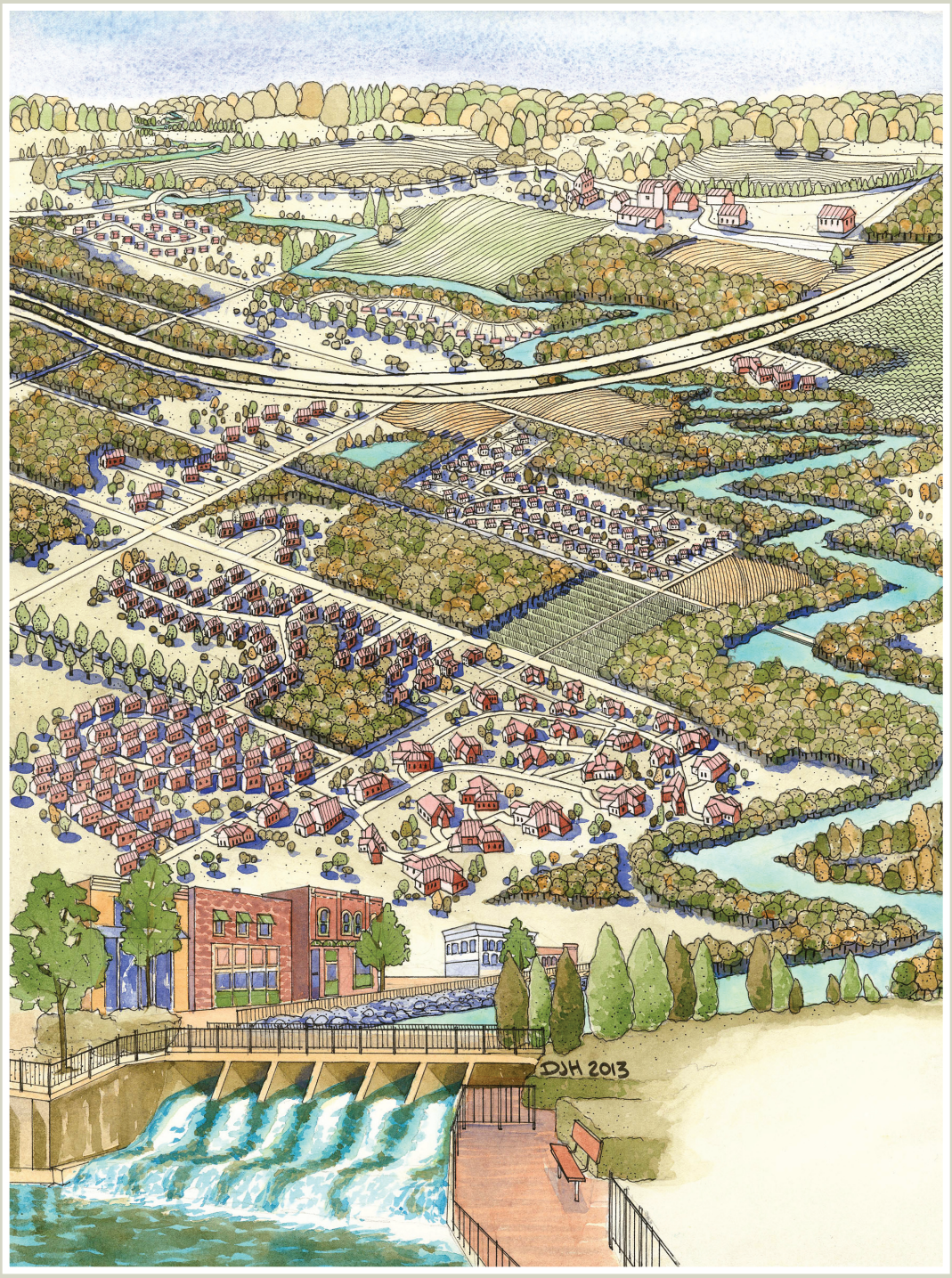

Rogue River Watershed

A Stormwater Guidebook

This project was funded with grant assistance from Section 319 of the Federal Clean Water Act through the Michigan Department of Environmental Quality. Matching funds were provided by the Frey Foundation, the Wege Foundation and the Wolverine Worldwide Foundation. This guidebook was produced as part of the Trout Unlimited Rogue River Home Rivers Initiative project. February 2014.

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Preface

What prompts a planning commissioner to step up and serve his or her community's Planning Commission? Most commissioners want to make and leave a better community for future generations. Some want to take a stand on a key issue associated with their families, neighborhoods, or professions. Still others may be looking for good ways to be useful or serve their communities. Planning commissioners are appointed by their elected officials to conduct the most important and difficult role in local government: researching, understanding, evaluating, and proposing solutions and methods for solving the most important issues facing our citizenry and their communities today. But instead of dealing with the big-picture visionary issues that may have first attracted them to the position, new planning commissioners are too often faced immediately with the job of mediating competing interests and arguing endlessly about issues such as sizes, distances, shapes, colors, and a host of more or less accurately determined impacts on the human senses. With the number of independent decisions which are routinely required of planning commissioners, there often is little time left for one of the most important reasons for serving on a planning commission: effectively and fairly coordinating land uses so as to ensure sustainable use of natural resources in accordance with their unique character and adaptability.

This is especially important for planning commissioners in the Rogue River watershed. The Rogue River is a high-quality coldwater river system because of the amount of groundwater it receives. The Rogue River watershed has the highest groundwater loading (0.47 cfs/mi2) measured in the Grand River watershed, and its groundwater yield is relatively high compared to other Lower Peninsula streams with similar-sized catchments (Wesley 2013). However, this unique river system is being threatened by changes in the amount of stormwater runoff it receives due to increases in precipitation and the number of rain days. This change in climate, both from natural variability and human impact, has biological implications to the coldwater fishery and physical implications to the river channel and its infrastructure. Higher frequencies of more severe storms are likely to further increase the pollution and flooding risks posed by stormwater runoff, especially in urban areas. Research by the Center for Watershed Protection has found that stream quality becomes impaired when 10% of the stream's watershed is impervious, and that an urban stream's ecology is severely impacted when more than 25% of its watershed is impervious. Because it is located near the second largest metropolitan area in the state of Michigan, this is a real threat for the Rogue River watershed.

The Rogue River Stormwater Guidebook is intended to bring the bigger picture of stormwater management into the routine world of local planning processes. It will provide a glimpse into the biggest problems facing the Rogue River today and offer a more complete understanding of the way local planning commissions can incorporate solutions into their ongoing meetings and procedures in their governing jurisdiction. The primary objective of this document is to create a guidebook that coordinates innovative engineering practices in specific transect zones for effective use by local governments to control stormwater runoff over a series of land use sectors.

1. Introduction

The Purpose of This Guidebook

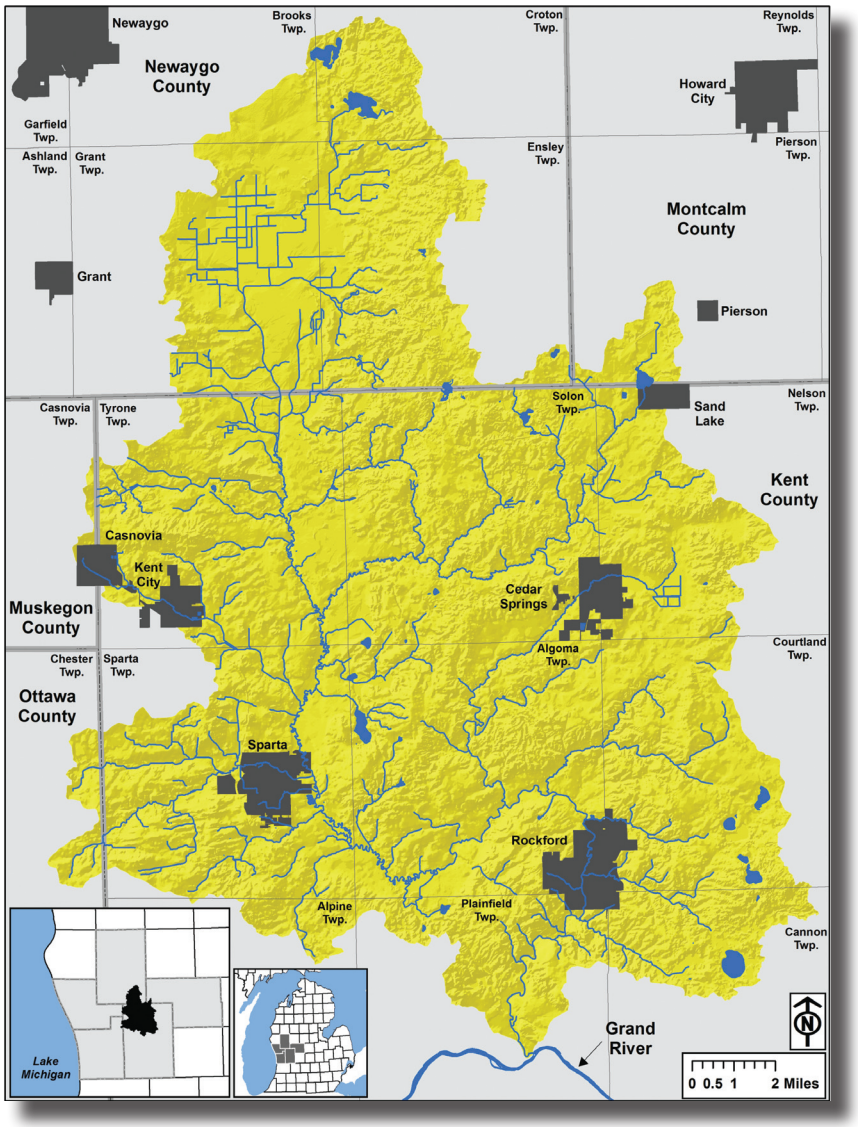
Stormwater is water that accumulates on land as a result of rain events. It is sometimes called stormwater runoff. Impervious land cover like driveways, sidewalks, streets, and roofs prevent stormwater runoff from naturally soaking into the ground, thereby creating faster and greater volumes of surface flows. Unmanaged stormwater runoff has caused serious damage to property, as well as to lakes and rivers, particularly where land uses change from rural to urban activities (USEPA 2003).

Stormwater runoff from agricultural and urban land is the leading source of water pollution in West Michigan. Recent efforts have been made in Michigan to offer tools for local units of government to provide a common understanding of stormwater practices through manuals and publications. Although such publications are valuable resources to explain specific practices, they fail to provide local governments with guidance on where to implement stormwater management practices in the larger land use context. To assist local governments in determining the appropriate placement of stormwater practices in this larger framework, this guidebook coordinates innovative engineering practices in specific transect zones (i.e., natural, rural, urban core). This guidebook will help local officials visualize the appropriate application of stormwater practices along a rural-to-urban transect in the Rogue River watershed, which will make it easier to incorporate useful standards into master plans and codes and ordinances.

Local officials that make many of the decisions impacting stormwater practices are members of planning commissions and planners, which is why they have been chosen as the target audience for this guidebook. A planning commission is a volunteer agency that is based on the belief that a group of citizens is able to objectively review and recommend sound and efficient planning regulations to the governing body of a community. The commission is granted the authority to recommend the establishment of zoning ordinance regulations, to designate specific zoning districts for a city or township, and to recommend a comprehensive plan for the development of the community. Planners work with elected and appointed officials, such as planning commissioners, to lead the planning process with the goal of creating communities of lasting value. Strong and well-trained planning commissions and planners are invaluable to communities and have a direct effect on the quality of the Rogue River watershed.

The Rogue River Watershed

The Rogue River is a major tributary of the Grand River and is a high-quality waterway located near the City of Grand Rapids, which is the second largest metropolitan area in Michigan. The Rogue River watershed is 167,625 acres, stretching through portions of Newaygo, Kent, Montcalm, Muskegon, and Ottawa counties. The watershed includes 22 local units of government, and features an outstanding combination of cold, cool, and warm waters, which support a high range of biological diversity as well as diverse fisheries. The Michigan Department of Natural Resources (MDNR) designated portions of the Rogue River and its tributaries a "Country Scenic" river under Michigan's Natural Rivers Act to help preserve, protect, and enhance the natural qualities of this valuable resource.



Political boundaries in the Rogue River watershed.

The Rogue River Watershed

The Rogue River is an extremely important trout fishery in southern Michigan. In angling trips alone, it brings in $485,000/year to the local communities (Hanshue and Harrington 2012).

However, the Rogue River watershed lies in the urban shadow of one of the fastest growing areas in Michigan. The pressures from growth and development could negatively impact productivity and diversity in this watershed. Summer water temperature is one of the major factors affecting growth, survival, and distribution of fish. A recent study based on fish population estimates in Michigan found that as mean July temperatures increase, brown trout densities decrease. In their analysis, as mean July temperatures approach 70°F, brown trout densities decrease dramatically (Zorn et al. 2009). From 2009 to 2011, the average mean July temperature in the Rogue River at 10 Mile Road was 69°F. Activities that reduce groundwater or increase the delivery of warm surface runoff will have negative impacts on the Rogue's ability to support coldwater species.

In 2000, a watershed management plan was completed for the Rogue River watershed. Sediment and thermal pollution are high priorities to address in order to prevent the degradation of watershed uses such as swimming and fishing. As high-priority pollutants, sediment and thermal pollution need to be addressed to protect and restore the uses (fishing, swimming, etc.) of this watershed. Sources of these pollutants included loss of wetlands, stormwater/surface runoff, and lack of streamside canopy and upland vegetation. The most significant cause of these sources is land use change and increased impervious surface. One often cited practice to help mitigate these pollutants was to work with local decision-makers to develop tools to help with land use planning decisions (AWRI 2000).

To assist with promoting the development of tools to protect and restore this valuable resource, Trout Unlimited launched a Home Rivers Initiative watershed restoration project in the Rogue River watershed. Trout Unlimited has had enormous success in the watershed working with various partners including local governments, citizens, anglers, businesses, schools, state and federal agencies, and other nonprofit organizations. With these partnerships, Trout Unlimited has been able to (1) help several local governments develop and implement improved planning policies to protect rivers, (2) increase opportunities to reconnect and restore local river systems by identifying fish barriers and areas of habitat loss in the watershed, and (3) engage the community in watershed efforts through community events and the creation of a citizen monitoring program to help determine the condition of their local waters. Trout Unlimited has received funds from the Michigan Department of Environmental Quality (MDEQ) to expand this effort to create a tool that can be presented to municipalities to explain the need for proper placement of stormwater management techniques and how to incorporate these standards into local master plans and codes and ordinances.

Blue Heron on the Rogue River.

Brook Trout on Duke Creek.

Sediment at construction site along the Rogue River.

Rogue River Cleanup.

Fishing on the Rogue River.

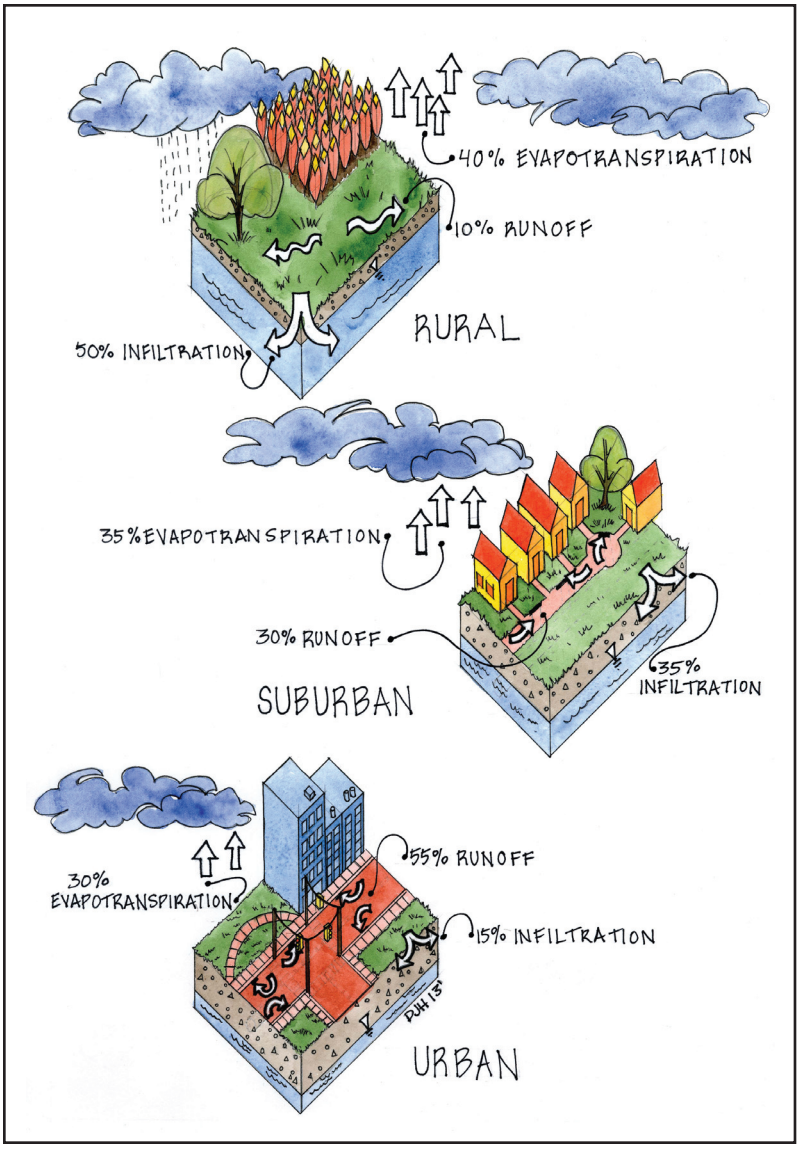
Nash Creek in Sparta. Flood of 2013.

