their habitat, feeding, and reproductory requirements. However, should the census taker have access to an appropriate taxonomic key and be able to determine these varietals, each could be listed in the spaces provided. Aides to taxonomic identification of fishes are available either on-line or in book form;[2] an example of a taxonomic key to distinguish green sunfish from bluegill, pumpkinseed, orange spotted sunfish, longear sunfish, and warmouth is shown as Figure A-2.

Against each fish species, spaces are provided for the respondent, whether the angler or census taker, to indicate the percentage of time spent fishing for a specific species of fish, the numbers caught, and the numbers kept. These latter numbers could reflect strikes by fishes that may be smaller than the regulatory limit, or fishes captured during a “catch-and-release” fishing experience. As noted above, the total time spent fishing is recorded in the header of the survey form, and the percentage of time spent angling for the various target species is reflected in the right hand column.

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[2]*George C. Becker,* Fishes of Wisconsin*, The University of Wisconsin Press, 1983; see also http:// limnology.wisc.edu/, then select Great Lakes, On-line System for Identifying Wisconsin Fishes, for an electronic version of this taxonomic key.*

The left hand column provides additional spaces for recording specific details about individual fishes captured. Using the code number provided in the right hand column for the specific type of fish, the angler or census taker should enter the appropriate information on each fish captured in the spaces provided. Total length is measured as the distance, in inches, between the tip of the snout to the tip of the tail. For those species having flexible tail fins, the recommended method of estimating total length is to group or bunch the tail fin and record the overall length. This dimension is shown in Figure A-3. Length is commonly reported in inches and tenths of inches.

In addition, the left hand column provides space to enter the weight of the individual fishes next to the overall length. As with length, weight is indicated in pounds and tenths of pounds using the following conversions:

1 to 2 ounces	=	0.1 pound	9 to 10 ounces	=	0.6 pound
3 ounces	=	0.2 pound	11 ounces	=	0.7 pound
4 to 5 ounces	=	0.3 pound	12 to 13 ounces	=	0.8 pound
6 to 7 ounces	=	0.4 pound	14 to 15 ounces	=	0.9 pound
8 ounces	=	0.5 pound	16 ounces	=	1.0 pound.

By examining length and weight data, the fisheries manager can make an estimate of the condition factor of the fishes.

The lower left hand portion of the form provides additional space for the angler or census taker to note any abnormalities observed, including deformities, damaged or eroded fins, lesions and tumors, and any visible parasites. Space is also provided for the observer to record the species of fish affected.

Finally, the lower right hand side of the form provides a bathymetric map of Lake Wisconsin that can be used by the angler or census taker to record locations of fishing efforts. Because this survey is based upon catches made by casual anglers, it is not subject to the potential bias introduced to sampling by more formalized sampling techniques. This is beneficial for assessment purposes as it results in a truly random sample of fishes and fisheries conditions within the Lake over time.

Data acquired should be reported on forms similar to that shown in Figure A-1 to the Town Clerk, Town of West Point. Data should be compiled in spreadsheets using standard statistical programs for personal computers. This will facilitate sharing the data with Wisconsin Department of Natural Resources fisheries staff or other fisheries professionals using electronic media.

DATA ANALYSIS AND INTERPRETATION

As noted above, the data gathered through the creel census process can be compiled and analyzed in a number of ways. While some of the more complex interpretations of the data should be undertaken by persons trained to conduct such an analysis, there are some basic facts that the census takers can glean from the data that will be of interest to the electors and property owners of the Town of West Point. These analyses are briefly described below.[3]

Species Caught

The most basic piece of information that can be gleaned from the census data is the numbers and types of fishes being caught from the Lake. Tabulating information on the types of fishes from year to year will provide information of how the fish communities may be changing over time. Data need not be compiled on an annual basis, but can also be assessed by comparing similar months or other periods of time, see analysis of catch per unit effort below. Simply listing the types of fishes and the numbers

[3] *See Richard C. Lathrop, Susan B. Nehls, Clifford L. Brynildson, and Karen R. Plass, Wisconsin Department of Natural Resources Technical Bulletin No. 181,* The Fishery of the Yahara Lakes*, 1992.*

caught, and calculating the percentage of the catch represented by each species, can provide useful information on the dominance of specific types of fishes. Major changes in the percentage represented by specific fishes can provide an indication of an ecosystem level change that should be investigated further. The percentage of the catch represented by a species, P, is calculated as:

P = number of species A caught / total number of fishes caught x 100 (1)

The data used to calculate these percentages can be found on the data sheet, shown as Figure A-1, using the numbers reported in the "# Caught" column in the right hand column in the body of the form (= number of species A caught), and the sum of the numbers shown in the "# Caught" column. Calculating this latter figure will require adding up the total of the numbers shown in the "# Caught" column.

Catch per Unit Effort

Catch per unit effort, or CPUE as it is often referred to, represents the dividend of the numbers of fishes of a particular species captured during a fishing excursion. This number is calculated using the data from the header box in combination with the numbers of fishes shown in the "# Caught" column. This number is calculated for individual fish species. Multiple forms can be added to provide estimates of catches of specific fishes per angler per hour (or day).

