



# City of McHenry Comprehensive Plan and Ordinance Assessment

An Implementation Step of the Silver Creek and  
Sleepy Hollow Creek Watershed Action Plan

November 2013

# Acknowledgments

As an implementation step of the Silver Creek and Sleepy Hollow Creek Watershed Action Plan, the City of McHenry Comprehensive Plan and Ordinance Assessment is the cumulative effort of many individuals to help improve the natural resources of their community. The City of McHenry and the Chicago Metropolitan Agency for Planning would like to thank all of the people who participating in this assessment.

## City of McHenry

**Geraldine Condon, *City Alderman***

**Doug Martin, *Deputy City Administrator***

**Robert Peterson, *City Alderman***

**Jon Schmitt, *Public Works Director***

**Ryan Schwalenberg,  
*Superintendent of Commercial Inspections***

**Shawn Strack, *Planning and Zoning Commission***

**Roger Thacker, *Planning and Zoning Commission***

## Environmental Defenders of Lake County

**Nancy Schietzelt, *President***

## Geosyntec Consultants

**Dennis Dreher, *Senior Consultant***

**Matt Bardol, *Senior Project Engineer***

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The Chicago Metropolitan Agency for Planning (CMAP) is the region's official comprehensive planning organization. Its GO TO 2040 planning campaign is helping the region's seven counties and 284 communities to implement strategies that address transportation, housing, economic development, open space, the environment, and other quality-of-life issues.

See [www.cmap.illinois.gov](http://www.cmap.illinois.gov) for more information.

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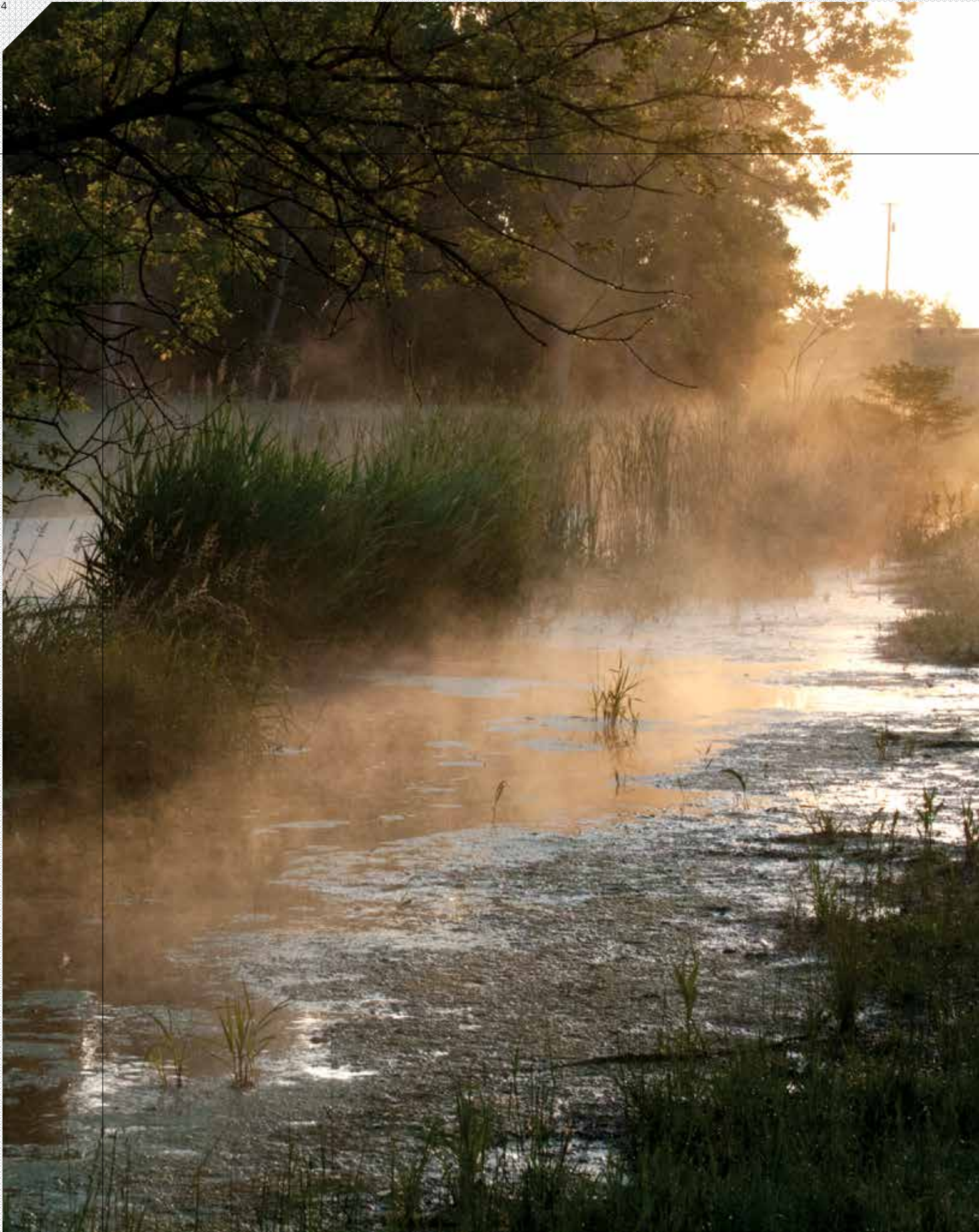


Image by Andrew Prickett.

# Introduction

Development and redevelopment can help bring in new residents, businesses, and investments, which in turn can give a community the resources to revitalize a downtown, build new schools, and undertake additional actions to improve the quality of life for its residents. However, because land development, capital improvements, and other actions directly affect watershed quality and function, the environmental impacts of development can make it difficult to achieve these goals while also protecting water quality and other natural resources. For example, when development occurs in previously undeveloped areas, the land alterations can affect how water moves into and through the landscape. This is primarily due to the creation of impervious surfaces and compacted soils that can no longer filter nor infiltrate as much water compared to the undeveloped landscape, thereby increasing surface stormwater runoff, decreasing groundwater infiltration, and increasing downstream flooding and erosion. In addition, conventional stormwater controls collect contaminated stormwater from impervious surfaces and transport the flow off site through channels and buried pipes to detention facilities or directly to receiving bodies of water. While this approach efficiently collects and transports stormwater, it can lead to the pollution of local streams and the Fox River, limiting their ability to support fishing, recreation, and water supply uses.

Development also can significantly impact the quality and quantity of natural areas and habitat. The design and layout of the lots, buildings, and streets of new development can lead to further encroachment into remnant natural areas or open spaces. Large, core open space areas, along with connecting corridors, are essential to maintaining well-functioning natural ecosystems that provide high-quality habitat for wildlife and plant communities. Within a development area, construction practices, such as clearing, grading, and tree removal, can remove valuable features of development sites that could otherwise be incorporated into the design and contribute to both the natural environment as well as the quality of life of future residents.

Communities throughout the Chicago region have been regularly updating stormwater regulations to improve the quality and reduce the quantity of stormwater runoff. One of the strategies is to require or encourage the use of green infrastructure and other best management practices (BMPs) that can filter, infiltrate, cool, and cleanse stormwater runoff before it reaches the receiving body of water. These techniques also reduce the amount of stormwater runoff during major storm events and thereby prevent flooding of private property and reduce channel and bank erosion within the community's waterways. Steps to improve the infiltration of

stormwater can also help communities maintain groundwater capacity and maintain lake levels during drought conditions. In addition to stormwater ordinances, municipalities are gradually updating local plans and subdivision, zoning, and landscaping ordinances to remove barriers and ensure that development codes reduce natural resource impacts.

While the McHenry County Stormwater Management Ordinance establishes standards for managing stormwater runoff once it is generated, it is the plans and ordinances at the municipal level that have the ability to guide the location of development and reduce the amount of impervious surfaces associated with new construction. These same local land use policies and regulations can also promote the preservation of natural areas and open spaces by encouraging infill development in areas that are already served by existing infrastructure, as well as by allowing flexible layout options to keep natural areas and features intact. Working to ensure that subdivision, zoning, landscaping, and stormwater ordinances are working together can also make it easier for developers to meet multiple requirements simultaneously.

When taken together, these practices offer cost-effective alternatives to conventional practice for both private developers and municipalities. For private developers, green infrastructure practices can reduce initial land acquisition, diminish land clearing and grading, reduce needed stormwater management facilities, and other infrastructure material costs. For example, clustered conservation design subdivisions have been shown to have significantly lower infrastructure costs than conventional subdivisions. And even when natural drainage practices are cost neutral to the developer, the lower life-cycle costs of certain green infrastructure practices should be considered. For municipalities, green infrastructure can lower ongoing maintenance and replacement costs. For example, a narrower neighborhood street will cost less to resurface in the coming years. Recent experience also suggests that green infrastructure designs, like permeable paving, often have longer lives than traditional designs and, hence, lower life-cycle costs. In addition, municipalities can benefit from indirect cost savings, such as reducing expenses related to downstream pipes and culverts, water treatment, and flood damage. The Kane County 2040 Green Infrastructure Plan includes a review of the cost effectiveness of these strategies using local case studies.<sup>1</sup>

<sup>1</sup> Kane County, Illinois, "Kane County 2040 Green Infrastructure Plan," 2013. See <http://bit.ly/1dWEUbO>.



## Project purpose and background

Completed in 2011, the Silver Creek and Sleepy Hollow Creek Watershed Action Plan was developed for two subwatersheds of the Upper Fox River Basin. The Silver Creek watershed has a drainage area of approximately 11 square miles and includes the Village of Oakwood Hills, portions of the Villages of Prairie Grove and Cary, the City of Crystal Lake, Nunda and Algonquin Townships, and unincorporated McHenry County. The Sleepy Hollow Creek watershed, with a drainage area of approximately 20 square miles, covers portions of the Cities of Crystal Lake and McHenry, encompasses the majority of the Village of Prairie Grove, borders the Village of Bull Valley, and includes portions of unincorporated McHenry County. The planning process was driven by local stakeholders (including the City of McHenry and residents) with assistance from CMAP and partner agencies the Environmental Defenders of McHenry County and Fox River Ecosystem Partnership.

Six main goals of the Watershed Action Plan were developed by the planning participants:

1. Maintain/achieve healthy surface waters within the adjacent watersheds of Silver Creek and Sleepy Hollow Creek.
2. Protect the quality of groundwater.
3. Protect the quantity of groundwater.
4. Restore natural areas and increase native species diversity.
5. Increase public awareness and knowledge to motivate needed action to implement the watershed plan.
6. Establish an ongoing community participation group to expand watershed planning and protection efforts and support project implementation.

The Watershed Action Plan inventories existing natural resources and land use features in the watershed planning area; identifies policy, planning, and stormwater management recommendations to protect and improve water quality; and recommends site-specific actions and projects. One of the central recommendations is to update municipal ordinances to better protect natural areas and open space, as well as surface water and groundwater quality and quantity.

The Silver Creek and Sleepy Hollow Creek Watershed Comprehensive Plan and Ordinance Assessment is a continuation of efforts to reduce the negative impacts of stormwater runoff, protect natural resources, and improve the quality of life in our region's watersheds. The purpose of this project is to provide suggested comprehensive plan and ordinance revisions to participating municipalities located within the Silver Creek and Sleepy Hollow Creek watersheds – the Cities of Crystal Lake and McHenry and the Villages of Oakwood Hills and Prairie Grove. This report is focused on the City of McHenry.

As identified in the Watershed Action Plan, this project recommends changes to municipal comprehensive plans, as well as subdivision, zoning, landscaping, and stormwater ordinances, in order to ensure that they complement each other and lead to improvements in water quality and overall watershed health. The recommended changes are strongly encouraged and have the potential to provide significant protection and improvement for the Silver Creek and Sleepy Hollow Creek Watersheds, as well as the Fox River.

## Project process

This project included several tasks to develop comprehensive plan and ordinance recommendations for each participating municipality within the Silver Creek and Sleepy Hollow Creek watersheds.

- 1. Establish a steering committee.** A steering committee composed of representatives from each municipality was formed to assist in guiding the development of the recommendations. The committee reviewed materials and provided feedback in coordination with relevant municipal staff and leadership.
- 2. Review best practices.** The project team consulted key resources relevant to reducing development impacts on water quality and other natural resources, collected from a variety of agencies and organizations. A reference list from the research can be found in Appendix B.
- 3. Review Watershed Action Plan.** The project team used the recently completed Watershed Action Plan as essential background information on the natural resource assets and key issues faced in this area. The proposed recommendations for reducing development impacts on water quality and other natural resource and improving watershed health provided the foundation for the recommended actions proposed in this report.
- 4. Review Comprehensive Plans.** The existing comprehensive plans for each of the participating jurisdictions in the watershed were analyzed. The analysis highlights specific areas within the comprehensive plan that the municipality may wish to revise to improve watershed health and to be more consistent with the Watershed Action Plan.
- 5. Review subdivision, zoning, and stormwater ordinances.** The existing subdivision, zoning, stormwater, and related ordinances for each of the participating jurisdictions in the watershed were analyzed. The analysis highlights specific areas of each municipality's ordinance that they may wish to revise to reduce development impacts to the Silver Creek and Sleepy Hollow Creek watersheds.

- 6. Create draft report.** A draft of the final report was created and sent to the steering committee for their review and comment in coordination with relevant municipal staff and leadership.
- 7. Discuss recommendations with municipalities.** A workshop was held with representatives from municipalities within the Silver Creek and Sleepy Hollow Creek watersheds, as well as McHenry County, to discuss and review the reasoning behind key recommendations.
- 8. Create final report.** Recommended changes to the comprehensive plan and subdivision, zoning, landscaping, stormwater, and related ordinances were compiled into individual reports for each municipality.

## Relationship with the GO TO 2040 comprehensive regional plan

As part of the larger Chicago metropolitan region, Crystal Lake, McHenry, Oakwood Hills, and Prairie Grove both influence and are influenced by the region. CMAP is the official regional planning organization of the northeastern Illinois Counties of Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will. CMAP developed and now guides the implementation of GO TO 2040, metropolitan Chicago's first truly comprehensive regional plan in more than 100 years. To address anticipated population growth of more than 2 million new residents, GO TO 2040 establishes coordinated strategies that will help the region's 284 communities address transportation, housing, economic development, open space, the environment, and other quality of life issues. The plan contains four themes and 12 major recommendation areas:

### **Livable communities**

1. Achieve greater livability through land use and housing
2. Manage and conserve water and energy resources
3. Expand and improve parks and open space
4. Promote sustainable local food

### **Human capital**

1. Improve education and workforce development
2. Support economic innovation

### **Efficient governance**

1. Reform state and local tax policy
2. Improve access to information
3. Pursue coordinated investments

### **Regional mobility**

1. Invest strategically in transportation
2. Increase commitment to public transit
3. Create a more efficient freight network

The livable communities, efficient governance, and regional mobility chapters are most relevant to this Silver Creek and Sleepy Hollow Creek Watershed Comprehensive Plan and Ordinance Assessment, particularly those recommendations that relate to:

- Water and natural resource protection and enhancement
- Green infrastructure protection and enhancement
- Water and energy conservation and efficiency
- Open space and trails enhancement
- Collaborative planning and interjurisdictional communication

GO TO 2040 states, "municipalities are critical to the success of GO TO 2040 because of their responsibility for land use decisions, which create the built environment of the region and determine the livability of its communities. The most important thing that a municipality can do to implement GO TO 2040 is to take this responsibility very seriously." By undertaking this comprehensive plan and ordinance assessment to reduce the negative impacts of development on watershed health, Crystal Lake, McHenry, Oakwood Hills, and Prairie Grove have taken responsibility for guiding their future and have demonstrated their commitment to helping shape the future of the region as well.

## Report organization

This report is focused on the City of McHenry. Section 2 identifies areas for improvement within the City's 2008 Comprehensive Plan and Development Policies. Section 3 reviews the existing development-related ordinances and identifies recommended alternatives. Section 4 identifies priority steps the City should take within the next year to implement the recommendations in this report.





Image by the Stream Team volunteers.



# Comprehensive Plan Assessment

In 2008, the City of McHenry adopted its Comprehensive Plan and Development Policies. This Plan lays out a 20-year vision for the city and guides the type, intensity, rate, and quality of growth. Using the U.S. Environmental Protection Agency's Water Quality Scorecard and the Watershed Action Plan as a starting point, the McHenry Comprehensive Plan was analyzed to see how it addresses a number of natural resources, water resources, open space, trees, development type and location, transportation, and parking indicators. See Appendix A for the checklist. Overall, while the Plan does recognize the value of sustainable design and natural resources, it lacks the specificity necessary to protect natural resources and reduce negative development impacts. This section of the report identifies areas for improving the comprehensive plan to be better aligned with watershed plan goals.

