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May 21th, 2013

THE RESILIENT REGION PROJECT
Attn: Cheryal Lee Hills
Region Five Development Commission
200 1st Street NE, Suite 2
Staples, MN 56479

Re: Stormwater Management – County Policy Review and Draft Model Ordinance

Dear RRP and Ms. Hills:

Enclosed, please find a memorandum outlining the current stormwater management policies within Region 5, summarizing improvements that can be made to the current stormwater management policies and ordinances, and a brief summary of current sustainable practices in the area of stormwater management. Attached to this memorandum and included separately as well, is a draft model ordinance that works to incorporate current county practices with the sustainable best practices to create a unified ordinance for the Region.

Thank you for allowing me to work on this project. I hope that the information included is helpful towards the Livability Principles and goals of the Resilient Region Project.

Sincerely,

WILLIAM MITCHELL COMMUNITY DEVELOPMENT CLINIC

Shannon Sobek
Certified Student Attorney

Diane Marie Dube
Clinic Director & Supervising Attorney

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May 21, 2013

TO: THE RESILIENT REGION PROJECT

FROM: WILLIAM MITCHELL COMMUNITY DEVELOPMENT CLINIC
Shannon Sobek, Certified Student Attorney
Diane Dube, Supervising Attorney

Re: Stormwater Management Plan: Comparison of Cass, Crow Wing, Morrison, Todd and Wadena County plans

I. Introduction:

All of the counties in Region Five have a stormwater management plan that meets some of the goals of the Resilient Region Project and is in line with the research done in past semesters by students in the Community Development Clinic. The purpose of this memo is to outline the areas in which the county stormwater management plans currently overlap with each other, where they differ, and where they may be able to be improved in light of current sustainability efforts that are working in other parts of the United States. The goal of this memo is to highlight what is currently being done well, show where improvements can be made, and offer suggestions for a new model ordinance for stormwater management that will meet the overarching goals of the Resilient Region Project. The proposed stormwater management plan for Region 5 is one that can be modified to fit a county or a city environment and should be compared to the current stormwater management plan in the jurisdiction to create the best plan possible for each locality, while trying to unify stormwater management in the region through a focus on sustainable efforts.

II. County Ordinances:

All of the county plans express a preference for the use of Natural materials and landscaping to control the stormwater runoff for the area. The language is similar in each and tends to state:

> When possible, existing natural drainage ways, wetlands, and vegetated soil surfaces shall be used to convey, store, filter, and retain stormwater runoff before discharge to public waters.[1]

This language is in line with the goals of the Resilient Region Project and the sustainable efforts being made.

In addition to the focus on Natural materials, such as rain gardens, wetlands, and buffer zones, each County places a strong focus on the commercial uses which operate on the waterfront and the development allowances in the shoreland districts. The most important resources in this area revolve around the lakes, rivers and streams and the goal of any stormwater management plan must be wholly focused on protecting these areas. The over-arching concern for regulation of commercial activities in these shoreland areas is more strongly worded in Todd, Morrison and Crow Wing Counties, but is also the primary focus of the Wadena County ordinance and is mentioned in the Cass County ordinance as well. Any region wide stormwater management initiative should carefully consider the impact of commercial and industrial uses in the shoreland regions especially, but also should include guidelines for commercial and industrial development and landscaping across the region.

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[1] Todd County Planning Dept. *A Resolution Adopting Land Use Ordinance for Todd County.* Section 7.09(a), Oct. 2nd, 2012. Available at: http://www.co.todd.mn.us/sites/default/files/env_land_resources/20121004%20P%26ZOrdinance%20Final.pdf

Finally, all of the county ordinances provide for control of the stormwater management mostly through the permitting process for new development or re-development land. Cass, Crow Wing, and Morrison counties require a stormwater management plan be submitted with any new construction project which will disturb more than one acre of land. Todd County simply states that any development that will result in significant additional runoff must submit a stormwater management plan with the building plans and specifications. While Wadena County does not specifically require a plan, it does follow suit with the rest of the region in requiring that development projects minimize the extent of the disturbed area in a development project and that these areas must be stabilized as soon as possible. While the language in the ordinances could be stronger and setting firm timelines could be a big improvement, as discussed later in this memo, the policies in place at the County level are working to curb the effects of new development by controlling the disturbed and exposed soils. This is an important part of a stormwater management piece of any locality, as exposed topsoil and other lands can produce a silt runoff into local lakes causing the lakes to shrink in size.