To calculate the number of hours fished, or "Total Fish Time," data shown in the header block as "Start Fish Time" and "End Fish Time" will allow determination of the numbers of hours fished:

Total Fish Time = End Fish Time – Start Fish Time (2)

Using a 24-hour clock (also known as "military time") will help in calculating the hours fished, although the hours fished can be calculated using the more traditional a.m. and p.m. time format. If more than one person is shown in the "Number in Fishing Party" block, the hours fished must be adjusted accordingly to produce a number of hours fished per angler. This statistic can be determined as:

Hours per Angler = Total Fish Time / Number in Fishing Party (3)

To calculate the catch per unit effort for a particular species, the numbers of fishes caught is divided by the time spent fishing:

CPUE = # Caught of species A / Hours per Angler (4)

The catch per unit effort is most often expressed in terms of the number of fishes of a particular species per angler-hour.

Average Total Length and Average Weight

Another statistic that is easily calculated, and which has value in determining the age and quality of the fishery, is the average total length and average weight for each species of fish. Using the data presented in the left hand column of the creel survey form shown in Figure A-1, data for each species can be totaled and averaged to generate these average values:

Average Total Length = Σ (Total Length for species A) / total number of fishes of species A caught (5)

Average Weight = Σ (Weight for species A) / total number of fishes of species A caught (6)

In a lake where conditions are not changing dramatically, these average total length and average weight values would be likely to remain somewhat similar over time. This similarity is due to the fact

that anglers are as likely to catch young fishes as well as older fishes in a random manner. Provided all of these data are recorded, the numbers of younger and older fish would tend to remain somewhat constant over time. Dramatic changes in these numbers would suggest that a summer kill or winter kill may have occurred, or that a particular species of fish had had a poor breeding season where few young survived. Dramatic changes could also indicate a change in angling pressure, such as would be expected in the case where anglers capture larger (or smaller) numbers of fishes in a given year, altering the make up of the fish community. These latter changes can be evaluated using total length and weight data "classes," since the length and weight of fishes is proportionate to their age. By plotting the data in the form of bar graphs or histograms, missing or abnormal age classes (see below) can be identified. Such instances should be reported to the Wisconsin Department of Natural Resources fisheries managers or other trained individuals for further investigation.

Age Classes

This statistic is analogous to the average growth curves many parents are familiar with through visits to their child's pediatrician. Statistically, over a large enough population, average body sizes can be determined and used to assess the progress of children as they mature. These same statistics can be employed in fisheries management to determine if recruitment, or the addition of new fishes to a population, is occurring, and the degree of breeding success. Successive years generally result in large numbers of young fish, distinguished by greater number of shorter, lighter fishes, that mature into fewer numbers of older fish, distinguished by longer, heavier fishes. The numbers of fishes decline due to natural mortality, angling pressures, and predation by piscivorous fishes and birds. These losses are normal and natural, and result in a relatively smooth transition from large numbers of young fishes to fewer numbers of older fishes over time. Gaps or major changes in this transition would indicate some traumatic occurrence, such as a year in which there was poor breeding success or a loss of the necessary habitat that would promote successful breeding, among other impacts. In Crystal Lake[4], preliminary age-growth data were compiled from the fish survey completed during this planning project for three fish species:

Bluegill	3.9 inches	Two-year old fishes
	5.9 inches	Three-year old fishes
	7.6 inches	Four-year old fishes
	8.2 inches	Five-year old fishes
	8.9 inches	Six-year old fishes
Pumpkinseed	4.3 inches	Two-year old fishes
	5.9 inches	Three-year old fishes
	7.4 inches	Four-year old fishes
	8.3 inches	Five-year old fishes
	9.3 inches	Six-year old fishes
Largemouth Bass	7.2 inches	Two-year old fishes
	10.0 inches	Three-year old fishes
	12.9 inches	Four-year old fishes
	14.5 inches	Five-year old fishes
	15.7 inches	Six-year old fishes
Black Crappie	6.1 inches	Two-year old fishes
	8.8 inches	Three-year old fishes
	10.1 inches	Four-year old fishes

[4] *Wisconsin Department of Natural Resources,* Crystal Lake Fishery Survey, *1999, MWBC 978900*

Black Crappie	11.1 inches	Five-year old fishes
	11.5 inches	Six-year old fishes
Yellow Perch	5.8 inches	Two-year old fishes
	8.0 inches	Three-year old fishes
	9.9 inches	Four-year old fishes
	11.4 inches	Five-year old fishes

These data can be refined and further developed over time as additional creel census data are added to the data set, and the District citizen monitors should seek the assistance of the Wisconsin Department of Natural Resources fisheries managers or other trained individuals in the determination and interpretation of the age classes and age class data.

Condition Factor

The information compiled from the creel survey form shown in Figure A-1 can also be used to estimate the condition factor of the fish species in the Lake. In like manner to the age classes based upon length or size of fishes, information on both the length and weight can be used to estimate the "condition" of the fishes captured. These data are also analogous to those compiled by physicians who record a patient's height and weight. Condition factor, CF, is determined as:

CF = Total Length / Weight (7)

The ratio between length and weight would be expected to remain relatively constant in a healthy population, length increasing in proportion to the increased weight attained with age. Graphing this relationship would result in a straight-line graph, beginning at zero and increasing steadily over time. Changes in this ratio, or deviations from the straight line graph, would provide warning of a change in the fishery, such as stunting of the population, that should be evaluated further by Wisconsin Department of Natural Resources fisheries managers or other trained individuals.