## Community profile

Chapter 2 of the Plan presents a summary of the existing conditions of the community and provides the basis for the Plan's policies and recommendations. This chapter currently lacks an adequate assessment of the natural resources present in the community. The Parks, Recreation, & Public Open Space section is largely devoted to recreational amenities of the community park system. While it does provide some information about the Boone Creek tributary, it does not identify other water resources. This section should be updated to include a map of the environmental features of the community, including watersheds, wetlands, floodplains, groundwater recharge areas, oak groves, steep slopes, prairies, and savannas. Many of these environmental features are already mapped and included in the McHenry County Green Infrastructure Plan. In addition, the Watershed Action Plan provides detailed information on the existing conditions of the Sleepy Hollow Creek Watershed. This section of McHenry's comprehensive plan should also identify publicly and privately held open space, including lands owned by the McHenry County Conservation District. The public sanitary sewer and water section of this chapter should also highlight the community's dependence on shallow groundwater aquifers for its drinking water supply and reflect the recent findings of the Illinois State Water Survey which have identified groundwater shortages as a growing concern for southeastern McHenry County.<sup>2</sup>

## Overall goals

The Plan identifies three overarching goals in Chapter 3:

1. The preservation, enhancement, and expansion of the qualities which make life more enjoyable and unique to the city.
2. To solve and avoid problems of growth and change.
3. To realize new social, economic, aesthetic, and environmental potentials inherent in the process of change and in the enduring qualities of the City, its people, location, economy, and the natural environment of which it is a part.

Protecting and improving water resources could fit within this existing goal framework. This section also includes a description of each of the three goals and each could be adapted to more directly address the relationship between development and natural resource protection.

Under the first goal, the Plan identifies the presence of open spaces, lakes, and the Fox River and its tributaries as attractive, unique, and contributing to quality of life. This could be expanded to recognize additional natural features and how the collection of natural resources (or perhaps the community's green infrastructure) provides essential services to the community. The description of the second goal recognizes many challenges, including the loss of large mature street trees, woodlands, and rural character as a potential problem. This list could be expanded to recognize the importance of water resources, as well as other land resources. This section states that failure to respond to these challenges will erode environmental quality due to encroachment or degradation of floodplains, wetlands, prairies, rare and endangered species habitat, and pollution of surface and groundwater resources. This is an important statement to include and the document should respond to this concern with more specificity throughout the Plan. The third goal poses questions on how the community will tackle an array of opportunities and challenges. This section could include questions on how to tackle specific environmental concerns, such as groundwater protection and natural area preservation.

Additional goals are presented in following chapters of the Plan. The city may also consider updating Chapter 3 to include all of the goals of the Plan so that they are presented in one place. Providing a comprehensive set of principles in the beginning will better communicate the values that have been articulated by the community.

<sup>2</sup> Meyer, S.C. et al, "Northeastern Illinois Regional Water Supply Planning Investigations: Opportunities and Challenge of Meeting Water Demand in Northeastern Illinois," 2010. See <http://cmap.is/17VyN1O>.

## Future land use

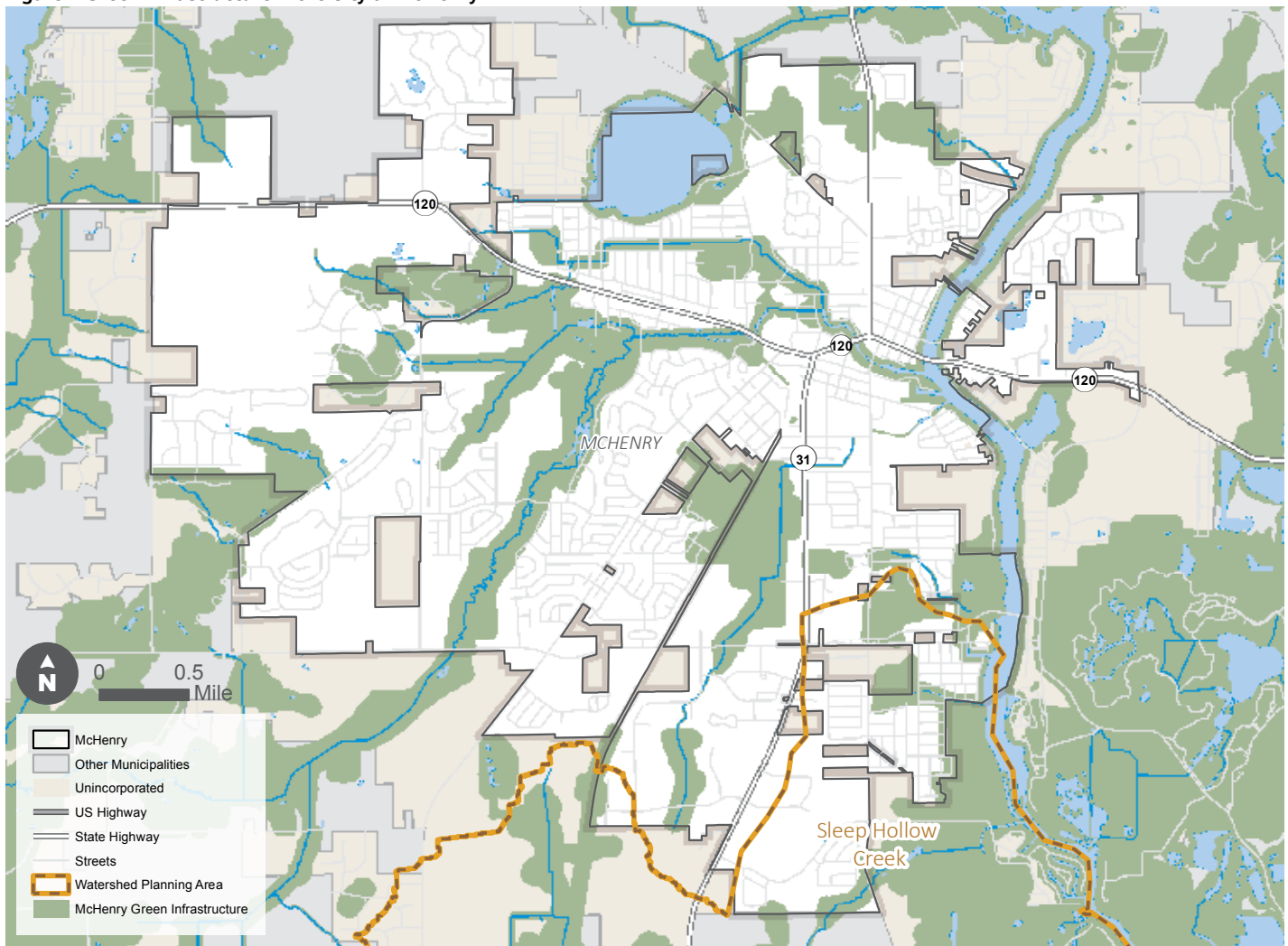
Chapter 4 presents the future land use map, land use categories, and additional goals relating to land use, unique character, and growth. It also includes a summary of how the five sub-area plans work in conjunction with the Comprehensive Plan.

The Plan should be applauded for its support of high-density residential and mixed-use development within and near the downtown. It recognizes that this type of development will help the community preserve the rural character of other areas of town by allowing for the preservation of open space and environmental corridors. However, the future land use map does not include a mixed-use land use category directly. It does refer to the Integrated Design District, but this zoning classification does not require a mix of uses. The Plan should clearly articulate where mixed-use development should occur and should provide a description of this land use category.

The Plan also encourages conservation developments, which is a form of development that clusters buildings in order to preserve significant environmental features of the site. While described in further detail in the Neighborhood Character chapter, conservation development is not a land use category recognized in the future land use map. The future land use map should be amended to include this as a category and it should be located in connection with natural resources. The Integrated Design District allows clustering of buildings, but the location of this district does not necessarily correspond with the location of important natural resources.

This chapter goes on to identify additional goals for land use, unique character, and growth. Under the land use goal, the Plan asserts a policy to preserve and expand areas of open space, recreation, and environment land uses. This policy should be more explicit in what types of natural resources should be protected and maintained. This section also contains a policy that encourages creative, innovative, and sustainable design. This policy should be further expanded to articulate what sustainable design means.

**Figure 1. Green infrastructure in the City of McHenry**



Source: Chicago Metropolitan Agency for Planning, 2013; McHenry County Green Infrastructure Plan.

The unique character goal contains an objective to protect and preserve the rural character of the City, as well as two relevant corresponding policies: encourage low-density residential land use on the outskirts of the city; and promote the preservation of open space, lakes, and the Fox Rivers and its tributaries. Low-density residential has been previously defined in this plan as one to four dwelling units per acre. Development at this density without further open space guidelines could lead to the erosion of the very character and resources it was intended to protect. This policy should be replaced with one that emphasizes the use of conservation design and encouraging compact, contiguous development where infrastructure already exists in order to minimize the development of open land.

The unique character goal also includes a policy of promoting mixed-use development in the downtown to preserve a more natural and historic feel to the area. Again, the Plan should be commended for including this policy and recognizing that mixed-use development is part of the community's historic pattern of development. McHenry may also consider adding additional information about the positive attributes of mixed-use development as it relates to natural resources. For example, compact development in the form of mixed use not only minimizes the development footprint per capita but can also reduce the need to drive for everyday trips.

This chapter also includes a growth goal that encourages responsible, orderly growth in the City by assisting property owners with annexation, supporting development plans, and promoting redevelopment. Regarding annexation, the Plan states that annexation of areas with septic systems and substandard streets, which are defined as areas with no curb-gutters or sidewalks, should only occur if there is a funding mechanism to remedy these deficiencies. This section should be updated to reflect that the lack of curb and gutter is not necessarily a deficiency. Combined with biofiltration stormwater practices, these areas can perform better in terms of water resource protection and potentially from a municipal cost perspective as well.

This section on growth also includes an objective of encouraging redevelopment of older, non-historic properties within the downtown area. The Plan should be commended for its emphasis on redevelopment. McHenry should consider placing an even stronger emphasis on this strategy, including directing development to previously developed areas as a priority over greenfield development. The Plan indirectly does this with the locations chosen for the five sub-area plans. Several are focused on previously developed areas with three targeted to bring the different parts of downtown together. The two remaining sub-area plans are designated for commercial streets that lead into downtown.

## Transportation

Chapter 5 defines the purpose of the City's transportation system as one that provides safe and efficient movement of people and goods into and out of the community. The Plan recognizes four primary modes for accomplishing this movement and then provides further goals for each one: public transit, bicycle, pedestrian, and highways. While the Plan should be commended for recognizing a more comprehensive list of travel modes, it should highlight that improvements in alternative modes of transportation are a way to reduce vehicle miles traveled, as well as the space required for vehicle movement and storage. Instead of the word "highways," the travel mode should be changed to "automobile" in recognition that the streets of the community are used by all four modes of transportation.

This chapter includes some basic information about the existing public transit system within the City, highlighting the infrequent service of both the commuter rail and Pace bus service. The Plan calls for increased transit service and transit-oriented development around the commuter rail station. However, the Plan also calls for additional parking at the train station without demonstrating a need for more spaces. The Plan should be updated to first call for other transportation demand management techniques<sup>3</sup> before the addition of more parking spaces, which may work against the transit-oriented development objective and will likely create more impervious surfaces. Within this section, the Plan could identify increased transit service (in addition to pedestrian and bicycle improvements) as a good way to reduce reliance on the automobile and decrease the parking lot requirements for those areas served by train or bus.

Bikeways are recognized as an important asset of the community, with an emphasis on the regional and recreational bike network. The Plan outlines off-street and on-street bikeways as a way to link residential neighborhoods with the community's amenities. Encouraging the use of the bicycle for commuting and other utilitarian trips is briefly discussed and should be elevated to an objective of this chapter. This chapter also recognizes that more people want to walk to get to daily destinations and that this is an important activity to accommodate. The Plan calls for pedestrian access and circulation to be fully integrated into the design for streets and major land development. The city should consider the adoption of walkability standards, adding street sections based on complete streets principles for new subdivisions, and identify existing areas that need to be improved.

<sup>3</sup> Transportation demand management is the application of strategies and policies to reduce travel demand (specifically that of single-occupancy private vehicles) or to redistribute this travel demand in space and in time to reduce congestion.



Most of this chapter is devoted to roads, with attention paid to the functional classification system and the corresponding design characteristics of different roadway types. The Plan calls for improving arterial capacity; it does not recognize the advantages of distributing traffic across several parallel streets and reducing the need for additional or expanded high capacity arterials with wide right-of-ways. The City should consider changing the emphasis of this chapter to tailoring street designs to better match the surrounding land use context and strengthening the street network over individual corridors. It should emphasize both the environmental and safety benefits of a compact and connected street network in new subdivisions, which allow for narrower street widths. The Plan should also promote the use of green infrastructure practices in street design and include a discussion of parking. Parking policy dictates how much land is required for a given development, contributes to stormwater impacts, and influences neighborhood vitality. The amount and availability of parking also has a large influence on how residents make travel decisions.

## Neighborhood character

Chapter 6 identifies the current housing mix as 75 percent low density, 18 percent medium density, and 7 percent high density and calls for the housing stock to become 80 percent low density, 15 percent medium density, and 5 percent high density. The City should carefully review this goal, especially given that this may work directly against other goals within the plan which call for redevelopment, preservation of open space, and walkability and transit improvements. In addition, national and regional housing studies are showing both demographic and preference shifts that highlight the need for more compact housing types to meet demand. By 2030, the nation is expected to have an oversupply of low-density housing which could lead to a significant devaluation of this housing type.<sup>4</sup>

The Plan should continue its promotion of conservation design principles for new residential development. This chapter highlights the environmental benefits of clustering buildings to preserve open space and the value of using stormwater practices that mimic natural systems. As discussed earlier, the Plan's objective to encourage conservation developments should be reflected within the future land use map with the inclusion of a conservation design land use category. The McHenry County Green Infrastructure Plan and the Watershed Action Plan should be used to guide the location of conservation developments so that they correspond with the natural resources of the community.

The Plan should be commended for the inclusion of a number of goals encouraging residential development within downtown, as well as within existing neighborhoods. This section also includes a policy to support transit-oriented development and other transportation programs that connect people to jobs and services while reducing traffic congestion, air pollution, and other transportation-related costs. This is an excellent addition to the Plan and should also be reflected in the transportation section.

<sup>4</sup> Nelson, Arthur C. *Reshaping Metropolitan America: Development Trends and Opportunities to 2030*. 2013. Island Press: Washington D.C.

## Economic development

Chapter 7 states that a primary goal of the Plan is to provide an opportunity for people to live close to employment opportunities and work to reduce cross-town traffic by a balanced distribution of housing and jobs. However, many of the objectives are still focused on creating isolated office and business parks instead of integrating these uses into mixed-use centers within walking distance of homes, commercial destinations, and transit service. The Plan should consider locations where office and business land uses do not necessarily need to be designed in a single-use setting. It should also extend its promotion of conservation design principles to include commercial development as well.

## Parks, recreation, and public open space

Chapter 8 includes a goal to preserve, expand, and connect environmental corridors to protect wetlands, floodplains, and mature forests for the purpose of maintaining diversity of wildlife habitat and for environmental health, recreational, and aesthetic purposes. With this goal, the Plan includes several desirable objectives focused on protecting steep slopes, minimizing massive grading of development sites, implementing erosion control measures, enhancing existing wetlands, floodplains, and groundwater recharge areas, and preserving mature trees. Additional protective measures are identified for the Boone Creek Corridor, including the use of stormwater best management practices to limit the impact of stormwater runoff. Protection and enhancement of the Sleepy Hollow Creek Watershed should be included within this list of objectives.

The Plan should be updated to include a comprehensive map of the existing environmental resources. This map can then help inform where other land uses, like conservation developments and public park space, should be located. The City's Parks and Open Space Plan also recognizes the value of low impact development and calls for the integration of these techniques within parks. It specifically identifies the goal of runoff prevention rather than mitigation and encourages permeable pavements, biofiltration, rain gardens, and native landscaping as a way to reduce runoff, increase infiltration, minimize pollution, and improve water quality. These sustainable stormwater management techniques should be encouraged throughout the municipality, not just within the Boone Creek Corridor or the Parks and Open Space Plan.

## Public facilities

Chapter 9 provides an overview of the existing public works facilities, including water and wastewater treatment facilities. The City of McHenry is solely dependent on groundwater for its drinking water supply, so a safe and adequate shallow groundwater supply is imperative to support public health and a prosperous economy. In addition, over pumping of groundwater can lead to streamflow capture, where groundwater that previously contributed to a stream's baseflow is diverted away into wells, negatively impacting the area's natural resources. This section should be updated to include information and strategies for maintaining the community's drinking water supply over the long term. Water conservation measures for municipal operations, businesses, and residents should be added to this section. McHenry County's Sensitive Aquifer Recharge Area (SARA) map should inform the City's future land use map. It identifies areas that are susceptible to aquifer contamination, as well as areas that may aid in protecting groundwater recharge.





Image by the Stream Team volunteers.



