

New Designs for Growth

# Planning with Green Infrastructure

*An Implementation Resource of the New Designs for Growth Guidebook*



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# **Green Infrastructure**

*Planning with Green Infrastructure* is an implementation resource publication of *New Designs for Growth Guidebook*. This publication was developed to aid local governments in their efforts to implement policies included in the *New Designs for Growth Guidebook*.

New Designs for Growth is a program designed to help guide the region's growth and development according to the ten tenets of smart growth. Vision: "Address development expansion and help the region prosper in a way that protects the natural resources, scenic beauty, rural landscape, and unique character of each community."

Implementation and outreach aspects of the New Designs for Growth program is administered by the Northwest Michigan Council of Governments.

**This document was prepared by:**

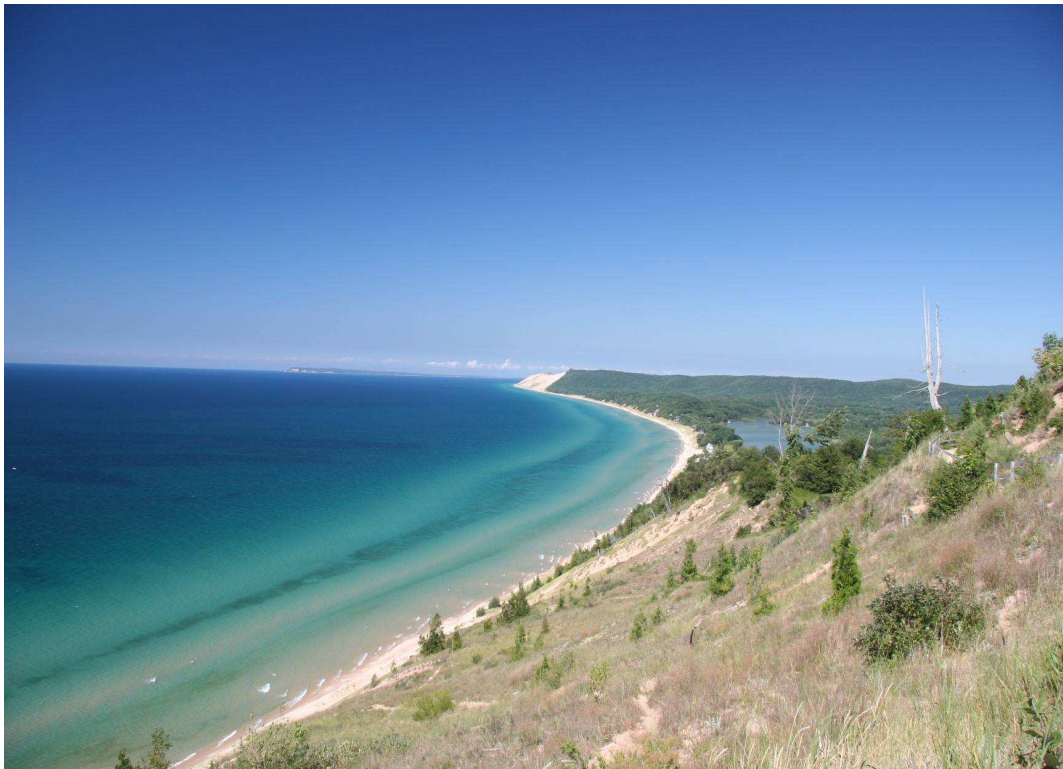
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**Scenic views, spectacular bays,  
inviting lakes and streams, miles of Great Lakes  
and inland lakes shoreline,  
year-round recreational opportunities,  
clean air, small town friendliness and  
overall quality of life are some of the many  
attributes stimulating development in the  
northwest, lower Michigan region.**



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# ***Green Infrastructure***

An Implementation Resource of the New Designs for Growth Guidebook

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# **Green Infrastructure: Introduction**

## **Green Infrastructure Defined**

Green Infrastructure is an adaptable term used to describe an array of products, technologies and practices that use natural systems - or engineered systems that mimic natural processes - to enhance overall environmental quality and provide utility services. When using Green Infrastructure principles, it is a systematic and strategic approach to land conservation and encourages land use planning and practices that are good for nature and people at the national, state, regional, and local levels.