Miscellaneous Information

The creel survey form shown in Figure A-1 also includes a block for the census taker or angler to record any abnormalities observed in the fishes captured. Consistent notations of deformities, eroded fins, lesions and tumors, and parasites should be reported to the Wisconsin Department of Natural Resources fisheries managers or other trained individuals for further investigations.

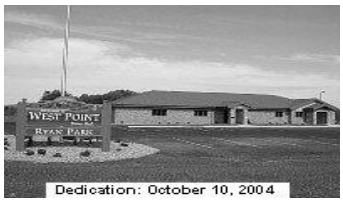
PUBLIC INFORMATIONAL PROGRAMMING

The data gathered, compiled, and analyzed through the conduct of the foregoing citizen-based volunteer fisheries survey could be presented annually at a meeting of the Lake Wisconsin Sanitary District Board of Commissioners in like manner to the Wisconsin Department of Natural Resources Self-Help volunteer monitoring program data. Information on the fishery combined with water quality information gathered through the volunteer water quality monitoring program can provide an early warning to the District and Lake Wisconsin community of changes in the lake ecosystem. These changes should ultimately encourage the District to initiate further investigations into the causes and nature of the changes underlying the observed conditions and can help to correct undesirable conditions before they become critical. In this way, programs such as the volunteer monitoring programs can help to protect and maintain the water quality and appeal of Lake Wisconsin.

APPENDIX B

QUESTIONNAIRE SURVEY INSTRUMENT

TOWN OF WEST POINT



608-592-7059 **N2114 Rausch Road**
www.townofwestpoint.us **email: townofwestpoint@verizon.net** **Lodi, WI 53555-9364**

February 20, 2006

TOWN OF WEST POINT
LAKE WISCONSIN
LAKE AND LAND USE SURVEY

Dear Friends and Neighbors,

This past summer, the Town of West Point embarked on a land use and lake protection planning program that would not only help the Town to protect the water resources within and adjacent to its boundaries, but also determine the manner in which West Point would evolve as a community. We now stand at a threshold. Decisions that we make as a community in the coming months will have a lasting impact on our community in the coming decades. Consequently, West Point is seeking your thoughts and ideas for managing its land use and neighboring waters of Lake Wisconsin.

West Point is working in cooperation with the consulting firm of Environmental Horizons, Incorporated, in the conduct of this questionnaire survey. We are conducting this survey as part of our Lake Planning Grant project, and if you have any questions about the survey or project overall please contact Sheila Landsverk, the Chair of the West Point Lake Planning Grant committee at 592-7445. We hope this input received from Lake Wisconsin area home and property owners will be of benefit not only to those of us in West Point, but to the entire Lake Wisconsin community as a whole.

We thank you in advance for the time you are taking in completing this survey and providing us with your opinions and responses. Please return the survey to Environmental Horizons staff by refolding this pre-paid mailer so that the Environmental Horizons address is on the outside, and seal with tape rather than stapler [the US Postal Service prefers tape]. Your responses are completely confidential. The results will help us to continue to develop an appropriate strategy for protecting our shared land and water resources. Thanks for your participation.

Your reply by March 15, 2006, would be appreciated.

Sincerely,

Dean Schwarz, Chair
Town of West Point

I. About your Home/Property in the West Point Lake Wisconsin area:

1. How did you acquire your property?
   ____ purchased from non-family party
   ____ purchased from family member [how long has this property been in the family? ___ Years]
   ____ inherited [how long has this property been in the family? ____ Years]

2. How long has the title for this property been in your name? ____ Years.

3. Does this property have a permanent living structure on it? ____ yes ____ no

4. If yes, what is the approximate square footage of this home?

____ under 1,500 sq ft ____ 2,501 to 3,000 sq ft
____ 1,501 to 2,000 sq ft ____3,001 to 3,500 sq ft
____ 2,001 to 2,500 sq ft ____over 3,500 sq ft

5. How would you characterize this property when you first purchased it?
____ three season home ____ four season home _____ mobile home/trailer ___ no structure present

6. How would you characterize this property now?
____ three season home ____ four season home _____ mobile home/trailer ___ no structure present

7. Approximately how much lake frontage do you currently own?
_____ Feet _____ don't own lake frontage, nor access _____ don't own lake frontage, have deeded access

8. How do you use this property?
_____ Year-round resident _____ seasonal or weekend resident _____investment/undeveloped property/farm

If you are a permanent, year-round resident at this location, answer the questions in **Section II. If you are a seasonal or recreational owner of the property, answer **section III**. If the property does not have a home at present, or is investment or farm property, answer the questions in **section IV**. EVERYONE SHOULD ANSWER ALL QUESTIONS BEGINNING WITH **SECTION V.**