# Ordinance Assessment

## Summary of recommendations

The following ordinances were analyzed using a checklist developed from a number of best practices:<sup>5</sup> City of McHenry's Subdivision; Zoning; Development in Special Flood Hazard Areas; Soil Erosion and Sedimentation Control; Trees, Shrubs, and Noxious Growths; Water and Sewers; Streets and Sidewalks; Building and Building Regulations; and the McHenry County Stormwater Management ordinance as adopted by the City. The following summary provides insight into the rationale behind the ordinance changes that are recommended in Tables 1 - 11, organized around the 11 major topic areas. The tables contain the full checklist, which includes sections of the municipal code of ordinances that already address water and other natural resource protection goals. The areas where the existing City or McHenry County ordinance currently meets best practices are highlighted in green. The 11 ordinance subject areas are:

- Stormwater drainage and detention
- Soil erosion and sediment control
- Floodplain management
- Stream and wetland protection
- Natural areas and open space
- Conservation design and infill
- Landscaping
- Transportation
- Parking
- Water efficiency and conservation
- Pollution prevention

The City of McHenry has the authority to adopt, revise, and enforce provisions in each of these areas. All municipalities, including McHenry, are required to adhere to the minimum provisions of the McHenry County Stormwater Management Ordinance, which are covered in the first four topic areas: stormwater drainage and detention; soil erosion and sediment control; floodplain management; and stream and wetland protection. The City can adopt more stringent standards, and McHenry has done this to a large degree by using the NIPC model ordinances. Currently, McHenry County is conducting a comprehensive review and revision of the Stormwater Management Ordinance and one of the primary objectives of the project is to establish regulations to implement the County's Water Resources Action Plan and the Green Infrastructure Plan. Ideally, the County's stormwater committee would consider updating the ordinance based on the recommended changes in these four sections so that improvements could be made uniformly throughout the county. This would result in more comprehensive water quality and natural resource protection; maintain consistent standards between municipalities; and a more level playing field for developers. At a minimum, McHenry is encouraged to advocate for these updates to the McHenry County Stormwater Management Ordinance. The City also is encouraged to independently adopt improvements to individual ordinance provisions that are in its own interest. Several specific recommendations are provided in the subsequent report sections. Appendix B provides a list of resources and reference materials that were used to guide the recommendations and could be helpful as the City begins to update the Comprehensive Plan and development-related ordinances.

<sup>5</sup> See Appendix B for resources and references used to develop the checklist.

## Stormwater drainage and detention

Stormwater runoff is responsible for a number of impacts to communities, including flood damage to susceptible properties, the erosion and destabilization of stream channels and lake shorelines, and a significant portion of nonpoint source pollution<sup>6</sup> to valuable stream, lake, and wetland resources. Development should use, to the extent practicable, the natural landscape and naturalized drainage and detention features to filter and infiltrate stormwater runoff from impervious surfaces on site. It is also important to reduce the effective impervious area of a site, which means the amount of impervious area that drains water directly into pipes, channels, and sewers without flowing over pervious areas. Methods of reducing the effective impervious areas focus on integrating (versus segregating) the pervious and impervious areas on a site. In particular, it is desirable to route runoff from parking lots, roads, and rooftops through such practices as bioswales, rain gardens, naturalized detention basins, natural landscaping, green roofs, filter strips, level spreaders, and rain barrels and cisterns. Stormwater detention facilities should be designed as multi-purpose, naturalized, wet or wetland basins, naturally landscaped above and below the water line. These practices serve multiple functions including but not limited to recreation, habitat, and improved aesthetics. Below grade stormwater storage, such as in aggregate layers beneath permeable paving systems and rain gardens, also should be allowed as temporary detention mechanisms.

Ideally, stormwater runoff from new development should not be directly discharged into natural areas, particularly streams, lakes, and wetlands. Discharge of pretreated stormwater runoff may be allowed via accepted methods of pre-treatment such as naturalized swales, biofiltration practices, naturalized wetland detention basins, and other measures that filter and/or detain runoff. Other communities are beginning to require conformance to numerical water quality performance standards — such as percent removal of sediment or phosphorus.

The City of McHenry uses the McHenry County Stormwater Management Ordinance to regulate stormwater drainage and detention and there are several areas of this ordinance that could be strengthened to better protect water quality, natural hydrology, and aquatic resources. Table 1 highlights potential amendments to the adopted County ordinance, which could be addressed during the County's revision process. The City of McHenry could consider City amendments to the updated County Ordinance if some of these items remain unaddressed. Table 1 also identifies areas of the City's subdivision ordinance that should be updated to allow for and encourage the use of natural drainage practices and detention. McHenry's ordinance is relatively prescriptive, encouraging or requiring traditional "gray infrastructure" design approaches. By providing greater ordinance flexibility and removing barriers to preferred natural drainage practices and detention, developers are more likely to willingly implement innovative designs.

In addition, proper management and maintenance of these elements is critical to maintaining their function and effectiveness. Like other "grey" infrastructure, communities may be challenged by the long-term maintenance, legal authority, and staff capacity to enforce compliance. Establishing performance standards at the outset for stormwater infrastructure design and maintenance, particularly landscaping elements, can give measurable objectives for both the land owner to follow and the City to refer to when action is required. Performance standards should identify proposed methods for establishing the areas and require monitoring and maintenance to ensure that the overall design and function is achieved and maintained. Tables 1 and 5 include recommendations and references for management and maintenance for natural areas. These address ownership, easements, funding arrangements, vegetative performance criteria, and inspections.

Many local governments implement demonstration projects of innovative stormwater management practices to ensure that their local staff has experience implementing and maintaining green infrastructure site designs. For example, Kane County installed a permeable parking lot and bioswale at the County complex in Geneva, in part to evaluate the effectiveness of these practices. The City of Aurora has similarly implemented permeable paving and related green infrastructure at a new police station and has installed numerous bioswales via funding from a recent Illinois Green Infrastructure grant. This level of experience is valuable when discussing new designs with private landowners and developers; McHenry should look to include these practices in upcoming municipal projects.

<sup>6</sup> According to the U.S. Environmental Protection Agency, nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. NPS is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters. It can include excess fertilizers, herbicides and insecticides from agricultural lands and residential areas, oil, grease and toxic chemicals from urban runoff and energy production, salt, pet wastes, faulty septic system, sediment from improperly managed construction sites and eroding streambanks, and atmospheric deposition.

## Soil erosion and sediment control

Development and construction can result in excessive quantities of soil eroding from a site, which can clog sewers and ditches and pollute and impair rivers, streams, lakes, and wetlands. In addition to retaining the full McHenry County Stormwater Management Ordinance, which includes soil erosion and sediment control provisions, the City has adopted a separate Soil Erosion and Sediment Control Ordinance which differs from the County ordinance. The City should clarify this duplication and continue to use their separate ordinance which largely follows the Northeastern Illinois Planning Commission's (NIPC) Model Soil Erosion and Sediment Control Ordinance. The model ordinance is focused on minimizing the area and time of disturbance, following natural contours, avoiding sensitive areas, and requiring that sediment control measures be in place before significant grading or disturbance is allowed. However, a few updates could be made and McHenry is encouraged to make these changes as City amendments and/or advocate for these changes at the County level, see Table 2. One recommendation is to add a statement that the delivery of sediment from sites affected by land disturbing activities should be limited, as closely as practicable, to that which would have occurred if the land had been left in its natural undisturbed state.

A second recommendation is to add more details on how inspections will work for phased projects and to specifically require inspections at critical stages of the construction process to assure that development practices and erosion control measures are effective. Erosion control practices can fail over time, especially during lengthy construction processes. While inspections may require more initial staff involvement; the relative costs of inspection can be minimal compared to the problems and damages that could arise without proper practices in place. The Illinois Field Manual for Implementation and Inspection of Erosion and Sediment Control Plans is a good resource for conducting inspections and includes a detailed checklist of inspection criteria.

## Floodplain management

Floodplains provide multiple benefits related to environmental quality, natural resource management, and recreational opportunity and are best able to provide these benefits if kept in a natural condition. Alterations within the floodplain often result in increased flood and stormwater hazards, reduced water quality, and loss of habitat and recreational opportunities. In addition to retaining the full McHenry County Stormwater Management Ordinance, which includes floodplain management provisions, the City has adopted a separate Special Flood Hazard Areas ordinance which differs from the County ordinance. The city should clarify this duplication. The City's separate Development in Special Flood Hazard Areas ordinance follows the minimum requirements established by the Federal Emergency Management Agency and Illinois Department of Natural Resources' Office of Water. Further improvements, as identified by the NIPC Model Floodplain Ordinance, should be made to preserve and enhance water quality, habitat, recreational opportunities, aesthetics, and/or provide an additional margin of safety, see Table 3. State law allows local regulations that are more restrictive if they are reasonable.

Currently, the City's ordinance allows a number of modifications in the floodway<sup>7</sup> that we recommend removing because of concerns that they will increase flood damages, interfere with natural functions of floodways, and/or impair water quality and habitat. These include new treatment plants and pumping facilities, detached garages, sheds, and other non-habitable structures, parking lots and aircraft parking aprons, and roadways which run longitudinally along a watercourse. Based on the NIPC Model Floodplain Ordinance, it is recommended that the City restrict modifications in the floodway to the following appropriate uses: public flood control projects, public recreation and open space uses, water dependent activities, and crossing roadways and bridges. For reference, the NIPC Model Floodplain Ordinance provides rationale for limiting specific types of modifications. For example, garages and sheds within the floodway are not advised because historically they have been severely damaged by floods, sometimes get swept away with flowing water, and may disrupt drainage and increase downstream flood damages.

Channel modifications are of particular concern because of their potential impacts on erosion, water quality, and habitat, as well as flood height and velocity. The City's ordinance already outlines a number of standards a project must meet if the proposed activity involves channel modification. The City should consider adding an analysis of different alternatives and the impacts of the proposed project, considering cumulative effects on the physical and biological conditions of the body of water affected.

<sup>7</sup> A floodway is not the same as a floodplain. The floodplain is an area of land adjacent to a stream or river that is susceptible to being inundated by water during storm events. The floodplain includes the floodway, which consists of a stream channel and adjacent areas that actively carry flood flows downstream, and the flood fringe, which are areas inundated by the flood, but do not experience a strong current.



## Stream and wetland protection

The City of McHenry uses the McHenry County Stormwater Management Ordinance to regulate stream and wetland protection and there are several areas of this ordinance that could be strengthened to better protect the water quality and function of streams and wetlands. Table 4 highlights potential City amendments to the adopted ordinance. Alternatively, the City could adopt a separate overlay district for these resources and use the NIPC Model Stream and Wetland Protection Ordinance to provide a higher level of stream and wetland protection.

Natural vegetation buffer strips along streams and around wetlands or ponds provide pollution control by allowing vegetation to filter sediments and contaminants from surface runoff before it enters waterbodies. The vegetation also stabilizes the natural drainageways and streambanks from erosion and provides a significant amount of open space, wildlife habitat, and scenic beauty. It is recommended that the City update several of the existing buffer requirements to emphasize the use of natural landscaping buffers from the ordinary high water mark of streams, lakes, ponds, or wetlands regardless of their size or quality.

In addition to natural vegetative buffers, establishing development setbacks of 75 to 100 feet from the ordinary high water mark will further minimize adverse water quality, habitat, and drainage impacts. Within the setback, development should be limited to the following types of activities: minor improvements like walkways and signs, maintenance of existing highways and utilities (but no new construction), and park and recreational area development. Conservation design, described in more detail in the following sections, allows for site designs that can more easily accommodate stream and wetland protection objectives due to more flexible site layout and design requirements.

## Natural areas and open space

In addition to the protection of streams, lakes, and wetlands covered above, other important natural resources that should be protected, restored, and managed include prairies, savannas, and woodlands. These features often buffer aquatic systems and provide critical landscape linkages for wildlife. The City of McHenry's subdivision and zoning ordinances require the identification of natural features during site review and include some mechanisms to set aside and then maintain open space. The recommendations outlined in Table 5 are focused on two main strategies: expanding the definition of natural resources to reflect the existing assets of the City, and providing additional guidelines for setting aside open space and then maintaining natural areas, natural features, common open space, buffers, and naturalized stormwater facilities in perpetuity.

The City of McHenry's subdivision ordinance calls for every subdivision to preserve to the fullest extent possible any natural ridges, large trees, and water courses that may be present on-site. With the creation of the McHenry County Green Infrastructure Plan, valuable prairies, grasslands, savannas, woodlands, and oak groves have been identified and can be incorporated into the subdivision ordinance as important features to protect.

The City's Integrated Design District, which appears to function much like a Planned Unit Development ordinance, already outlines a more comprehensive list of natural resources than the subdivision ordinance, but this too could be expanded based on the McHenry County Green Infrastructure Plan. The City's Integrated Design District currently allows, but does not require conservation design (clustering development, preserving large open spaces, and using natural drainage practices or other stormwater management best practices) in new development. In order to satisfy the conservation design goals already outlined in the City's Comprehensive Plan, it is recommended that this zoning district be updated or supplemented by a conservation design overlay district using the McHenry County Subdivision Ordinance on Conservation Design as a model. As a fully operational conservation design overlay district, the City can then zone this district for areas where natural resources exist as identified through the McHenry County Green Infrastructure Plan.

For both conventional and conservation design subdivisions, funding, management, and maintenance of natural areas, natural features, common open space, buffers, and stormwater best management practices should be the responsibility of property owners and/or the homeowners association (HOA), who will be responsible for creating and implementing management plans for such areas. Common open space may be managed by a third party non-owner, homeowners association, conservation organization, or the City. At the time of plan approval, the City should require establishment of a management funding mechanism and revenue source such as a Special Service Area (SSA) or a backup SSA to fund the recommended management activities if necessary management is not being conducted by the HOA. Other options include deeding the property to a local land conservancy or requiring that the developer establish an escrow account to pay for necessary management.

## Conservation design and infill

Redevelopment of previously developed land—known as infill—is one of the best ways to create vibrant downtowns and neighborhoods while also minimizing the impacts of our built environment on the watershed. When combined with stormwater best management practices, redevelopment can actually lead to a net improvement in watershed conditions. The City already has a downtown overlay district and several sub-area plans that encourage compact, pedestrian- and transit-oriented, mixed-use development. Continuing to encourage infill development is recommended and should be seen as an important technique for improving environmental health.

Where infill development is not possible, greater flexibility within the zoning and subdivision ordinances should be allowed to encourage clustering of buildings and preservation of natural areas, features, and open space, see Table 6. As previously discussed, the updated Integrated Design District or a new conservation design overlay district should be zoned for areas with green infrastructure and should be required or allowed by right. In addition, conservation design guidelines should be required if sites outside of these designated areas are found to contain priority natural resources.

Conservation design would ideally incorporate a six-step site design process:

1. Identify all natural resources, conservation areas, open space areas, and physical features on the site through a site analysis.
2. Perform a site capacity analysis based on the remaining developable land after removing floodplains, streams, wetlands, and other legally undevelopable land. This allows for a more objective analysis of the number of units that the zoning allows and the starting point for density bonuses for design excellence.
3. Locate the buildable area to minimize impacts on natural areas and highly permeable soils and to take advantage of open space and scenic views that were identified in the site analysis.
4. Design the street network to minimize encroachment into sensitive natural areas while still maintaining internal and external connectivity.
5. Allow flexibility in lot and block layouts to provide the required open space and accommodate naturalized stormwater management features and natural landscapes, while also maintaining a connected street network.
6. Minimize clearing, grading, and modification of the site and ensure compatibility with the site's natural areas, features, topography, soils, and water resources.

## Landscaping

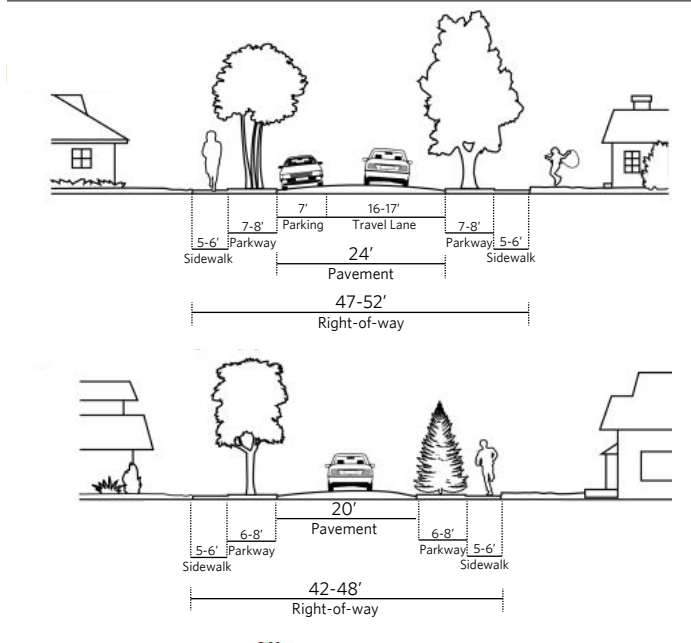
Natural landscaping can greatly benefit the preservation of water quality and natural hydrology. Native landscaping requires little or no chemical pesticides or fertilizers, common pollutants impacting streams and water bodies in watersheds. In addition, the type of landscape can influence the amount and rate of stormwater runoff. Wherever feasible and appropriate, deep-rooted natural landscaping should be used in lieu of conventional, shallow-rooted turf grass landscaping. Landscaping provisions are included within the City's zoning, subdivision, and trees, shrubs, and noxious growths ordinances. Native landscaping should be encouraged and/or required, where appropriate, in common areas in lieu of conventional turf grass landscapes, see Table 7. It can also be specifically targeted to stormwater management applications, such as biofiltration swales, rain gardens, filter strips, and naturalized detention basins. Unfortunately, some landscaping ordinances, including McHenry's, may unintentionally discourage the use of native landscaping via "weed" prohibition language and should be updated to allow native vegetation, including native grasses.

The City already has tree protection and replacement language in place. Recommended updates to this section focus on distinguishing native and desirable tree species from undesirable tree species, adding additional protective measures, providing flexibility to allow the removal of trees where appropriate for proper forest and natural area management, and advancing the replacement criteria for the unavoidable removal of desirable species.