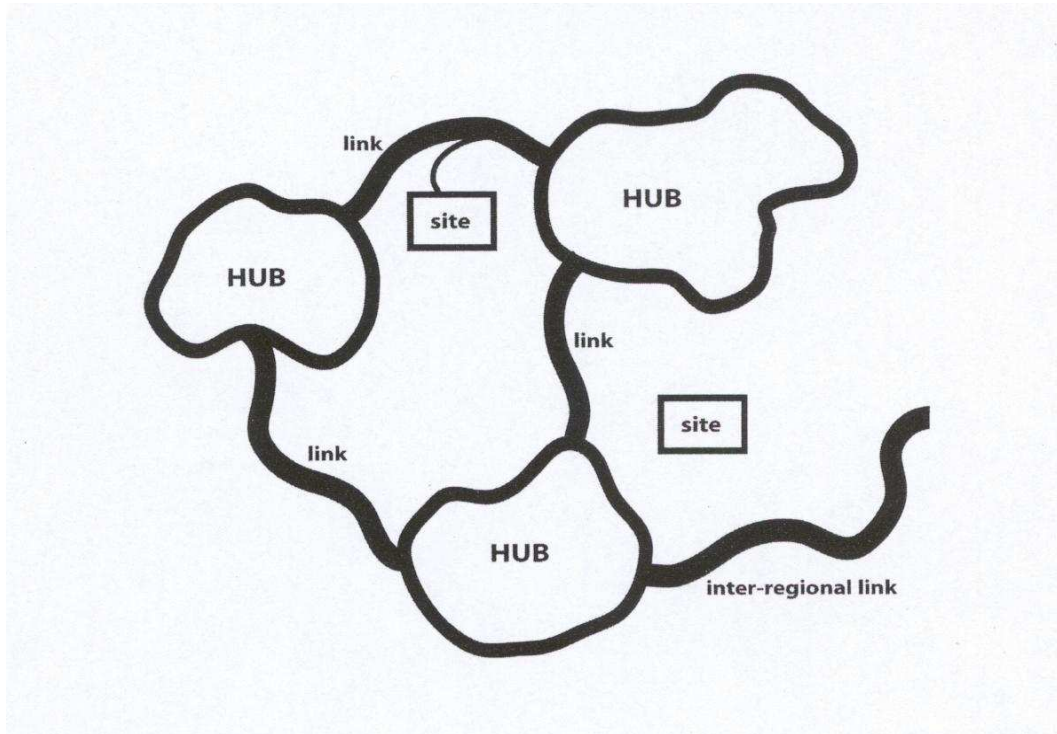
## **What Green Infrastructure Looks Like**

Green Infrastructure consists of a large variety of natural and restored ecosystems and landscape features which includes wetlands, woodlands, waterways, groundwater recharge areas, and wildlife habitat. It also includes public and private conservation lands such as national, state, and local parks; nature preserves; non-motorized transportation facilities, and wildlife corridors. Even working lands of conservation value like forests and farms are included in Green Infrastructure.

A Green Infrastructure network connects these ecosystems and landscape features in a system of *hubs, links, and sites*.

- Hubs are the anchor of Green Infrastructure networks. They are the origin or destination for wildlife moving through the system and provide the space for native plants and animal communities to grow and flourish. Hubs come in many shapes and sizes. They can be national or state forests, regional and local parks, other publicly owned lands, or private land such as farms or forested areas.
- Links are what tie the Green Infrastructure systems together. These connections are essential parts of the network that help maintain the health and biodiversity of wildlife populations. Links also vary in size and will have different lengths and widths. Examples include landscape linkages or conservation corridors that can be long and wide and can include river and stream floodplains, as well as smaller greenways such as hiking and biking trails or natural ribbons along roadways.
- Sites can range in size from a small park or school grounds to a rain garden on the property of a private residence. They are much smaller than hubs and may not be directly attached to the larger system, however, they still provide important ecological benefits by being part of the ecosystem.