II. Questions for year –round permanent residents only :

9. How many people are in your household?
   _____ adults [aged 18 and older]

   _____Children – list ages:
_____

10. Of the adults whom are not full time students, how many work full-time? _____ Part-time?_____
11. Are any members of the adult household retired? ____ no ____ yes – if yes, how many?_____
12. List the occupation of each adult in the household that is working at least part time:
    Adult 1: _____
    Adult 2 _____
    Adult 3:_____

13. Please place an 'X' where those who are working at least part time commute to work:

	Sauk Prairie area	Lodi area	Madison /Middleton area	Portage area	Work in West Point	Work out of home in West Point	Other – please list
Adult 1							
Adult 2							
Adult 3							

14. How long have you – or the longest resident adult in your household, lived in West Point?
____ entire life _____ under 5 years ____ 5-10 years ____ 11-15 years ____16-20 years ____ over 21 yrs_____ off and on entire life

III. Questions for seasonal and recreational homeowners only:

15. If you are a seasonal resident, do you see yourself living here permanently some time in the future?
____ yes _____ no _____ not sure

16. If you answered yes above, in how many years do you think you would move here permanently?
___ Within 2 years ____ within 5 years ___ within 10 years ___ more than 10 years ___ never/not applicable

IV. Questions for owners of undeveloped land without a home – farmland or investment property only:

17. Is your undeveloped land more than one acre? ____ yes _____ no
18. If yes, how many acres do you have total undeveloped in this area? _____
19. Is the undeveloped land currently being farmed? ____ yes ____ no
20. Is any of the undeveloped land wooded? ____ yes ____ no
21. Does your property participate in any of the following programs [check all applicable]
_____ Managed Forest _____ Conservation Reserve Program ____ other –List: _____
22. Does your undeveloped land include lakefront property? ____ yes _____ no
23. Does your undeveloped land include steep slope areas? _____ yes ____no

V. Your attitudes about Land Use and Zoning Issues:

24. Land use planning implemented at the local level increases local control of local development issues.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

25. There needs to be land-use planning in the town of West Point.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

26. There needs to be more cooperation among communities in planning for growth.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

27. Use of private land should be based on what the owner wants rather than being restricted by zoning.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

28. We do not have adequate public access to Lake Wisconsin at present.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

29. Zoning restrictions hurt more than they help an area.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

30. Development in West Point should be held in check to protect the unique rural character and environmental quality.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

31. We should do all we can to ensure farming and agriculture remain viable in West Point.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

32. West Point should work with willing landowners to conserve some of the natural areas remaining in the town, particularly along the lakeshore.
Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

33. I support having a park with a picnic area on the lake in our town, besides at the ferry.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

VI. How do you use Lake Wisconsin?

34. How do you access the lake?
____ live directly on the lake ____ have deeded access ____ friend _____ public boat landing
___ don't use the lake [skip to question 51]

Fishing [If you do not fish, skip this group of questions.]
35. I fish on Lake Wisconsin _____yes _____no
36. I fish from [check all that apply] ____ a boat _____ a pier _____ weekdays _____weeknights _____ weekends _____ice fishing
37. Approximate Number of Days fished last year _____

38. Which species of fish did you catch last year [circle all that apply]
a. northern pike b. panfish
c. walleyed pike d. muskellunge
e. largemouth bass f. smallmouth bass
g. other: _____

39. Which of the following fish did you think increased in Number of fish caught [write I] decreased in NUMBER of fish caught, [write D] or remained the same [write S] in the last ten years? If you don't know, write DK.
____a. northern pike ____b. panfish
____c. walleyed pike ____d. muskellunge
____e. largemouth bass ____ f. smallmouth bass
____g. other: _____

40. How do you rate the fishing quality?

Excellent Good Fair Poor

|----------|----------|----------|----------|----------|----------|

User Conflicts

41. How would you rate your general level of satisfaction with speed limits/no wake zone enforcements on the lake?

Well satisfied Satisfied Neutral Not Satisfied Very Dissatisfied

|----------|----------|----------|----------|----------|----------|

42. How would you rate your general level of satisfaction with jet skis on the lake?

Well satisfied Satisfied Neutral Not Satisfied Very Dissatisfied

|----------|----------|----------|----------|----------|----------|

43. How would you rate your general level of satisfaction with noise levels on the lake?

Well satisfied Satisfied Neutral Not Satisfied Very Dissatisfied

|----------|----------|----------|----------|----------|----------|

44. How would you rate your general level of satisfaction with fireworks on the lake?

Well satisfied Satisfied Neutral Not Satisfied Very Dissatisfied

|----------|----------|----------|----------|----------|----------|

45. How would you rate your general level of satisfaction with snowmobiles on the lake?

Well satisfied Satisfied Neutral Not Satisfied Very Dissatisfied

|----------|----------|----------|----------|----------|----------|

46. How would you rate your general level of satisfaction with law enforcement on Lake Wisconsin [eg., boating, fish and game regulations?