II. Possible Improvements to the County Ordinances

The biggest improvement that could be made in the County stormwater management ordinances is uniformity and consistency. Laying out a stormwater management plan that is consistent throughout the region helps to foster efficient development and approval processes as developers in the region will know what the expectations for this piece of the development are throughout the area. The permitting process benefits from uniformity as people in multiple locations will be subject to the same requirements and will adapt site plans and Best Management Practices (BMP's) that can be used across the region to create effective

management from the beginning; rather than having to make changes to design plans to meet differing requirements in each locality.

Specific development standards concerning stormwater management and soil erosion controls during development of a site is one place that lacks consistency at this time. Crow Wing County does not mention any requirement to stabilize exposed soils to prevent erosion and sediment runoff. Cass and Wadena Counties say that it should be stabilized, but do not layout a specific timing requirement. Both Todd and Morrison provide a specific time requirement, but each gives a different standard.

The development process typically involves the removal of vegetation, the alteration of topography, and the covering grassy or vegetative surfaces with impervious cover such as roads, driveways, and buildings. These changes to the landscape may result in the erosion of soil and the sedimentation of water bodies as soil and contaminants travel to streams, rivers, and lakes in water runoff during storms at an increased velocity due to the lack of vegetative cover. The removal of vegetative cover and its roots system compromise the ability of vegetation to stabilize soil, reduce the velocity of runoff, shield the soil surface from rain, and maintain the soil's ability to absorb water.[2] In sensitive shoreland areas, it is important that any exposed soil be stabilized or contained within 24 hours to prevent any impactful runoff directly into the lakes and streams of the area. In non-shoreland areas, exposed soil can still have an impact and should be controlled within three days, to make sure that the impact of the development is minimized. Setting out these specific timelines in the ordinance is important to regulate the construction

[2] New Hampshire Department of Environmental Services, *Innovative Land Use Planning Techniques: A Handbook for Sustainable Development.* Sept. 2010. Available at: http://des.nh.gov/organization/divisions/water/wmb/repp/documents/ilupt_chpt_2.8.pdf last accessed 05/13/2013.

phases of development and ensure that developers in the area know the standards they are to follow.

The counties also differ on whether or not the Minnesota Pollution Control Act (MPCA) permitting requirements should be used on any size development, on only certain development affecting more than one acre of land, or not at all. The MPCA permit standards are attached to this memo in Appendix B, but generally require that when one acre or more of impervious surface is built on a site, the site must be planned in a way so as to allow for up to one half inch of stormwater to be absorbed on site, rather than running into the existing stormwater drainage infrastructure surrounding the site. There are several design options that can help to ensure that a site is capable of doing so and these design options are things that truly any development of any site should include, regardless of size, to make sure that the development is not increasing the amount of runoff into the water resources. All counties should require all development over one acre to meet the MPCA permit standards and may want to provide that all development be capable of handling at least one half inch of stormwater on site, preferably through Green Infrastructure[3] rather than man-made drainage infrastructure.

One final area where consistency and uniformity is needed is in the amount of impervious surface allowed on any lot being developed. Impervious surfaces inhibit the natural infiltration of rainwater into the ground, which leads to more stormwater runoff and higher stormwater peak flows. Streets, parking lots, and other transportation-related structures comprise the bulk of impervious surfaces within a watershed and, as such, collect pollution like heavy metals, grease, and oils. Runoff can mobilize and transport these pollutants and other contaminants (ex, harmful bacteria and fertilizers) to streams and lakes, which can have severe impacts on the health of

[3] Discussed in detail in Section III. of this memo.

these receiving waters. Controlling the amount of impervious surface allowed on a site is an important piece of any stormwater management plan. Three of the counties in the region currently regulate the amount of impervious surface to 25%, which is a common standard and should be in place for all development.