Green Infrastructure system with hubs, links, and sites. Source: Maryland Dept. of Natural Resources

### ***Why Green Infrastructure?***

- **To Prevent the Loss of Natural Areas and Degradation of Water Quality:** Loss of wetlands and other natural systems reduces the capacity to perform flood control, stormwater runoff control, the filtration of toxics, sediment retention, and other natural functions.
- **To Prevent Fragmentation of Open Spaces:** As land is converted, it is fragmented into smaller and more isolated patches. There is a resulting reduction in the amount of habitat available to sustain plant and animal species. And, as the distance between undisturbed habitat areas increases, wildlife populations become increasingly isolated. This prevents animals from safely moving between habitats and decreases diversity among species.
- **To Prevent and Control Increased Costs of Public Services:** Loss of pervious surface or hardening of the landscape causes the price of dealing with flooding and stormwater runoff (examples) to increase for infrastructure, restoration, and clean up.

# Section 1

## Green Infrastructure Principles

### Ten Principles of Green Infrastructure

Although Green Infrastructure projects are called different names (conservation development, ecosystem management, greenway planning, habitat restoration, watershed protection, etc.), they are based on common principles. The following principles provide a framework for the sustainable use of land that will benefit people, nature, and the economy.

#### **Principle One: Connectivity is key**

The goal of a Green Infrastructure plan is the creation of a network of ecological areas within a region that function as an ecosystem or watershed. This strategic connection of ecosystem components is critical to maintaining the services of natural systems and to maintaining the health and diversity of wildlife.

Successful Green Infrastructure activities also requires linkages among the programs and staff of different agencies, organizations, and private businesses involved in the planning. A Green Infrastructure network would be supported in a fashion similar to how a network of federal, state and local highways creates a functional road network.

#### **Principle Two: Context matters**

A fundamental concept of landscape ecology is that the study of individual content areas is not adequate. Understanding and predicting change in native ecosystems and landscapes requires the study of the biological and physical factors of the surrounding areas. The context in which these ecosystems exist is vital to a strategic conservation initiative. The managers of individual parks, wildlife habitats, and other conservation areas need to consider what is happening outside their borders and develop ways to link up with each other to meet common goals.

#### **Principle Three: Green Infrastructure should be grounded in sound science and land use planning theory and practice**

Successful Green Infrastructure plans build on the foundation of many disciplines and engage experts from many fields such as biology, watershed management, landscape architecture, urban, rural and regional planning, and civil engineering. Professionals from these different fields ensure a balance of ecological, practical, and social considerations.

1. Connectivity is key
2. Context matters
3. Green infrastructure should be grounded in sound science and land-use planning theory and practice
4. Green infrastructure can and should function as the framework for conservation and development
5. Green infrastructure should be planned and protected *before* development
6. Green infrastructure is a critical public investment that should be funded up front
7. Green infrastructure affords benefits to nature and people
8. Green infrastructure respects the needs and desires of landowners and other stakeholders
9. Green infrastructure requires making connections to activities within and beyond the community
10. Green infrastructure requires long-term commitment





Green Infrastructure systems should connect across urban, suburban, rural and wilderness landscapes and function at the state, regional, community and parcel scales. It is important to note that Green Infrastructure systems do not require public ownership of all land in the system as privately owned land, such as working farms and forested areas, can play an important role in these plans.

***Principle Four: Green Infrastructure can and should function as the framework for conservation and development***

Green Infrastructure planning can help communities prioritize conservation needs and determine where to direct development in their master plans and zoning ordinances. Planning with green infrastructure can also help to consolidate past conservation efforts that focused on protecting individual parks, preserves, or other isolated areas and identify opportunities to restore and maintain vital ecological connections. These plans and activities can help reduce opposition to new development by assuring that the development will occur within a framework of conservation and open space land determined by green infrastructure principles and activities.