Well satisfied Satisfied Neutral Not Satisfied Very Dissatisfied

|----------|----------|----------|----------|----------|----------|

47. Recreation

Relative Importance to you [1-5] 1= least impt; 5 = most impt	Activity	Your Participation – check the column that applies to how often you participate in this activity on or near Lake Wisconsin.			
		Often	Sometimes	Seldom	Never
	Power Boating				
	Jet Skiing				
	Sailing/boardsailing				
	Canoeing/Kayaking				
	Waterskiing/Tubing				
	Swimming				
	Snowmobiling				
	Snowshoeing				
	Bird watching				
	Picnicking/BBQ				
	Hiking/Jogging				
	Hunting/Birding				

48. Boating – complete for boats you own

Type of Boat you own	Ski /tubing boat	Pontoon boat	Fishing boat or other motor boat	Personal watercraft[jetski]	Non-motor – canoe/kayak/sail
horsepower					NA
2 cyc or 4 cycle					NA
# owned					

49. On WEEKDAYS do you consider Lake Wisconsin to be:
____a. lightly used _____b. moderately used _____ c. heavily used ____d. over used
50. On WEEKENDS do you consider Lake Wisconsin to be:
____a. lightly used _____b. moderately used _____ c. heavily used ____d. over used

VII. Water Quality

51. I am satisfied with the sanitation regulations [waste disposal, sewerage] in the areas that drain to the lake.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

52. I believe most of the private sewerage systems in the lake watershed are working properly.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

53. I am satisfied with the West Point stormwater management and erosion control ordinance.

Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

54. I think the bays are filling in more with sediment in recent years.
Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

55. I think water clarity is an issue on Lake Wisconsin.
Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

56. I am worried about algae growth on Lake Wisconsin.
Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

57. I am worried about invasive species on Lake Wisconsin.
Strongly agree agree disagree strongly disagree
|----------|----------|----------|----------|----------|----------|

58. What type of onsite sewerage system is on your property?
____Private septic tank and field ____Community septic tank and field
____Private holding tank ____Mound system
____None ____Don't know

59. Do you know in what year the system was installed? _____[list approximate year]
60. Do you know in what year the system was last inspected? _____ [list approximate year]

61. Are there any services or facilities that you feel would benefit the town of West Point?
____ Yes – Specify: _____
____ No

VIII. Top Five Issues

62. What are your top FIVE concerns for the Lake Wisconsin area in West Point – place a number 1 next to the issue most important to you, and a 2 next to the second most important, and so on up to 5.

____ General water quality	____ unpleasant odors
____ number of boats	____ farm run off
____ speed of boats	____ stormwater runoff
____ size of boats	____ development around the lake
____ number of water skiers/tubing	____ shoreline erosion
____ number of jet skiers	____ sedimentation/shallow bays
____ decline in fishery resources	____ use of lake and access sites by non residents
____parking for non residents	____ boat and trailer parking
____ excessive noise	____ intoxicated individuals
____ snowmobiles	____ other:_____

63. Please use this space to list any other issue you would like to mention:

Thank you!

Appendix C

NONPOINT SOURCE POLLUTION CONTROL MEASURES

Nonpoint, or diffuse, sources of water pollution include urban sources such as runoff from residential, commercial, industrial, transportation, and recreational land uses; construction activities; and onsite sewage disposal systems and rural sources such as runoff from cropland, pasture, and woodland, atmospheric contributions, and livestock wastes. These sources of pollutants discharge to surface waters by direct overland drainage, by drainage through natural channels, by drainage through engineered stormwater drainage systems, and by deep percolation into the ground and subsequent return flow to the surface waters.

A summary of the methods and estimated effectiveness of nonpoint source water pollution control measures is set forth in Table C-1. These measures have been grouped for planning purposes into two categories: basic practices and additional. Application of the basic practices will have a variable effectiveness in terms of control level of pollution control depending upon the subwatershed area characteristics and the pollutant considered. The additional category of nonpoint source control measures has been subdivided into four subcategories based upon the relative effectiveness and costs of the measures. The first subcategory of practices can be expected to generally result in about a 25 percent reduction in pollutant runoff. The second and third subcategory of practices, when applied in combination with the minimum and additional practices, can be expected to generally result in up to a 75 percent reduction in pollutant runoff, respectively. The fourth subcategory would consist of all of the preceding practices, plus those additional practices that would be required to achieve a reduction in ultimate runoff of more than 75 percent.

Table C-1 sets forth the diffuse source control measures applicable to general land uses and diffuse source activities, along with the estimated maximum level of pollution reduction which may be expected upon implementation of the applicable measures. The table also includes information pertaining to the

costs of developing the alternatives set forth in this chapter.[1] These various individual nonpoint source control practices are summarized by group in Table C-2.

Of the sets of practices recommended for various levels of diffuse source pollution control presented in Table C-2, not all practices are needed, applicable, or cost-effective for all watersheds, due to variations in pollutant loadings and land use and natural conditions among the watersheds. Therefore, it is recommended that the practices indicated as needed for nonpoint source pollutant control be refined by local level nonpoint source control practices planning, which would be analogous to sewerage facilities planning for point source pollution abatement. A locally prepared plan for nonpoint abatement measures should be better able to blend knowledge of current problems and practices with a quickly evolving technology to achieve a suitable, site-specific approach to pollution abatement.