Stormwater Runoff

Porous and varied terrain of natural landscapes like forests, wetlands, and meadows traps rainwater and snowmelt and allows filtering slowly into the ground. In contrast, impervious (nonporous) surfaces like roads, parking lots, and rooftops prevent rain and snowmelt from infiltrating, or soaking, into the ground. Most of the rainfall and snowmelt remains above the surface, where it runs off rapidly in unnaturally large amounts, making it costly to continually contain, convey, and manage over the long term. As stated in the preface, research by the Center for Watershed Protection has found that stream quality becomes impaired when 10% of the stream's watershed is impervious and that an urban stream's ecology is severely impacted when more than 25% of its watershed is impervious (CWP 2003).

Stormwater runoff from agricultural and urban land is the leading source of water pollution in West Michigan. It is carried through storm sewer systems or over land, resulting in a powerful and fast delivery of runoff to our nearby waterways. Increased storm flows carry sediment loads from construction sites and other denuded surfaces and eroded streambanks. Urban runoff often carries higher water temperatures from streets, rooftops, and parking lots, which are harmful to the health and reproduction of aquatic life. In addition, stormwater runoff carries pollutants from our land surfaces such as oil, pet waste, and lawn fertilizers directly to streams and rivers. The loss of infiltration from developed land may also cause changes to the groundwater supply. Although land development leads to great increases in flooding during and immediately after wet weather, in many instances it results in lower stream flows during dry weather. Many native fish and other aquatic life cannot survive when these conditions prevail (USEPA 2003).

To protect surface water quality and groundwater resources, development should be designed and built to minimize increases in runoff. Municipalities in the Rogue River watershed can reduce threats to water resource quality and quantity from stormwater by managing activities on the landscape within their boundaries. Municipal boards have a powerful influence because of the hands-on roles they play in crafting community plans and visions, shaping community policies, projecting community attitudes, and determining which development plans are accepted.



As the amount of impervious area — sidewalks, paved streets, parking lots, etc. — increases in a watershed, the amount of surface runoff increases while the amount of infiltration decreases. As little as 10 percent impervious cover in a watershed can result in stream degradation.

2. Stormwater Tools

The traditional approach to handling stormwater runoff consisted of calculating excess water volumes likely to be generated on newly developing properties, then designing structural networks (pipes, ducts, ditches, ponds, etc.) to capture, divert, or store these waters for the purpose of limiting expensive damage to properties within the drainage area. Though the conventional approach has worked for centuries and has been successfully applied throughout our growing cities, communities, and countrysides, examination of a “whole-system” of drainage has been rarely conducted. Today, after a half century of maintaining expensive, declining urban infrastructure and building new uncoordinated developments across ill-equipped open fields surrounding our cities, we are seeing the need for new stormwater-handling solutions that are less expensive, longer lasting, and naturally integrated.

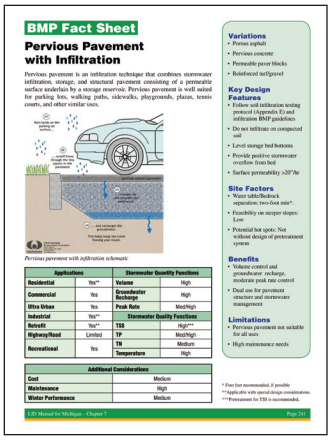
One approach to reduce reliance on more traditional stormwater solutions is Low Impact Development (LID). LID, or as some refer to the concepts broadly, "Green Infrastructure," is a term used by stormwater professionals for a suite of stormwater management practices that are designed to capture rainfall where it lands so that it can infiltrate into the ground at a more naturalized rate. Proper training in the design of LID practices should be required of any stormwater professional before implementation. Many of these practices are generally regarded today by developers, designers, engineers, planners, and agency officials as a more sustainable method for handling natural waters as they move through our communities.

Existing Tools and Resources

Over the past decade, there have been many new methods, techniques, and approaches for promoting stormwater management on a system-wide basis (Appendix 1 - LID Resource Review Matrix). While not all specifically address LID, most address in some way the handling of stormwater as a more distributive and integrated part of community development. These LID tools or resources are offered as an alternative to large, expensive collection systems based on ever-increasing contributions from a branching system of closed pipes. LID tools offer stormwater solutions which work on a site-by-site basis and usually include a series of site-based designs involving smaller structures which work with pre-existing natural systems and landscape features. Smaller integrated structures can be less expensive for property owners and are often found to be desirable ways to bring natural landscaping alternatives to all types of developing communities: large lots in rural areas, smaller developments and subdivisions, group housing in developed areas, and even in central downtowns of our established metropolitan areas.

All of the LID tools examined for this guidebook in Appendix 1 have adopted approaches to improving awareness and increasing use of LID designs. Tools generally offer basic report elements such as introduction, problem description, and a digest of best management practices (BMPs). BMP sections vary somewhat, but most include guidance on how they may be used and offer suggestions on integration into whole systems. Greater variations do exist between tools, however, and a brief analysis of strengths and weaknesses over six review categories for each of these LID tools presented here.

Existing Tools and Resources


BMP Fact Sheet

Pervious Pavement with Infiltration

Pervious pavement is an infiltration technique that combines stormwater infiltration, storage, and structural pavement consisting of a permeable surface underlain by a storage reservoir. Pervious pavement is well suited for parking lots, walking paths, sidewalks, playgrounds, plazas, tennis courts, and other similar uses.

Pervious pavement with infiltration schematic

Applications		Stormwater Quantity Functions	
Residential	Yes**	Volume	High
Commercial	Yes	Groundwater Recharge	High
Ultra Urban	Yes	Peak Rate	Med/High
Industrial	Yes**	Stormwater Quality Functions	
Retrofit	Yes**	TSS	High***
Highway/Road	Limited	TP	Med/High
Recreational	Yes	TN	Medium
		Temperature	High

Additional Considerations	
Cost	Medium
Maintenance	High
Water Performance	Medium

Variations
- Porous asphalt
- Pervious concrete
- Permeable paver blocks
- Reinforced turf/gravel

Key Design Features
- Follow soil infiltration testing protocol (Appendix E) and infiltration BMP guidelines
- Do not infiltrate in compacted soil
- Level storage bed bottoms
- Provide positive stormwater overflow from bed
- Surface permeability >20"/hr

Site Factors
- Water table/Bedrock separation: two-foot min*.
- Feasibility on steeper slopes: Low
- Potential hot spots: Not without design of pretreatment system

Benefits
- Volume control and groundwater recharge, moderate peak rate control
- Dual use for pavement structure and stormwater management

Limitations
- Pervious pavement not suitable for all uses
- High maintenance needs

* Four feet recommended, if possible
**Applicable with special design considerations.
***Pretreatment for TSS is recommended.

LID Manual for Michigan - Chapter 7 Page 241

Source: SEMCOG, 2008, Low Impact Development Manual for Michigan: A Design Guide for Implementers and Reviewers

BMP Representations

While nearly all of the documents explain attributes of individual management practices, there is a great variety in the choice of portrayals, including sketches, visual references, scaled measurements, calculations, costs, and other information for use. The most thorough BMP approach was found in the *Low Impact Development Manual for Michigan,* where BMPs were grouped into Nonstructural and Structural types and included "BMP Fact Sheets" for each. These BMP fact sheets are consistently organized and include a case study, descriptions, applications, design considerations, construction guidelines, functions/calculations, and a generic checklist for use in a variety of policy or guideline documents. Other documents adequately described BMPs as well, including the *American Rivers Low Impact Development Manual, EPA Stormwater Best Management Practices,* and MDEQ's *Stormwater Management Guidebook*. BMP depictions can also be found throughout the main text of the document entitled *A Natural Solution for the Grand Traverse Bay Region or Light Imprint Handbook*. These documents, however, were designed more for understanding LID than for creating a thorough understanding of the details of each BMP.


LID Practices Labels

FOR PLANNING YOUR NEXT PROJECT

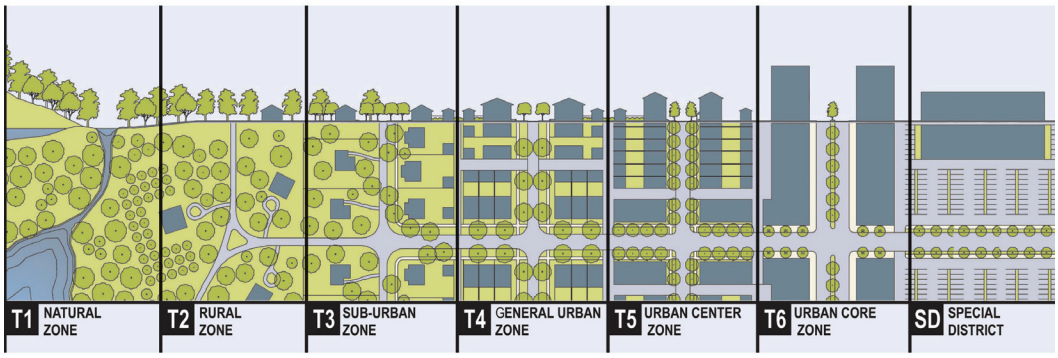
Stickers have become a tool in recent years to facilitate exploring concepts in community planning workshops. Similarly, stickers illustrated with LID techniques are a useful tool in designing plans to manage stormwater on a development site. For more stickers please contact the Watershed Center Grand Traverse Bay.

Source: The Watershed Center Grand Traverse Bay and Michigan Department of Environmental Quality

Checklists

Many of the resources reviewed include checklists in the form of charts, inventories, bulleted "to-do" lists, or step-by-step measures which should be followed for specific BMPs or for augmenting effective use of the respective tool. As already mentioned, the *Low Impact Design Manual for Michigan* includes proposed checklists for each of the BMP Fact Sheets. While this appears to be the most consistent use of checklists, there are other approaches to producing such lists that may be more practical for plan reviewers (such as the "sticker"-based approach adopted by *A Natural Solution for the Grand Traverse Bay Region*). This approach offers a series of stickers which can be placed on plans being reviewed for recommendations on the use of specific BMPs.

Comprehensiveness
Each of the tools or resources examined attempts to expand the use of LID into larger systems of knowledge, practice, or governance. Larger systems include statutes or regulatory frameworks such as local planning/zoning, the State of Michigan's Municipal Separate Storm Sewer System (MS4) program, and the Clean Water Act. Other larger systems include more-broadly defined voluntary initiatives such as Smart Growth, New Urbanism, and employing general sustainability practices across a range of measures such as economics, social equity, or environmental integrity. Resources which have aimed LID practices to higher initiatives of smart growth or sustainability include the *Light Imprint Handbook* (chart below), *Leadership in Energy and Environmental Design – Neighborhood Development (LEED-ND), American Rivers Low Impact Development Manual,* and the *EPA Stormwater Best Management Practices.* Nearly all of the resources referred in some manner to larger requirements of the Clean Water Act, but the two MDEQ resources and the Storm Water Pollution Prevention Initiative (SWPPI) plans were most directly connected to this initiative.



Source: Duany Plater-Zyberk & Company

Local Applicability
Despite the wide range of tools serving a variety of users, there are very few directly relating to local governments. Michigan has established many types of local governments interacting at all levels with citizens, business owners, and developers. It is during these transactions that most BMPs will be directly applied. One rating system, LEED-ND, is a sustainability rating system for neighborhood development and offers a useful set of review criteria for zoning ordinances or other land use regulations (USGBC 2012). This has already been done in various West Michigan jurisdictions where a point system based on LEED-ND has been used in the zoning review process. Further, two DEQ documents, *Guidebook of BMPs for Michigan Wetlands* and *Stormwater Management Guidebook,* include guides for use in ordinances or other stormwater policies. Also, SWPPI plans adopted by the City of Rockford and the Village of Sparta include appendices that are directly related to local government actions necessary under the state's MS4 permit requirements.

Kent County Stormwater Ordinance

Beginning in 1999, the Kent County Model Stormwater Ordinance was developed in accordance with the requirements of the National Pollutant Discharge Elimination System (NPDES) Phase II regulations. Those regulations, created by the Environmental Protection Agency (EPA), are intended to cover all non-point sources of pollution to streams, rivers, lakes, and the oceans. The Model Ordinance was the result of a multi-year collaborative effort between many partners.

The Model Ordinance provided a standardized approach to stormwater management throughout municipalities within Kent County. Although each municipality adopted their own specific ordinance, the general framework and regulatory processes of each ordinance remained in common.

At the heart of the Model Ordinance is the concept of Stormwater Management Zones. Each watershed was to be evaluated in its totality, determining the flow characteristics of each tributary stream or conveyance structure. Dependent upon those conditions, the specific levels of stormwater control would vary, with resultant regulations for potential development. Although these zones were to be watershed-based, each political entity was tasked to create its own mapped zones within its jurisdiction.

Since its adoption in 2001, the Model Ordinance has proved to be an effective regulatory structure for most political units within the Rogue River watershed and Kent County. The communities which have not adopted the Model Ordinance typically have other ordinances or prescribed methodologies in place covering stormwater management. The Model Ordinance's consistent application has streamlined the development process while protecting the existing drainageways from flooding, and controlling soil erosion and sedimentation. A new effort is coalescing to expand and reinforce the Model Ordinance, establishing a mechanism to review and revise it every 5 to 10 years.

Green Grand Rapids

When the City of Grand Rapids updated its Master Plan in 2011, the focus of the new comprehensive planning document was made clear by its title: Green Grand Rapids. With its adoption, the concepts of green infrastructure, sustainability, and quality of life became the guiding principles for all City planning, zoning, and development decisions.

The new Master Plan update centered on six topics: Natural Systems, Greening, Connections, the Grand River, Parks & Recreation, and Local Food. Included in each topic were green infrastructure tenets providing the bridge between these topics and actual planning choices. Those topics were then weaved through three themes taken from the previous Master Plan: Balanced Transportation, A City That Enriches Our Lives, and A City in Balance with Nature.

As Grand Rapids' most significant natural resource, the Grand River corridor is covered extensively in the updated Master Plan. However, several BMPs outlined for the riparian edges and flow characteristics of the Grand River are applicable for other river corridor preservation and enhancement efforts such as those in the Rogue River.

MS4 Program Overview and Requirements

Stormwater runoff is commonly transported through MS4s, typically a system of drainage (including roads, storm drains, pipes, ditches, etc.) from which stormwater is often discharged untreated into local waterbodies. To prevent harmful pollutants from being washed or dumped into an MS4, the EPA requires municipal entities to obtain NPDES permits and develop stormwater management programs.

Entities that are regulated by the MS4 permit have urbanized areas as defined by US census data, and own and operate MS4s that discharge to waters of the state. In the Rogue River watershed this includes: the Village of Sparta, the City of Rockford, and parts of Algoma, Sparta, Alpine, and Plainfield Townships that drain to MS4s owned by Kent County or the Kent County Road Commission.

EPA requires that regulated MS4 operators "develop, implement and enforce a program to reduce the pollutants in post-construction runoff to their MS4 from new development and redevelopment projects that result in a land disturbance of greater than or equal to 1 acre." This program should include strategies that include a combination of structural and nonstructural BMPs, a regulatory mechanism that requires the implementation of post-construction runoff controls, and a requirement for long-term operation and maintenance of post-construction controls.

The 2003 NPDES General Permit for MS4s subject to Watershed Plan Requirements requires the "development, implementation and enforcement of a comprehensive stormwater management program for post-construction controls for areas of new development and significant redevelopment." In order to meet this permit requirement the permittee must evaluate and implement BMPs to prevent or minimize the impacts on water quality. Examples of BMPs include policies and ordinances to encourage infill, limits on the rate and volume of stormwater discharges, and protecting sensitive areas. The permit also requires permittees to have requirements to ensure the long-term operation and maintenance of these BMPs.

The 2013 Storm Water Discharge Permit Application requires that permittees submit a description of their Post-construction Stormwater Runoff Control Program to maintain or restore stable hydrology in receiving waters by limiting surface runoff rates and volumes and reducing pollutant loadings from development and significant redevelopment. In their application, permittees must explain how their regulatory mechanism provides or is as effective as the following: water quality treatment standard, channel protection performance standard, provide for site-specific BMPs in areas of soil or groundwater contamination so that existing conditions are not exacerbated, require site plan review and approval of post-construction BMPs, and require the long-term operation and maintenance of all structural and vegetative BMPs.

The recommendations found in this Guidebook – e.g., stormwater management guidelines, BMPs, long-term maintenance requirements – are specifically tailored towards guiding MS4 communities within the Rogue River watershed to compliance with the State of Michigan and EPA permit requirements.

Existing Tools and Resources

Administrative Integration
Due to the voluntary nature of employing LID solutions, resources are most often used as educational or promotional tools to encourage spontaneous use by citizens, designers, or plan reviewers. Seldom are they seen and described as part of the standard work flow within local jurisdictions. While individual departments or committees covering subjects such as planning/zoning, public works, engineering, or law may review these practices, or implement various components, it does not appear to be a common practice to apply LID approaches across all administrative or functional parts of local governing jurisdictions. One resource which stood out in this regard was the *EPA Stormwater Best Management Practices*. In several sections of this document, "talking points" were offered about how to discuss LID-related topics in various local government departments.