***Principle Five: Green Infrastructure should be planned and protected before development***

Green Infrastructure plans should set acquisition and restoration priorities and help identify opportunities to reconnect isolated habitat islands. Identifying these areas in Green Infrastructure plans ensures that existing open spaces and working lands are seen as essential community assets and not left vulnerable to development.

Restoring natural systems is far more expensive than protecting ecosystems, and mitigation projects such as human-made wetlands have been proven not to function properly, especially in comparison to their natural counterparts.

***Principle Six: Green Infrastructure is a critical public investment that should be funded up front***



Utilizing Green Infrastructure practices have shown to save developers and communities money. Also, Green Infrastructure should be included in any community development project just as gray infrastructure - roads, sewer, water, power and telecommunications lines, and other support systems - which are designed and financed in budgets spread across time and a large pool of financial options. Coordination between jurisdictions for Green Infrastructure should be planned like any other large infrastructure projects.

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***Principle Seven: Green Infrastructure affords benefits to nature and people***

Green Infrastructure planning and actions benefit people, water quality, businesses, wildlife, ecological systems, and community quality of life while reducing the need for gray infrastructure. Utilizing green infrastructure principles and implementation activities help reduce the risk of floods, wildfires, erosion, and other natural disasters. It is also far less expensive to plan development away from natural hazards than to deal with a flood or forest fire. Natural hazards mitigation plans locate the hazard prone areas and can be used as part of Green Infrastructure planning to place residential and commercial development elsewhere.

***Principle Eight: Green Infrastructure respects the needs and desires of landowners and other stakeholders***

Green Infrastructure involves diverse stakeholders and can forge alliances between private, public, and nonprofit entities. Care must be taken to ensure that the voices of all groups are heard and that their rights are respected. The success of Green Infrastructure planning and implementation also depends on sharing plans with a wide range of stakeholders. When it is presented as a concept that will help plan development, the strongest opponents sometimes become the strongest allies.

***Principle Nine: Green Infrastructure requires making connections to activities within and beyond the community***

The success of Green Infrastructure requires bringing together people and programs engaged in various conservation and planning activities. Considering Green Infrastructure in conjunction with smart growth helps to provide a useful and beneficial framework. Successful programs will see beyond political boundaries to focus on the natural landscape and the desired outcome for the initiative is a natural network that functions as an ecological whole.

***Principle Ten: Green Infrastructure requires long-term commitment***

A Green Infrastructure plan and network design should be considered living documents that will need to be modified and updated periodically to remain relevant. This requires considering land management issues at the outset of the initiative, as well as how restoration and ongoing maintenance will be funded.



## Ten Tenets of Smart Growth

- Mix land uses
- Take advantage of compact building design
- Create a range of housing opportunities and choices
- Create walkable neighborhoods
- Foster distinctive, attractive communities with a strong sense of place
- Preserve open space, farmland, natural beauty, and critical environmental areas
- Strengthen and direct development toward existing communities
- Provide a variety of transportation choices
- Make development decisions predictable, fair, and cost-effective
- Encourage community and stakeholder collaboration in development decisions

## Section 2 Benefits of Green Infrastructure

Implementing Green Infrastructure planning helps to maintain or repair natural systems and defines a framework for future development patterns. Initiatives that support Green Infrastructure principles create tangible benefits for ecological systems and biodiversity, contribute measurable economic value to the region, and provide substantial health rewards to local residents.

### **Green Infrastructure provides ecological support**

Green Infrastructure protects the environment in many ways. The same forests, wetlands, and open spaces that support plant and animal species also provide several ecological benefits.