[1]*Costs are presented in more detail in the following SEWRPC Technical Reports: No. 18,* State of the Art of Water Pollution Control in Southeastern Wisconsin*, Volume Three,* Urban Storm Water Runoff*, July 1977, and Volume Four,* Rural Storm Water Runoff*, December 1976; and No. 31,* Costs of Urban Nonpoint Source Water Pollution Control Measures*, June 1991.*

Table C-1

GENERALIZED SUMMARY OF METHODS AND EFFECTIVENESS OF NONPOINT SOURCE WATER POLLUTION ABATEMENT

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Urban	Litter and pet waste control ordinance	Prevent the accumulation of litter and pet wastes on streets and residential, commercial, industrial, and recreational areas	2 to 5	Ordinance administration and enforcement costs are expected to be funded by violation penalties and related revenues
	Improved timing and efficiency of street sweeping, leaf collection and disposal, and catch basin cleaning	Improve the scheduling of these public works activities, modify work habits of personnel, and select equipment to maximize the effectiveness of these existing pollution control measures	2 to 5	No significant increase in current expenditures is expected
	Management of onsite sewage treatment systems	Regulate septic system installation, monitoring, location, and performance; replace failing systems with new septic systems or alternative treatment facilities; develop alternatives to septic systems; eliminate direct connections to drain tiles or ditches; dispose of septage at sewage treatment facility	10 to 30	Replace one-half of estimated existing failing septic systems with properly located and installed systems and replace one-half with alternative systems, such as mound systems or holding tanks; all existing and proposed onsite sewage treatment systems are assumed to be properly maintained; assume system life of 25 years. The estimated cost of a septic tank system is $5,000 to $6,000 and the cost of an alternative system is $10,000. The annual maintenance cost of a disposal system is $250. An in-ground pressure system is estimated to cost $6,000 to $10,000 with an annual operation and maintenance cost of $250. A holding tank would cost $5,500 to $6,500, with an annual operation and maintenance cost of $1,800
	Increased street sweeping	On the average, sweep all streets in urban areas an equivalent of once or twice a week with vacuum street sweepers; require parking restrictions to permit access to curb areas; sweep all streets at least eight months per year; sweep commercial and industrial areas with greater frequency than residential areas	30 to 50	Estimate curb-miles based on land use, estimated street acreage, and Commission transportation planning standards; assume one street sweeper can sweep 2,000 curb-miles per year; assume sweeper life of 10 years; assume residential areas swept once weekly, commercial and industrial areas swept twice weekly. The cost of a vacuum street sweeper is approximately $120,000. The cost of the operation and maintenance of a sweeper is about $25 per curb-mile swept
	Increased leaf and clippings collection and disposal	Increase the frequency and efficiency of leaf collection procedures in fall; use vacuum cleaners to collect leaves; implement ordinances for leaves, clippings. and other organic debris to be mulched, composted, or bagged for pickup	2 to 5	Assume one equivalent mature tree per residence, plus five trees per acre in recreational areas; 75 pounds of leaves per tree; 20 percent of leaves in urban areas not currently disposed of properly. The cost of the collection of leaves in a vacuum sweeper and disposal is estimated at $180 to $200 per ton of leaves
	Increased catch basin cleaning	Increase frequency and efficiency of catch basin cleaning; clean at least twice per year using vacuum cleaners; catch basin installation in new urban development not recommended as a cost-effective practice for water quality improvement	2 to 5	Determine curb-miles for street sweeping; vary percent of urban areas served by catch basins by watershed from Commission inventory data; assume density of 10 catch basins per curb-mile; clean each basin twice annually by vacuum cleaner. The cost of cleaning a catch basin is approximately $10
	Reduced use of deicing salt	Reduce use of deicing salt on streets; salt only intersections and problem areas; prevent excessive use of sand and other abrasives	Negligible for pollutants addressed in this plan, but helpful for reducing chlorides and associated damage to vegetation	Increased costs, such as for slower transportation movement, are expected to be offset by benefits, such as reduced automobile corrosion and damage to vegetation

Table C-1 (continued)