Implementation
If LID is to become widely adopted in handling and managing stormwater, a clear path of moving myriad key participants through all parts of the process must be worked out. This includes generating public awareness and support, documenting stormwater management as a major component of a community's vision for the future, working through each local government's broad policy stance on tools, adopting the appropriate statutes and regulatory framework to make the tools work, and adopting internal measures to support and sustain the approach.

Though none of the examined resources focused on effective implementation at the local level, several documents referred to the concept, including the *American Rivers Low Impact Development Manual* and the *EPA Stormwater Best Management Practices*.

Need for Integration

While none of the existing LID tools or resources reviewed in this document covered all of our chosen attributes, it is clear that there has been important work accomplished over the years. By carefully reviewing and evaluating the most applicable features of each of these tools, wasteful duplication and unnecessary redundancy can be avoided. The primary objective of this document is to create a guidebook that coordinates innovative engineering practices (LID practices) in specific transect zones for effective use by local governments to control stormwater runoff over a series of land use sectors.

3. Integrating Concepts with Local Planning and Zoning

Primer on Local Planning and Zoning

Despite the great variety of personal beliefs about politics, property, liberty, happiness, community, natural stewardship, or any of dozens of similar personal ideals present in our country, we have adopted long-standing governance systems designed to narrow our views into single shared settlement pattern and land use developments. This system includes laws, codes, practices, procedures, evaluations, judgments, and decision-making that reflect the same complex hierarchy associated with the establishment of our home sites, neighborhoods, cities, region and nation. Tied to the level of activity and the degree to which the general public has an interest in the choices being made, we rely on a complete range of governance and regulation pertaining to community development. At the national or state level, we authorize permits or regulate regional uses (such as dredging rivers, discharging stormwater, or building inter-state highways). At the local level (township, city, or village) we administer a full set of authorizations including permits for building homes, permissions to conduct a wide range of land uses, and dozens of property-related approvals, assessments, or resolutions. Even at the neighborhood level, we recognize associations and boards with authority over the way we conduct our lives. Depending on our choices, all of these functions at every level of government can profoundly affect the quality of our public waters.

Due to our “home-rule” tradition in Michigan (legal autonomy granted to cities and villages by the Home Rule City Act of 1909, together with limited autonomy granted to counties and townships in respective public acts), the most significant level of government, especially as it relates to the building of community, is our local governments. Townships, cities, villages, and many counties play the key role in regulating orderly development and determining appropriate locations and configurations of land use. They also have significant, if not controlling, roles to play in providing for roads, utilities, and a host of services and amenities. Common forms of local rules and procedures used to guide both development and community activities include master-or comprehensive-plans, zoning regulations, land division regulations, and ordinances.

Master- or Comprehensive-Planning
Perhaps the most significant exercise a local community enters into is creating or updating their master plan. Also known as a Comprehensive Plan, General Plan, Development Plan, or Future Land Use Plan, this document is the product of a process which is based on direct public involvement and a wide range of studies from an array of community functions. As with most planning documents for any enterprise, they usually include data gathering; attitude and opinion surveys; vision and goal setting; evaluation of major issues; comparisons of scenarios; and the adoption of maps, policies, and recommendations for a series of implementation and funding methods including capital improvement programs and grants.

Zoning Regulations
Zoning is the primary regulatory instrument governing the development and use of land for all local governments (unless they have deferred to a county level of zoning). Since zoning is designed to prescribe in law where and how various land uses can be placed and conducted, it is a very powerful instrument. Zoning regulations must be adopted as provided by the Michigan Zoning Enabling Act (PA 33 of 2008), and, since these regulations usually cover the entire municipality, they have great influence over all residents and business owners living or working in that jurisdiction. "Zoning" derived its name from the practice of dividing a jurisdiction into various "zones" within which a range of land uses and structures is permitted. Unfortunately, this method of dividing larger municipal areas, like Michigan's standard 36 square mile townships, has led to overly simplified zoning layouts which do not recognize important distinctions between various landforms, natural conditions, or parts of a functional community.

Land Division and Subdivision Regulations
Subdivision regulations were first created to establish a more orderly way of dividing, conveying, recording, and accounting for property and its ownership. Today, the process of dividing and using land has been broadened to cover all land divisions and linked to planning, zoning, and the entire land development process. Subdivision and land division ordinances have rules covering how new parcels should be created and will be served by utilities, roads, walkways, drainage ways, parks, and other easements dedicated for various purposes or uses.

Other "Police Power" Ordinances
In addition to zoning and subdivision regulations, the State of Michigan allows local jurisdictions to adopt any number of ordinances or statutes designed to regulate activities that promote public health, safety, and general welfare. Depending on the locality, such ordinances cover many aspects of local governance, including stormwater management, junk or refuse disposal, animal control, hazardous substances, soil erosion, floodplains, utilities, sewer and water use, and specific issue regulations like assemblies or events.

Contemporary Practices

Land use planning and many of its associated tools and techniques were first established in the United States during the first half of the last century. The origins of "good planning" were rooted in two basic precepts: 1) good plans can be designed with a rational, data-driven model of component assembly so that the right number of uses in the right place at the right time produces the correct design, and 2) good public administration will be served through a utilitarian political imperative (providing the greatest good for the greatest number of citizens establishes justice). During the 1950s, 1960s, and 1970s, planners used this rationale to produce countless land use plans to guide local government decision-making during a period of unprecedented residential development. Rational-utilitarian planning, known today simply as "sprawl," applied at the local level kept a development-infrastructure cycle running for nearly 50 years. Instant residential communities and new infrastructure construction were "leap-frogging" one another over open landscapes across the country. This early period of planning both unintentionally produced urban sprawl and became the foundation upon which most of our land use guidance tools were based.

However, since the 1970s, the emergence of three important movements in local land use planning started a growing awareness of the shortcomings in previously adopted practices, and new approaches were critically necessary to reverse these trends. These movements were: design with nature, new urbanism, and growth management.

Design with Nature

In 1969, Ian McHarg wrote *Design with Nature,* a seminal work describing how planning in America could incorporate both man-related development objectives and basal or steady state conditions of nature. As a practical follow-up to Rachel Carson's *Silent Spring* (1962), McHarg's book presented a step-by-step approach to analyzing various "land use suitabilities" based on an ecological view and considering suitability factors such as hydrology, soils, climate, vegetation, etc. His work offered a methodology of rating matrices that prescribed and correlated the relative importance of a series of environmental and social value factors. With very few usable computers available to professional planners at the time, the techniques were simple and the method may not have had complete scientific rigor backing its reliability, but for the first time in American planning history, recommendations for future man-made settlements and community development could be based on compatibility with natural conditions including water quality. Since that time, environmental protections have been codified at all levels of government, giving rise to federally mandated "environmental impact statements" and a series of planning efforts including the clean water act, coastal zone management, brownfields restoration, river corridor planning, and concepts leading to the latest fields of sustainability, regenerative design, and bio-mimicry.

New Urbanism

In our earliest efforts to build the places we inhabit, there were no deliberate systems of review or regulatory restrictions guiding the development of neighborhoods, main streets, and downtowns. These places were the simplest aggregations of human lives and activities and evolved in the most cost-efficient ways from our most immediate needs (i.e., travel, shelter, food, work, play, etc.). However, beginning in the post-World War II community development cycle mentioned above, new massive levels of urban infrastructure were built to support an exploding suburban exodus, where personal automobiles connected separated homes and services supplied in more isolated land use types such as shopping centers and industrial parks. In her renowned work in the early 1960s, *The Death and Life of Great American Cities,* Jane Jacobs wrote about the tragic results of the earliest planning initiatives, particularly those that undermined cohesive neighborhoods and well-founded urban form. Instead planning initiatives promoted single-use housing projects, large car-dependent arterials and thoroughfares, segregated commercial centers and industrial parks, and other major public infrastructure works that supported modern planning at the expense of the best characteristics of American cities. Recognition of the need for returning to "good urbanism" grew and eventually led to the creation of the Congress for New Urbanism, founded in 1993, and the adoption of the Charter for New Urbanism. Since then, planners throughout the country have been re-acquainting themselves with the importance of building, renovating, and sustaining high-quality urban areas in ways which preserve environmental quality and better handle water resources.

Growth Management

In an effort to curb the undesirable and expensive effects of uncoordinated growth and the "sprawl" development cycle mentioned earlier, many states, regions, and local governments examined new approaches of controlling growth and development during the 1970s and the early 1980s. In an effort to promote more concise, better planned growth patterns, many states adopted new land use planning techniques and strategies aimed at slowing or restricting growth, or at least pacing community growth to better match required public infrastructure. During this time, several states also adopted land use initiatives and introduced new techniques such as impact fees, urban growth boundaries, utility or urban services boundaries, and infrastructure concurrency requirements. While all of these statutory mechanisms for growth control were adopted with the same rational-utilitarian approach embedded in early planning tools, they also created various and arguable outcomes in reshaping the negative effects of sprawl. They also collectively lead to two divergent conclusions in the public planning realm which guide community development and land preservation today: that governments' ability to restrict growth is strictly limited by constitutional restrictions in the "taking" of land rights, and that new rationales and strategies would be necessary to produce more desirable outcomes.

Sustainability and Greening

The most recent trends in land use planning and its associated regulatory support are based on the belief that government subsidies for excessive infrastructure have hidden the true costs of decades of sprawling growth. Recognizing and accounting for the true costs and long-term consequences of today's development practices will require significant change in our current systems of planning and development. Fortunately, many new concepts and techniques are being introduced to the process of local planning, and they are direct descendants of the earlier efforts in combining nature, better cities and promoting realistic and more efficient infrastructure, particularly those maintaining water quality.

Smart Growth

In the early 1990s, being "smarter" meant using new digital technologies and data collection and electronic distribution methods to assist with planning. Such technologies have revealed much about our existing conditions and allowed much easier scenario planning and the testing of expected outcomes. This led many leading planners across the country to experiment with emerging concepts of merging both design with nature and the need for better urban design. This movement produced several key components generally referred to as "smart growth principles" (Smart Growth Network, www.epa.gov/smartgrowth). These principles include:

- Mixing land uses
- Taking advantage of compact building design
- Creating a range of housing opportunities and choices
- Creating walkable neighborhoods
- Fostering distinctive, attractive communities with a strong sense of place
- Preserving open space, farmland, natural beauty, and critical environmental areas
- Strengthening and directing development towards existing communities
- Providing a variety of transportation choices
- Making development decisions predictable, fair, and cost-effective
- Encouraging community and stakeholder collaboration in development decisions

Principles for Good Urbanism
In 1991, a group of urban planners gathered to discuss and establish a set of principles to declare what was necessary to support good urbanism or what were referred to as "resource-efficient" communities. These principles were termed the Ahwahnee Principles (Local Government Commission, www.lgc.org/ahwahnee/principles) and include:

Preamble

Existing patterns of urban and suburban development seriously impair our quality of life. The symptoms are: more congestion and air pollution resulting from our increased dependence on automobiles, the loss of precious open space, the need for costly improvements to roads and public services, the inequitable distribution of economic resources, and the loss of a sense of community. By drawing upon the best from the past and the present, we can plan communities that will more successfully serve the needs of those who live and work within them. Such planning should adhere to certain fundamental principles.

Community Principles

- All planning should be in the form of complete and integrated communities containing housing, shops, workplaces, schools, parks, and civic facilities essential to the daily life of the residents.
- Community size should be designed so that housing, jobs, daily needs, and other activities are within easy walking distance of each other.
- As many activities as possible should be located within easy walking distance of transit stops.
- A community should contain a diversity of housing types to enable citizens from a wide range of economic levels and age groups to live within its boundaries.
- Businesses within the community should provide a range of job types for the community's residents.
- The location and character of the community should be consistent with a larger transit network.
- The community should have a center focus that combines commercial, civic, cultural, and recreational uses.
- The community should contain an ample supply of specialized open space in the form of squares, green areas, and parks whose frequent use is encouraged through placement and design.

List continued on the following page.

Sustainability and Greening

Community Principles *continued*

- Public spaces should be designed to encourage the attention and presence of people at all hours of the day and night.
- Each community or cluster of communities should have a well-defined edge, such as agricultural greenbelts or wildlife corridors, permanently protected from development.
- Streets, pedestrian paths, and bike paths should contribute to a system of fully connected and interesting routes to all destinations. Their design should encourage pedestrian and bicycle use by being small and spatially defined by buildings, trees, and lighting; and by discouraging high-speed traffic.
- Wherever possible, the natural terrain, drainage, and vegetation of the community should be preserved with superior examples contained within parks or greenbelts.
- The community design should help conserve resources / minimize waste.
- Communities should provide for the efficient use of water through the use of natural drainage, drought tolerant landscaping, and recycling.
- The street orientation, the placement of buildings, and the use of shading should contribute to the energy efficiency of the community.

Regional Principles

- The regional land-use planning structure should be integrated within a larger transportation network built around transit rather than freeways.
- Regions should be bounded by and provide a continuous system of greenbelt/ wildlife corridors to be determined by natural conditions.
- Regional institutions and services (government, stadiums, museums, etc.) should be located in the urban core.
- Materials and methods of construction should be specific to the region, exhibiting a continuity of history and culture and compatibility with the climate to encourage the development of local character and community identity.

Implementation Principles

- The general plan should be updated to incorporate the above principles.
- Rather than allowing developer-initiated, piecemeal development, local governments should take charge of the planning process. General plans should designate where new growth, infill, or redevelopment will be allowed to occur.
- Prior to any development, a specific plan should be prepared based on these planning principles.
- Plans should be developed through an open process and participants in the process should be provided visual models of all planning proposals.

Sustainability
Though simple in its proposition, attaining a state of "sustainability" is perhaps the most ambitious and elusive aim of the most recent planning approaches. Put simply, it can be defined as "the capacity to endure." But "endurance" is most often seen as the adoption of complex measures across all sectors of our economy, all parts of our environment, and all facets of social involvement in our communities. Creating such a state of endurance has recently led sustainability planning into new, very broad initiatives such as resiliency planning (planning to withstand future disasters related to natural catastrophes, economic downturns, or social injustice) and planning for mitigating global climate change. However, most efforts for sustainability in our currently established planning and zoning structures involve devising new methods of meeting what has been referred to as "triple bottom line" outcomes, which set up a regulatory structure promoting simultaneous positive outcomes concerning the environment, the economy, and social equity.

New Tools for New Ideals

Smart Growth, New Urbanism, and Sustainability are all laudable contemporary planning initiatives and have introduced planners, developers, local officials, service providers, and many others to a whole new set of concepts and tools which can be used to meet their professional objectives while still ensuring we are improving our neighborhoods, communities, and regions in the process. Many new tools have already been adopted such as rules for transit-oriented developments (TODs), programs purchasing development rights (PDRs), Form-based Codes (zoning which recognizes urban form), conservation design codes (rules allowing clustering of residential developments), and sustainability incentives (bonus provisions for energy efficiency or greenhouse gas reduction).

Preserving and maintaining our natural waters and managing water as it moves through our communities are another critical area of planning for sustainability. This guidebook is intended to provide new perspectives on incorporating provisions for handling stormwater in a manner which fits well within these new planning initiatives.

4. Using a Community Assessment for Smart LID Practices

As we have found in previous sections, a well-developed Master Plan, together with supporting zoning regulations and other land development/resource protection ordinances, is the primary way land use and community development occur in all local governments in Michigan. Therefore, the best way to implement LID practices is to make sure they are well integrated with the components of a meaningful community planning process and adopted as a part of an overall program for carrying out Master Plan recommendations. Planning Commissions, which conduct the most critical role in initiating and following through on programs like LID, must therefore take the first steps in placing such guidelines into their community.

To accomplish such a comprehensive approach and establish a long-lasting program for LID, it is recommended that it be done in conjunction with the most recent trends in land use and community planning. Therefore, a Community Assessment for Smart LID has been created as part of this guide to help evaluate a community's Master Plan, Zoning Ordinances, and Procedural Approvals & Review processes for more effectively incorporating LID or other stormwater management practices into current or future planning and zoning processes.

Reviewing Community Readiness for Smart LID Practices

Using the assessment checklist provided in Appendix 2, a planning commission should initiate a review process by examining each of the following elements as it currently exists in their community. Depending on the chosen review process and work assignments, such an assessment could take some time, perhaps spanning several meetings. A planning commission should make sure their workload, annual budget, and legislative body support can sustain several months of review and discussion. Also, due to the potential for significant and meaningful revisions or amendments to the communities, planning and zoning practices, concurrence or active involvement by the legislative body is advisable, as is citizen involvement if dedicated study committees are formed.

The assessment checklist includes a brief description of each of the elements described below and is designed to allow for a complete review of numerous critical aspects of planning and zoning tools, practices, and procedures. As reviewers consult various sources of information about each element, notations on findings should be made as part of the checklist to allow for additional evaluations at a later time. It is also highly recommended that all notations, materials collected, and evaluations be well documented and archived in suitable volumes for future reference. The following explanations of assessment review elements follow the order in which they are found in the checklist and cover three main sections: Master Plan, Zoning and Other Ordinances, and Approvals and Reviews.