- **Enhances stormwater management and hazard mitigation:** Forests and wetlands reduce the risk of flooding by controlling stormwater runoff and provide protection from storm damage and erosion in coastal areas. This natural protection from floods and other hazards is one of the many valuable benefits.
- **Creates source water protection:** Groundwater recharge is enhanced by Green Infrastructure activities. The recharge areas such as wetlands, absorb more water than areas that are paved or built upon to replenish water tables and aquifers. These areas also act like water filters to remove pesticides and other toxic contaminants.
- **Provides air purification and cooling:** Plants and trees take carbon from the air and store it in fiber and wood. Vegetation also purifies the air from other contaminants. Shade trees can significantly lower surface temperatures and help to reduce the harms of heat islands that form around urban areas and conifer trees can help provide wind breaks from cold winds.

### **Economic benefits of Green Infrastructure**

Direct and indirect economic gains should be considered when looking at the investment costs implementation. The reduction in gray infrastructure investment that is facilitated by natural systems creates economic benefits. All the various elements of Green Infrastructure such as forests, agricultural lands, greenways, and parks can all add economic benefit to the regions that support them.

- **Protects working lands and guides growth:** Farms, fisheries, vineyards and working forestland can all see direct benefits from local Green Infrastructure. Defining agricultural land areas and urban places directs growth and protects fragile ecosystems. It also promotes the connection between farmers and urban businesses and residents to highlight the economic and health benefits of local foods.
- **Promotes many forms of tourism:** Increased eco-tourism is a direct benefit of a Green Infrastructure initiative. People concerned with conservation and environmental protection will plan vacations in areas that support these values. Recreational trails for biking and hiking, hunting and fishing activities, and agricultural tourism destinations like wineries and organic farms are all part of a Green Infrastructure network that bring tourism dollars into an area and increase employment in the region.
- **Increases land values:** Green Infrastructure can increase the value of nearby real estate. Greenway spaces like biking and hiking trails are often seen as more valued amenities by residents than even golf courses or swimming pools. Since the value of property near trails and parks may increase, there will be a corresponding increase in tax revenues.
- **Increases energy efficiency:** Green Infrastructure networks reduce energy use by moderating building/home temperatures, and promoting non-motorized transportation, low impact development and local food sources. These practices help eliminate some of the need for energy consumption in communities.



### ***Green Infrastructure promotes biodiversity***

Green Infrastructure supports forests and wetlands that offer a rich habitat for plant and animal species. The greatest threats to biodiversity are the loss of habitat and the rise of invasive species. By directing development away from fragile habitats and encouraging the reproduction of native plants and animals, biodiversity can be protected. Unlike many wildlife conservation programs that focus on a single site or species, Green Infrastructure can provide a substantial network that helps a multitude of plant and animal species.

- **Increases wildlife habitat:** The hubs and links of a Green Infrastructure interconnected network provide a protected area for wildlife. It is essential that the hubs are connected by links for safe corridors for wildlife to migrate from one habitat area to another.



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- **Saves species from extinction:** Green Infrastructure creates wildlife corridors that are crucial to help save many plant and animal species from extinction. Selection of appropriate natural areas to include in planning protects the habitats of rare, threatened or endangered species. This ensures that animals and plants have adequate space and healthy ecosystems to live.
  - **Protects native plant gene pools and halts invasion of non-native species:** Green Infrastructure will help to reduce the occurrence of contrasting natural environments known as the edge effect and this will then help to reduce the spread of invasive species and protect the native species gene pool.

### ***Public health rewards from Green Infrastructure***

Enhanced air and water quality and other natural benefits of Green Infrastructure directly improve the fitness and wellbeing of the people who live, work, and play in the region.

- **Creates and protects recreational space:** Green Infrastructure provides for facilities that allow for hiking, biking, walking, and other outdoor activities. Waterways can be used for canoeing, kayaking, swimming, and other water sports. These opportunities for physical activity can help reduce the risk of many medical conditions including high blood pressure, diabetes, obesity, and other diseases.
- **Fosters a connection with nature:** Green Infrastructure also has the ability to improve mental health and general community safety. It can create a bond with nature, alleviate stress, and improve self-esteem. It also protects and enhances community pride and strengthen connections.
- **Helps provide cleaner water:** The benefit that Green Infrastructure can provide is improved quality of groundwater and surface water in the region which is beneficial to humans, wildlife and plant populations. Water quality also plays a part in recreational opportunities.
- **Cleans air and reduces heat island effect:** The reduction in both air pollutants and average temperatures can have a significant impact on the health of human populations. Cleaner, cooler air is beneficial to at-risk segments of the population, people with allergies and asthma, and to all people in general.