III. Best Management Practices (BMP's) to Promote a Sustainable Region

The existing Grey Infrastructure models for stormwater management have created more problems than they have solved as urban sprawl in development has grown Because of this, many sustainably focused measures are being brought to the forefront of stormwater management policy. For example, researchers and developers are experimenting with minimizing the distance between land uses to decrease infrastructure requirements. Another method reduces stormwater runoff by conserving forests and green spaces and protecting stream buffers. Yet another technique diminishes impervious surfaces by narrowing road and sidewalk widths, reducing parking lot sizes, minimizing or removing cul-de-sacs, and replacing traditional paving materials with pervious concrete. Such innovative site designs grew out of concerns that rapid urban development was not only impairing water quality but also eroding quality of life. [4]

One of the largest areas of growth and research is in the area of Green Infrastructure. Green Infrastructure uses natural means to allow stormwater to be absorbed and filtered before it enters the Grey or Man Made Infrastructure of the drainage pipes and sewer system which tend to feed into water sources carrying contaminants and sediment with them. Green Infrastructure, in addition to helping to manage and filter stormwater runoff, is also cheaper to establish and maintain than Grey Infrastructure, allowing cities to control costs. The best way to encourage

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[4] Low Impact Development and other Green Design Strategies Fact Sheet. US Environmental Protection Agency. Last Updated Dec. 17, 2012. Available at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=124

this type of Green Infrastructure in development is to make it a requirement in the permitting process and provide tradeoffs such as credits towards the impervious surface percentage allowed on a site.

Green Infrastructure is an important part of helping to foster Low Impact Development (LID). This type of development works to meet many sustainability and environmental concerns in the design of the project and the phasing of construction. Like other alternative development strategies, LID seeks to control stormwater at its source. Rather than moving stormwater offsite though a conveyance system, the goal of LID is to restore the natural, pre-developed ability of an urban site to absorb stormwater. LID integrates small-scale measures scattered throughout the development site. Constructed green spaces, native landscaping, and a variety of innovative bioretention and infiltration techniques capture and manage stormwater on-site. LID reduces peak runoff by allowing rainwater to soak into the ground, evaporate into the air, or collect in storage receptacles for irrigation and other beneficial uses. In areas with slow drainage or infiltration, LID captures the "first flush" before excess stormwater is diverted into traditional storm conveyance systems.[5]

Included in the model stormwater ordinance at Appendix D are several ideas for Green Infrastructure that can provide on-site water management benefits. It includes the addition of rain gardens which are typically small-scale, landscaped depressions containing plants and a soil mixture that absorbs and filters runoff. In addition to rain gardens for filtering, green roofs can be used on top of buildings to ensure that the runoff from the roofs is absorbed and filtered as much as possible. The next step is making sure that some of the rainwater is contained on site to be used for future irrigation, providing an additional benefit of water conservation. This is done

[5] *Id.*

by allowing the filtered stormwater runoff to be collected in cisterns or rain barrels that can harvest the rainwater and contain it on site. By storing and diverting runoff, these devices help reduce flooding and erosion. Also, permeable and porous pavement should be used where possible to reduce runoff by allowing water to soak through the paved surface into the ground beneath. Permeable pavement can be anything from porous concrete to plastic grid systems and interlocking paving bricks suitable for driveways and pedestrian areas. Finally, the last line of defense between impervious surfaces and adjoining Grey Infrastructure should be grass or vegetative swales. Swales are broad, open channels sown with erosion resistant and flood tolerant grasses and native vegetation. They also cost less to install than curbs, storm drain inlets, and piping systems.[6]

These LID and Green Infrastructure measures should be incorporated in a regulatory environment that also encourages smarter and sustainable development design on the whole. The goals of smart site design are to reduce impervious cover, preserve natural lands, and capture stormwater onsite. To meet these goals, designers employ a variety of methods. To reduce impervious cover, they narrow streets and sidewalks, minimize cul-de-sacs, tighten parking spaces, and reduce the size of driveways and housing lots. To reduce stormwater runoff, designers preserve natural lands, using them as buffer zones along streams, wetlands and steep slopes. They employ landscaping techniques that flatten slopes and preserve native vegetation and clusters of trees. They create bioretention areas such as open channels, filter strips and vegetated swales to increase stormwater infiltration, helping to protect streams, lakes, and wetlands.