Master Plan Elements

As enabled by Public Act 33 of 2008, Master Plans are expected to guide future development so that it is coordinated, adjusted, harmonious, efficient, and economical. In doing so, a Master Plan assumes the examination of all pertinent aspects of community development, the projection of future expectations and needs, and provides for suitable methods to arrive at community-supported goals. Those goals are typically centered around transportation, safety, light and air, population distribution, civic design, public utilities and improvements, and the use of resources in accordance with their character and adaptability. Check the following elements in the Community Assessment for Smart LID:

1. Plan Currency

Find the date of the last update for your community's Master Plan. If it is due for a required 5-year update, note that in the chart and make sure that LID and stormwater management are specified as a component of the next review.

Reviewing Community Readiness for Smart LID Practices

Master Plan Elements continued

2. Green Infrastructure

As part of an overall review, start with those sections of the Master Plan which inventory natural resources or otherwise account for larger environmental features associated with open spaces and/or green infrastructure. Check for data collected and evaluated on water bodies, protected sensitive lands, land enrolled in PDRs, conservation easements, or other significant open lands set aside as parks, wildlife corridors, preserves or dedicated open lands in clustered developments. Does the plan consider an overall approach to continuing protection or maintenance of such areas? Particular note should be made for any form of protected lands related to water quality (i.e., well-head protection, land application rules, river buffers or corridors).

3. Water Quality

Check out those sections of the Master Plan which deal with or refer to water. Does the plan address provisions for surface waters such as streams and rivers, ponds and wetlands? Does the plan consider or review groundwater quality or protection, including well permit logs, well-head protection, or site-drained stormwaters?

4. Stormwater Management

Review any references to impacts of surface or stormwater collection, storage, diversions, or movements. This would include references to a wide range of water-based issues including erosion, sedimentation, basement flooding, septic-system drainage, changes in pond depths, major flood events, etc. Many communities will cover such materials as part of their NPDES permits, if required, or stormwater management plans may also be mentioned in relation to meeting requirements at local, county, state, and sometimes federal levels.

5. Watershed Management Plan[1]

A well-done watershed management plan will include numerous goals, objectives, and strategies all aimed at improving water quality and stormwater management. These documents should be fully evaluated for specific recommendations on key water-related issues for inclusion into local Master Plans.

[1] Watershed Management Plans are specific documents created and adopted by entities governing watersheds or an informal consortium of local governments sharing a watershed. The Rogue River watershed and the Lower Grand River watershed both have approved watershed management plans outlining important community concerns. Having watershed management plans that have been approved by MDEQ and USEPA is important for incorporating into local planning, but also can be a catalyst for designing and funding key water quality projects in your community.

6. Planned Use Review

Master Plans evaluate existing and proposed population and/or land use patterns in their communities. Examine the basis for determining population and/or use concentrations and locations. In sparsely developed governmental jurisdictions, future use may be based on grossly distributed projected future populations. In more densely populated jurisdictions, future use may be based on existing or historic neighborhood patterns with future populations handled through expanded use boundaries, infill, or increased use density.

Check to see if there are any references to a "transect" or new urbanism. This would typically include a more focused examination of any existing developed areas, particularly those which may identify sectors or neighborhood types based on functional relationships to more concentrated development centers in the area. These could include special studies with names like "sub plan," "sub area plan," "neighborhood plan," "corridor plan," or similar detailing of various sectors or segments of the community called out as a special planning area. Any references to such plans should be examined for special provisions related to stormwater or LID practices.

7. Planned Infrastructure Review

Evaluate provisions for streets and public utilities and how they connect or service various use groups or building activities. Master Plans are also intended to match future populations with appropriate types and service levels of streets, public utilities, rights-of-way, parks, recreation facilities, and other services and amenities together with associated infrastructure. Though this sounds like a reasonable exercise, this can be particularly difficult since new population centers may not be expected with enough certainty to project and provide such expensive infrastructure. If large increases in population are expected, planning commissions should realistically examine and recommend efficient, cost-effective ways to provide long-term services and infrastructure. Check to see if in forecasting and servicing future populations, there have been provisions made for protecting water and managing stormwater in long-term sustainable ways.

8. Public Engagement

Review portions of the plan reporting opinions or issues and the creation of goals, objectives, and "action steps" for implementation measures related to survey findings. Master Plans should be laid out to accomplish long-range goals as desired by the community. Has the community been brought into the process and did they have a chance to express their opinions on water management or quality issues? If so, have any follow-up provisions been initiated in the planning process to solve those issues?

Reviewing Community Readiness for Smart LID Practices

Zoning and Ordinance Elements

If your community's Master Plan is up to date, it may already include a complete review of existing regulations, and in some cases may have already set up changes which ensure a greater emphasis on water-related issues associated with development approvals. If not, municipalities generally keep all of their ordinances in a codified system or an online collection. Smaller villages and cities or rural townships may still keep ordinances as separately maintained documents. Look first for zoning and subdivision (or land division) regulations since they are the most common. Also consider other ordinances such as: stormwater management,[2] waterways, utilities, wetlands protection, environment, etc.

1. Zoning Ordinance

Since "zoning" deals with all aspects of conducting human activities, zoning ordinances have become large complex ordinances promulgating a wide range of rules on buildings, general structures, all forms of land use, landscape design or changes, vegetative cover, water resources, property access, neighborhood nuisances, keeping of animals, property maintenance, and dozens of others. It is therefore very important to review your local zoning ordinance and thoroughly examine the following standard types of requirements or regulations likely contained there:

a. General Provisions

Any zoning provisions entitled "General," "Supplemental," or "Other" are regulations or standards which apply universally to the placement of structures or the conduct of uses in all zones or for all types of uses. They are often found in separate chapters of the zoning ordinance and cover a wide range of use types or activities which varies greatly by community. These provisions can substantially regulate the placement or conduct of such items as accessory buildings, swimming pools, animal keeping, private drives, lot divisions, yard structures, fences, retaining walls, landscaping, parking lots, loading areas, and many others too numerous to list completely here.

Conduct a thorough search of these zoning requirements and note in particular all of those that pertain to regulated uses that affect water such as shaping land, changing elevations, landscaping, tree retention, protecting groundwater, preventing pollution, or otherwise generally handling stormwater or lands adjacent to water bodies.

[2] See SAMPLE STORMWATER ORDINANCE from Filling the Gap or *LID Manual for Michigan.*

b. Zoning District Use Approvals

Zoning ordinances refer to various zones usually called "districts" which allocate uses in broad categories (like Residential, Commercial, and Industrial). Within each of these zones, very specific land uses are listed and authorized based on a set of standards. These standards are usually listed within each district, but may also be listed in tables or charts referenced in one location in the ordinance. Use regulations are usually of two types: permitted uses or special uses.

Permitted Uses. Uses which are allowed to advance to building authorization or can be conducted without special authorization if they meet certain criteria set forth for the district are known as permitted uses. For example, a single family residence may be listed as one of many permitted uses in a residential zone. However, before receiving permits to build a home or occupy the building, the owner may have to submit a site plan (see next page) and indicate that minimum lot size and setback criteria are met. Look through each use and any associated criteria, noting particularly any criteria that may relate to water management or water quality. For example, residential permitted uses may include criteria relating minimum lot sizes to the availability of public sewer and demand greater lot area if on-site sewage disposal will be required for building.

Special Uses. Special or conditional uses are also authorized by district (though can be listed independently or as general provisions), but only after meeting some level of greater scrutiny and decision-making by a designated local official or governmental body. The process for granting such uses must include standards or guidelines for approval, and the ability to conduct a special use is frequently conditioned on findings made during the approval process. Standards for approving special uses can be included by district where the use is cited, in special sections covering all special uses, or in separate district use charts. Review these criteria or standards for any references to water handling and protection.

Reviewing Community Readiness for Smart LID Practices

Zoning and Ordinance Elements continued

c. Site Plan Reviews
Site plan reviews are a part of the overall zoning administration process and will usually be found as a section within the administrative procedures or as a general provision. They can also be in a separate chapter. Site plan reviews are required throughout the ordinance for a variety of purposes, not the least of which is authorizing any land use, land change, or building activity (though single family homes and many solitary structures do not require them). Site plan review criteria can be cursory or extensive, but most include references to conditions on the site, so take particular note of those related to site water management and storm drainage.

d. Planned Developments Procedures
These are a widely used type of zone or approval process that can be applied to certain types of large cohesive or unified "developments" distinguished by a deliberative and interactive approval process. Planned developments are also known as "planned unit development" or "planned [specified use] development" where the specified use is any number of land use types (residential, commercial, industrial, institutional, or various mixes). The planned development can either be treated as a stand-alone zoning district (which is often "floating" or established only upon application), pre-designated as overlay zones applying more stringent review criteria over existing use-based zones, or as specially approved development agreements that are applied to specific properties. Planned development regulations are set up as design-based approvals for special properties intended for complete developments, often of mixed uses or densities, and include a comprehensive set of review and approval criteria with strict procedures governing timing, public input, and adoption. Planned development regulations are usually easy to find within zoning ordinances and should be examined closely for references to stormwater collection, storage, and conveyance; protection of critical areas such as wetlands or shorelines; and water quality protection. Planned development requirements for plan content submissions, design criteria, and review standards should be examined closely, noting all references to water management and related details.

e. Special Zones
Specialized districts or zones can be used for unique locations or site conditions which are linked to a particular location or geographic boundary. These zones may be identified as either a specific independent district (such as a Floodplain Zone), or as an "overlay" zone which applies or imposes an additional set of restrictions to zoning districts which are located in specific geographic areas of special concern (such as a Well Head Protection Overlay area). An example of this kind of zone or special area is created by the Natural Rivers Act, Part 305 of PA 451 of 1994, which may provide a unique zone of special regulation for identified natural river segments (of which the Rogue River is one). Since special zones apply additional criteria related to land preservation, resource protection, or public safety, they should be thoroughly reviewed for adding water-related regulations for critical areas such as floodplains or floodways, wetland preservation, and well-head protection.

f. Form-based, Smartcodes or Hybrids
A more recent approach for regulating the arrangement, use, and development of land involves a more complete or integrated use of special zones or planned developments (as described earlier). With these, rules are based less on the type or conduct of use through zoning districts and more on types and interrelationships between buildings, structures, facilities, and amenities. Whether part of an entire zoning ordinance or part of smaller portions in stand-alone districts or areas, regulations of this type are known as "form-based" codes, "smartcodes," or "hybrid codes." "Form-based" codes specify extensive development criteria for primarily urban environments, while "smartcodes" arrange form-based criteria in a more integrated community-wide, "transect based" approach. "Hybrid" codes include parts of traditional zoning and form-based codes. These zoning approaches typically include greater reliance on development specifications, including drawings and illustrations. They also rely more heavily on administrative approvals (like special uses), to allow for exceptions and variations to the required urban forms or transect-based rules. Since this set of LID guidelines uses the transect as a basis for making appropriate choices, review these ordinances carefully for attention to water-related details as prescribed by urban forms or transect zones.

Reviewing Community Readiness for Smart LID Practices

Zoning and Ordinance Elements continued

2. Review Subdivision or Land Division Regulations

The subdivision of land at the local level is governed by a set of reviews and prescribed steps for approval (similar to planned developments as described above). These regulations can be stand-alone ordinances with references to zones and development criteria found in zoning ordinances, or they may be written as a part of zoning ordinances. Subdivision regulations are enabled by the Land Division Act (also known as the "Plat Act" or "Subdivision Control Act") and set out the rules for reviewing and approving the creation of lots or "owned" parcels or tracts of land. When more than the allowable parcels[3] are created by a set of divisions, the lots or "owned" parcels need to be recorded in a "plat" which is certified and kept by the State of Michigan. Even though actual land uses are not yet established, subdivision or land division regulations imply future use by subsequent sale (typically for residential development). Subdivision regulations require that plats be submitted to the applicable county and state agencies for review and sign-off that the new "development" will meet their respective requirements for public streets, public health, and the protection of public waters.

Subdivision ordinances in most jurisdictions apply standards and design guidelines for plats which include requirements for streets and drainage ways, even if they are simple references to the standards adopted by county agencies. Check plat requirements for plan content and design guidelines for references to any stormwater management and/or LID requirements.

3. Stormwater Ordinances

In recent years, more local jurisdictions are adopting stormwater ordinances. Like subdivision ordinances, these regulations can be stand-alone ordinances with references to zoning, or incorporated as an integral part of a zoning ordinance itself. If adopted as a separate ordinance, a permit will likely be required and procedures for receiving a stormwater permit will include a full set of drainage plans, design criteria, and submission of maintenance agreements and performance guarantees. In reviewing stormwater regulations, note particularly references to BMPs and requirements of the county drain and road commissions.

[3] See Sections 108 and 109 of the Land Division Act, Act 288 of 1967.

4. Other Ordinances and Regulations

Local jurisdictions have adopted a variety of separate ordinances through local police powers. Such ordinances are typically dedicated to a fairly narrow set of concerns and often create a form of local licensing, independent certification, or permitting. Review the entire set of ordinances adopted by your jurisdiction and select for review those which appear to regulate water supply or the protection of unique or sensitive water-related features in the jurisdiction. Some examples include ordinances covering tree protection, river or lake protection, well-head protection, open lands, parks and recreation, street design, and green building provisions for building permitting.

Reviewing Community Readiness for Smart LID Practices

Approval and Review Elements

Even if communities are already working with zoning provisions and ordinances such as those described earlier, the local process of managing or protecting water resources may still be incomplete. The procedures followed by local governments in handling applications, ensuring plans are complete, interactive reviews during project design, and proceeding through the various approvals required from staff, planning commissions, legislative bodies, and other public agencies are critical for establishing successful LID or other stormwater management practices. As part of the community assessment, review the following procedures as they may be provided by your community.

1. Online Presence or General Office Personnel

Most local governments provide routine office hours and have hired administrative personnel to assist citizens, business owners, builders, developers, and others who may be interested in land use approval or conducting some other regulated activity. Review any advisories, checklists, or other materials that are available for distribution describing specific stormwater-related requirements or more general information that local home or business owners should consider for handling their own on-site stormwater.

2. Local Zoning Administrator/Building Staff

Zoning ordinances and other local government statutes designate key personnel to administer their many provisions. In more developed or fast-growing communities, there may be departments devoted to planning, community development, zoning, land use approvals, etc. Staff persons in such departments often include planners, zoning administrators, economic development personnel, inspectors, and office administrative staff. In smaller or more rural jurisdictions, there may be one or two persons who are responsible for all zoning and building approvals, often a building inspector or elected official such as a township supervisor. Review any job descriptions, training requirements, or similar performance expectations concerning knowledge of stormwater management or related issues.

3. Pre-Application Conferences

Complex regulatory procedures such as Planned Developments or subdivision platting often include pre-application conferences. These conferences allow for meetings between local planning, zoning, or building staff and design professionals or developers to review critical aspects of a project under consideration. Pre-application conferences may be required with specific outcomes or more generally adopted as a matter of policy. Check any regulatory references to pre-application conferences and note particularly those related to topography, drainage, reduced paving, tree retention, proposed LID installations, or other stormwater-related issues. If pre-applications are informal, interview local officials to determine what level of review of stormwater- or water-related issues they typically conduct.

4. Initial Planning Commission Reviews

For larger developments, the first review by a public body is usually the Planning Commission. Zoning regulations usually specify a series of early or initial reviews ranging from simple pre-application meetings to formal preliminary plan approvals. They also will be required to conduct public hearings through the process of review for planned developments, special uses, or other conditional approvals. Check any requirements for early reviews by the Planning Commission, including bylaws or procedural practices, zoning requirements, or pre-application and preliminary plan protocols for references to properly handling stormwater.

5. Local Engineering Review

During the local review of large developments, detailed construction plans will require specific reviews by local engineering professionals or consultants. Zoning and other ordinances usually require specific reviews, recommendations, and/or approvals by designated licensed engineers. Those aspects of stormwater systems that local engineering professionals are required to review should be checked and any references to BMPs or LID practices should be noted. Further, check for provisions requiring easements, bonds, or escrow accounts related to stormwater management improvements.

Reviewing Community Readiness for Smart LID Practices

Approval and Review Elements continued

6. County or State Agency Review

As development proposals advance through local governmental processes, other agencies with responsibility for ensuring that environmental damage is avoided or mitigated must review plans as well. Check for references or provisions which require additional review by county or state agencies regarding stormwater management and water protection and note those.

7. Final Reviews

After local reviews and approvals are conducted and met, there is usually a separate set of processes for final approval. These usually involve ensuring that all steps have been taken, legal requirements have been met, certain improvements have been made, and any surety or performance guarantees are established and executed. Check and note where any stormwater-related BMPs or LID practices are required as part of the overall final review process.

8. Monitoring

Once stormwater improvements or management systems have been installed, ongoing maintenance and assurances for proper function must be established. Check and note references in any ordinances or approval procedures for establishing ongoing requirements in maintaining the function and effectiveness of stormwater management provisions.

Implications for Community Readiness Findings

After a thorough examination of the way your municipality handles its water resources, a clearer picture of the type of land use planning and system of codes and regulations in your community can be seen. Using your community assessment form and notations, review the following to determine how ready your community might be for adopting smart growth principles for choosing LID practices. Since these findings are not empirically derived, there may be great variation between the three degrees of "readiness" presented here. Depending on your findings and the type of municipal organization you represent, the methods for improving stormwater management in your jurisdiction may vary greatly.