## Section 3

# Green Infrastructure Techniques and Tools

There are many important reasons to implement and maintain Green Infrastructure initiatives. It can help guide land use priorities, enhance conservation efforts, and provide a framework to unite diverse groups of land owners, agencies, organizations, and users and offer an enhanced quality of life to the entire community. One of the most compelling reasons for embracing Green Infrastructure is to reduce the dependence on traditional gray infrastructure and replace it with more efficient and sustainable natural systems.

In a few communities there are local projects already underway that aim to implement Green Infrastructure principles. Green Infrastructure advocates Mark A. Benedict and Edward T. McMahon have described this process as the *implementation quilt*. It weaves together the various patches of efforts that are made of different cloth/communities into a cohesive whole. The goal is to create a program to promote green infrastructure principles and implementation in the region.

### **Voluntary Implementation Strategies**

Voluntary programs are often effective methods to create Green Infrastructure networks.

- **Tax incentives:** Reduction of property tax assessments on agricultural or forested land.
- **Conservation practices by property owners:** Conservation easements; vegetative buffers along bodies of water and wetlands; sustainable forestry.
- **Smart growth techniques:** Focusing on the elimination of sprawl into natural and agricultural lands.
- **Low Impact Development (LID):** Controlling and reducing stormwater runoff by reducing impervious surfaces; migrating flooding; filter runoff.
- **LEED (Leadership in Energy and Environmental Design):** Integration of buildings and neighborhoods that conform to LEED standards that promote the same type of environments recommended under the green infrastructure principles.

### LOCAL EXAMPLES Of Potential GREEN INFRASTRUCTURE Linkages

**Boardman River  
Watershed**

**Huron Manistee  
National Forest**

**Pere Marquette  
State Forest**

**Sleeping Bear Dunes  
National Lakeshore**

**TART Trails, Inc.  
Top of Michigan Trails  
North Country Trail**

**Land Conservancy/  
Trusts Preserves**

**Protected Farmland  
Areas in Peninsula  
Township with PDRs**

**Wildlife Corridors  
Identified in the  
Ten Counties**

**County Natural Hazard  
Mitigation Plans**

**Low Impact  
Development  
Education:  
Watershed Center  
Grand Traverse Bay**

**Leelanau State Park**

**Wilderness State Park**

**Stormwater Best  
Management Practices:  
Tip of the Mitt  
Watershed Council**

- **Technical assistance:** Educating professionals and the public about green infrastructure principles, planning, and implementation. It would be very helpful for landowners and developers to have an easy to find “one-stop shop” to learn about, sign up, and implement voluntary Green Infrastructure programs.

### **Land Acquisition**

A cornerstone tool of Green Infrastructure is land acquisition. Examples include:

- **Fee simple purchase:** Governments (federal, state, county, local) and land trust/conservancy organizations can purchase land that becomes part of Green Infrastructure networks. Purchasing individual parcels in this way can be an expensive and slow-moving process.
- **Conservation easements:** A conservation easement is a voluntary agreement that allows a landowner to limit the type or amount of development on their property while retaining private ownership of the land. The easement is signed by the landowner, who is the easement donor and the party receiving the easement. Conservation easement examples include prohibiting the construction of buildings or roads, limiting where development can occur on the property, and/or maintaining the land as a working farm or forest.
- **Purchase of Development Rights (PDR):** A PDR is a transaction that allows private landowners to conserve natural lands or working landscapes using market and incentive based, non-regulatory techniques. Purchase of Development Rights programs are voluntary, cooperative, public-private partnerships that help realize the permanent protection of lands that define many communities.
- **TDR - Transfer of Development Rights (TDR):** While a PDR will permanently sell or retire the development rights, a TDR will transfer development rights from one parcel to another. The land to be conserved is in the "sending" area and the rights are transferred to a "receiving" area. One example is often that buildings in the "receiving" area can be larger than normally allowed. In many states, including Michigan, it is difficult, if not impossible, to transfer development rights across jurisdictional lines such as city or county boundaries.