## Transportation

Streets compose a substantial proportion of a community's impervious surfaces and are thereby a significant generator of stormwater runoff. The City's subdivision ordinance plays a large role in the design and layout of new streets and driveways; a key to ecologically-sensitive design is limiting the amount of impervious cover to that which is necessary and to the most appropriate areas, see Table 8.

**Figure 2. Narrow street cross-sections**



Streets should be designed for the minimum required pavement width needed to support travel lanes, on-street parking, and emergency access. Reductions in street width standards are recommended in new subdivisions. Minor decreases in width can result in large reductions in impervious surfaces when executed over the length of a street. Narrower streets have been shown to be safer streets with slower speeds, addressing a common neighborhood concern. Narrower street requirements should be paired with connectivity thresholds to ensure that access is maintained. Connectivity is essential for emergency response, giving emergency vehicles several, more direct routes; shortening response times; and potentially providing service to more buildings per station.

In addition to narrowing the pavement width, naturalized stormwater infiltration and conveyance systems should also be encouraged. Instead of requiring conventional curb and gutters, new subdivisions should be allowed to use swales and rain gardens as part of the stormwater management system along streets. Since new stream crossings can cause significant stream impacts, these should be minimized wherever possible and then designed to reduce harmful impacts.

## Parking

Parking lot and driveway design should first minimize stormwater runoff and then treat the remaining runoff to the greatest extent practical. A prime focus is to maintain as much pervious or unpaved surface as possible, followed by managing the runoff that does occur. Maintaining pervious surfaces can be accomplished primarily by reducing the overall size of parking lots and driveways and by replacing impervious materials with appropriate pervious materials. Once the amount of impervious surface has been minimized, BMPs that filter and/or infiltrate runoff are the best tools for controlling runoff volumes and protecting water quality, see Table 9.

A number of recommendations are focused on reducing parking requirements as well as parking space and aisle design standards. Additional recommendations include encouraging shared parking with nearby uses, further reducing parking requirements based on location, and including credits for bicycle parking. Encouraging the use of permeable parking surfaces such as interlocking concrete pavers, porous asphalt, and porous concrete is recommended except for specific areas used for transfer or storage of hazardous materials. These types of permeable paving systems, interlocking concrete pavers in particular, have been shown to be as durable as conventional asphalt and concrete paving, require less repair and rehabilitation, and need not be limited to overflow parking areas. However, it should be recognized that permeable paving systems do require sweeping or vacuuming to minimize clogging by fine sediments and maintain their long-term permeability. Driveways also create a significant portion of impervious surface on individual parcels; recommendations encourage reduced widths and lengths, shared driveway designs, alleys, and permeable surfaces.

Portions of the existing City's Zoning Ordinance require the physical separation of pervious and impervious surfaces on site, thereby effectively preventing runoff from impervious surfaces from flowing into pervious areas where it can be filtered and infiltrated. For example, the city currently requires raised, fully curbed landscaped islands instead of recessed islands that could hold and treat stormwater runoff in parking lots. Landscaping ordinances should encourage and/or require the integration of pervious, landscaped areas with the impervious areas of the site. Language to specifically allow or require integration of biofiltration into parking lot islands and street side landscaping strips is recommended.



## Water efficiency and conservation

Groundwater withdrawals can negatively impact wetlands, streams, and lakes, as well as lead to shortages in drinking water. While the techniques outlined in the previous sections can reduce impervious surfaces and promote natural groundwater recharge, additional measures are needed to reduce the quantity of groundwater withdrawn for every day uses. With growing concerns about groundwater shortages for portions of southeastern McHenry County by 2030, water efficiency and conservation measures are recommended for sections of the City's building and subdivision code, as well as the water and sewer ordinance, see Table 10.

Water efficiency measures, such as reducing water use by toilets, showers, and faucets, through installation of high-efficiency fixtures, is recommended for new development and redevelopment that meets a specific threshold. CMAP's Model Water Use Conservation Ordinance can be used as a reference for a number of updates within the municipal code. Conservation measures, such as establishing landscaping irrigation days and schedules, have been proposed by the Northwest Water Planning Alliance, a consortium of municipal and county governments (including the City of McHenry and McHenry County), which has created the Regional Water Conservation Lawn Watering Ordinance.

## Pollution prevention

Nonpoint source pollution is a leading cause of water quality problems across the country. These pollutants have harmful effects on drinking water supplies, recreation, fisheries, and wildlife. In addition to pollution of surface waters, studies have shown that Illinois groundwater quality is being degraded and that chloride concentrations are trending upward in shallow wells throughout the region.

As a groundwater-dependent community, the City can take additional measures to protect its surface and groundwater resources from contamination, see Table 11. For example, steps to reduce phosphorus applications to lawns, more strictly regulate storage locations for hazardous substances, and encourage proper disposal of pet waste can all help protect surface water quality. For groundwater protection, the City also should consider such measures as adopting a groundwater protection ordinance, establishing a wellhead protection program, encouraging demand-initiated water softeners, and promoting sensible and eco-friendly salting practices. Conservation design can be designated for groundwater sensitive recharge areas to help balance the protection of this resource with new development. The City of St. Charles has a groundwater protection ordinance that establishes regulations for land uses within groundwater protection areas. McHenry County's model groundwater protection program also has a number of resources City could use, including establishing regulations for activities within sensitive groundwater aquifer recharge areas, prohibiting phosphorous fertilizers on turf areas, and managing salt storage and handling.

## Current codes and recommended code revisions

Tables 1 through 11 summarize the existing codes and recommended code revisions covering eleven topics for the City of McHenry. Each table is divided into eight columns, each described below.

- 1. Reference number.** This first column numbers every recommendation and is provided for reference.
- 2. Category and checklist question.** The second, third, and fourth columns identify the main topic area, the checklist question that was used to evaluate the current ordinance, and a quick statement of whether the current ordinance meets the best practice objective.
- 3. Local code reference.** If the municipality's existing ordinance addresses the category area in the third column, the location of that language within the community's code is referenced in the fifth column. If the code does not address the category, then an appropriate location for inserting the recommended language within the codes is identified and listed in this column (e.g., Subdivision Code Section 19.72 – 3).
- 4. Current standard.** The sixth column briefly summarizes the municipality's current standard (e.g., bike trails must be a minimum of eight feet wide). If the ordinance does not address this particular standard, then "N/A" or not applicable is indicated.
- 5. Recommended standard or action.** The seventh column contains the recommended language for insertion into the community's ordinance or a recommended action. Wording options are provided (e.g., require/allow, may/shall) depending on the municipality's preference.
- 6. References.** The eighth column identifies references, including model ordinance language, examples from neighboring municipalities, and other design guidelines. The references are intended to provide the municipality with materials that can be used to update the current municipal ordinance.



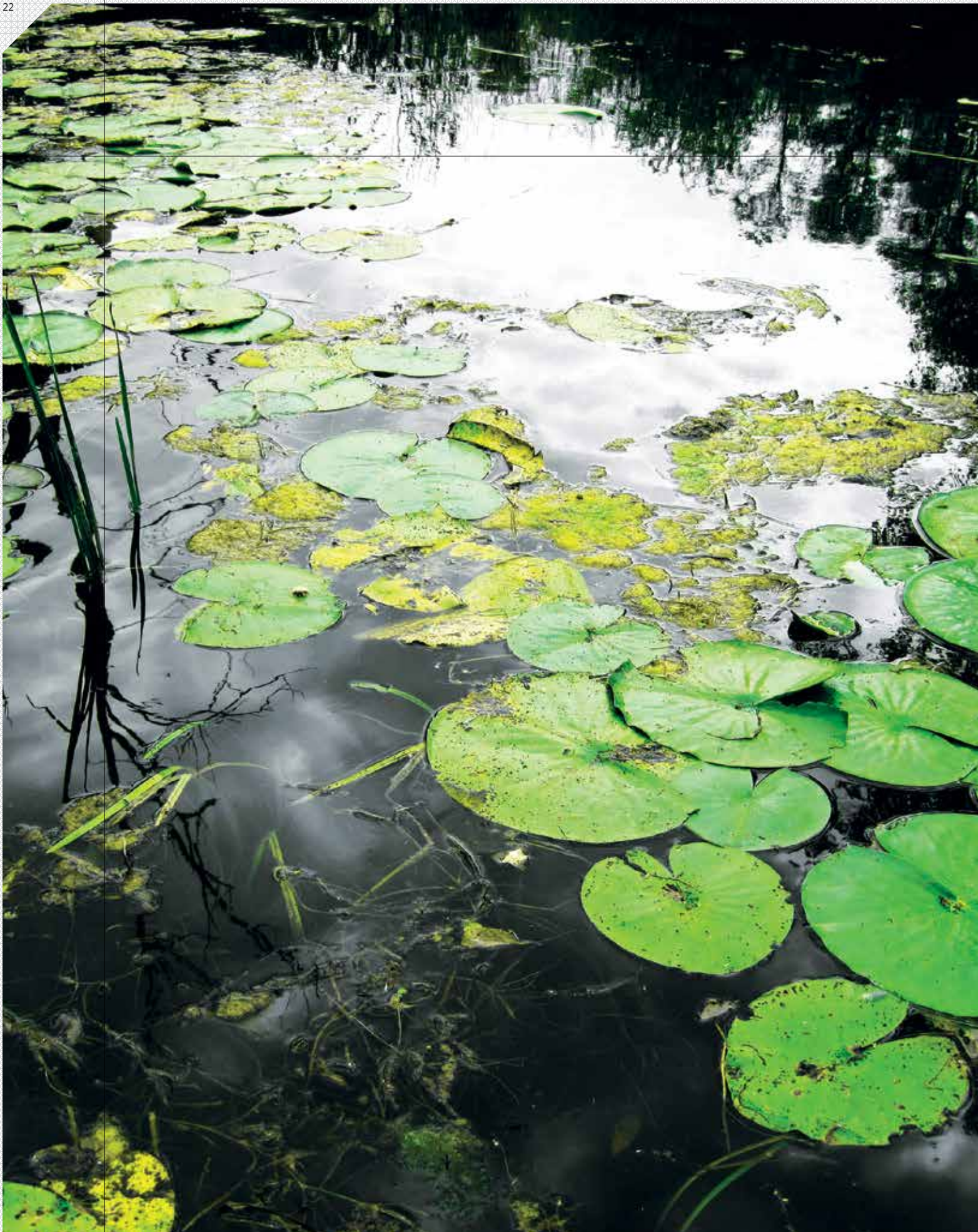




Table 1. Stormwater drainage and detention

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Purpose	Include control of runoff rate, volumes, and quality in the purpose statement?	Mostly addressed	County Stormwater I.B.7	Protect the hydrologic, hydraulic, water quality, and other beneficial functions of streams, lakes, wetlands, floodplains, and flood prone areas.	Consider updating the purpose to include specific reference to controlling runoff rate, volumes, and quality.	NIPC Model Stormwater Drainage and Detention Ordinance, Section 100.0.
2	Minimize stormwater quantity	Encourage the use of permeable paving, greenroofs, and similar practices that reduce the quantity of runoff that must be handled with innovative or conventional drainage practices?	No	County Stormwater V.F.2	Outlines a hierarchy in preparing a drainage plan, which includes preservation of natural resource features, preservation of existing natural drainageways, minimizing impervious surfaces, use of natural landscaping, use of open vegetated channels, filter strips, and infiltration, etc.	Add language about additional best management practices, such as permeable paving, greenroofs, and other techniques that reduce the quantity of runoff and indicate that such practices may allow for an approved reduction in the size of the required conveyance and detention facilities.	Village of Lakewood's Best Management Practices for R-2 Zoning, BMP hierarchy.
3	Natural drainage practices	Encourage or require the use of natural drainage practices (e.g., swales, filter strips, bio-infiltration devices, and natural depressions over storm sewers) to replace storm sewer infrastructure?	No	Subdivision 6.11 B1	All subdivisions and development shall include provisions for the construction of storm sewers. No ponding.	Encourage or require the use of natural drainage systems in place of storm sewers in subdivisions where the average distances between driveways is more than 50 feet and there are diminished on-street parking needs. Where curb and gutter is required, flat or "ribbon" curbs or curb cuts may be used to allow use of naturalized drainage systems and streetside bioswales. Indicate that such practices may allow for an approved reduction in the size of required conveyance and detention facilities.	Campton Hills Zoning Code Analysis and Ordinance Language Recommendations.
4			No	Subdivision 6.12 B	Topsoil in parkways shall be graded to meet the back of curb height	Encourage natural drainage systems in the parkways, in coordination with street tree requirements.	
5			Yes	County Stormwater V.B.2	Natural drainage practices are recognized as one of the treatment methods to reduce pollution and stormwater volumes		
6	Detention credits	Provide detention credit for practices, such as permeable paving or bio-infiltration, that provide temporary storage of runoff in the sub-surface void spaces of stone or gravel?	No	County Stormwater V.F	N/A	Incorporate detention credits for the temporary storage provided by permeable paving or bio-infiltration which use an aggregate base to temporarily store runoff.	Kane County Stormwater Management Article 2, Sec. 200 e5 (as amended in 2009).
7			No	Subdivision T-4.7 A	All commercial, industrial, and multi-family zoned development, regardless of size and all single-family residential developments two acres or larger shall include provisions for stormwater runoff storage facilities.	Consider connecting the requirements for detention to the amount of impervious area created by the project, not the land use, and relocating this provision into the zoning ordinance.	
8			No	Zoning VI C3 (c )	To increase the maximum allowable building-to-gross land area ratio, water retention/detention areas shall be provided in one or more locations in the Business Park to handle stormwater drainage from all improved sites within the Business Park. The water retention/detention areas shall be landscaped so as to maintain aesthetic conformity with the entire Business Park landscape design.	Update to reflect the incorporation of detention credits for the temporary storage provided by permeable paving or bio-infiltration. Update to encourage wet bottom and wetland designs for detention basins.	Kane County Stormwater Management Sec. 9-29 (g) (4).
9	Discharge	Require that peak post-development discharge from events less than or equal to the two-year, 24-hour event be limited to 0.04 cubic feet per second (cfs) per acre of watershed?	Yes	County Stormwater V.F.3.a	Release rates shall not exceed 0.04 cfs per acre for the two-year, 24-hour storm event nor 0.15 cfs per acre for the 100-year, 24-hour storm event. The release rate requirement shall apply to the hydrologically disturbed area of the ownership parcel.		
10	Detention design	Require detention design standards that maximize water quality mitigation benefits, with a requirement for “naturalized” wet bottom and/or wetland basins over dry basins?	No	Subdivision T-4.7 B	Refers to an older version of the McHenry County Stormwater and Floodplain Ordinance (Article 9, sections 15-113 and 15-114) with no preference for wet basins over dry basins.	Detention basins shall incorporate design features to capture stormwater runoff pollutants. In particular, designers shall give preference to wet bottom and wetland designs and all flows from the development shall be routed through the basin (i.e., low flows shall not be bypassed). Retention and infiltration of stormwater shall be promoted throughout the property’s drainage system to reduce the volume of stormwater runoff and to reduce the quantity of runoff pollutants. Using green infrastructure best management practices to count for detention helps move towards water quality benefits.	NIPC Model Stormwater Drainage and Detention Ordinance, Sections 600, 705, and 706, provides design guidelines.
11			No	County Stormwater V.F.4.i	No preference for wet basins over dry basins, but recognizes that the preferred method of shoreline stabilization of a wet detention basin is native wetland and wet prairie vegetation with deep root system to stabilize the soils.		
12	Water quality performance standards	Require conformance to numerical water quality performance standards (such as percent removal of sediment or phosphorus)?	No	County Stormwater V.F	N/A	Consider requiring conformance to numerical water quality performance standards (such as percent removal of sediment or phosphorus).	New practice being used elsewhere in the country. It has yet to be implemented in Northeastern Illinois, but could be in the next few years.
13	Detention—on-stream and floodway	Prohibit on-stream detention and detention in the floodway, unless it provides a regional stormwater storage benefit (e.g., for upstream properties and/or multiple sites) and is accompanied by other upstream water quality BMPs, such as bio-infiltration?	Mostly addressed	County Stormwater V.F.4.e	On-stream detention basins are discouraged but allowable if they provide regional public benefits and if they meet the other provisions of this ordinance with respect to water quality and control of the two-year and 100-year, 24-hour events from the property. Detention basins shall be placed in the floodway only in accordance with on-stream detention requirements.	Consider updating to include the environmental criteria listed in NIPC Model Stormwater Drainage and Detention Ordinance Section 708.3 to mitigate the impacts of on-stream detention.	NIPC Model Stormwater Drainage and Detention Ordinance Section 708.3.
14	Stormwater discharge	Prohibit the direct discharge of undetained stormwater into wetlands?	Mostly addressed	County Stormwater V.F.5	Drainage into wetlands may be allowed, but only under certain circumstances which vary based on the type of wetlands.	Consider adding guidelines for the discharge, such as requiring that all runoff from the development shall be routed through a preliminary detention/sedimentation basin designed to capture the two-year, 24-hour event with the release rate of 0.04 cfs per acre which should provide a holding time of at least 24 hours, before being discharged to the wetland.	NIPC Model Stormwater Drainage and Detention Ordinance, Section 709.4.
15	Maintenance	Require formal maintenance plans and contracts for the long-term maintenance and vegetative management of all new detention facilities?	Mostly addressed	County Stormwater V.F.9	A plan for the ongoing maintenance of all stormwater management system components including wetlands and buffer areas is required. However, specific vegetative maintenance standards are not outlined.	Consider updating to require the maintenance plan to include performance standards for all natural open space areas and naturalized stormwater management facilities and buffers. The performance standards shall identify proposed methods for establishing the areas and shall require monitoring and maintenance for at least three full growing seasons following initial enhancement, restoration, and planting, or until initial performance standards have been met. The standards are intended to address the establishment of native vegetation cover and control of invasive plant species. The maintenance plan should be included in the requirements for site plan submittal.	Performance criteria outlined in the stewardship plan section (A1118) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures. NIPC Model Stormwater Drainage and Detention Ordinance, Section 713 and 1100.