The assessment checklist includes a brief description of each of the elements described below and is designed to allow for a complete review of numerous critical aspects of planning and zoning tools, practices, and procedures. As reviewers consult various sources of information about each element, notations on findings should be made as part of the checklist to allow for additional evaluations at a later time. It is also highly recommended that all notations, materials collected, and evaluations be well documented and archived in suitable volumes for future reference. The following explanations of assessment review elements follow the order in which they are found in the checklist and cover three main sections: Master Plan, Zoning and Other Ordinances, and Approvals and Reviews.

Not Ready for Smart LID

Community assessments that generally indicate the following conditions are probably not ready for LID programs and should consider a more complete review of how stormwater and water protection is handled in their community:

- Master Plan is out of date by 10 years or more
- Marginal references made to stormwater management, water protection, or water quality in the Master Plan
- Planning approach which emphasizes only existing use, zoning history, and parcel availability
- Failure to emphasize centers of growth/use density, additional support for infrastructure/facilities, or protection of vital natural areas or open spaces
- Natural areas, unique or sensitive landscapes, or currently dedicated open lands are not systematically identified or integrated
- Plan goals and policies not supported by strong public consensus
- Zoning regulations for handling water-related issues with only minimal or generalized statements of review

List continued on the following page.

Implications for Community Readiness Findings

Not Ready for Smart LID continued

- Absence of planned development reviews for water management or special zones for unique water bodies or sources
- No interrelated or coordinated approach to laying out zoning and building regulations to support good community design or urbanism
- No ordinances for reviewing or approving subdivisions
- No ordinances for reviewing or approving plans for stormwater handling, wetlands, or other similar issues
- Insufficient office staffing or online guidance for navigating approval procedures
- Local zoning and/or building officials that are not trained or enabled to guide significant land use projects or larger developments
- Few or no provisions for meeting with local officials as part of the design process
- Planning Commission not well enough organized for early interaction in project design procedures
- No ongoing relationship with engineering professionals, even for occasional plan reviews
- No final review procedures including checklists or establishing bonds or escrows
- Very little ongoing effort to monitor or ensure that approved land uses are conducted properly on an ongoing basis

Somewhat Ready for Smart LID

Community assessments that generally indicate the following conditions are probably at some level applying LID solutions, but may not be ready for a more complete accounting through a whole-community, transect-based approach:

- Master Plan has been updated recently, or not much more than 5 years ago
- Master Plan includes scattered references to stormwater management, water protection, or water quality, but does not provide more concise programming or an integrated approach
- Planning process includes population and/or use projections and distributes future use on the basis of visionary goals and appropriate locations

- Planning process includes an analysis of aggregated uses and steering new growth to areas with existing supportive infrastructure/facilities
- Planning process accounts for high-value natural areas or open spaces
- Plan goals and policies are based on thorough surveying of public opinions and attitudes indicating a strong consensus supporting planning visions and recommendations
- Various zoning regulations include specific standards for stormwater management and include considerations for other water-related issues over a wide range of building and use activities
- Planned development regulations provide for specific plan content and reviews for water management for proposed developments
- Zoning districts with special overlay or buffering zones associated with protecting waters or requiring best management practices
- Zoning and building regulations are context derived and support good community design or urbanism
- Subdivisions and land division regulations are adopted in ordinances which are linked to local zoning standards
- Other ordinances exist for reviewing or approving plans for stormwater management, wetlands, or other similar issues
- Administrative offices are staffed and online presence provides information on approval procedures
- Local zoning administrators and building officials are trained to work with project designers to guide significant land use projects or larger developments
- Some level of pre-application conference, even if informal, exists as part of the design process
- Planning Commission has adopted formal procedures for their roles in early receipt and advancing of projects through design and approval procedures
- Local government has a designated engineering professional for involvement with project designs and plan reviews
- Final review, approval, and performance procedures exist and are exercised
- Procedures exist for monitoring of approved land uses and are conducted routinely

Implications for Community Readiness Findings

Ready for Smart LID

Community assessments that generally meet the following conditions may already be applying LID practices and should consider a more integrated transect-based approach:

- Master Plan is the result of a routine procedure established for evaluating and updating the Master Plan no less frequently than every 5 years
- Master Plan includes an independent analysis of stormwater management practices, water protection, or water quality, and establishes recommendations promoting a program of tracking stormwater management practices across all phases of earth change and land development
- Planning is based on a broad examination of existing regional, community, and neighborhood centers and seeks to enhance existing locations with design principles creating more desirable sustainable growth or redevelopment in those areas
- Planning process aligns appropriate patterns of building, use, and facilities with identified centers promoting new growth based on sustainable, context sensitive expansion of infrastructure and amenities
- Planning process establishes long-range programs for acquiring, preserving, or protecting high-value natural areas, open spaces, or green infrastructure
- Community goals, area plans, and policies are based on front-end interactive public input, ongoing refinement and testing, and follow-up consensus building from supporting planning visions, goals, plans, and recommendations
- Various zoning regulations include specific standards for stormwater management and requirements for water-related issues over a wide range of building and use activities
- Planned development regulations provide specific plan content and review requirements for water management in proposed developments
- Special zones are established as overlays or buffers associated with protecting waters or requiring best management practices for water resources
- Zoning and building regulations are context derived and support good community design or urbanism
- Subdivisions and land division regulations are adopted in ordinances which are linked to local zoning standards
- Other ordinances have been adopted for reviewing or approving plans for stormwater management, wetlands, or other similar issues

- Administrative offices are fully staffed and website includes educational materials, checklist and ordinance downloads, ample procedural information, and expedient contact capability
- Designated consulting or staff planner and zoning administrator are routinely engaged with project designers to guide significant land use projects or larger developments
- Pre-application conferences are written into review requirements or otherwise formally adopted, as part of the design process
- Planning Commission's role in early receipt and advancing of projects is formally adopted and routinely observed
- Local government has hired or retained a designated engineering professional or firm for ongoing involvement with project designs and plan reviews
- Final review, approval and performance procedures are formally established and routinely used
- Key officials are responsible for monitoring of approved land uses, and formal procedures are conducted routinely

Adopting a Smarter Local Water Management Approach

No matter how your community might be characterized in its readiness for broader, more thorough, and integrated programs for stormwater management, the assessment you have conducted may be of significant use in determining how to proceed toward greater readiness for adopting smarter LID practices in the future. The elements identified in your assessment may have characterized your community as "not ready," but each of these elements can be compared with higher levels of readiness to advance your community in the years ahead and to enhance your community's capability to support smarter stormwater management systems.

For example, perhaps assessment notations for your community suggest that very little mention has been made in the Master Plan about water-related or stormwater management issues and the plan has adopted very few, if any, regulatory measures to review development or earth change proposals. Looking at both the assessment checklist and the descriptions, a reviewer could infer that the next steps for your community would be to: (1) collect additional data on natural, open, or sensitive lands and review for protection; (2) conduct public opinion surveys or involve citizens in an interactive evaluation of needs for specifically managing community water resources; (3) review best practices and watershed management plans for applicability to your community's needs and interests in water resource protection; and (4) produce an action-based set of goals and objectives and associated policy statements for your community to stimulate movement to the next level of readiness in the next round of Master Plan review. With such a progressive approach, all communities in the Rogue River watershed, no matter what level of readiness currently exists, should able to move closer to becoming a community supporting a fully planned and integrated system of stormwater management.

All communities in the Rogue River watershed that wish to establish a well-integrated approach to stormwater management, including those already prepared for more complete stormwater management programs, can use the following general approach to bring about a more consistent focus for managing all development in their communities. The underlying framework advocated in this document for integrating community development with the selection of effective LID solutions is the urban-to-rural transect as described earlier in Stormwater Tools.

The transect model, as developed by Andres Duany of Duany Plater-Zyberk and Company, has been used by community planners, urban designers, and zoning officials for well over a decade.[4] The "transect" is a general term applying to a linear cross-section which describes change occurring along the line. The "rural to urban transect" is a transect used to describe land use arrangements in a typical human settlement pattern. It provides a useful portrayal of how healthy and desirable urban areas can and should be designed in a manner that does not completely exclude human settlement and associated uses in less-developed areas surrounding urban centers. It also does not ignore the undeveloped open spaces and green areas that should remain for not only the enjoyment of all who live within the region, but to support critical habitats and natural services, especially for handling natural waters as they move through our regions.

Also characterized for its use in a variety of "smart growth" manuals and guidelines, the rural-to-urban transect is a fairly precise descriptive tool being used by those who study or design urban environments and can be employed for a variety of purposes. In this guidebook, the rural-to-urban transect is being recommended as a guiding model for the appropriate placement of LID stormwater management practices in a manner which systemically fits a broader, more integrated community planning and development approach taken by local governments. The LID approach proposed here is being considered as a "smart growth" approach to LID and must therefore be aligned with a much broader set of local planning initiatives which reflect such an approach.

Green Infrastructure & Growth Centers on the Transect
Smart growth begins with correctly identifying a community's urban places at various geographical or planning sector levels. Regional, community, neighborhood, block, or street level data should be fully examined for the degree to which existing development patterns fit a normative schematic for well-designed or well-executed urban growth.

Identify all such urbanized areas falling within the jurisdiction and those close enough to be influencing development patterns within the jurisdiction. If necessary, consult other transect resources to confirm the type of transect, whether it's urban, suburban, rural, or preserved areas in the community.

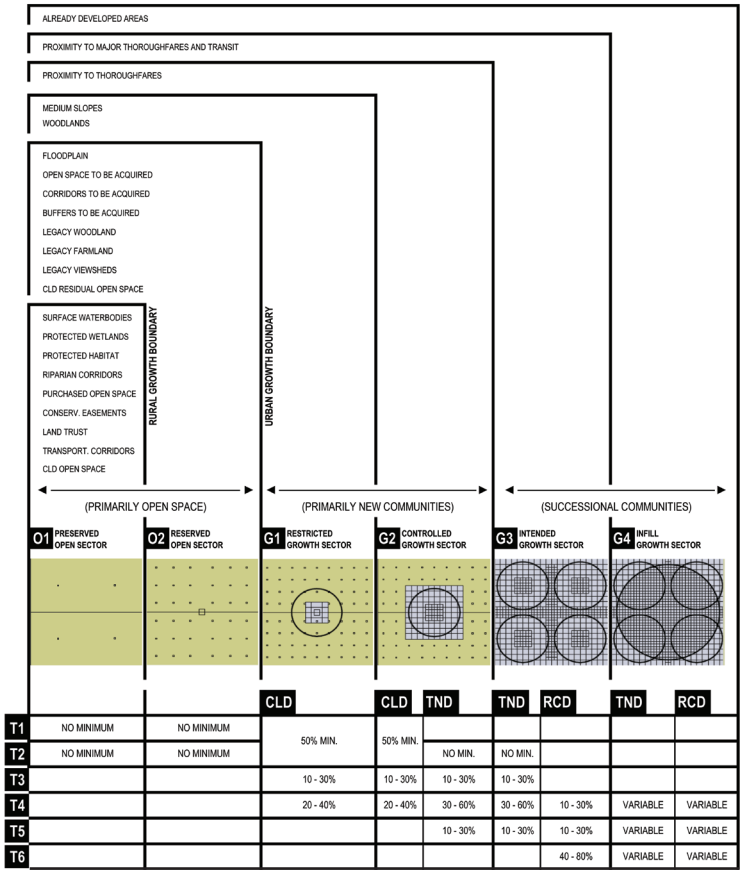
At the nonurban or preserved end of the transect scale, consult all lands that can or should be considered as permanently restricted from development, including water bodies or natural drainage areas, regional retention areas, areas with conservation

[4] *The Smart Growth Manual*, 2010.

Adopting a Smarter Local Water Management Approach

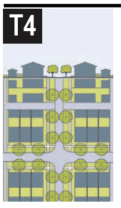
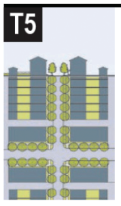
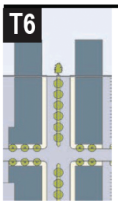
easements, government-owned lands such as parks or conservation preserves, lands owned by public foundations to preserve unique lands or habitat, and significant portions of land set aside through clustered development or otherwise dedicated to open space as part of development approvals.

Once a more complete analysis has been done on the regional or whole-community level, the jurisdiction being examined can be further divided into its transect-oriented parts based on a locally evaluated and calibrated transect definition. Smartcode 9.2 includes a general description of six transect areas that are commonly used for this type of analysis and can be translated locally for use in planning.



Sector/Community Allocation
Smartcode.9.2[5]

[5] Smartcode 9.2, DPZ, 2010, model ordinance available online at: http://smartcodecentral.org/.

 T1	**T-1 NATURAL** T-1 Natural Zone consists of lands approximating or reverting to a wilderness condition, including lands unsuitable for settlement due to topography, hydrology or vegetation.	**General Character:** **Building Placement:** **Frontage Types:** **Typical Building Height:** **Type of Civic Space:**	Natural landscape with some agricultural use Not applicable Not applicable Not applicable Parks, Greenways
 T2	**T-2 RURAL** T-2 Rural Zone consists of sparsely settled lands in open or cultivated states. These include woodland, agricultural land, grassland, and irrigable desert. Typical buildings are farmhouses, agricultural buildings, cabins, and villas.	**General Character:** **Building Placement:** **Frontage Types:** **Typical Building Height:** **Type of Civic Space:**	Primarily agricultural with woodland & wetland and scattered buildings Variable Setbacks Not applicable 1- to 2-Story Parks, Greenways
 T3	**T-3 SUB-URBAN** T-3 Sub-Urban Zone consists of low density residential areas, adjacent to higher zones that have some mixed use. Home occupations and outbuildings are allowed. Planting is naturalistic and setbacks are relatively deep. Blocks may be large and the roads irregular to accommodate natural conditions.	**General Character:** **Building Placement:** **Frontage Types:** **Typical Building Height:** **Type of Civic Space:**	Lawns and landscaped yards surrounding detached single-family houses; pedestrians occasionally Large and variable front and side yard Setbacks Porches, fences, naturalistic tree planting 1- to 2-Story with some 3-Story Parks, Greenways
 T4	**T-4 GENERAL URBAN** T-4 General Urban Zone consists of a mixed use but primarily residential urban fabric. It may have a wide range of building types: single, Sideyard, and Rowhouses. Setbacks and landscaping are variable. Streets with curbs and side-walks define medium-sized Blocks.	**General Character:** **Building Placement:** **Frontage Types:** **Typical Building Height:** **Type of Civic Space:**	Mix of Houses, Townhouses and small Apartment buildings with scattered Commercial activity; balance between landscape and buildings; presence of pedestrians Shallow to medium front and side yard Setbacks Porches, fences, Dooryards 2- to 3-Story with a few taller Mixed Use buildings Squares, Greens
 T5	**T-5 URBAN CENTER** T-5 Urban Center Zone consists of higher density mixed use building that accommodate Retail, Offices, Row- houses and Apartments. It has a tight network of streets, with wide sidewalks, steady street tree planting and buildings set close to the sidewalks.	**General Character:** **Building Placement:** **Frontage Types:** **Typical Building Height:** **Type of Civic Space:**	Shops mixed with Townhouses, larger Apartment houses, Offices, work place and Civic buildings; predominantly attached buildings; trees within the public right-of-way; substantial pedestrian activity Shallow Setbacks or none; buildings oriented to street defining a street wall Stoops, Shopfronts, Galleries 2- to 5-Story with some variation Parks, Plazas, and Squares, median landscaping
 T6	**T-6 URBAN CORE** T-6 Urban Core Zone consists of the highest density and height, with the greatest variety of uses, and civic buildings of regional importance. It may have larger Blocks; streets have steady street tree planting and buildings are set close to wide sidewalks. Typically only large towns and cities have an Urban Core Zone.	**General Character:** **Building Placement:** **Frontage Types:** **Typical Building Height:** **Type of Civic Space:**	Medium to high-Density Mixed Use buildings, entertainment, Civic and cultural uses. Attached buildings forming a continuous street wall; trees within the public right-of-way; highest pedestrian and transit activity Shallow Setbacks or none; buildings oriented toward the street, defining a street wall Stoops, Dooryards, Forecourts, Shopfronts, Galleries and Arcades 4-plus Story with a few shorter buildings Parks, Plazas and Squares; median landscaping

Transect Zone Descriptions
Smartcode.9.2[6]

[6] Ibid, Smartcode 9.2.

Adopting a Smarter Local Water Management Approach

Master Plan Context
Though there are no specific criteria in the Michigan Planning Enabling Act for the way a Community Master Plan can be laid out, starting with a transect-based approach should lead to a graphical and descriptive portrayal of a community that in turn can lead to a more thorough review of all types and levels of community infrastructure. They can then be logically grouped according to their relationship with other infrastructure and allow for scaling and design choices to better fit building types, lot layouts, and other requirements typically expressed in a Master Plan.

In any transect-based Master Plan, each type of infrastructure or natural system or amenity that should be studied within a Master Plan (see MPEA, 2008, Sec. 33 (2), (b)) can be reviewed for its relevance and design imperatives over each of the transect zones intended for development or redevelopment. This lends itself well to conducting a separate evaluation of each community's needs for a particular Master Plan component, in this case stormwater management, and ensuring that specifications or recommendations are made over each of the community segments (sectors) that are intersected by whatever system is designed. In other words, a transect-based Master Plan can use the transect model for prescribing various infrastructural needs over a wide range of community transitions and still provide a consistent service level for each.