### **Regulatory Approaches**

A Green Infrastructure program can include regulations such as master planning, zoning, and other public policy methods which are commonly used by municipalities to influence the pattern of development:

- **Master plans:** Communities may plan for green infrastructure at a larger scale, incorporating green infrastructure goals, objectives, recommendations, and maps into their master plans.
- **Zoning ordinances:** Zoning has been a traditional means of implementing local land use plans. By defining allowable uses of land, establishing standards for development, and offering incentives for different development types or patterns, zoning offers a number of opportunities to achieve specific objectives. While it has not been used extensively for green infrastructure objectives, there is a role for zoning in ensuring that the objectives are addressed, either by the jurisdiction itself or by private developers.

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- **Planned Unit Development (PUD):** This development type provides flexibility in design, lot area, uses, or other requirements to a developer and in return receives benefits such as green infrastructure services, open space preservation or recreation areas. The zoning ordinance may allow these developments throughout the community as an overlay or only in certain zoning districts.
  - **Conservation Design:** Conservation design is controlled-growth land use development that adopts the principle for allowing limited sustainable development while protecting an area's natural environmental features in perpetuity, including preserving open space landscape, protecting farmland, forests, or natural habitats for wildlife, and maintaining the character of rural communities.
  - **Site Design and Development Review:** Site design is the location and pattern of streets, buildings, landscaping, and open space and has enormous impacts on the protection of natural resources. Site plan review is a tool that can be used to ensure that site design incorporates green infrastructure techniques throughout the community.

Almost all zoning ordinances require site plan reviews or another type of design review to ensure that projects are well-designed, compatible with the community's master plan and surrounding uses, provide adequate infrastructure and services, and in compliance with the zoning provisions.

- **Service districts and growth boundaries:** A growth boundary or service district is a regional boundary that is set in an attempt to control development sprawl by mandating that the area inside the boundary be used for higher density development and the area outside be used for lower density development, natural resource protection, or farmland preservation.

The growth boundary circumscribes an entire developed area and is used by local governments as a guide to zoning and land use decisions. If the area affected by the boundary includes multiple jurisdictions, a special regional agency may be created by the state or regional government to manage the boundary. In a rural context, the terms town boundary, village curtilage or village envelope may be used to apply the same constraining principles.

While zoning and some regulations can be a relatively quick and easy method to enact, they are often not an effective tool to use alone when creating a Green Infrastructure network.



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## **Section 4**

# **Assistance Sources and Funding Strategies**

A variety of technical and funding assistance programs are available to help implement Green Infrastructure principles and implementation. Communities may have different needs so a combination of methods are suggested.

### **Federal programs**

The Center for Environmental Finance (CEF) at the U.S. Environmental Protection Agency (USEPA) assists public and private groups in finding ways to fund environmental programs including infrastructure planning: <http://www.epa.gov/efinpage/>

For assistance using this program in the State of Michigan, help can be found at the Great Lakes Environmental Finance Center which is located at Cleveland State University: <http://urban.csuohio.edu/glefc/>

The Conservation Reserve Program (CRP) at the U.S. Department of Agriculture provides assistance to farmers and ranchers in complying with environmental laws and encourages environmental enhancement: <http://www.nrcs.usda.gov/programs/CRP/>

An offshoot of the CRP is the Conservation Reserve Enhancement Program (CREP) which helps governmental agencies identify and protect environmentally sensitive land: <http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep>

Other federal programs and agencies that can be of assistance are:

- **National Environmental Protection Act (NEPA)**
- **Farmland Protection and Policy Act (FPPA)**
- **Clean Air Act**
- **Clean Water Act**
- **Endangered Species Act**
- **Safe Drinking Water Act**