The community’s ordinance was evaluated using a checklist developed from a number of best practices, see Appendix B. The areas where the existing City or County ordinance currently meets best practices are highlighted in green.



Table 2. Soil erosion and sediment control

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Limiting sediment delivery	Include a comprehensive purpose statement which limits sediment delivery, as close as practicable, to pre-disturbance levels and minimizes effects on water quality, flooding, and nuisances?	No	M.C. Sec 18.50 - 2	Control soil erosion and sedimentation caused by development activities including clearing, grading, stripping, excavating, and filling of land. Measures taken to control soil erosion and offsite sediment runoff should be adequate to assure that sediment is not transported from the site by a storm event of ten-year frequency or less.	Add that the delivery of sediment from sites affected by land disturbing activities should be limited, as closely as practicable, to that which would have occurred if the land had been left in its natural undisturbed state.	NIPC Model Soil Erosion and Sediment Control Ordinance, Section 100.
2	Minimize sediment transport	Include a comprehensive set of principles that minimize sediment transport from the site for all storms up to the ten-year frequency event?	Yes	M.C. Sec 18.50 - 2	Twelve general principles: development should be related to the topography and soils of the site so as to create the least potential for erosion; areas of steep slopes should be avoided wherever possible, natural contours should be followed as closely as possible; natural vegetation should be retained and protected, etc.		
3	Ordinance applicability—size	Require ordinance applicability for any land disturbing activity in excess of 5,000 square feet?	Yes	M.C. Sec 18.50 3 (1)	Any land disturbing activity that will affect an area in excess of 5,000 square feet.		
4	Ordinance applicability—location	Require ordinance applicability for any land disturbing activity in excess of 500 square feet if adjacent to stream, lake, or wetland?	Yes	M.C. Sec 18.50 3 (2)	Any land disturbing activity that will affect an area in excess of 500 square feet if the activity is within 25 feet of a lake, pond, stream, or wetland.		
5	Site design requirements	Include explicit site design requirements for sediment control measures, conveyance channels, soil stabilization, construction adjacent to water bodies, construction entrances, etc.?	Yes	M.C. Sec 18.50-12	On-site sediment control measures, stormwater conveyance channels, disturbed areas, land disturbance activities in stream channels shall be avoided, stormwater inlets and culverts protection, soil storage piles, dewatering requirements, entrances, etc.		
6	Site design references	Adopt by reference the "Illinois Urban Manual" published by the Natural Resources Conservation Service and the Illinois Environmental Protection Agency (1995, updated 2010) and the "Illinois Procedures and Standards for Urban Soil Erosion and Sedimentation Control" published in 1988 (the Greenbook)?	Yes	M.C. Sec 18.50-13	The standards and specifications contained in "Standards and Specification for Soil Erosion and Sedimentation Control" and "Illinois Procedures and Standards for Urban Soil Erosion and Sedimentation Control."		
7	Maintenance	Require routine maintenance of all erosion and sediment control practices?	Yes	M.C. Sec 18.50-14	All soil erosion and sediment control measures necessary to meet the requirements of this ordinance shall be maintained periodically by the applicant or subsequent landowner during the period of land disturbance and development of the site in a satisfactory manner to ensure adequate performance.		
8	Inspection	Require inspection by appropriately trained personnel of construction sites at critical points in the development process to ensure that measures are being correctly installed and maintained?	Mostly addressed	M.C. Sec 18.50-15	The Director of Construction and Neighborhood Services shall make inspections, or shall cause them to be made, and shall either approve that portion of the work completed or shall notify the permittee wherein the work fails to comply with the site development or erosion and sedimentation control plan as approved. The permittee shall give notice and request inspection at the completion of each of the work stages in the plan.	Consider adding language on how inspections will work for phased projects and specifically require inspections at critical stages of the construction process.	NIPC Model Soil Erosion and Sediment Control Ordinance, Section 506; City of Elgin (Article 3, Sec. 300 and Article 7, Sec. 701).
9	Enforcement	Provide effective enforcement mechanisms including performance bonds, stop-work orders, and penalties, as appropriate?	Yes	M.C. Sec 18.50-7; 18.50-20; Sec 18.50-21	The ordinance establishes provisions for bonds, stop-work orders, violations, and penalties.		

The community’s ordinance was evaluated using a checklist developed from a number of best practices, see Appendix B. The areas where the existing City or County ordinance currently meets best practices are highlighted in green.

Table 3. Floodplain management

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Purpose	Include protection of hydrologic functions, water quality, aquatic habitat, recreation, and aesthetics in the purposes for the ordinance?	Yes	M.C. Sec 8-1.9	To preserve the natural characteristics and functions of watercourses and floodplains in order to moderate flood and stormwater impacts, improve water quality, reduce soil erosion, protect aquatic and riparian habitat, provide recreational opportunities, provide aesthetic benefits, and enhance community and economic development.		
2	Floodway restrictions—use	Restrict modifications in the floodway to the following appropriate uses—public flood control projects, public recreation and open space uses, water dependent activities, and crossing roadways and bridges?	No	M.C. Sec 8-7.4	Allows new pumping and treatment facilities; detached garages, sheds, and other non-habitable structures; roadways; and parking lots.	Consider updating to the alternative language presented in NIPC Model Floodplain Ordinance, Section 802.1, which is more restrictive than the appropriate uses allowed by State rules. In particular, uses such as pumping and treatment facilities, garages and sheds, roadways running longitudinally along a watercourse, and parking lots are not considered appropriate because of concerns that they will increase flood damages, interfere with natural functions of floodways, and/or impair water quality and habitat.	NIPC Model Floodplain Ordinance, Section 802.1 Alternative.
3	Limit stream channel modification	Discourage stream channel modification and require mitigation of unavoidable adverse water quality and aquatic habitat impacts?	Mostly addressed	M.C. Sec 8-7.5 (i), (ii), and (iii)	If the proposed activity involves a channel modification, (i) it shall be demonstrated that there are no practicable alternatives to the activity which would accomplish its purpose with less impact to the natural conditions of the body of water affected; (ii) water quality, habitat, and other natural functions will be significantly improved; (iii) designed to minimize adverse impacts.	Consider updating to add an analysis component of different alternatives and an analysis of the impacts of the proposed project, considering cumulative effects on the physical and biological conditions of the body of water affected.	NIPC Model Floodplain Ordinance, Sections 801.1.q and 802.1.i.
4			No	Subdivision T-4.2 G	Existing stream and channels may be realigned and improved subject to approval of the city engineer. New open channels may be provided.	Update to complement the criteria used on M.C. Sec 8-7.5.	NIPC Model Floodplain Ordinance, Sections 801.1.q and 802.1.i.
5	Floodway restrictions—erosion	Require effective soil erosion and sediment control measures for ALL disturbances in the floodway?	Yes	M.C. Sec 8-7.5 (k)	For all activities in the floodway, including grading, filling, and excavation, in which there is potential for erosion of exposed soil, soil erosion, and sedimentation control measures shall be employed consistent with a number of criteria.		

The community’s ordinance was evaluated using a checklist developed from a number of best practices, see Appendix B. The areas where the existing City or County ordinance currently meets best practices are highlighted in green.

Table 4. Stream and wetland protection

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Purpose	Include a comprehensive purpose statement that addresses the protection of hydrologic and hydraulic, water quality, habitat, aesthetic, and social and economic values and functions of wetlands?	Mostly addressed	County Stormwater I.B.7	Protect the hydrologic, hydraulic, water quality, and other beneficial functions of streams, lakes, wetlands, floodplains, and flood prone areas.	Consider updating to include the ten objectives in the NIPC Model Stream and Wetland Protection Ordinance, Section 3.00.	NIPC Model Stream and Wetland Protection Ordinance, Section 3.00.
2	Protection	Protect the beneficial functions of streams, lakes, and wetlands from damaging modifications, including filling, draining, excavating, damming, impoundment, and vegetation removal?	Mostly addressed	County Stormwater V.H	Outlines a number of provisions in order to protect the wetland, lake, and stream resources. Activities are subject to mitigation requirements.	Establish a minimum setback of development activity from streams, lakes, ponds, and wetlands, see recommendation 5 below. Development activities will only be approved based upon a report, prepared by a qualified professional, which demonstrates that they will not adversely affect water quality; destroy, damage, or disrupt significant habitat area, adversely affect drainage and/or stormwater retention capabilities; adversely affect flood conveyance and storage; lead to unstable earth conditions, etc.	NIPC Model Stream and Wetland Protection Ordinance, Sections 6.03, with the definition of development outlined in Section 4.00.h.
3	Modification	Prohibit the modification of high quality, irreplaceable wetlands, lakes, and stream corridors?	Yes	County Stormwater V.H	Modification is prohibited unless no feasible alternatives exist and all applicable regulatory approvals or clearances are granted.		
4	Wetland modification—stormwater	Discourage the modification of wetlands for stormwater management purposes unless the wetland is severely degraded and nonpoint source BMPs are implemented on the adjacent development?	Mostly addressed	County Stormwater V.F.5	Drainage into wetlands may be allowed, but only under certain circumstances which vary based on the type of wetlands.	Consider updating to state that modification of degraded wetlands for purposes of stormwater management is permitted where the quality of the wetland is improved (e.g. via removal of invasive plant species) and total wetland acreage is preserved.	NIPC Model Stream and Wetland Protection Ordinance, Section 6.03.
5	Waterbody setback	Designate a minimum 75- to 100-foot setback zone from the edge of identified wetlands and water bodies in which development is limited to the following types of activities—minor improvements like walkways and signs, maintenance of highways and utilities, and park and recreational area development?	No	County Stormwater V.H	N/A	Update to state absolutely no development activity (except as provided) may occur within the minimum setback that is defined as 75- to 100-feet from the ordinary high water mark of streams, lakes, and ponds, or the edge of wetlands, or within a designated depressional area.	NIPC Model Stream and Wetland Protection Ordinance, Section 6.03.
6	Waterbody buffer	Establish a minimum 30-foot wide protected native vegetation buffer strip along the edge of identified wetlands and water bodies?	Mostly addressed	County Stormwater V.C.1, 2, and 5	Linear buffers along channels and waterbody buffers vary between 30-100 feet based on size and quality and shall be vegetated to 100 percent cover. Existing communities of desirable, native plant species shall be protected from any development impacts.	Consider updating buffer requirements so that a natural vegetation strip shall extend landward a minimum of 30 feet from the ordinary highwater mark of a perennial or intermittent stream, lake, or pond and the edge of a wetland regardless of size or quality.	NIPC Model Stream and Wetland Protection Ordinance, Section 6.08; U.S. EPA Aquatic Buffer Model Ordinance.
7	Relocation	Prohibit watercourse relocation or modification except to remedy existing erosion problems, restore natural habitat conditions, or to accommodate necessary utility crossings; and require mitigation of unavoidable adverse water quality and aquatic habitat impacts?	Mostly addressed	County Stormwater V.D	If the proposed activity involves a channel modification, it shall be demonstrated that water quality, habitat, and other natural functions would be improved by the modification and no significant habitat area may be destroyed, or the impacts are offset by the replacement of an equivalent degree of natural resource values.	Consider requiring that allowed modifications follow a relocation plan that must address specific environmental criteria, including, but not limited to the creation of a natural meander pattern, pools, riffles, and substrate; formation of gentle side slopes; utilization of natural materials wherever possible; planting of vegetation normally associated with streams, etc.	NIPC Model Stream and Wetland Protection Ordinance, Sections 7.00, 7.01, and 7.02.
8	Restoration	Encourage the restoration of stream and wetland habitat, hydrology, and morphology on development sites that contain degraded aquatic systems? (This could be accomplished through a streamlined permitting process and/or other development incentives.)	No	County Stormwater V	N/A	Update to encourage restoration of stream and wetland habitat, hydrology, and morphology on development sites that contain degraded aquatic systems. Consider combining this with a streamlined permitting process or other development incentive, as well as encouraging it through conservation development provisions.	Minimum performance standards for restoration, planting, maintenance, and monitoring of natural open space and naturalized stormwater facilities are included in Stewardship Plan section (A1118) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.

The community’s ordinance was evaluated using a checklist developed from a number of best practices, see Appendix B. The areas where the existing City or County ordinance currently meets best practices are highlighted in green.



Table 5. Natural areas and open space

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Natural areas protection	Protect remnant natural areas, including steep slopes, prairies, woodlands, and savannas (in addition to regulated wetlands and floodplains)?	Mostly addressed	Subdivision 5.2	Preservation of Natural Features: Every subdivision shall be designed to preserve to the fullest extent possible all natural features of the land, such as natural ridges, large trees, and watercourses, which add to the attractiveness and environmental value of the land and the proposed subdivision.	Expand definition of natural features to include woods and savannas, wetland buffers, prairies and grasslands, slopes greater than 12 percent, in addition to inherently unbuildable areas like wetlands and floodplains.	Applicability section (A1102) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures; Village of Algonquin Conservation Design Standards and Procedures (Zoning Sec. 21.11 J); City of Crystal Lake Conservation Developments (UDO Article 5 Section 5-300).
2			No	Zoning XI and Subdivision 5	One of the purposes of the Integrated Design District is to protect and enhance the City's natural and man-made resources such as streams and watercourses, wetlands, native vegetation, groundwater recharge areas, mature tree stands, view sheds, historical character, and the like.	Update the Integrated Design District to be a conservation design overlay for areas that contain and/or abut sensitive natural resource areas, and is also mandatory due to automatic and cumulative triggers based on the presence of specific features present on the site. Automatic and cumulative triggers could include woods and savannas, wetland buffers, prairies and grasslands, and slopes greater than 12 percent, in addition to inherently unbuildable areas like wetlands and floodplains.	
3	Open space—amount	Set aside onsite open space for residential development, generally conforming to the following guidelines: estate residential: 60 percent; moderate residential: 45 percent; urban residential: 30 percent?	No	Subdivision 8.5 A and E	Required land donation of 1.5 acres of parkland for 100 ultimate population. Stormwater detention or retention areas shall not qualify as land suitable for donation for park and recreation purposes, except as may be approved by the City after the suitability of such land for park and recreation purposes as a secondary use is clearly demonstrated.	Consider updating to state that the open space could serve multiple purposes, including stormwater management, natural areas, and recreation.	
4			No	Zoning XI and Subdivision 5	The Integrated Design District does not specify an amount of open space to be set aside.	Require specific amounts of open space depending on the underlying zoning. Using a Conservation Design Overlay district, consider requiring at least 40 percent of the site set aside as open space. Common open space is preferable, but deed-restricted open space also is acceptable.	Bulk requirements section (A1112) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
5	Restoration	Encourage the restoration of protected natural areas to reduce invasive species and enhance biodiversity?	No	Zoning XI and Subdivision 5	One of the purposes of the Integrated Design District is to protect and enhance the City's natural resources, but restoration is not specifically named.	Using a Conservation Design Overlay district, require that development shall preserve, restore, and/or create environmentally sensitive areas and shall include plans and the means to restore, manage, and maintain such areas. Degraded remnant natural areas shall be restored to a natural state.	Stewardship plan section (A1118) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
6	Open space—ownership	Require the identification of an open space ownership entity, with a preference for a qualified public or private land conservation organization?	No	Zoning XI and Subdivision 5	For Integrated Design Districts, long-term maintenance and funding of open space and natural area easements are required criteria in the application review process, but the ownership of the space is not specifically addressed.	For standard subdivisions and Conservation Design developments, require identification of the ultimate owner of the dedicated open space, as well as the entity responsible for maintaining it. Ownership options for common open space includes qualified public or private land conservation organizations with experience in managing natural areas.	Open space ownership and funding section (A1117) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
7	Open space—easement	Require the dedication of natural open space via a binding conservation easement or similar binding legal instrument that ensures protection in perpetuity?	Mostly addressed	Zoning XI D-2(4)	For Integrated Design Districts, long-term maintenance and funding of open space and natural area easements are required criteria in the application review process	Using a Conservation Design Overlay district, require dedicated open space shall be protected in perpetuity by a binding conservation easement or similar legal instrument.	Open space ownership and funding section (A1117) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
8	Open space—management	Require secure and permanent funding arrangements for the long-term management and maintenance of open space, natural areas, and stormwater facilities once responsibilities are turned over to a conservation entity or the homeowners/property owners association?	No	Subdivision 5	N/A	For standard subdivisions and Conservation Design developments, outline specific options for secure and permanent funding arrangements for the long-term management and maintenance of open space, natural areas, and stormwater facilities once responsibilities are turned over to a homeowners/property owners association.	Open space ownership and funding section (A1117) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
9			Mostly addressed	Zoning XI D-2(4)	For Integrated Design Districts, long-term maintenance and funding of open space and natural area easements are required criteria in the application review process, but specific options are not outlined.		
10	Open space—funding	Encourage the establishment of a back-up SSA in order to provide funds necessary to support the maintenance of open space and stormwater management areas (in the event that the responsible land owner/manager does not meet the required maintenance standards)?	Mostly addressed	Zoning XI and Subdivision 5	For Integrated Design Districts, long-term maintenance and funding of open space and natural area easements are required criteria in the application review process.	Using a Conservation Design Overlay district, identify a back-up special service area as one of the potential funding options for open space management.	Open space ownership and funding section (A1117) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
11	Open space—management plans	Require or encourage long-term management/stewardship plans for all common open space areas, natural areas, and stormwater facilities?	No	Zoning XI B8 and Subdivision 5	For Integrated Design Districts, stewardship plans are not specifically required.	For standard subdivisions and Conservation Design developments, require a stewardship plan be submitted to identify the means to properly maintain and manage dedicated open space in perpetuity.	Stewardship plan section (A1118) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
12	Open space—performance criteria	Establish measurable performance criteria for managed natural areas, including ground coverage, species diversity, and control of invasive species?	No	Zoning XI and Subdivision 5	For Integrated Design Districts, performance criteria are not outlined.	Using a Conservation Design Overlay district, require that the stewardship plan include performance standards for all natural open space areas and naturalized stormwater management facilities and buffers. The performance standards shall identify proposed methods for establishing the areas and shall require monitoring and maintenance for at least three full growing seasons following initial enhancement, restoration, and planting. Long-term monitoring after initial restoration has been completed should also be required.	Minimum performance standards for restoration, planting, maintenance, and monitoring of natural open space and naturalized stormwater facilities are included in the Stewardship Plan section (A1118) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.