Another approach to determining appropriate Master Plan arrangements of land use and infrastructure can be adapted from LEED-ND rating guidelines (see previous discussion in Stormwater Tools). Though LEED-ND is intended to evaluate large neighborhood developments in metropolitan areas, it uses point-based criteria for smart locations and linkages, neighborhood patterns and designs, green construction and technology, and more innovative ratings more directly related to individual developments in specific locations. Perhaps most useful to a smarter Master Plan process are the Smart Locations & Linkages section which offers a set of ideals for locating neighborhoods within larger communities or regions. Scoring for these standards can be translated to useful standards in master planning.

A comprehensive master planning approach to a more integrated set of LID practices is critical to building strong community support for stormwater management and implementing it over a long period of time. Reinforcing the adoption of smart growth and transect-based planning concepts starts with a broad community outreach program including surveys, workshops, focus groups, and training sessions. An informed, enthusiastic constituency will more likely support new policies, ordinances, incentives, and funding programs necessary to ensure smarter LID practices become a long-term reality for local communities.

Adopting Smarter Codes

Master Plans can be better designed to accommodate various levels of community growth types across the rural-to-urban transect, but to bring plans into the physical world local zoning or building regulations must be established with a similar alignment to the transect. These ordinances or "codes" are being written to re-orient traditional zoning practices from the last 60 years (as discussed in Integrating Concepts with Local Planning and Zoning) from over-reliance on various land use types in simplistic "puzzle-piece" districts which primarily produce a safe building on a prescribed lot which allows a narrow range of use to a model based more on the way new structures and uses fit together in a well-built community environment, including its attendant infrastructure and amenities. Using this approach, growth or rehabilitation in a community can better fit into the context of appropriately designed, cherished community.

Form-based codes are typically focused on detailed building and location guidelines which place structures in appropriate locations best fitting the prevailing urban form or based on established urban design guidelines. Smartcodes are form-based codes which are called "smart" since they are designed to include a wider array of community types and usually offer greater attention to the rural and undeveloped parts of the community as well. The Smartcode (described in Stormwater Tools and cited previously in this section) was created by Duany Plater-Zyberk and Company as a specific model for regulating development across a context-sensitive transect and is connected to overall land use planning for various scaled sectors such as regions, communities, or neighborhoods.

Since traditional zoning is still so prevalent today, many communities are adopting a kind of mixed code called a "hybrid." As the name implies, hybrid codes usually include aspects of both traditional codes and form-based or smartcodes. For example, instead of changing all zoning districts to context-sensitive, fully planned community types, various classifications can be described both in planning and zoning, which set out specific areas (like special districts, PUDs or overlays) for form-based or smart coding.

These guidelines are based on use of the rural-to-urban transect used for organizing the Smartcode. The adoption of a smartcode or a hybrid version of such a code would be the best way to make full use of its recommendations.

Adopting a Smarter Local Water Management Approach

More Effective Stormwater LID Choices

For communities that have adopted or are in the process of adopting some level of stormwater regulation but have not yet considered an overall smart growth or transect-based planning approach for master planning and associated regulations, the *LID Manual for Michigan*[7] outlines a series of steps in Chapters 4 and 5 which should be consulted. In Chapter 4, become more familiar with the types of Master Plan policies that should be associated with stormwater management goals, the adoption of LID-friendly regulations (including a stormwater ordinance), and incorporating LID into existing regulations. In Chapter 5, be sure to incorporate suggestions for site design procedures and consider the Site Design checklist for LID on page 53. The *LID Manual for Michigan* also has a complete set of BMPs which are considered to be Low Impact Development measures and is an essential guide for ongoing selection of appropriate LID practices.

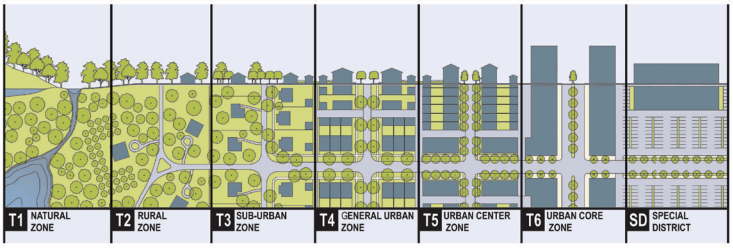
If your community has embarked on a more complete smart growth or transect-based approach to planning, land regulation, and development, the *Light Imprint Handbook*[8] will provide a primary tool to use in selecting various LID practices which correlate to the rural-to-urban transect conditions planned or existing in your community. Choices made in recommending and approving LID practices can be directly aligned to smartcode provisions or as recommendations in various transect zones. Transect-based guidelines for aligning LID practices are described more fully in the handbook and are shown in the following table, more legible excerpts of which may be found on pages 54-57.

[7] *Low Impact Development Manual for Michigan: A Design Guide for Implementers and Reviewers.*
[8] *Light Imprint Handbook,* Thomas E. Low, DPZ Charlotte, 2008.

Smartcode Module — Light Imprint Storm Drainage Matrix

Municipality

Note: All requirements in this Table are subject to calibration for local context.



	T1	T2	T3	T4	T5	T6	SD	Maint.	Cost	
a. PAVING										
Compacted Earth	▪	▪	▪					L	$	
Wood Planks	▪	▪	▪					H	$$$	
Plastic Mesh/Geomat		▪	▪	▪				L	$	
Crushed Stone/Shell		▪	▪	▪				M	$	
Cast/Pressed Concrete Paver Block			▪	▪	▪			L	$$	
Grassed Cellular Plastic			▪	▪	▪			M	$$$	
Grassed Cellular Concrete			▪	▪	▪	▪		M	$$$	
Pervious Asphalt			▪	▪	▪	▪		L	$$	
Asphalt			▪	▪	▪	▪		L	$	
Concrete			▪	▪	▪	▪		L	$$	
Pervious Concrete			▪	▪	▪	▪		L	$$	
Stamped Asphalt			▪	▪	▪	▪		L	$$$	
Stamped Concrete			▪	▪	▪	▪		L	$$$	
Pea Gravel				▪	▪	▪		M	$	
Stone/Masonry Paving Blocks				▪	▪	▪		L	$$$	
Wood Paving Blocks on Concrete					▪	▪		L	$$$	
Asphalt Paving Blocks					▪	▪		M	$$	
b. CHANNELING										
Natural Creek	▪	▪						L	$	
Terracing	▪	▪	▪					M	$$	
Vegetative Swale	▪	▪	▪					L	$	
Drainage Ditch	▪	▪	▪					L	$	
Stone/Rip Rap Channels		▪	▪	▪				L	$$	
Vegetative/Stone Swale		▪	▪	▪	▪			L	$	
Grassed Cellular Plastic			▪	▪	▪			M	$$$	
Grassed Cellular Concrete			▪	▪	▪			M	$$$	
Soakaway Trench			▪	▪	▪			M	$$$	
Slope Avenue			▪	▪	▪			M	$$$	
French Drain			▪	▪	▪			M	$	
Shallow Channel Footpath/Rainwater Conveyor			▪	▪	▪	▪		L	$	
Concrete Pipe			▪	▪	▪	▪		L	$$	
Gutter			▪	▪	▪	▪		L	$$	
Planting Strip Trench			▪	▪	▪	▪		L	$	
Masonry Trough				▪	▪			L	$$	
Canal				▪	▪	▪		H	$$$	
Sculpted Watercourse, i.e. cascades					▪	▪		M	$$$	
Concrete Trough					▪	▪		L	$$	
Archimedean Screw					▪	▪		L	$$$	
c. STORAGE										
Irrigation Pond		▪	▪					L	$	
Retention Basin with Sloping Bank		▪	▪					L	$$	
Retention Basin with Fence		▪	▪	▪				L	$$	
Retention Hollow			▪	▪				M	$	
Detention Pond			▪	▪				L	$	
Vegetative Purification Bed			▪	▪	▪			M	$$	
Flowing Park			▪	▪	▪			M	$$	
Retention Pond			▪	▪	▪			M	$$	
Landscaped Tree Well				▪	▪			L	$$	
Pool/Fountain				▪	▪	▪		H	$$$	
Underground Vault/Pipe/Cistern-Corrugated Metal				▪	▪	▪		L	$$	
Underground Vault/Pipe/Cistern-Precast Concrete				▪	▪	▪		L	$$	
Underground Vault/Pipe/Cistern-Cast in place Concrete				▪	▪	▪		L	$$	
Grated Tree Well					▪	▪		L	$$	
Underground Vault/Pipe/Cistern-Plastic					▪	▪		L	$$$	
Paved Basin					▪	▪		M	$$$	
d. FILTRATION										
Wetland/Swamp	▪	▪						L	$	
Filtration Ponds	▪	▪						L	$$	
Shallow Marsh	▪	▪	▪					M	$	
Surface Landscape	▪	▪	▪					L	$	
Natural Vegetation	▪	▪	▪	▪	▪	▪		L	$	
Constructed Wetland		▪	▪					M	$	
Bio-Retention Swale		▪	▪					M	$$	
Purification Biotope		▪	▪	▪				H	$$	
Green Finger		▪	▪	▪	▪	▪		L	$$$	
Roof Garden		▪	▪	▪	▪	▪		M	$$$	
Rain Garden			▪	▪				M	$$	
Detention Pond			▪	▪				L	$	
Grassed Cellular Plastic			▪	▪				M	$$$	
Grassed Cellular Concrete			▪	▪				M	$$$	
Waterscapes				▪	▪	▪		H	$$$	

*NOTE - Maintenance is denoted as L=Low, M=Medium and H=High.

Also shown on p. 54

Also shown on p. 55

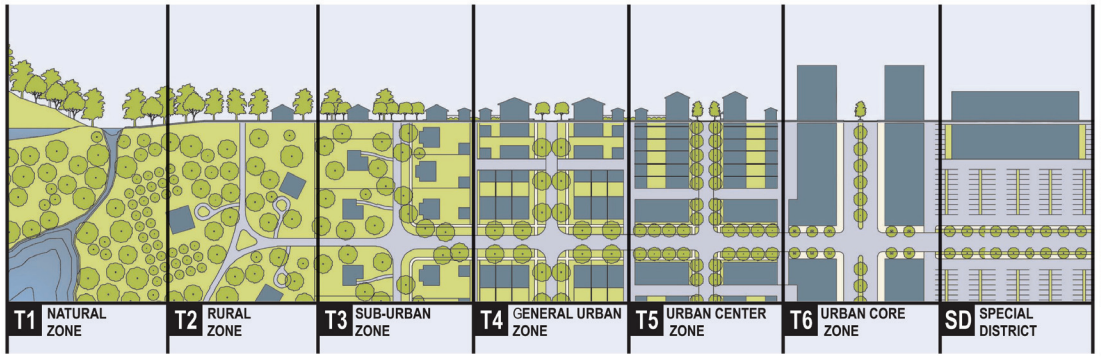
Also shown on p. 56

Also shown on p. 57

Smartcode Module — Light Imprint Storm Drainage Matrix

Municipality

Note: All requirements in this Table are subject to calibration for local context.



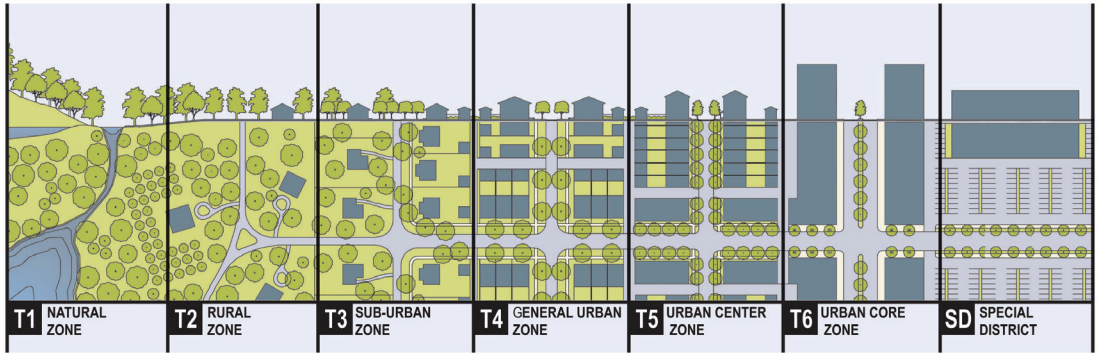
a. PAVING	T1 NATURAL ZONE	T2 RURAL ZONE	T3 SUB-URBAN ZONE	T4 GENERAL URBAN ZONE	T5 URBAN CENTER ZONE	T6 URBAN CORE ZONE	SD SPECIAL DISTRICT	Maint.	Cost
Compacted Earth	▪	▪	▪					L	$
Wood Planks	▪	▪	▪					H	$$$
Plastic Mesh/Geomat		▪	▪	▪				L	$
Crushed Stone/Shell		▪	▪	▪				M	$
Cast/Pressed Concrete Paver Block			▪	▪	▪			L	$$
Grassed Cellular Plastic			▪	▪	▪			M	$$$
Grassed Cellular Concrete			▪	▪	▪	▪		M	$$$
Pervious Asphalt			▪	▪	▪	▪		L	$$
Asphalt			▪	▪	▪	▪		L	$
Concrete			▪	▪	▪	▪		L	$$
Pervious Concrete			▪	▪	▪	▪		L	$$
Stamped Asphalt			▪	▪	▪	▪		L	$$$
Stamped Concrete			▪	▪	▪	▪		L	$$$
Pea Gravel				▪	▪	▪		M	$
Stone/Masonry Paving Blocks				▪	▪	▪		L	$$$
Wood Paving Blocks on Concrete					▪	▪		L	$$$
Asphalt Paving Blocks					▪	▪		M	$$

*Note – Maintenance is denoted as L=Low, M=Medium and H=High.

Smartcode Module — Light Imprint Storm Drainage Matrix

Municipality

Note: All requirements in this Table are subject to calibration for local context.



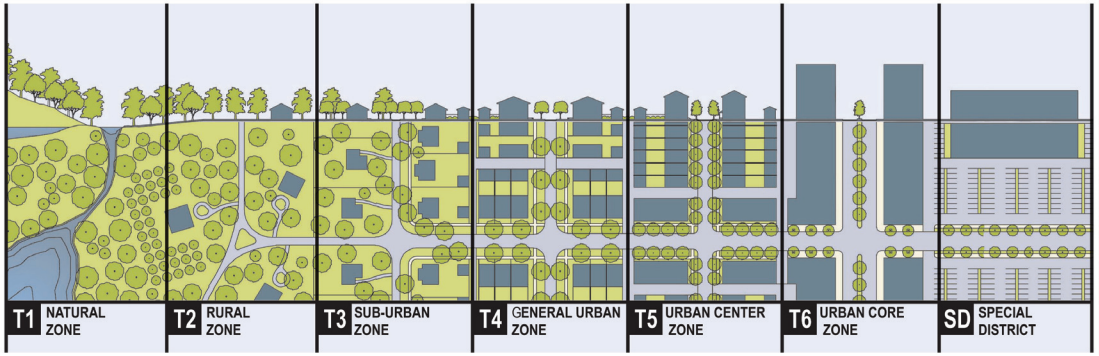
b. CHANNELING	T1	T2	T3	T4	T5	T6	SD		
Natural Creek	▪	▪						L	$
Terracing	▪	▪	▪					M	$$
Vegetative Swale	▪	▪	▪					L	$
Drainage Ditch	▪	▪	▪					L	$
Stone/Rip Rap Channels		▪	▪	▪				L	$$
Vegetative/Stone Swale		▪	▪	▪	▪			L	$
Grassed Cellular Plastic			▪	▪	▪			M	$$$
Grassed Cellular Concrete			▪	▪	▪			M	$$$
Soakaway Trench			▪	▪	▪			M	$$$
Slope Avenue			▪	▪	▪			M	$$$
French Drain			▪	▪	▪			M	$
Shallow Channel Footpath/Rainwater Conveyor			▪	▪	▪	▪		L	$
Concrete Pipe			▪	▪	▪	▪		L	$$
Gutter			▪	▪	▪	▪		L	$$
Planting Strip Trench			▪	▪	▪	▪		L	$
Masonry Trough				▪	▪			L	$$
Canal				▪	▪	▪		H	$$$
Sculpted Watercourse, i.e. cascades					▪	▪		M	$$$
Concrete Trough					▪	▪		L	$$
Archimedean Screw					▪	▪		L	$$$

*Note – Maintenance is denoted as L=Low, M=Medium and H=High.

Smartcode Module — Light Imprint Storm Drainage Matrix

Municipality

Note: All requirements in this Table are subject to calibration for local context.