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Urban (continued)	Improved street maintenance and refuse collection and disposal	Increase street maintenance and repairs; increase provision of trash receptacles in public areas; improve trash collection schedules; increase cleanup of parks and commercial centers	2 to 5	Increase current expenditures by approximately 15 percent
	Parking lot stormwater temporary storage and treatment measures	Construct gravel-filled trenches, sediment basins, or similar measures to store temporarily the runoff from parking lots, rooftops, and other large impervious areas; if treatment is necessary, use a physical-chemical treatment measure, such as screens, dissolved air flotation, or a swirl concentrator	5 to 10	Design gravel-filled trenches for 24-hour, five-year recurrence interval storm; apply to off-street parking acreages. For treatment, assume four-hour detention time. The capital cost of stormwater detention and treatment facilities is estimated at $40,000 to $80,000 per acre of parking lot area, with an annual operation and maintenance cost of about $200 per acre
	Onsite storage—residential	Remove connections to sewer systems; construct onsite stormwater storage measures for subdivisions	5 to 10	Remove roof drains and other connections from sewer system wherever needed; use lawn aeration, if applicable; apply dutch drain storage facilities to 15 percent of residences. The capital cost would approximate $500 per house, with an annual operation and maintenance cost of about $25
	Stormwater Infiltration—urban	Construct gravel-filled trenches for areas of less than 10 acres or basins to collect and store temporarily stormwater runoff to reduce volume, provide groundwater recharge and augment low stream flows	45 to 90	Design gravel-filled trenches or basins to store the first 0.5 inch of runoff; provide at least a 25-foot grass buffer strip to reduce sediment loadings. The capital cost of stormwater infiltration is estimated at $12,000 for a six-foot-deep, 10-foot-wide trench, and at $70,000 for a one-acre basin, with an annual maintenance cost of about $10 to $350 for the trench and about $2,500 for the basin
	Stormwater storage—urban	Store stormwater runoff from urban land in surface storage basins or, where necessary, subsurface storage basins	10 to 35	Design all storage facilities for a 1.5-inch runoff event, which corresponds approximately to a five-year recurrence interval event, with a storm event being defined as a period of precipitation with a minimum antecedent and subsequent dry period of from 12 to 24 hours; apply subsurface storage tanks to intensively developed existing urban areas where suitable open land for surface storage is unavailable; design surface storage basins for proposed new urban land, existing urban land not storm sewered, and existing urban land where adequate open space is available at the storm sewer discharge site. The capital cost for stormwater storage would range from $35,000 to $110,000 per acre of basin, with an annual operation and maintenance cost of about $40 to $60 per acre
	Stormwater treatment	Provide physical-chemical treatment which includes screens, microstrainers, dissolved air flotation, swirl concentrator, or high-rate filtration, and/or disinfection, which may include chlorination, high-rate disinfection, or ozonation to stormwater following storage	10 to 50	To be applied only in combination with stormwater storage facilities above; general cost estimates for microstrainer treatment and ozonation were used; some costs were applied to existing urban land and proposed new urban development. Stormwater treatment has an estimated capital cost of from $900 to $7,000 per acre of tributary drainage area, with an average annual operation and maintenance cost of about $35 to $100 per acre

Table C-1 (continued)

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Rural	Conservation practices	Includes such practices as strip cropping, contour plowing, crop rotation, pasture management, critical area protection, grading and terracing, grassed waterways, diversions, woodlot management, fertilization and pesticide management, and chisel tillage	Up to 50	Cost for Natural Resources Conservation Service (NRCS) recommended practices are applied to agricultural and related rural land; the distribution and extent of the various practices were determined from an examination of 56 existing farm plan designs within the Region. The capital cost of conservation practices ranges from $3,000 to $5,000 per acre of rural land, with an average annual operation and maintenance cost of from $5.00 to $10 per rural acre
	Animal waste control system	Construct streambank fencing and crossovers to prevent access of all livestock to waterways; construct a runoff control system or a manure storage facility, as needed, for major livestock operations; prevent improper applications of manure on frozen ground, near surface drainageways, and on steep slopes; incorporate manure into soil	50 to 75	Cost estimated per animal unit; animal waste storage (liquid and slurry tank for costing purposes) facilities are recommended for all major animal operations within 500 feet of surface water and located in areas identified as having relatively high potential for severe pollution problems. Runoff control systems recommended for all other major animal operations. It is recognized that dry manure stacking facilities are significantly less expensive than liquid and slurry storage tanks and may be adequate waste storage systems in many instances. The estimated capital cost and average operation and maintenance cost of a runoff control system is $100 per animal unit and $25 per animal unit, respectively. The capital cost of a liquid and slurry storage facility is about $1,000 per animal unit, with an annual operation and maintenance cost of about $75 per unit. An animal unit is the weight equivalent of a 1,000-pound cow
	Base-of-slope detention storage	Store runoff from agricultural land to allow solids to settle out and reduce peak runoff rates. Berms could be constructed parallel to streams	50 to 75	Construct a low earthen berm at the base of agricultural fields, along the edge of a floodplain, wetland, or other sensitive area, design for 24-hour, 10-year recurrence interval storm; berm height about four feet. Apply where needed in addition to basic conservation practices; repair berm every 10 years and remove sediment and spread on land. The estimated capital cost of base-of-slope detention storage would be $500 per tributary acre, with an annual operation and maintenance cost of $25 per acre
	Bench terraces	Construct bench terraces, thereby reducing the need for many other conservation practices on sloping agricultural land	75 to 90	Apply to all appropriate agricultural lands for a maximum level of pollution control. Utilization of this practice would exclude installation of many basic conservation practices and base-of-slope detention storage. The capital cost of bench terraces is estimated at $1,500 per acre, with an annual operation and maintenance cost of $100 per acre
Urban and Rural	Public education programs	Conduct regional and county-level public education programs to inform the public and provide technical information on the need for proper land management practices on private land, the recommendations for management programs, and the effects of implemented measures; develop local awareness programs for citizens and public works officials; develop local contract and education efforts	Indeterminate	For first 10 years, includes cost of one person, materials, and support for each 25,000 population. Thereafter, the same cost can be applied for every 50,000 population. The cost of one person, materials, and support is estimated at $55,000 per year

Table C-1 (continued)