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[6] *Id.*

The EPA provides guidance on what a local ordinance could do to help control stormwater runoff and the issues that come along with it. Ideally, they prefer ordinances that establish broad authority for the locality to require erosion and sediment control practices, which most of the counties in the region already have. The EPA also emphasizes that developmental controls should include grading limits, design requirements, erosion control practices, sediment control practices and other stormwater management BMP's. It also suggests that the reference to specific requirements and methods should be separate to allow for updates from time to time without having to amend the ordinance. This is reflected in the BMP's list attached to the model ordinance at Appendix D. Below are the goals that the EPA finds a local stormwater management program should accomplish:

1. Require the preparation of a stormwater pollution prevention plan (SWPPP) or an equivalent document;
2. Require the installation and maintenance of general erosion and sediment controls, such as perimeter controls, inlet protection, and soil stabilization;
3. Specify the amount of time allowed to stabilize exposed soil when construction activities have temporarily or permanently ceased;
4. Require the installation of sediment traps for drainage areas of less than 10 acres;
5. Require the installation of sediment basins for drainage areas of 10 or more acres;
6. Require the removal of accumulated sediment from sediment controls when sediment storage capacity has been reduced by at least 50 percent; and
7. Require that inspections be conducted at least every 7 days (or every 14 days plus following any rainfall event of 0.5" or more).[7]

Appendix D includes a model stormwater management plan geared towards residential, commercial and industrial development, but does not consider agricultural factors. It aims to accomplish these EPA suggested items, as well as incorporating the sustainable methods of Green Infrastructure in order to accomplish these goals.

[7] *Id.*

IV. Conclusion

Each of the counties in Region Five has taken some steps to address the complications that can come with the increase of stormwater runoff carrying pollutants and sedimentation into its lakes, streams and rivers, by enacting some controls over the development or re-development process. By working to create a consistent stormwater management plan throughout the region, the counties in Region 5 will be working in concert with the Minnesota Legislature which is promoting management at the watershed level rather than simply geared towards individual bodies of water.[8] By adding a focus on Green Infrastructure, the stormwater management ordinance will help to further the sustainability goals of the Region Five Comprehensive Plan and the Livability Principle of Support Existing Communities; which are economically reliant on these local lakes, rivers and streams. Protecting these resources is of the utmost importance.

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[8] Stephanie Hemphill, *Clean Water Accountability Act expected to pass Legislature this week,* MPR NEWS, May 13, 2013. Avaiable at: http://minnesota.publicradio.org/display/web/2013/05/13/environment/clean-water-accountability-act

APPENDIX A: COUNTY STORMWATER MANAGEMENT PRACTICES COMPARED

Stormwater Management Practice	Cass	Crow Wing	Morrison	Todd	Wadena
Emphasis on existing natural drainage ways, wetlands, and vegetated soil surfaces shall be used to convey, store, filter, and retain storm water runoff before discharge to public waters, over manmade structures.	X	X	X	X	X
Minimize the extent of disturbed areas, runoff velocities, erosion potential, and reduce and delay runoff volumes.	X		X	X	X
Disturbed areas to be stabilized and protected within a set time frame, or as soon as possible and facilities or methods used to retain sediment on the site.	No timeline – simply says must be stabilized.		3 days	24 hours	No timeline – simply says must be stabilized
Total maximum impervious surface coverage of lots must not exceed XX percent of the lot area.	No set percentage mentioned.	Controls in place in the Shoreland Protection Zone, but not generally.	25% or 100% of the buildable lot area.	25%	25%
New constructed stormwater outfalls to public waters must provide for filtering or settling of suspended solids and skimming of surface debris before discharge.	X			X	X
Silt fencing must be installed to retain soils at an upland site when runoff from the construction site is towards a waterbody			X		
Credit towards impervious surface if permeable surfacing system in place.		100% if designed and inspected by	50% of area covered by porous pavers		

		MN licensed prof. engineer	is counted as impervious surface.		
More stringent permitting process for inside the Shoreland Area, particularly for Commercial and Institutional uses.	X	X	X	X	X
COMM & INDUST. USE: the uses must be designed to incorporate topographic and vegetative screening of parking areas and structures.				X	
For a commercial property, or where construction or reconstruction activity results in the disturbance of one or more acres the owner of the property shall use only personnel certified in erosion and sediment control to develop and implement best management practice design, installation, inspection, and management to meet the MPCA General Stormwater Permit requirements or, if not possible, use of grass swales, retention areas or natural depression for infiltration prior to water discharge.			X		
Any activity must comply with MPCA standards.	X				
Developments with 1 (one) acre or more of impervious surface shall also have a stormwater control plan.	X	X – makes them subject to a MPCA permit.			
The Department shall evaluate the storm water management needs of each lot in doing all reviews, approvals, and permit issuances.		X			
All Stormwater plans shall be designed for permanent on-site treatment of xx inches of stormwater runoff on all impervious surface coverage on the lot. This means that a volume of water equal to one inch multiplied by the area of impervious surface must be treated.	One inch		½- 1 inch		