The Lake Michigan Lakewide Management Plan (LaMP) at the USEPA Great Lakes National Program Office has some groundwork for planning and implementing Green Infrastructure principles and implementation: <http://www.epa.gov/greatlakes>

### **State**

Michigan Department of Environmental Quality has some programs and projects for watershed management and implementation: [www.michigan.gov/deq](http://www.michigan.gov/deq)

The Michigan Natural Features Inventory (MNFI) is operated by MSU Extension and helps with the conservation of biodiversity: <http://web4.msue.msu.edu/mnfi/>



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## **Regional**

The New Designs for Growth, a program of the Northwest Michigan Council of Governments (NWMCOG) promotes and distributes the *New Designs for Growth Guidebook* that includes information on the following Green Infrastructure Activities:

### **Guidebook Section 1: Critical Design Practices**

Trails, Forestry, Alleys, Cluster Developments, Conservation Easements, Conservation Planning, Habitat Protection, Hillside Development, Landscaping, Natural Features, Nonpoint Source Pollution Open Space, Alternative Pavement Surfaces, Purchase of Development Rights, Sand Dune Protection, Scenic Views, Preserving Sensitive Areas, Stream Protection, Streetscape, Topography, Transfer of Development Rights, Water Resource Protection, Wetlands, Woodland Protection.

The Guidebook is available from the Northwest Michigan Council of Governments which also offers Green Infrastructure workshops and planning materials.

<http://www.newdesignsforgrowth.org>

### **Private programs**

The Conservation Fund offers educational and investment assistance for Green Infrastructure and other environmental programs: <http://www.conservationfund.org/>

Other options such as foundations, private donations, and memberships can be explored.

### **Taxes, Fees, Bonds, and Other Options**

Property taxes (millages), sales taxes, real estate transfer taxes and others have been used to fund Green Infrastructure initiatives. Other taxation options include special assessment districts, license plate fees, and development impact fees. In many states, including Michigan, impact fees are not enabled by the state legislature and are currently not a viable funding option.

A number of Green Infrastructure initiatives have been funded through bond measures. These include state and local bonds, as well as small denomination environmental bonds sold to the general public.



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# ***Appendices***



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# Appendix A

## County Maps

### SOURCES OF DATA LAYERS ON THE COUNTY MAPS:

#### **Lakes, Rivers, Streams, Forested Areas, Agricultural Areas**

Michigan Department of Information Technology's Center for Shared Solutions and Technology Partnerships

#### **County Composite Wetland Areas:**

The wetland areas layer on the following maps are a composite of three sources of wetland information:

- a. The National Wetland Inventory, conducted by the U.S. Fish and Wildlife Service using aerial photography and topographic data. Note: National Wetland Inventory digital data is available for most of the county (excluding only the south-eastern edges).
- b. The U.S. Soil Conservation Service Soil Survey of Antrim County which identifies hydric soils and soils with hydric inclusions.
- c. The Michigan Resource Inventory System (MIRIS) Land Cover interpretation from 1978 aerial photographs.

These three data layers were combined using PC ArcInfo (GIS software).

This project was conducted in coordination with the Michigan Department of Environmental Quality with funds from the U.S. Environmental Protection Agency.

DISCLAIMER: This map has not been field checked and should only be used for general planning purposes. This map should be used to supplement a field inventory by a qualified wetland expert. This map is not a complete inventory of all the wetlands in this area. Regulated wetland areas may exist that are not included on this map.

#### **Non-Motorized Transportation Facilities**

*Northwest Michigan Regional Non-Motorized Strategy 2008*; Northwest Michigan Council of Governments

#### **Parks, Nature Preserves, Natural Areas**

County governments  
Leelanau Conservancy  
Grand Traverse Regional Land Conservancy  
Little Traverse Conservancy  
Cadillac Area Land Conservancy  
Sleeping Bear Dunes National Lakeshore



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