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Urban and Rural (continued)	Construction erosion control practices	Construct temporary sediment basins; install straw bale dikes; use fiber mats, mulching, and seeding; install slope drains to stabilize steep slopes; construct temporary diversion swales or berms upslope from the project	20 to 40	Assume acreage under construction is the average annual incremental increase in urban acreage; apply costs for a typical erosion control program for a construction site. The estimated capital cost and operation and maintenance cost for construction erosion control is $250 to $5,500 and $250 to $1,500 per acre under construction, respectively
	Materials storage and runoff control facilities	Enclose industrial storage sites with diversion; divert runoff to acceptable outlet or storage facility; enclose salt piles and other large storage sites in crib and dome structures	5 to 10	Assume 40 percent of industrial areas are used for storage and to be enclosed by diversions; assume existing salt storage piles enclosed by cribs and dome structures. The estimated capital cost of industrial runoff control is $2,500 per acre of industrial land. Material storage control costs are estimated at $75 per ton of material
	Stream protection measures	Provide vegetative buffer zones along streams to filter direct pollutant runoff to the stream; construct streambank protection measures, such as rock riprap, brush mats, tree revetment, jacks, and jetted willow poles, where needed	5 to 10	Apply a 50-foot-wide vegetative buffer zone on each side of 15 percent of the stream length; apply streambank protection measures to 5 percent of the stream length. Vegetative buffer zones are estimated to cost $21,200 per mile of stream and streambank protection measures cost about $37,000 per stream mile
	Pesticide and fertilizer application restrictions	Match application rate to need; eliminate excessive applications and applications near or into surface water drainageways	0 to 3	Cost included in public education program
	Critical area protection	Emphasize control of areas bordering lakes and streams; correct obvious erosion and other pollution source problems	Indeterminate	Indeterminate

[a] *Not all control measures are required for each subwatershed. The characteristics of the watershed, the estimated required level of pollution reduction needed to meet the applicable water quality standards, and other factors will influence the selection and estimation of costs of specific practices for any one subwatershed. Although the control measures costed represent the recommended practices developed at the regional level on the basis of the best available information, the local implementation process should provide more detailed data and identify more efficient and effective sets of practices to apply to local conditions.*

[b] *The approximate effectiveness refers to the estimated amount of pollution produced by the contributing category (urban or rural) that could be expected to be reduced by the implementation of the practice. The effectiveness rates would vary greatly depending on the characteristics of the watershed and individual diffuse sources. It should be further noted that practices can have only a "sequential" effect, since the percent pollution reduction of a second practice can only be applied against the residual pollutant load which is not controlled by the first practice. For example. two practices of 50 percent effectiveness in series would achieve a theoretical total effectiveness of only 75 percent control of the initial load. Further, the general levels of effectiveness reported in the table are not necessarily the same for all pollutants associated with each source. Some pollutants are transported by dissolving in water and others by attaching to solids in the water; the methods summarized here reflect typical pollutant removal levels.*

[c] *For highly urbanized areas which require retrofitting of facilities into developed areas, the costs can range from $400,000 to $1,000,000 per acre of storage.*

Source: SEWRPC.

Table C-2

ALTERNATIVE GROUPS OF DIFFUSE SOURCE WATER POLLUTION CONTROL MEASURES PROPOSED FOR STREAMS AND LAKE WATER QUALITY MANAGEMENT

Pollution Control Category	Level of Pollution[a] Control	Practices to Control Diffuse Source Pollution from Urban Areas[b]	Practices to Control Diffuse Source Pollution from Rural Areas[a]
Basic Practices	Variable	Construction erosion control; onsite sewage disposal system management; streambank erosion control	Streambank erosion control
	25 percent	Public education programs; litter and pet waste control; restricted use of fertilizers and pesticides; construction erosion control; critical areas protection; improved timing and efficiency of street sweeping, leaf collection, and catch basin cleaning; material storage facilities and runoff control	Public education programs; fertilizer and pesticide management; critical area protection; crop residue management; chisel tillage; pasture management; contour plowing; livestock waste control
Additional Diffuse Source Control Practices[c]	50 percent	Above, plus: Increased street sweeping; improved street maintenance and refuse collection and disposal; increased catch basin cleaning; stream protection; increased leaf and vegetation debris collection and disposal; stormwater storage; stormwater infiltration	Above, plus: crop rotation; contour strip-cropping; grass waterways; diversions; wind erosion controls; terraces; stream protection
	75 percent	Above, plus: An additional increase in street sweeping, stormwater storage and infiltration; additional parking lot stormwater runoff storage and treatment	Above, plus: Base-of-slope detention storage
	More than 75 percent	Above, plus: Urban stormwater treatment with physical-chemical and/or disinfection treatment measures	Bench terraces[b]

[a]*Groups of practices are presented here for general analysis purposes only. Not all practices are applicable to, or recommended for, all lake and stream tributary watersheds. For costing purposes, construction erosion control practices, public education programs, and material storage facilities and runoff controls are considered urban control measures and stream protection is considered a rural control measure.*

[b]*The provision of bench terraces would exclude most basic conversation practices and base-of-slope detention storage facilities.*

[c]*In addition to diffuse source control measures, lake rehabilitation techniques may be required to satisfy lake water quality standards.*

Source: SEWRPC.