APPENDIX B: MPCA CONSTRUCTION PERMIT REQUIREMENTS

When a project replaces vegetation or other pervious surfaces with one or more acres of cumulative impervious surface, one-half inch of runoff from the new impervious surface must be treated by one of the following methods (consult the permit for specific design requirements):

- Wet sedimentation basin
- Infiltration/filtration
- Regional ponds
- Combination of practice
- Alternative method, pending MPCA approval.
- At least 90 days before the start of the project submit:
    - all calculations, drainage areas, plans and specifications
    - two-year monitoring plan
    - mitigation plan if alternative method fails

Possibilities for BMPs include:

- Construction phasing
- Vegetative buffer strips
- Temporary seeding
- Sod stabilization
- Horizontal-slope grading
- Minimization of land disturbance
- Preservation of trees and natural vegetation
- Mulch or wood-fiber blankets and stockpile covers.

APPENDIX C: LIST OF BEST MANAGEMENT PRACTICES[9]

- **Rain Gardens** (or Bioretention Cells)

  A rain garden is a depressed area with porous backfill (material used to refill an excavation) under a vegetated surface. These areas often have an underdrain to encourage filtration and infiltration, especially in clayey soils. Bioretention cells provide groundwater recharge, pollutant removal, and runoff detention. Bioretention cells are an effective solution in parking lots or urban areas where green space is limited.

- **Curb and gutter elimination**

  Curbs and gutters transport flow as quickly as possible to a stormwater drain without allowing for infiltration or pollutant removal. Eliminating curbs and gutters can increase sheet flow and reduce runoff volumes. Sheet flow, the form runoff takes when it is uniformly dispersed across a surface, can be established and maintained in an area that does not naturally concentrate flow, such as parking lots. Maintaining sheet flow by eliminating curbs and gutters and directing runoff into vegetated swales or bioretention basins helps to prevent erosion and more closely replicate predevelopment hydraulic conditions. A level spreader, which is an outlet designed to convert concentrated runoff to sheet flow and disperse it uniformly across a slope, may also be incorporated to prevent erosion.

- **Grassed swales**

  Grassed swales are shallow grass-covered hydraulic conveyance channels that help to slow runoff and facilitate infiltration. The suitability of grassed swales depends on land use, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the grassed swale system. In general, grassed swales can be used to manage runoff from drainage areas that are less than 4 hectares (10 acres) in size, with slopes no greater than 5 percent. Use of natural, low-lying areas is encouraged and natural drainage courses should be preserved and utilized.

- **Green parking design**

  Green parking refers to several techniques that, applied together, reduce the contribution of parking lots to total impervious cover. Green parking lot techniques include: setting maximums for the number of parking lots created; minimizing the dimensions of parking lot spaces; utilizing alternative pavers in overflow parking areas; using bioretention areas to treat stormwater; encouraging shared parking; and providing economic incentives for structured parking.

- [9] *Stormwater Management Best Practices.* ENVIRONMENTAL PROTECTION AGENCY. Updated 11/5/2012. Available at: http://www.epa.gov/oaintrnt/stormwater/best_practices.htm.

- **Infiltration trenches**

  Infiltration trenches are rock-filled ditches with no outlets. These trenches collect runoff during a storm event and release it into the soil by infiltration (the process through which stormwater runoff penetrates into soil from the ground surface). Infiltration trenches may be used in conjunction with another stormwater management device, such as a grassed swale, to provide both water quality control and peak flow attenuation. Runoff that contains high levels of sediments or hydrocarbons (for example, oil and grease) that may clog the trench are often pretreated with other techniques such as water quality.

- **Inlet protection devices**

  Inlet protection devices, also known as hydrodynamic separators, are flow-through structures with a settling or separation unit to remove sediments, oil and grease, trash, and other stormwater pollutants. This technology may be used as pre-treatment for other stormwater management devices. Inlet protection devices are commonly used in potential stormwater "hot spots"—areas where higher concentrations of pollutants are more likely to occur, such as gas stations.