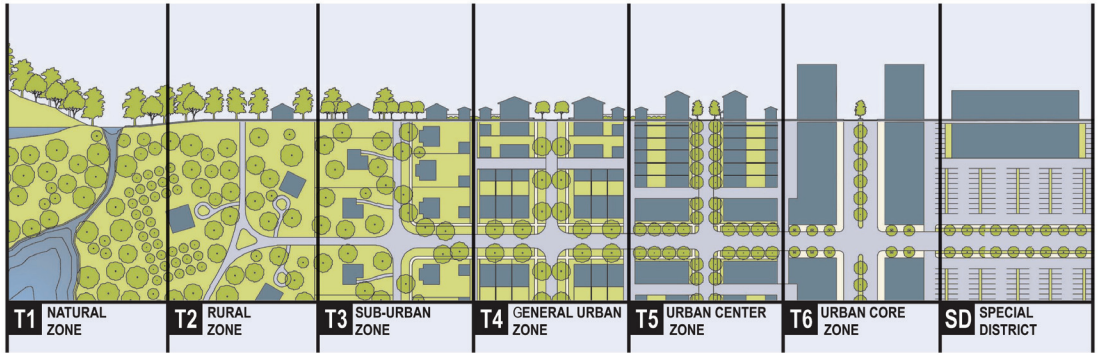
c. STORAGE	T1	T2	T3	T4	T5	T6	SD		
Irrigation Pond		▪	▪					L	$
Retention Basin with Sloping Bank		▪	▪					L	$$
Retention Basin with Fence		▪	▪	▪				L	$$
Retention Hollow			▪	▪				M	$
Detention Pond			▪	▪				L	$
Vegetative Purification Bed			▪	▪	▪			M	$$
Flowing Park			▪	▪	▪			M	$$
Retention Pond			▪	▪	▪			M	$$
Landscaped Tree Well				▪	▪			L	$$
Pool/Fountain				▪	▪	▪		H	$$$
Underground Vault/Pipe/Cistern-Corrugated Metal				▪	▪	▪		L	$$
Underground Vault/Pipe/Cistern-Precast Concrete				▪	▪	▪		L	$$
Underground Vault/Pipe/Cistern-Cast in place Concrete				▪	▪	▪		L	$$
Grated Tree Well					▪	▪		L	$$
Underground Vault/Pipe/Cistern-Plastic					▪	▪		L	$$$
Paved Basin					▪	▪		M	$$$

*Note – Maintenance is denoted as L=Low, M=Medium and H=High.

Smartcode Module — Light Imprint Storm Drainage Matrix

Municipality

Note: All requirements in this Table are subject to calibration for local context.



d. FILTRATION	T1	T2	T3	T4	T5	T6	SD		
Wetland/Swamp	▪	▪						L	$
Filtration Ponds	▪	▪						L	$$
Shallow Marsh	▪	▪	▪					M	$
Surface Landscape	▪	▪	▪					L	$
Natural Vegetation	▪	▪	▪	▪	▪	▪		L	$
Constructed Wetland		▪	▪					M	$
Bio-Retention Swale		▪	▪					M	$$
Purification Biotope		▪	▪	▪				H	$$
Green Finger		▪	▪	▪	▪	▪		L	$$$
Roof Garden		▪	▪	▪	▪	▪		M	$$$
Rain Garden			▪	▪				M	$$
Detention Pond			▪	▪				L	$
Grassed Cellular Plastic			▪	▪				M	$$$
Grassed Cellular Concrete			▪	▪				M	$$$
Waterscapes				▪	▪	▪		H	$$$

*Note – Maintenance is denoted as L=Low, M=Medium and H=High.

Adopting a Smarter Local Water Management Approach

Though the *Light Imprint Handbook* provides a convenient way to choose LID practices, it does not offer any shortcuts to a thorough study and construction of a well-designed water collection system which may be required in any given jurisdiction or neighborhood. Such a study should only be carried out by a professional engineering firm. The *Light Imprint Handbook* can, however, be used in conjunction with a stormwater system that has been designed to work with or encourage the use of on-site LID practices as part of the overall solution to stormwater management.

To give an idea as to how the *Light Imprint Handbook* can be used, this guidebook highlights a few LID practices as they may relate to various sections of the rural-to-urban transect. An illustration of how these practices look in a landscape can be found on the following page.

Rural

Rain Gardens: Rain gardens are shallow depressions designed to accommodate stormwater runoff in small quantities and strategic locations. These depressions are typically filled with native plantings designed to take up pollutants while trapping sediments.

Filter Strips: Filter strips are areas of vegetation alongside ponds, wetlands, and other water bodies specifically designed to prevent direct stormwater runoff and other pollutants. These filter strips may be placed along roadways in rural areas where little maintenance is required.

Suburban

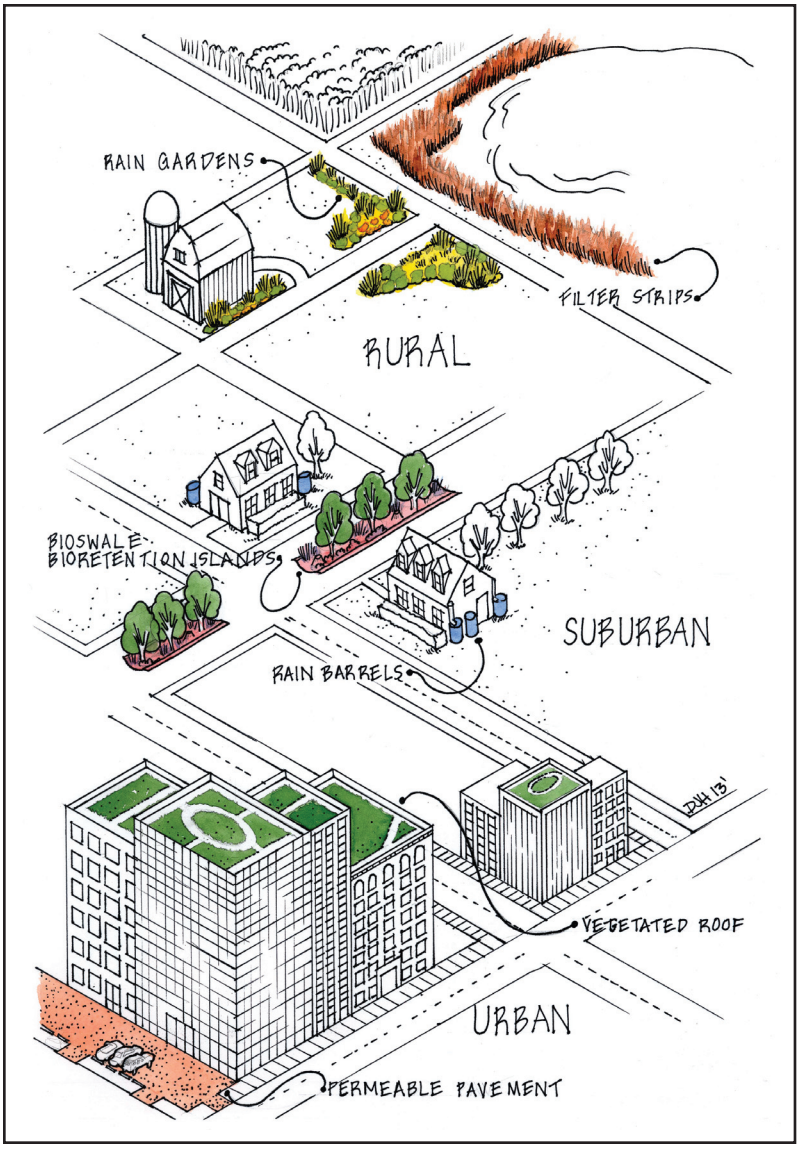
Bioswales / Bioretention Islands: Bioswales or Bioretention islands are used in suburban locations such as center medians and parking lot margins to store and filter immediate stormwater runoff. These installations can mitigate flooding due to under-capacity storm sewers while promoting infiltration.

Rain Barrels: Rain barrels are water tanks used to catch and hold rainwater, typically adjacent to residential homes. The stored rainwater may be used to irrigate flowers, gardens, and yards as an alternative to potable water.

Urban

Permeable Pavement: Permeable pavement may be used in urban environments to promote infiltration in lieu of hard surfaces. These are best situated where traffic is light, such as parking lots, and where subsurface conditions are favorable for rapid infiltration.

Vegetated Roofs: Vegetated or green roofs are roofs in typically urban settings where plantings are installed over a waterproof membrane to absorb rainwater and provide cooling effects.



This selection of LID practices should correlate to the rural-to-urban transect conditions planned or existing in your community.

Adopting a Smarter Local Water Management Approach

Selecting and Maintaining LID Practices
To fully incorporate LID practices on a rural-to-urban transect basis, all procedures outlining LID selection in zoning (whether traditional, smartcode, or form-based), subdivision regulations, stormwater ordinances, or other ordinances prescribing the selection of stormwater practices should refer to the transect or some similar scale of relative levels of development. Where traditional zoning is the only option, sufficient references in the Master Plan may be made to normalized urban development zones which provide a basis for comparison in recommending various LID practices. For example, the percent of existing impervious area can be used as a rough guide approximating a transect, and LID practices can be selected from that basis.

Maintenance of LID stormwater management systems is vital in order to reap the full benefits these systems provide. Routine maintenance is needed on these systems to prevent expensive large-scale repair or catastrophic problems. Thus, the challenge becomes: How to institutionalize this maintenance?

Local governments are generally the responsible party for maintenance of stormwater management systems. Unfortunately local government stormwater maintenance has been mainly driven by complaints rather than routine scheduled maintenance. For public lands, local governments need to include annual or seasonal maintenance for LID facilities in their planning, implementation, and budgeting. For private lands, education, incentives, and regulation are three strategies local governments can use to foster regular stormwater maintenance.

Education: Stormwater runoff and the use of stormwater management strategies traditionally have not been on the top of local governments' to-do list. Thus, it is important for citizens to understand this role of the local government and also the value of effective stormwater management. Simple, straightforward messages will help citizens understand LID benefits, which are not always visible. These messages can be in the form of brochures or information bulletins over public access channels. Community volunteers and informal workshops can equip citizens with technical LID management strategies. If citizens are required to pay fees to maintain local LID, they must be convinced that LID is worth the funding.

Incentives: Local governments can get creative with different ways to incentivize the maintenance of LID systems. One idea is to provide property owners (with LID systems on the premises) with technical advice and materials such as mulch, tools, or plants. Another idea is to reward and recognize property owners who properly maintain stormwater management systems. Finally, if fees are imposed on property owners, an incentive may be to decrease or eliminate the fee for property owners who have developed effective LID facilities on their own.

Regulation: Prior to project approvals, local governments can require maintenance plans and agreements. These plans and agreements include proposed facilities and locations, a routine maintenance schedule, monitoring requirements, and an agreement stating all relative property owners are liable for the regular maintenance of LID facilities. If maintenance agreements are not followed, fines may be required for corrective action. In addition, entities that are regulated by the MS4 permit have to comply with the State of Michigan and EPA permit requirements (outlined on page 17).

All LID practices, no matter how they are selected, require additional measures to ensure they are implemented properly, continually function as designed, and are effectively maintained. Communities adopting these practices should fully review the installation and maintenance inspection agreement samples shown in the *Low Impact Development Manual for Michigan*. For most jurisdictions that meet the Smart LID "readiness" criteria in their community assessment, existing procedures for reviewing, finalizing, and monitoring the effectiveness of such installations should be readily adaptable to including the LID practices recommended here.

Appendixes

Appendix 1

Low Impact Development (LID) Resource Review Matrix

Resource Reviewed	Best Management Practice (BMP) Representations *Rendered, and effective design portrayals.*	Checklists *Easy to read and easy to use checklist system for rapid plan reviews.*
Low Impact Design Manual for Michigan		
Great detail sheets for BMPs. Includes worksheets and model/samples but little integrative material. Cumbersome size; office use limited to desk work.	Information sheets. Consistent and informative.	Worksheets for stormwater calculations and maintenance inspections.
A Natural Solution for the Grand Traverse Region		
Nicely illustrated diagrams for various BMPs. Interesting sticker system for use in plan reviews. Needs more site plan processing information and master plan guidance.	Text Snippets, easy to read.	Sticker system good for local government review.
Light Imprint Handbook		
Written in book form and difficult to use in the field on the fly. Does offer a good connection to overall land use patterns since it involves the *Rural-to-Urban Transect.* Still does not offer a more government-oriented path to meeting long-term community planning interests.	Photos and sketchy snippets. Various information sheets and cost estimates.	No checklists but does have Classification Matrix.
Leadership in Energy and Environmental Design for Neighborhood Developments (LEED-ND)		
Offers a very comprehensive and practical method for evaluating smart growth attributes of whole neighborhoods. Includes very few specific stormwater provisions, but many of the scoring factors can indirectly lead to reduced stormwater creation and promote broader smart growth practices.	Some standards indicated for attaining points.	Based on a checklist-type rating system accruing for points.
American Rivers Low Impact Development (LID) Manual		
Well-done document. Many references to Ohio and Michigan statutes and ample discussion about using the materials for better design in developments. BMPs are similar to, or referencing, Michigan LID information sheets. Should have great applicability to RRW Stormwater Guidebook.	Well-organized use of information sheets.	Various charts, sidebars, and maintenance schedules.

Comprehensiveness	Local Applicability	Administrative Integration	Implementability
Includes broader initiatives such as Green Infrastructure, Tree Canopy, Ordinances, LEED-ND, or other urban design initiatives.	*Approaches are logically applicable to local governing units such as Townships, Villages, etc.*	*Approaches are easy to use and convey through various administrative departments in same jurisdictions.*	*Presents a clear, persistent path from long-range planning to permit approvals/follow-ups/ maintenance.*
Low Impact Design Manual for Michigan			
Briefings and pamphlets included.	No specifics per various government forms.	Introductory material only.	Nothing clearly stated.
A Natural Solution for the Grand Traverse Region			
Oriented to contractors and homeowners.	No specifics per various government forms.	Oriented to contractors and homeowners.	Nothing clearly stated.
Light Imprint Handbook			
Integrated with *Rural-to-Urban Transect.* Not broadly related to other planning initiatives.	No specifics per various government forms.	Introductory material only.	Connection to *Zoning Plans* but less so to *Comprehensive Plans.*
Leadership in Energy and Environmental Design for Neighborhood Developments (LEED-ND)			
Covers widest array of guidelines related to other critical smart growth factors.	Covers multiple factors for smart growth primarily at local and regional levels.	Ratings not likely to be adapted or adopted by local administrative departments.	Most effective at the building design level, but entirely voluntary unless incorporated into local regulations.
American Rivers Low Impact Development (LID) Manual			
Good referencing with *Tree Canopy Ordinances* and other programs.	Most references to Michigan and USEPA Statutes. Some local examples.	Mostly design elements, not by jurisdictions.	Good references in text promoting implementation.

Low Impact Development (LID) Resource Review Matrix *continued*

Resource Reviewed	Best Management Practice (BMP) Representations *Rendered, effective design portrayals.*	Checklists *Easy to read and use checklist system for rapid plan reviews.*
EPA Stormwater Best Management Practices		
A series of great ideas for making smart growth decisions pertaining to stormwater BMPs at the local level. Combining this approach with several of the others would be very good.	Good discussions on BMP types and applications, very few depictions.	No real activity checklists, but several good bullet point lists.
DEQ Guidebook of BMPs for Michigan Watersheds		
Simple approaches to interacting at local government level. Much of the discussion, however, deals with creating watershed management plans and site plans.	No real depictions. Discussion on use of BMPs.	Good checklist for State/County actions. Also good "step-by-step" lists.
DEQ Stormwater Management Guidebook		
BMPs are discussed with much more technical detail than would be applicable to local governing entities. However, there are many good lists and ideas for approaches that can be taken at the local level for improved stormwater management performance.	BMPs discussed and information given, but not many depictions.	Good but limited checklist for local ordinances and operations/maintenance.
Rockford & Sparta / Storm Water Pollution Prevention Initiative (SWPPI)		
These documents are key to local actions since they are required for many local MS4 communities. For those who are not in that category, much can be emulated from the forms, guidelines, and checklists, but these need to be worked into local governing documents and policies.	No depictions.	Many charts and local "must do" checklists.

Comprehensiveness	Local Applicability	Administrative Integration	Implementability
Includes broader initiatives such as Green Infrastructure, Tree Canopy, LEED-ND or other urban design initiatives.	*Approaches are logically applicable to local governing units such as Townships, Villages, etc.*	*Approaches are easy to use and convey through various administrative departments in same jurisdictions.*	*Presents a clear, persistent path from long-range planning to permit approvals/follow-ups/ maintenance.*
EPA Stormwater Best Management Practices			
Many references made to broader initiatives under the banner of *Smart Growth*.	Good general guidelines on local applicability.	Great guidance on "talking" at various administrative levels.	Though not entirely clear, there is an emphasis on broad principles at the local level.
DEQ Guidebook of BMPs for Michigan Watersheds			
Related more to Watershed Management Plans and Site Plans. Minor reference to broader initiatives.	Good sample approaches for local guidance.	No real discussion on various levels of review and enforcement, especially at local level.	Good discussion on state laws and applicability, but no details on local agency efforts.
DEQ Stormwater Management Guidebook			
Weakly alluded to as part of watershed or regional landscapes.	Good but small list of ordinances and stormwater utility.	Did not discuss relations between various local administrative departments.	Several suggestions that have strong local implementation implications.
Rockford & Sparta / Storm Water Pollution Prevention Initiative (SWPPI)			
References to watershed management plans with little on broader initiatives.	Appendices are solely dedicated to local government actions required under MS4 program.	Does not appear to include enough discussion on inter-departmental actions, otherwise accomplished through a *Stormwater Education Committee*.	Implementation is mandatory and is not rooted throughout goals and ordinances of local entity.

Appendix 2

Master Plan Review Checklist

☑ Elements for Consideration

Review the following 8 elements as appropriate for your situation.
Check the box next to each element after you have completed an assessment.