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Table 6. Conservation design and infill

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Natural Resource inventory	Require a site analysis map that includes a natural resources inventory at the Concept Plan stage or prior to the Preliminary Plan stage?	No	Subdivision 3.1 c and d	A soils map and analysis report, prepared by the McHenry County Soil and Water Conservation District, and documented inspection by a qualified professional to determine whether or not a wetland or special flood hazard area is present, is required for the proposed development.	Prior to submitting an application for a Plat of Subdivision or site plan review, the applicant must present an existing resources and site analysis plan that provides the natural resource information for the entire site as well as the property within 200 feet of the development site—topography, waterbodies, wetlands, floodplain/ floodway, depressional storage areas, existing drainage patterns, divides, and flow paths, high-priority groundwater recharge areas (Class III Special Resources Groundwater areas), designated natural areas, threatened and endangered species, woodlands, savannas, prairies, tree inventory, soils, farmland, etc.	Site analysis (A1104.1) requirements of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
2			No	Zoning XI D	Integrated Design Districts are not required to conduct a site analysis beyond what is required in Subdivision 3.1 c and d.		
3	Site Design	Require that the proposed development be designed to preserve natural drainage patterns, use and preserve native vegetation, stabilize soils during construction, and protect, enhance, and maintain natural resources (such as remnant woodlands, prairies, and steep slopes)?	Mostly addressed	Subdivision 5.2	Every subdivision shall be designed to preserve to the fullest extent possible all natural features of the land, such as natural ridges, large trees, and watercourses, which add to the attractiveness and environmental value of the land and the proposed subdivision.	Establish an open space protection hierarchy to guide the decision-making process of which natural resource areas are the priority areas to preserve. For Conservation Design Districts, areas to be preserved shall be identified on a site-specific basis in an effort to conserve and provide the best opportunities to restore and enlarge the best quality natural features of each particular site.	Site analysis (A1104.1), general standards for design (A1108), and open space (A1114) requirements of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures; Village of Algonquin Conservation Design Standards and Procedures (Zoning Sec. 21.11 J); City of Crystal Lake Conservation Developments (UDO Article 5 Section 5-300 E2).
4			Mostly addressed	Zoning XI A	In the Integrated Design District, a development must incorporate innovative design techniques that protect and enhance the City’s natural and main-made resources such as streams and watercourses, wetlands, native vegetation, groundwater recharge areas, mature tree stands, and view sheds.		
5			Mostly addressed	Zoning IV B	RS-3 Medium-High-Density Single-Family Residential District encourages innovative designs, maintenance of natural features and topography, preservation of open space, and provision of amenities to serve residents.	Consider updating purpose of all districts to include the goals outlined for the RS-3 district.	
6	Clearing and Grading	Restrict to on-site clearing and grading locations and extent?	No	Subdivision 5.2	N/A	On-site clearing and grading shall be restricted to avoid environmentally sensitive area and mass grading should be avoided wherever possible.	Campton Hills Zoning Code Analysis and Ordinance Language Recommendations.
7	Clustering	Encourage or require clustering of residential lots around sensitive natural areas, thereby creating a protected common open space area?	No	Zoning XI C	The Integrated Design District allows varied lot layouts, including cluster housing design, with side and rear loaded garages. This is not tied to the natural resources of the site.	Using a Conservation Design overlay district, require a site capacity analysis to first establish the buildable acreage. The resulting acreage shall then be multiplied by the maximum allowable dwelling units per acre for the underlying zoning district. Lots, buildings or building sites should be clustered where possible. Such clusters shall be located so as to minimize the negative impacts on the natural, visual, and cultural resources of the site and between incompatible uses and activities.	Site capacity (A1105) and conservation design development standards (A1108.1) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
9	Density bonus	Provide density bonuses for conservation developments that exceed minimum standards (such as additional open space, providing for regional trails and greenways, or incorporating environmentally sensitive design features beyond what is required by the Ordinance)?	No	Zoning XI	The Integrated Design District does not specify development density, so cannot provide density bonuses.	Update the Integrated Design District to allow an increase in density if it is demonstrated that the proposed conservation design plan offers a superior layout and quality of design which incorporates environmentally sensitive design features that substantially exceed the minimum requirements of the ordinance. The maximum increase in density shall be limited to 20 percent of the permitted density.	Density bonuses for open space and innovative design section (A1106) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
10	Conservation design—by right	Allow conservation design as a “by-right” form of development?	No	Zoning XI B (4)	To use the integrated design district, applicants are required to obtain a conditional use permit.	Update the Integrated Design District so that it is allowed by right, not via a conditional use permit.	Applicability section (A1102) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures; Village of Plainfield Conservation District (Zoning 9-52).
11	Conservation design—zoning map	Does the zoning map indicate areas where conservation development is required?	No		N/A	After updating the Integrated Design overlay district, establish areas where the standards apply on the zoning map. These areas should correspond with known green infrastructure resources, such as streams, wetlands, floodplains, groundwater recharge areas, mature tree stands, prairies, savannahs, and steep slopes.	Applicability section (A1102) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
12	Mixed use	Is there a downtown overlay district or another mechanism to encourage mixed-use development in neighborhood centers?	Yes	Zoning VI F	Downtown Overlay District calling for compact, pedestrian, transit-oriented mixed-use development.		
13	Impact fees	Are there reduced impact fees or other incentives to encourage infill development?	No	M.C. Chapter 7-3	Impact fees are set regardless of location within the community.	Consider tailoring fees based on the location to encourage redevelopment of previously developed land that is already connected to City infrastructure.	

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Table 7. Landscaping

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Native landscaping	Include “noxious weed” provisions that might intentionally, or unintentionally, preclude natural landscaping because of vegetation height standards or similar restrictive provisions?	Yes	M.C. Sec 24-27	It shall be unlawful for the owner or occupant of any premises to permit the growth thereon of any weeds, unhealthful or noxious plants or grass in excess of eight inches in height, or upon the parkway area.	Create an exception from this provision for areas preserved within an open space easement or plat-designated natural area; native plant growth, which should consist of grasses, wildflowers, shrubs, and trees that are native to the greater Chicago region.	Plants of the Chicago Region (Swink and Wilhelm, 1994) and Green Landscaping: Greenacres, A source book on Natural Landscaping for Public Officials.
2	Native landscaping	Encourage/require the use of native plant materials for the default landscaping of common areas, stormwater facilities, common open space areas, and the buffers of streams, lakes, wetlands, and other natural areas?	No	Zoning VIII B4c	Detention areas should be designed to appear as natural as possible. Landscaping shall be required around the perimeter of all retention and detention basins, which shall consist of trees, shrubs, and emergent plantings in a quantity, species, and arrangement that will create an aesthetically pleasing and ecologically functional environment. Such landscaping shall be in conformance with Best Management Practices as determined by the City.	Encourage or require the use of native plant materials as the default landscaping of stormwater facilities and for the buffers of streams, lakes, wetlands, and other natural areas and encourage integrating native plant materials in common areas. For standard subdivisions, the City could set a minimum percent coverage using native vegetation.	Natural landscaping standards section (A1110) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Procedures.
3			Mostly add	Zoning XI C	For Integrated Design Districts, one of the recognized design techniques is landscaping for environmental corridors, dominant with natural prairie plantings.	Encourage the use of native plant materials for landscaping throughout and along the perimeter of the development site in addition to requiring native plant materials for those areas containing bio-swales, detention basins, common areas, buffers of streams, lakes, wetlands, and other water bodies.	
4			No	Zoning VI C3 (b)	Business Park development standards state that landscaping as a design element shall play the key role in creating and conveying the park-like working environment.	Consider encouraging the use of native plant materials as the default landscaping of business parks.	
5			No	Zoning VII Table 16	Provides a planting list of recommended, approved, and undesirable species.	Consider adopting a native landscaping section to specifically identify native plants.	
6	Native landscaping—management	Require provisions for long-term oversight, management, funding, and performance criteria for common areas and natural landscapes (as referenced above in greater detail)?	Yes	Zoning VIII G	Applicant shall be responsible for the maintenance, repair, and replacement of all landscaping and screening so as to preserve at least the same quantity and quality as the remainder of the existing material onsite. The developer shall provide to the City a two-year guarantee on all landscape materials in the form of a letter of credit.		
7	Street trees	Require planting street trees? If yes, how many trees?	Mostly addressed	Subdivision 6.12; Subdivision T-1.1 I1	Trees shall be planted in the right-of-way along both sides of all streets in and adjacent to all subdivisions and shall be spaced at approximate 40-foot intervals.	Consider relocating this provision to the zoning ordinance so that it applies to all new development, instead of only subdivisions, in order to help establish street trees in already developed areas.	Park Forest Sustainability Audit of Zoning and Subdivision Codes.
8	Tree protection ordinance	Require protection of native/desirable trees (i.e., a tree protection ordinance)?	Yes	M.C. Sec 24-42	No live tree measuring 6 inches in diameter at breast height (DBH) or greater, shall be removed from properties outline in Sec 24-41. Applies to subdivisions for three or more lots; single family lots larger than two acres; all other lots larger than one acre.	Update tree protection ordinance to identify and distinguish native and desirable tree species from undesirable tree species.	Tree protection standards section (A1119.2 C) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Practices; City of Elgin Tree Protection Ordinance (Zoning 19.16).
9	Tree replacement	Require replacement of any trees that are unavoidably impacted by construction activities?	Yes	M.C. Sec 24-47	Identifies tree protection techniques required during construction, which are focused on keeping construction activities and materials outside of a tree's drip line.	Consider updating to prevent construction activities and materials from occurring within the Critical Root Zone (CRZ), instead of the tree's drip line. The CRZ protects more of the tree's roots than using a drip line measurement. Also include consideration of trees that are outside of the property line but may have their CRZ extending into the subject site.	Tree protection standards section (A1119.2 C) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Practices.
10			Yes	M.C. Sec 24-48	Establishes a tree replacement schedule that requires all replacement trees to have a minimum caliper of two inches measured at six inches above the base of the tree. For the largest caliper trees, three replacement trees are required.	Consider updating to focus replacement of native and desirable trees and require higher replacement ratios so that the lost tree is replaced with a number of trees with a combined total caliper inches that is equal to or greater than the total DBH inches removed.	
11			Yes	Zoning VIII G	If a mature tree is lost, a replacement tree is required of at least 1/4" per 1" of caliper lost, but shall not be less than a 4" minimum.	Update to use DBH for the lost tree instead of caliper.	
12	Tree replacement—funding	Require payment into a tree replacement fund or “mitigation bank” when removed trees cannot be replaced/mitigated on site?	Yes	M.C. Sec 24-48	Fees for each tree not planted should be paid to the City and utilized for tree planting or tree preservation programs operated by the City.		

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Table 8. Transportation

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Street network—location	Require the street network to minimize encroachment in sensitive natural resources and take advantage of open space vistas, while providing an interconnection of internal streets and street connections to adjoining land parcels to create opportunities for future connectivity?	No	Subdivision 5.3	Streets shall be considered in their relation to existing and planned streets, to topographic conditions, to public convenience and safety, and their appropriate relation to proposed uses of the land to be served.	To the greatest extent possible, new roadways shall respect natural contours and ridgelines to minimize grading. The street layout should minimize encroachment onto sensitive natural resources such as wetlands, designated natural areas, woodlands, significant tree stands, and wildlife habitats and should be designed to take advantage of open space vistas.	Blackberry Creek Zoning Code Analysis and Ordinance Language Recommendations.
2	Street network—stream crossings	Limit stream crossings by the street network?	No	Subdivision 5.3	N/A	Stream crossings shall be limited to the minimum necessary to provide safe circulation and ensure two ingress/egress locations. Stream crossings shall be located to minimize stream disturbance. Bridges or culverts of sufficient size shall be used for all perennial stream crossings to preserve stream channel width and natural stream substrates.	Campton Hills Zoning Code Analysis and Ordinance Language Recommendations.
3	Street connectivity—external	Require connections to surrounding areas?	Mostly addressed	Subdivision 5.3 A.1; Subdivision 5.3 A6	Provide for the continuation of existing, planned, or platted streets in surrounding area or conform to a plan for the adjacent area.	New streets shall connect to existing or potential streets in the surrounding area unless connections cannot be made because of physical obstacles. Consider adding a connectivity measurement to ensure future connections at regular intervals that promote walkability. For example, the standard of one through-street intersecting or terminating at the project boundary at least every 800 feet could be established, with exceptions for natural resources, open spaces, existing buildings, and other physical obstructions.	LEED for Neighborhood Development Walkable Streets Prerequisite.
4	Street connectivity—internal	Require subdivisions to achieve a certain score on an index for internal street connectivity?	No	Subdivision 5.4 A	Block length in residential areas shall not exceed 1,500 feet.	Consider establishing a maximum block length of 800 feet and a preferred length of 300 feet to 600 feet for residential subdivisions.	Park Forest Sustainability Audit of Zoning and Subdivision Codes.
5	Street—widths	Encourage narrower street widths to reduce the amount of impervious surface?	No	Subdivision Table 6-1	Local streets are 60' ROW, 28' roadway width.	Design residential streets for the minimum required pavement width needed to support travel lanes, on-street parking, and emergency access. These widths should be based on desired traffic speeds and should respond to the surrounding development context.	Model language in Conservation Design Resource Manual, NIPC and Chicago Wilderness; Center for Watershed Protection Better Site Design; ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach; CNU Emergency Response & Street Design; Village of Plainfield Traditional Neighborhood District (Zoning Sec. 9-54); City of Crystal Lake Street Standards for Conservation Design (UDO Article 4 Section 4-100 E).
6	Street—frontage roads	Discourage frontage roads?	No	Subdivision 5.3	Where a parcel abuts or contains an existing arterial or collector street, the City may require frontage roads, double frontage lots with screen planting contained in a non-access reservation not less than 10 feet wide along the rear property line, or such other treatment as may be necessary for adequate protection of residential properties and to separate through and local traffic.	Consider removing the option of requiring frontage roads as they create additional impervious surfaces. Identify additional options to provide access to sites along arterial roads without having to build an additional street. Multi-way boulevards, with integrated sustainable stormwater measures, could be an option.	ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach.
7	Street—length	Encourage reduced or flexible lot widths to reduce imperviousness and street length?	No	Zoning IV Table 4	Minimum lot area, lot width, required front yard depth specified for residential districts.	Reduce lot widths to limit the length of the street per residential unit in appropriate contexts.	Center for Watershed Protection Better Site Design; Village of Plainfield Traditional Neighborhood District (Zoning Sec. 9-54).
8	Cul-de-sacs	Discourage cul-de-sacs and promote smaller scale design?	No	Subdivision 6.5 D, Subdivision Table T-1.2	Allowed where it is determined that a through street is not practicable. Must have a concentric teardrop shape with a minimum ROW of 140 feet in diameter, pavement diameter of 90 feet.	Cul-de-sac streets shall be limited to a maximum of 15 percent of total road footage in a residential development, maximum of 10 percent in a non-residential or mixed-use development with exemptions for natural resource protection or other barriers. Reduce the impervious cover by reducing the radius of the turnaround bulb, minimum radius allowed of less than 35 feet, maximum of 45 feet. Allow landscaped island in center of cul-de-sac to store and treat stormwater runoff.	Center for Watershed Protection Better Site Design.
9	Curb and gutter requirements	Encourage/require the use of natural drainage practices?	No	Subdivision 6.5 F; Subdivision T1.1 D1	PCC curbs and gutters shall be provided on all new streets, and on existing streets within or adjacent to the subdivision in accordance with the City Technical Specifications Manual.	Curb and gutter street drainage systems are not required except where the average distances between driveways is less than 100 feet and there are on-street parking needs. Where curb and gutter is required, flat or "ribbon" curbs or curb cuts may be used to allow use of naturalized drainage systems and streetside bioswales.	Campton Hills Zoning Code Analysis and Ordinance Language Recommendations.
10	Paving materials—streets	Promote use of pervious materials for streets?	No	Subdivision T-5.2 A (iv) and Subdivision T-5.3 A (iii)	Allows brick pavers for driveways, but not specifically recognized as a pervious material.	Update to encourage permeable pavement (interlocking concrete pavers, porous concrete, or porous asphalt) except for vehicle service stations, gas stations, and other areas used for transfer or storage of hazardous materials	Center for Watershed Protection Better Site Design; Campton Hills Zoning Code Analysis and Ordinance Language Recommendations.
11			No	Subdivision T-1.1 A 2 and 3, B	Identifies street design references, pavement design, and pavement construction standards.		
12	Sidewalks	Promote connected sidewalks in new developments and use of pervious materials?	Mostly addressed	Subdivision 6.6; Subdivision T-1.1 F1; Subdivision T-1.1 F2a	Sidewalks shall be provided on both sides of all streets within all new subdivisions or developments; shall be four feet in width for residential areas and five feet in width for all other areas. Sidewalks shall conform to the requirements of Article 624, Portland Cement Concrete Sidewalk, Standard Specifications for Road and Bridge Construction, Illinois Department of Transportation, latest edition and the City's development standards.	Consider allowing wider sidewalks in areas where pedestrian traffic warrants, such as on retail or mixed-use blocks. Encourage permeable pavement (interlocking concrete pavers, porous concrete, or porous asphalt), while also maintaining other design considerations like the Americans with Disabilities Act.	Blackberry Creek Zoning Code Analysis and Ordinance Language Recommendations; LEED for Neighborhood Development Walkable Streets Prerequisite.

The community’s ordinance was evaluated using a checklist developed from a number of best practices, see Appendix B. The areas where the existing City or County ordinance currently meets best practices are highlighted in green.

Table 9. Parking

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Purpose	Does the purpose include a statement about tailoring parking requirements to meet average day-to-day demand as opposed to peak demand?	No	Zoning VII A1	To provide access to land uses generating large traffic volumes in a community dependent on automobile and truck transportation; foster safe and efficient circulation of vehicles and pedestrians both on private property and on adjacent public streets; minimize nuisance in residential areas from on-street parking of large numbers of vehicles.	Establish off-street vehicle and bicycle parking requirements that balance the City's goal to encourage walking, bicycling, and transit use with the goal to provide adequate off-street parking to meet the needs of shoppers, visitors, and residents and reduce on-street parking demand on nearby residential streets. Parking requirements are designed to accommodate average day-to-day demand, as opposed to peak demand, in order to reduce excessive off-street parking and free up land for other uses.	
2	Applicability	Apply off-street parking requirements only to parcels of a certain size or greater?	No	Zoning VII A2	Applies to any existing or new development.	Create an exemption for small non-residential lots regardless of use.	Village of Riverside: no off-street parking spaces required for non-residential uses under 3,000 sq. ft GFA. City of Evanston: no off-street parking spaces required for buildings between 2,000 to 3,000 sq. ft. GFA in specific districts.
3	Requirements	Establish parking requirements as a maximum or a minimum?	Minimum	Zoning VII A3 Tables 12 and 13	Sets minimums except for a maximum of four spaces per dwelling unit.	In addition to the minimum requirements, establish a maximum threshold (for example, 10 percent over the requirement) to prevent projects from including too much off-street parking. Require that all parking provided in excess of the maximum shall be designed and maintained as permeable paving.	Center for Watershed Protection Better Site Design; Campton Hills Zoning Code Analysis and Ordinance Language Recommendations.
4	Parking ratio—office	Require a parking ratio for a professional office building that is three spaces or less, per 1,000 square feet?	No	Zoning VII A3 Table 13	Office buildings are required to have a minimum of 3.5 spaces per employee. Standard is not based on square footage.	Use a standard based on 1,000 sq. ft. of Gross Floor Area (GFA) instead of per employee and recalibrate based on surveyed usage. Consider model standards that require a minimum of two to three spaces per 1,000 feet of GFA. Could be tied to providing or supporting alternatives to driving. For example, bicycle parking or carpool programs.	NW Connecticut Model Zoning Regulations for Parking; State of Oregon's Model Development Code and User's Guide for Small Cities.
5	Parking ratio—retail	Require a parking ratio for retail that is three spaces or less, per 1,000 square feet?	No	Zoning VII A3 Table 13	Shopping center, four to five spaces per 1,000 sq. ft. depending on size, Supermarket, five spaces per 1,000 sq. ft., other retail, 4.5 spaces per 1,000 sq. ft., Bowling Alley, seven spaces per lane.	Recalibrate based on surveyed usage and consider model standards that require a minimum of two spaces per 1,000 sq. ft. of GFA for Big Box or Large Scale Retail, one space per 1,000 sq. ft. of GFA for Free Standing Retail, and three spaces per 1,000 sq. ft. of GFA for small shopping centers.	
6	Parking ratio—residential	Require a parking ratio for a single family home that is two spaces or less?	No	Zoning VII A3 Table 12	Less than two spaces required for efficiency and one-bedrooms. 2.33 for all other units. A maximum of four spaces shall be provided per dwelling unit.	One space per studio and one-bedroom units, 1.5 spaces per two-bedroom units, and two spaces per three-bedroom or larger units. Maintain maximum.	
7	Requirements—flexibility	Provide flexibility regarding alternative, reduced parking requirements, and discourage over-parking of developments?	No	Zoning VII A3	N/A	The total number of parking spaces can be reduced to 50 percent of the required if alternative approaches are demonstrated to result in a reduced automobile travel. For example, an office development could use transit programs, vehicle sharing, and bicycle programs to reduce the need for employee parking.	Campton Hills Zoning Code Analysis and Ordinance Language Recommendations.
8		Allow a reduction in the number of current parking spaces?	No	Zoning VII A3; Zoning VII A5	No off-street parking spaces provided in conformity shall be reduced in size or number so long as the use they serve continues in operation.	Provide flexibility to reduce parking spaces if it can be demonstrated that the original provision of parking was in excess of the day-to-day demand for parking.	
9	Off-site parking	Provide flexibility regarding alternative, reduced parking requirements (e.g., shared parking, off-site parking), and discourage over-parking of developments?	No	Zoning VI C3 (a)	Business Park Development standards state that no parking shall be permitted on any street or at any other place other than on paved parking spaces to be constructed on each lot.	Separate from, or in conjunction with Shared Parking provisions, an applicant may use off-site parking to satisfy their parking requirements. Off-site parking shall be within 300 to 1,000 feet of the property for which it is being requested. Off-site parking spaces provided by a separate private property owner shall be subject to a legally binding agreement that will be presented during the Site Plan Review process or as a condition of approval.	NW Connecticut Model Zoning Regulations for Parking.
10			No	Zoning VII B1	Off-street parking, unless otherwise stated, shall be for the uses on that same lot.		
11	Shared parking	Provide flexibility regarding alternative, reduced parking requirements (e.g., shared parking, off-site parking), and discourage over-parking of developments?	No	Zoning VII B2	Required parking spaces for different uses may be provided collectively, however no space shall serve as the required space for more than one use.	Allow two or more land uses to share 100 percent of off-street parking if there is not overlap in demand. Also allow sharing between uses that do have some parking demand overlap. For example, allow up to 30 percent of the parking spaces required for the predominant use on a site may be shared with other uses operating during the same time of day and days of the week.	NW Connecticut Model Zoning Regulations for Parking; City of Elgin Shared Off-Street Parking Facilities (Zoning 19.45.055); Village of Plainfield Shared parking (Zoning Sec. 9-74).
12	Requirements—location	Provide for uses in downtown areas by reducing or not requiring parking given the walkable, transit-served location?	Yes	Zoning VII A4	Exception for C-4 Downtown Commercial District, no off-street parking or loading shall be required for individual uses located in this district.		
13	Credits—on-street parking	Allow a reduction in off street parking requirements when nearby on street parking is available?	No	Zoning VII A3	N/A	Parking space credit will be given for on-street parking space located either directly adjacent to the property line or within a certain number of feet from the property on the same side of the street.	State of Oregon's Model Development Code and User's Guide for Small Cities.
14	Credits—bicycle parking	Allow a reduction in off street parking requirements when bicycle parking is provided?	No	Zoning VII B11	All uses providing over 25 spaces shall provide space and facilities for bicycle parking, except business park or industrial districts classifications.	Establish minimum required bicycle parking spaces for different uses using model standards. Consider allowing the amount of vehicle parking spaces to be reduced by one space for every eight bicycle parking spaces provided.	Campton Hills Zoning Code Analysis and Ordinance Language Recommendations.

The community’s ordinance was evaluated using a checklist developed from a number of best practices, see Appendix B. The areas where the existing City or County ordinance currently meets best practices are highlighted in green.

Table 9. Parking (continued)

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
15	Size—parking stall	Require parking stalls to be less than or equal to 9 ft. by 18 ft.?	No	Zoning VII A3 Table 10	No less than nine ft. by 18 ft.	Establish standard parking space size as follows: Regular, 90 degrees space: nine ft. by 18 ft.; On-street: eight ft. by 23 ft.; Compact space: 7.5 ft. by 15 ft.	Center for Watershed Protection Better Site Design, State of Oregon’s Model Development Code and User’s Guide for Small Cities.
16		Allow for reduction in parking stall size to account for vehicle overhang onto landscaped islands or perimeter landscaping?	No	Zoning VII B4	N/A	Up to two feet of the required vehicle parking space depth used for a vehicle overhang may be improved and maintained as a landscaped island or perimeter landscaping.	
17	Size—compact stalls	Specify that a percentage of all parking stalls can be dedicated for compact cars, with correspondingly smaller stall dimensions?	No	Zoning VII A3	N/A	Up to 50 percent of all required vehicle parking spaces, excluding accessible spaces, may be sized for compact cars.	
18	Size—parking aisles	Establish narrower aisle widths to minimize impervious surfaces?	Mostly addressed	Zoning VII A3 Table 10	Minimum aisle widths: 0 degree (parallel): 13 ft.; 30 degree: 12 ft.; 45 degree: 13 ft.; 60 degree: 18 ft.; 90 degree: 24 ft.	Encourage one-way aisles with angled parking to significantly reduce the overall size of the parking lots. Maximum aisle width: 0 degree (parallel): one-way: 12 ft.; two-way: 24 ft.; 30 degree: one-way: 12 ft.; two-way: 24 ft.; 45 degree: one-way: 12 ft.; two-way: 24 ft.; 60 degree: one-way: 18 ft.; two-way: 24 ft.; 90 degree: one-way: 24 ft.; two-way: 24 ft.	Blackberry Creek Zoning Code Analysis and Ordinance Language Recommendations.
19	Driveways	Encourage/require reduced driveway widths?	No	Subdivision T-5.2 B	Non-residential driveways shall not exceed 12 feet per lane of traffic, up to a max of 36 feet.	Consider ten foot lanes.	Center for Watershed Protection Better Site Design.
20		Encourage/require reduced driveway widths for single-family developments?	No	Subdivision T-5.3 D	Width of residential driveways shall be no less than nine feet nor more than 20 feet, unless serving three to four garage vehicle stalls.	Design residential driveways for the minimum required pavement to access a garage, nine feet or less for one lane or 18 feet for two lanes for multi-family developments. Set two lanes as the maximum width for a driveway.	
21		Encourage reduced front setbacks to limit the length (and amount of impervious surface) associated with a driveway?	No	Zoning IV Table 4	Minimum lot area, lot width, required front yard depth specified for residential districts.	Reduce front setbacks to limit the amount of impervious surface associated with a driveway.	
22	Driveways—shared	Encourage/require shared driveways?	No	Subdivision T-5.3 D	N/A	Shared or common drives shall be permitted and shall comply with the following standards, provided there is a recorded covenant applicable to the properties utilizing such drive which establishes standards for its maintenance and use. A common drive may serve multiple units and may be built to serve residential or non-residential uses. A common drive shall extend from a public or private street and may connect to other existing or planned public or private streets. A maintenance agreement running with the land for the shared driveway must be executed by all units served and recorded with the County Recorder’s office.	Street and trail standards section (A1108.1 H) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Practices; NIPC Conservation Design Resource Manual, Common Drives model ordinance.
23	Paving materials	Promote use of pervious materials for paved areas, including parking lots and driveways?	No	Zoning VII B4	All open off-street parking areas shall be surfaced with a blacktop, sealcoat, brick, or concrete all-weather pavement.	Encourage the use of pervious materials over conventional pavement for parking spaces, as well as parking aisles, provided that the grades, subsoils, drainage characteristics, and groundwater conditions are suitable. Encourage the use of "cool" pavement—with a solar reflectance index (SRI) of at least 29—to reduce the urban heat island effect.	Center for Watershed Protection Better Site Design; LEED for Neighborhood Development Heat Island Reduction Credit.
24	Landscaping—amount	Specify a minimum percentage of pervious landscaping for parking lots?	Mostly addressed	Zoning VIII B3	A eight by 15 foot landscape island is required for every 15 spaces.	Consider requiring a landscaped island for every ten spaces and adding a minimum amount (25-30 percent) of tree canopy coverage.	City of Crystal Lake: Site Landscaping (UDO Article 4 Section 4-400 F1 and F2).
25	Landscaping—design	Encourage/require the use of recessed landscape islands (vs. raised islands) to facilitate the infiltration and filtering of parking lot runoff?	No	Zoning VIII B3	Intent is to provide shade, reduce the effects of the urban heat island, and visually break up the expanse of asphalt.	Update purpose of landscaped islands to include minimizing impervious surface area and maximizing the opportunity to infiltrate and filter stormwater runoff from the lot. Encourage or require that parking lot runoff shall be routed to internal and/or peripheral swales and bio-swales.	City of Crystal Lake Standards for Parking Areas in Conservation Developments (UDO Article 4 Section 4-200 E5); Village of West Dundee Parking Lot Design and Maintenance Standards (Zoning 10-9-1-6 C).
26			No	Zoning VIII B6	For business parks and health care districts, all parking island strips and parking perimeters shall be separated on all sides from the parking surface by concrete curbing.	Update to allow a determination of whether curbing is necessary. If it is necessary, allow frequent curb cuts to allow stormwater runoff to enter swale and bio-swale structures.	Parking lot standards section (A1111.1) of the McHenry County Subdivision Ordinance on Conservation Design Standards and Practices.
27			No	Zoning VIII E	All parking island strips and parking screening strips shall be separated on all sides from the parking surface by curbing.		

The community’s ordinance was evaluated using a checklist developed from a number of best practices, see Appendix B. The areas where the existing City or County ordinance currently meets best practices are highlighted in green.



Table 10. Water efficiency and conservation

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Water conservation—indoor	Encourage plumbing fixtures and fittings and appliances in all new and remodeled construction to not exceed specific flow rates and must be a labeled Water Sense product if available?	No	M.C. Sec 7-41	Uses the Illinois State Plumbing Code.	Update to require new and remodeled construction to use the most current, water efficient plumbing fixtures, fittings, and appliances (i.e. WaterSense products). Tailor requirements for residential, commercial, industrial, and institutional uses.	CMAP Model Water Use Conservation Ordinance, 1.0, 2.0, 3.0, 8.0, 9.0, 10.0, 11.0, 12.0, and 13.0.
2	Water conservation—outdoor	Set guidelines for vegetation, such as limiting turf area and location and soil depth, and irrigation equipment, irrigation days and schedules, and irrigation permits?	No	Subdivision 6.12	Landscaping guidelines do not encourage minimizing the amount of turf area or encourage native or low water use plants. Topsoil in parkways shall be graded to meet the back of the curb height, the topsoil depth for the rest of the site is not specified.	Update to minimize the amount of turf area, require a minimum of six inches of topsoil depth for areas planted with turf grass, and encourage the use of native or low water use plants.	CMAP Model Water Use Conservation Ordinance, 4.0.
3			No	M.C. Sec. 26-7	The City is authorized to temporarily prohibit the use of water from the municipal water supply system for the purpose of sprinkling lawns.	Update to set requirements on landscape irrigation equipment, establish landscape irrigation days and schedules, establish irrigation permit system for new landscape watering, and prohibit watering of impervious surfaces. Tailor requirements for residential, commercial, industrial, and institutional uses.	Northwest Water Planning Alliance's Regional Water Conservation Lawn Watering Ordinance; CMAP Model Water Use Conservation Ordinance, 5.0., 6.0, 7.0, 14.0, 15.0, 16.0, 17.0, and 23.0.
4	Rainwater harvesting and water reuse	Establish a water reuse model ordinance to encourage preservation of groundwater supplies?	No	M.C. Sec. 26	N/A	Pending state legislation permitting the use of greywater harvesting for non-potable purposes, the City should prepare to allow rainwater harvesting for landscape irrigation for toilet flushing.	CMAP Model Water Use Conservation Ordinance, 18.0 and 19.0; McHenry County Water Reuse Model Ordinance.
5	Downspout—sanitary sewer connection	Restrict downspouts from being directly connected to a sanitary or storm sewers?	No	M.C. Sec. 26-109	Prohibits connection of roof downspouts, exterior foundation drains, areaway drains or other sources of surface runoff or groundwater to a building sewer or building drain that in turn is connected to a public sanitary sewer.	Allow downspouts to connect to storm sewers only in areas where soil conditions or other natural features make infiltration and or dispersal difficult.	City of Milwaukee Downspout Disconnection ordinance.
6	Water waste prevention	Prohibit water waste or inefficient use of water?	Mostly addressed	M.C. Sec. 26-5	Prohibits tampering with, altering, or injuring any part of the City waterworks or supply system.	Update to reduce the general misuse or inefficient use of potable water, which could include adding language prohibiting unauthorized use of hydrants.	CMAP Model Water Use Conservation Ordinance, 20.0.
7			Mostly addressed	M.C. 26-17	Outlines maintenance responsibilities of private service lines to the municipal water system.	Consider adding requirements for fixing leaks in private water lines within a specified number of days of notification by water utility or discovery of leak.	CMAP Model Water Use Conservation Ordinance, 21.0.
8			Yes	M.C. Sec. 26-20	Meters are required for occupancy. Where an unmetered water distribution system is acquired by the City and added to its sewer and water system, a water meter shall be installed by the owner of each unmetered premises.		CMAP Model Water Use Conservation Ordinance, 22.0.
9	Water pricing	Establish a conservation pricing structure or other economic incentive to promote water conservation?	Mostly addressed	M.C. Sec. 26-24	Bi-monthly user rates using a uniform rate structure after the first 4,000 gallons.	Consider implementing conservation pricing structures and economic incentives that encourage desirable water management practices. Conservation pricing structures include seasonal rates (higher per unit water rate during the peak usage summer months), uniform rates or increasing block rates in which the unit price of water increases as the quantity of water used increases.	CMAP Model Water Use Conservation Ordinance, 32.0.