☐ 1. Plan Currency

If: Community's Master Plan is done routinely and is currently up to date (being no older than 5 years).

Review: If updates were minor, major, or complete, and when they were done.

Review Resources: Sec. 45, (2) of the Michigan Planning Enabling Act, Act 33, 2008.

Link: http://www.legislature.mi.gov/(S(xj3g1jal1er4tq45ve4x5vuz))/documents/mcl/pdf/mcl-act-33-of-2008.pdf

Contacts: Planning & Zoning Center at MSU, 517-884-7742, wyckoff@pzcenter.msu.edu

Notes: _____

☐ 2. Green Infrastructure

If: Existing Plan includes inventories and/or recommendations regarding overall local or regional green infrastructure.

Review: Mapped data depicting water bodies, protected lands, Purchase Development Rights (PDR) lands, conservation easements, significant open lands in clustered developments.

Review Resources: West Michigan Toolkit for Green Inventories;
Natural Connections Map: A Vision of Green Infrastructure for the Lower Grand River;
Watershed Michigan's Critical Assets;
EPA Water Quality Scorecard.

Links: http://gvmc.org/naturalresources/documents/WMI_ToolKit_LGI.pdf;
ftp://148.61.56.205/Natural_Connections.pdf;
http://www.landpolicy.msu.edu/modules.php?name=Pages&sp_id=601;
http://www.epa.gov/smartgrowth/pdf/2009_1208_wq_scorecard.pdf

Contacts: Southeast Michigan Council of Governments, 313-324-3350, mangus@semcog.org

Notes: _____

☐ 3. Water Quality

If: Existing Plan makes recommendations regarding comprehensive water quality or protection.

Review: Specific provisions with regard to water-related environmental issues.

Review Resources: Filling the Gaps: Environmental Protection Options for Local Governments; Low Impact Development Manual for Michigan.

Links: http://www.michigan.gov/deq/0,1607,7-135-3313_3677_3696-73358--,00.html; http://www.semcog.org/lowimpactdevelopmentreference.aspx

Contacts: Trout Unlimited, 231-557-6362, ndemol@tu.org.
Annis Water Resource Institute, 616-331-3792, kochesj@gvsu.edu

Notes: _____

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☐ 4. Stormwater Management

If: Existing Plan specifically references needs or provisions for a comprehensive system of stormwater collection, storage, diversions, or movements.

Review: Coordinated Best Management Practices (BMPs) or Low Impact Development (LID) practices, regional drain projects or stormwater utilities.

Review Resources: Low Impact Development Manual for Michigan; Sustainably Managing Stormwater in Grand Rapids, August 2012.

Links: http://www.semcog.org/lowimpactdevelopmentreference.aspx; http://thewmeacblog.files.wordpress.com/2012/03/sustainably-managing-stormwater-in-grand-rapids1.pdf

Contacts: Trout Unlimited, 231-557-6362, ndemol@tu.org.
Grand Valley Metropolitan Council, 616-776-7605, wendy.ogilvie@gvmc.org.

Notes: _____

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Master Plan Review Checklist *continued*

☑ *Elements for Consideration*

Check the box next to each element after you have completed an assessment.

☐ 5. Watershed Management Plan

If: Existing Plan references or incorporates strategies or BMPs from an approved Watershed Management Plan.

Review: Information on the Rogue River watershed and Lower Grand River watershed.

Review Resources: Rogue River Watershed Management Plan;
Lower Grand River Watershed Management Plan.

Link: ftp://148.61.56.205/ISCWebDocuments/Rogueplan2-02.pdf

Contacts: Trout Unlimited, 231-557-6362, ndemol@tu.org.
Grand Valley Metropolitan Council, 616-776-7605, wendy.ogilvie@gvmc.org

Notes: _____

☐ 6. Planned Use Review

If: Existing plan has a rational or normative basis for determining population levels and concentrations, types and locations of land use.

Review: Any mentions of Traditional Neighborhood Developments (TND), Transit-Oriented Developments (TOD), mixed-use centers, regional centers, or other guidelines for neighborhood groupings.

Review Resources: Form Based Code Study, Grand Valley Metro Council Smartcode 9.2;
Metropolitan Development Framework, Grand Valley Metro Council Commerce Center Templates;
Grand Valley Metro Council Leadership in Energy and Environmental Design-Neighborhood Development (LEED-ND) rating system.

Links: http://gvmc.org/landuse/documents/fbc_intro_sites.pdf;
http://landuselaw.wustl.edu/3000-BookletSC.pdf;
http://www.gvmc.org/blueprint/framework.shtml;
http://gvmc.org/blueprint/documents/gvmctemplates.pdf;
http://www.usgbc.org/resources/leed-neighborhood-development-v2009-current-version

Contacts: Michigan State Housing Development Authority-Community Development, 517-241-0050, tischlerj@michigan.gov

Notes: _____

☐ 7. Planned Infrastructure Review

If: Existing plan makes provisions or adopts plans and guidelines for streets and public utilities and connections to planned uses, user groups, building activities, or green space.

Review: Adopted street guidelines (complete streets or local-county standards), transportation corridors and stormwater utility, or other managed infrastructure plans.

Review Resources: Michigan Complete Streets Amendment to Planning Act;
Complete Streets General Guidelines;
Oakland County Smartcode 9.2 Leadership in Energy and Environmental Design-Neighborhood Development (LEED-ND) rating system.

Links: http://www.michigan.gov/documents/mdot/MDOT_2010-PA-0134_339673_7.pdf;
http://michigancompletestreets.files.wordpress.com/2010/07/oakland-county-road-commission-complete-streets-guidelines.pdf;
http://landuselaw.wustl.edu/3000-BookletSC.pdf;
http://www.usgbc.org/resources/leed-neighborhood-development-v2009-current-version

Contacts: Michigan State Housing Development Authority-Community Development, 517-241-0050, tischlerj@michigan.gov

Notes: _____

☐ 8. Public Engagement

If: Existing plan reports on opinions or issues and the creation of goals, objectives, and "action steps" for implementation measures related to survey findings.

Review: Citizen support for walkable communities, green infrastructure, water body preservation, Low Impact Development (LID) practices, bike lanes, trails, etc.

Review Resources: Surveys, meeting minutes, hearings, and media stories.

Contacts: Clerks, supervisors, or planning staff at individual local government.

Notes: _____

Appendix 3

Zoning & Statutes Review Checklist

☑ Elements for Consideration

Review the following 4 elements, and their subsets, as appropriate for your situation. Check the box next to each element after you have completed an assessment.

☐ 1. Zoning Ordinance

If: Existing ordinance has sections dealing with water quality, water management, and other water-related criteria. These can be found in a single chapter of the ordinance, but are more likely spread throughout in various regulatory sections.

Contacts: Clerks, supervisors, or planning staff at individual local government.

☐ General Provisions

Review: Various rules for a variety of uses and structures which regulate land form, landscape, groundwater, pollution, or stormwater management.

Review Resources: Local zoning ordinance; index, table of contents, word search.

Notes: _____

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☐ Zoning District Use Approvals

Review: Regulations linking permitted or special uses to additional criteria such as sewer hookups, land to floor area ratios, impervious surfaces, or range of environmental impacts.

Review Resources: Local zoning ordinance; district provisions for permitted uses and special uses.

Notes: _____

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☐ Site Plan Review

Review: Checklists or conditions of approval which refer directly to stormwater provisions and site drainage for individual building or use sites.

Review Resources: Local zoning ordinance; administrative section, general provision or word search.

Notes: _____

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Zoning Ordinance

☐ Planned Development Procedures

Review: Multi-use or large development approval checklists or conditions of approval which refer to building and site drainage, stormwater systems, critical water protection areas, landform, landscape, and other environmental standards.

Review Resources: Local zoning ordinance; individual sections or chapters, or zoning district provisions.

Notes: _____

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☐ Special Zones

Review: District specific permitted or special uses related to water features or bodies or to locations which typically handle stormwater management.

Review Resources: Local zoning ordinance; zoning district provisions or feature related criteria;
Natural Rivers Program and statute;
Rogue River Natural River Plan, August 1973;
State statutes applying development restrictions applied at the local level.

Links: http://www.michigandnr.com/PUBLICATIONS/PDFS/fishing/NaturalRivers/MoreNR.pdf;
http://www.michigan.gov/documents/Rogue_River_Plan_22967_7.pdf;
http://www.michigan.gov/documents/deq/lwm-jpa-water-land-regs_213041_7.pdf

Notes: _____

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☐ Form-based, Smartcodes or Hybrids

Review: Complete ordinance or special zones or provisions blended with conventional zoning, which set up water-related or environmental development criteria linked to normalizing or coordinating urbanizing areas.

Review Resources: Local hybrid zoning ordinance using "form-based" elements in a standard zoning statute;
Separate "form-based" code with distinct criteria scaled for urbanizing locations or zones;
Smart Growth Code and Zoning Audit;
State statutes applying development restrictions applied at the local level.

Links: http://www.formbasedcodes.org/files/Hybrid_Codes(2).pdf;
http://www.planningmi.org/downloads/fbc_guidebook_introduction_0.pdf;
http://www.smartgrowthamerica.org/documents/zoningaudit.pdf

Notes: _____

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Zoning & Statutes Review Checklist *continued*

☑ *Elements for Consideration*

Check the box next to each element after you have completed an assessment.

☐ 2. Subdivision or Land Division Regulations

If: Plan includes regulations pertaining to the creation of subdivisions or "plats" and any other type of divisions of property. In recent years, many local jurisdictions have combined older subdivision regulations into overall land division ordinances. Other jurisdictions may provide separate ordinances or include land division rules in either the zoning ordinance or subdivision ordinance.

Review: Requirements for approvable subdivisions (plats) including handling and properly conveying stormwater and protecting rivers, streams, lakes, and groundwater from destructive development.

Review Resources: Local Subdivision or Land Division ordinance; design criteria; County Drain Commissioner guidelines and requirements for subdivision design; MDEQ guidelines and requirements for subdivision design.

Links: http://www.accesskent.com/Departments/DrainCommissioner/rules.htm. http://www.michigan.gov/deq/0,4561,7-135-6832-54665--,00.html

Contacts: Clerks, supervisors, or planning staff at individual local government.

Notes: _____

☐ 3. Stormwater Ordinances

If: Plan includes regulations which provide review standards and require permits for managing stormwater on sites undergoing land development or significant renovations.

Review: Applicability, permit requirements and design guidelines, especially concerning stormwater management plans and required Best Management Practices (BMPs) and Low Impact Development (LID) solutions.

Review Resources: Local Stormwater Ordinance; standards, requirements, design criteria; County Drain Commissioner guidelines and requirements for subdivision design; GVSU Stormwater Educational Handbook.

Link: http://www.accesskent.com/Departments/DrainCommissioner/stormwater_ordinance.htm

Contacts: County drain commissioner staff officials or local clerks, supervisors, or planning staff.

Notes: _____

☐ 4. Other Ordinances and Regulations

If: There are other ordinances, statutes, and guidelines that are used to review the development or maintenance of land uses or significant land form alterations.

Review: Any ordinances or statutes which provide guidelines, standards, permitting requirements, and other regulatory approaches related to water management.

Contacts: Clerks, supervisors, or planning staff at individual local government.

Notes: _____

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Appendix 4

Procedural Approvals & Reviews Checklist

☑ Elements for Consideration

Review the following 8 elements as appropriate for your situation.
Check the box next to each element after you have completed an assessment.

☐ 1. Online Presence or General Office Personnel

If: Internet sites are maintained by local jurisdictions or office staff that are designated for answering general questions about the local municipality.

Review: Any specific links or special calling instructions for permits, particularly those with stormwater implications.

Review Resources: Local websites or other contact information.

Contacts: Local government.

Notes: _____

☐ 2. Local Zoning Administrator/Building Staff

If: There are key individuals who serve as the main office contact for building permits, land or land use changes, building occupancies, general code enforcement, etc.

Review: Local staff contact to explain permitting process and inform citizens about stormwater rules.

Review Resources: Local websites or other contact information.

Contacts: Local government.

Notes: _____

☐ 3. Pre-Application Conferences

If: There are special informal meetings conducted in your jurisdiction, often required in zoning or utility ordinances, which bring together key individuals or departments dealing with procedures and timelines for permitting land use, utility infrastructure, water management, etc.

Review: Developer and design professionals meet with local staff to discuss stormwater issues and priorities involving specific development site.

Review Resources: Filling the Gaps: Environmental Protection Options for Local Governments; Low Impact Development Manual for Michigan.

Contacts: Local government.

Notes: _____

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☐ 4. Initial Planning Commission Reviews

If: Zoning ordinances or Planning Commission bylaws provide for initial meetings with the Planning Commission to discuss general issues or required procedures surrounding use or development applications.

Review: Overall site review by public officials; specific stormwater design concepts discussed.

Review Resources: Low Impact Development Manual for Michigan, Sustainably Managing Stormwater in Grand Rapids, August 2012.

Contacts: Local government.

Notes: _____

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Procedural Approvals & Reviews Checklist *continued*

☑ *Elements for Consideration*

Check the box next to each element after you have completed an assessment.

☐ 5. Local Engineering Review

If: Procedures, often established by ordinances or local policies, require certain uses or developments to be involved with local engineering staff or consultants.

Review: Construction plans submitted for local staff review and approval. Maintenance agreements recommended and escrow accounts established for long-term maintenance, if necessary.

Review Resources: Rogue River Watershed Management Plan;
Lower Grand River Watershed Management Plan.

Contacts: Local government.

Notes: _____

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☐ 6. County or State Agency Review

If: Significant land use changes, especially those involving critical or sensitive natural resources, are often required to receive special reviews and/or permits under laws or regulatory rules at county, state, or federal levels.

Review: County Drain Commissioner, Road Commission, MDEQ, Michigan Department of Transportation, and other regulatory agency reviews. Necessary permits (e.g., Wetlands, Floodplains) required before construction commences.

Review Resources: County Stormwater Ordinance & Procedures;
MDEQ permitting process.

Links: accesskent.com; michigan.gov/deq
http://www.michigan.gov/deq/0,4561,7-135-6844-89034--,00.html

Contacts: Local, County, State, or Federal government agencies.

Notes: _____

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☐ 7. Final Reviews

If: All permitting entities have some version of a final review or authorization to conduct the use or make the change being proposed. These are intended to ensure that all requirements have been met before commencing the project.

Review: Subsequent to construction, local staff and regulatory agencies approve project installations, issue Occupancy Permits, release bonds.

Review Resources: County Stormwater Ordinance & Procedures;
MDEQ permitting process.

Contacts: Local government or pertinent reviewing agency.

Notes: _____

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☐ 8. Monitoring

If: The approval agency and their authorizing agencies, require monitoring of how the project proceeds or how the use is being conducted. Monitoring can be self-reporting, periodic, agency site visits, or other methods to ensure compliance with approved uses.

Review: Local staff and regulatory agencies inspect installations, exercise escrow accounts if repairs or replacements are necessary.

Review Resources: Local zoning, development review, occupancy certification and escrow procedures.

Contacts: Local government or pertinent reviewing agency.

Notes: _____

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References and Resources

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Acronyms and Glossary

Acronyms

BMPs	**Best Management Practices**
EPA	**Environmental Protection Agency**
LEED-ND	**Leadership in Energy and Environmental Design – Neighborhood Development**
LID	**Low Impact Development**
MDEQ	**Michigan Department of Environmental Quality**
MDNR	**Michigan Department of Natural Resources**
MPEA	**Michigan Planning Enabling Act**
MS4	**Michigan Municipal Separate Storm Sewer System**
NPDES	**National Pollutant Discharge Elimination System**
PUD	**Planned Unit Development**
SWPPI	**Storm Water Pollution Prevention Initiative**
TND	**Traditional Neighborhood Development**
TOD	**Transit-Oriented Development**

Glossary

Best Management Practices
Structural, vegetative, and managerial practices implemented to control nonpoint source pollution.

Green Infrastructure
The use of nature, natural features, or man-made ecological systems to provide critical services for human settlements or activities.

Impervious
A surface through which little or no water will move. Impervious areas include paved parking lots and rooftops.

Low Impact Development
An innovative stormwater management approach with a basic principle that is modeled after nature: manage rainfall at the source using uniformly distributed decentralized micro-scale controls.

Municipal Separate Storm Sewer System
A system of conveyances that include catch basins, curbs, gutters, ditches, man-made channels, pipes, tunnels, or storm drains that discharge into waters of the United States.

New Urbanism
An urban design movement which promotes walkable neighborhoods containing a range of housing and job types. It arose in the United States in the early 1980s, and has gradually informed many aspects of real estate development, urban planning, and municipal land-use strategies.

Smart Growth
Smart growth is a better way to build and maintain our towns and cities. Smart growth means building urban, suburban, and rural communities with housing and transportation choices near jobs, shops, and schools. This approach supports local economies and protects the environment.

Stormwater Runoff
That portion of the precipitation that travels over the land surface and ends up in surface streams or water bodies.

Transect
The urban-to-rural transect is an urban planning model created by New Urbanist Andrés Duany. The transect defines a series of zones that transition from sparse rural farmhouses to the dense urban core.

Watershed
The geographic region within which water drains into a particular river, stream, or body of water. Watershed boundaries are defined by the ridges separating watersheds.

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