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Table 11. Pollution prevention

	CATEGORY	CHECKLIST QUESTION	YES/NO	CODE SECTION	CURRENT STANDARD	RECOMMENDED STANDARD OR ACTION	REFERENCE
1	Groundwater protection	Regulate activities within groundwater protection areas?	No	M.C. Sec. 26	N/A	Minimize intensive development activities, minimize impervious surfaces and mass grading, and employ stormwater best management practices that promote infiltration and treatment where possible in sensitive groundwater aquifer recharge areas, including Class III Special Resource Groundwater areas.	City of St. Charles, IL Chapter 13: Groundwater Protection; City of Marengo, IL, M.C. Chapter 30: Groundwater protection; Fox River Grove, IL, M.C. Article IX, Section 23-200 Groundwater protection; McHenry County Groundwater Protection Action Plan; U.S. EPA Model Ground and Surface Protection Overlay District.
2	Phosphorus reduction	Discourage the use of phosphorus in manufactured fertilizers in order to reduce the amount of phosphorus that enters water resources?	No	M.C. Sec. 26	N/A	Prohibit commercial and non-commercial application to any turf area any fertilizer, liquid, or granula, which contains any amount of phosphorus or other compound containing phosphorus, such as phosphate, except naturally occurring phosphorus in unaltered natural or organic fertilizing products such as yard waste compost. Exceptions are made where soil tests show a need for phosphorus and for newly seeded or sodded lawns.	McHenry County Phosphorus Model Ordinance; Village of Long Grove (8-14-2).
3	Coal tar sealants	Discourage use of coal tar sealants to prevent loss of aquatic life?	No	Subdivision T1.1 B; Zoning VII B4	N/A	Prohibit the use, sale or retail display of sealcoat products for use on an asphalt or concrete surface, including driveways or parking areas, which contain high levels of carcinogens and are harmful to aquatic life.	McHenry County Coal Tar Sealants Model Ordinance.
4	Chloride management	Adopt storage and handling ordinances that ensure proper salt, storage, handling and transport?	No	M.C. Sec. 8-9.2	No developments in the Special Flood Hazard Area shall include locating or storing chemicals, explosives, buoyant materials, animal wastes, fertilizers, flammable liquids, pollutants, or other hazardous or toxic materials below the flood protection elevation unless such materials are stored in a specified way.	Expand the geography of this requirement to also include buffer areas to waterbodies and specifically address the storage and handling of salt.	
5	Pet waste disposal	Has a pet waste disposal ordinance?	Mostly addressed	M.C. Sec. 26-74.	It shall be unlawful for any person to place, deposit, or permit to be deposited in any unsanitary manner on public or private property within the City any human or animal excrement, garbage, or other objectionable waste.	Consider updating to explicitly state that pet owners should remove and properly dispose of any excreta deposited by her/his pet on public or private property. Proper disposal can be achieved either through the placement of waste in designated receptacles or containers that are regularly emptied by the municipality, or by flushing the waste.	State of New Jersey Pet Waste Model Ordinance.
6	Private sewage treatment and disposal ordinance	Adopted the McHenry County Private Sewage Treatment and Disposal Ordinance?	Yes	M.C. Sec 26 Division 2	A permit for a private sewage disposal system shall not become effective until the installation is completed in accordance with the ordinances and rules and regulations of the County of McHenry.		

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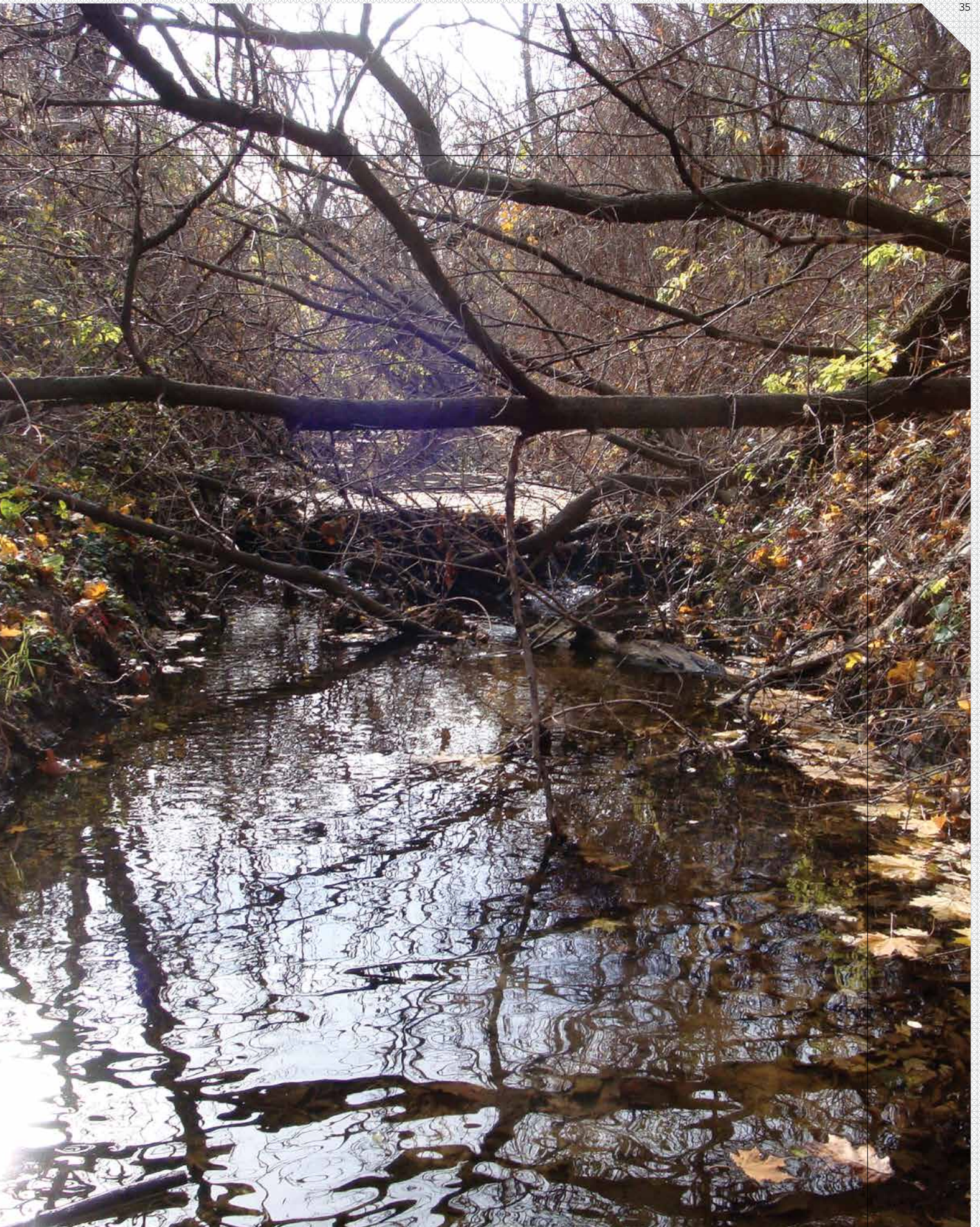






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## Implementation Steps

This report identifies a number of recommendations to help better align the City's Comprehensive Plan and development-related ordinances with watershed protection. Updating the City's Comprehensive Plan can set the stage for more specific ordinance changes in the future. While all of the recommendations within this report merit consideration, there are a number of key steps the City can prioritize to implement the recommendations in this report within the next year:

1. Incorporate the McHenry County Green Infrastructure Map into the City's Comprehensive Plan.
  2. Update the Integrated Design District or create a new Conservation Design Overlay District using McHenry County's Conservation Design ordinance as a model and zone areas of the City using the Green Infrastructure Map as a foundation.
  3. Advocate for amendments to the McHenry County Stormwater Management Ordinance and/or consider City amendments that encourage additional natural drainage practices, further improvements to soil erosion and sediment control, updated limits on floodplain activities, and additional measures to protect streams and wetlands.
  4. Adopt water efficiency and conservation measures to ensure that new development and significant redevelopment uses water efficient plumbing fixtures and appliances and advances landscape irrigation practices to minimize water loss.
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## Appendix A: Comprehensive Plan Checklist

	CHECKLIST QUESTION	YES/NO	NOTES	PAGE
<b>NATURAL AND WATER RESOURCES</b>				
1	Identify and map critical natural and water resource areas?	N	Future land use map has lakes, Fox River, and environmental corridors, which identifies areas to preserve yet does not distinguish between resources. No wetlands, floodplains, groundwater recharge areas are shown in any of the maps. Parks map is simply a map of municipal owned properties. Doesn't include other open spaces or natural areas.	32, 60
2	Contain a natural resource protection element with goals calling for preservation of identified critical natural resource areas?	Y	Goal to preserve, expand, and connect environmental corridors to protect wetlands, floodplains, and mature forests for the purpose of maintaining diversity of wildlife habitat and for environmental health, recreational, and aesthetic purposes. Objective to protect steep slopes and ridges -- development should fit into the natural landscape.	58
3	Contain a water quality protection element with goals calling for protection of identified water bodies and other water resource areas such as wetlands?	Y	Objective to preserve and enhance existing wetlands and floodplains to protect area watersheds and replenish groundwater supplies and create better access.	58
4	Identify key natural resource areas for protection in jurisdiction's parks and open space plan?	~	Parks and Open Space Plan: General Recommendation: Revise Subdivision Control and Development ordinance to reflect the type of land to be dedicated as part of the land donation component of the ordinance. 1) Park land counted should be dry developable property capable of supporting active recreational activities. 2) Park land should be consistent with natural resource management objectives and useable for passive recreation and trail or bicycle path connections.	Parks Plan 68
5	Identify key critical water resource areas for protection in jurisdiction's parks and open space plan?	N	N/A	
6	Establish and enforce areas which are available for development and which lands are a priority for preservation?	Y	Environmental Corridors in land use map identify areas that should be preserved.	27
7	Outline protection measures for source water protection areas through land use controls and stewardship activities?	Y	Boone Creek corridor is given special attention; 400 foot buffer from the centerline of the creek, adjacent development using BMPs to limit stormwater runoff. No other areas are identified.	58
8	Identify and map aquifer recharge/ source water areas and/or wellheads and recommend protective measures?	N	N/A	
<b>OPEN SPACE</b>				
9	Identify adequate open space in both developed and greenfield areas of the community?	~	Goal of 15 acre of open space / 1,000 population.	57
10	Contain an open space/parks element that recognizes the role of open space in sustainable stormwater management?	Y	Comprehensive Plan recognizes environmental corridors as a land use category to protect wetlands, floodplains, and mature forests for environmental health. Sustainable stormwater management is not addressed. Parks and Open Space Plan recommends the creation of a new type of park, Greenway, and adding it to the subdivision ordinance. Also recommends park developments should include to the greatest extent possible the integration of green technology into park developments. Identifies the following techniques: permeable pavements, rain gardens, native landscaping, and focusing planning on runoff prevention rather than mitigation.	58; Parks Plan 16, 71



	CHECKLIST QUESTION	YES/NO	NOTES	PAGE
<b>OPEN SPACE</b>				
9	Identify adequate open space in both developed and greenfield areas of the community?	-	Goal of 15 acre of open space / 1,000 population.	57
10	Contain an open space/parks element that recognizes the role of open space in sustainable stormwater management?	Y	Comprehensive Plan recognizes environmental corridors as a land use category to protect wetlands, floodplains, and mature forests for environmental health. Sustainable stormwater management is not addressed. Parks and Open Space Plan recommends the creation of a new type of park, Greenway, and adding it to the subdivision ordinance. Also recommends park developments should include to the greatest extent possible the integration of green technology into park developments. Identifies the following techniques: permeable pavements, rain gardens, native landscaping, and focusing planning on runoff prevention rather than mitigation.	58; Parks Plan 16, 71
<b>TREES</b>				
11	Include tree preservation and replacement as community goals?	Y	Preserve all existing mature trees to the greatest extent possible	58
12	Support the planting of street trees by all private and public development projects?	N	N/A	
<b>DEVELOPMENT TYPE AND LOCATION</b>				
13	Direct development to previously developed areas?	Y	Encourages redevelopment of non-historic buildings in the downtown area	29
14	Identify potential brownfield and greyfield sites and support their redevelopment?	Y	Downtown, Crystal Lake Road, Main Street sub-areas are recognized as having specific sites ready for redevelopment. Does not identify as greyfields specifically.	30
15	Direct growth to areas with existing infrastructure, such as sewer, water, and roads?	Y	Establish annexation priorities based on water/sewer, avoid leap frog.	28
16	Are mixed-use and transit-oriented developments allowed or encouraged?	Y	Downtown and Main Street subareas identified as mixed-use redevelopment opportunities. Transit-oriented development discussed near rail station.	28
17	Identify appropriate areas for higher-density mixed-use developments (e.g., at transit stops) and recommend policies to encourage their development?	-	Higher density developments should be promoted only where transportation services exist to facilitate traffic.	28

	CHECKLIST QUESTION	YES/NO	NOTES	PAGE
<b>TRANSPORTATION AND PARKING</b>				
18	Emphasize alternative modes of transportation (walking, biking, and transit) to reduce vehicle miles traveled and width and prominence of roads/streets?	N	Identifies four modes (public transit, bicycle, pedestrian, and highway) and promoting transit use, but not specifically to reduce vehicle miles and nothing about reducing the prominence of roads/streets	35
19	Call for distributing traffic across several parallel streets, reducing the need for high capacity streets with wide rights-of-way?	N	Wide street dimensions identified in Table 4-2. Nothing about the street network other than it exists. Calls for improving arterial capacity, but not necessarily through network.	36; 41
20	Include or recommend the creation of a formal bicycle/pedestrian master plan?	~	Includes bike path map with connection to regional trails and goal to increase utilitarian trips.	35-36
21	Recommend supporting "safe routes to school" programs or other pedestrian/bike safety initiatives?	N	N/A	
22	Recommend improvements to walking/ biking conditions	Y	Off-street and on-street bike lanes. Pedestrian access and circulation to be fully integrated into the design of streets and major land development	39-40
23	Promote green infrastructure practices in street design?	N	BMPS only discussed in connection with conservation development; not in connection with streets directly.	47
24	Recognize the advantages to reduced parking requirements generally and specifically for mixed-use and transit-oriented developments?	N	Silent on reducing parking. Plan indicates more parking is needed at the Metra station.	39
25	Recommend alternative, flexible approaches to meeting parking demands?	N	On-street parking is only allowed on one side of residential streets, see Table 4-2.	37
26	Recommend provision of bicycle parking spaces and reduction in vehicle parking spaces?	N	N/A	
27	Recognize transportation demand management as an approach to reducing vehicle miles traveled and parking requirements?	N	N/A	
28	Call for landscaping in parking lots to help reduce stormwater runoff?	N	Landscaping is mentioned as a way to improve the aesthetics of areas with older strip commercial areas; significant landscaping enhancements, such as natural landscaping, water, and other aesthetic features shall be incorporated into new business and industrial parks at major entrances, around the perimeter, and on individual sites.	16, 29, 53

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Chicago Metropolitan  
Agency for Planning

233 South Wacker Drive, Suite 800  
Chicago, IL 60606

312-454-0400  
[info@cmap.illinois.gov](mailto:info@cmap.illinois.gov)  
[www.cmap.illinois.gov](http://www.cmap.illinois.gov)