- **Permeable pavement**

  Permeable pavement is an alternative to asphalt or concrete surfaces that allows stormwater to drain through the porous surface to a stone reservoir underneath. The reservoir temporarily stores surface runoff before infiltrating it into the subsoil. The appearance of the alternative surface is often similar to asphalt or concrete, but it is manufactured without fine materials and instead incorporates void spaces that allow for storage and infiltration. Underdrains may also be used below the stone reservoir if soil conditions are not conducive to complete infiltration of runoff.

- **Permeable pavers**

  Permeable pavers promote groundwater recharge. Permeable interlocking concrete pavements (PICP) are concrete block pavers that create voids on the corners of the pavers (pictured to the right). Concrete grid paver (CGP) systems are composed of concrete blocks made porous by eliminating finer particles in the concrete which creates voids inside the blocks; additionally, the blocks are arranged to create voids between blocks. Plastic turf reinforcing grids (PTRG) are plastic grids that add structural support to the topsoil and reduce compaction to maintain permeability. Grass is encouraged to grow in PTRG, so the roots will help improve permeability due to their root channels. Includes installing Runnells in the sidewalk system to help direct and filter runoff.

- **Rain barrels and cisterns**

  Rain barrels and cisterns harvest rainwater for reuse. Rain barrels are placed outside a building at roof downspouts to store rooftop runoff for later reuse in lawn and garden watering. Cisterns store rainwater in significantly larger volumes in manufactured tanks or

underground storage areas. Rainwater collected in cisterns may also be used in non-potable water applications such as toilet flushing. Both cisterns and rain barrels can be implemented without the use of pumping devices by relying on gravity flow instead. Rain barrels and cisterns are low-cost water conservation devices that reduce runoff volume and, for very small storm events, delay and reduce the peak runoff flow rates. Both rain barrels and cisterns can provide a source of chemically untreated "soft water" for gardens and compost, free of most sediment and dissolved salts.

- **Riparian buffers**

  A riparian, or forested, buffer is an area along a shoreline, wetland, or stream where development is restricted or prohibited. The primary function of aquatic buffers is to physically protect and separate a stream, lake, or wetland from future disturbance or encroachment. If properly designed, a buffer can provide stormwater management and can act as a right-of-way during floods, sustaining the integrity of stream ecosystems and habitats.

- **Sand and organic filters**

  Sand and organic filters direct stormwater runoff through a sand bed to remove floatables, particulate metals, and pollutants. Sand and organic filters provide water quality treatment, reducing sediment, biochemical oxygen demand (BOD), and fecal coliform bacteria, although dissolved metal and nutrient removal through sand filters is often low. Sand and organic filters are typically used as a component of a treatment train to remove pollution from stormwater before discharge to receiving waters, to groundwater, or for collection and reuse. Variations on the traditional surface sand filter (such as the underground sand filter, perimeter sand filter, organic media filter, and multi-chamber treatment train) can be made to fit sand filters into more challenging design sites or to improve pollutant removal.

- **Soil amendments**

  Soil amendments increase the soil's infiltration capacity and help reduce runoff from the site. They have the added benefit of changing physical, chemical, and biological characteristics so that the soils become more effective at maintaining water quality. Soil amendments, which include both soil conditioners and fertilizers, make the soil more suitable for the growth of plants and increase water retention capabilities. The use of soil amendments is conditional on their compatibility with existing vegetation, particularly native plants.

- **Stormwater planters**

  Stormwater planters are small landscaped stormwater treatment devices that can be placed above or below ground and can be designed as infiltration or filtering practices. Stormwater planters use soil infiltration and biogeochemical processes to decrease stormwater quantity and improve water quality, similar to rain gardens and green roofs but smaller in size—stormwater planters are typically a few square feet of surface area compared to hundreds or

thousands of square feet for rain gardens and green roofs. Types of stormwater planters include contained planters, infiltration planters, and flow-through planters.

- **Tree box filters**

  Tree box filters are in-ground containers used to control runoff water quality and provide some detention capacity. Often premanufactured, tree box filters contain street trees, vegetation, and soil that help filter runoff before it enters a catch basin or is released from the site. Tree box filters can help meet a variety of stormwater management goals, satisfy regulatory requirements for new development, protect and restore streams, control combined sewer overflows (CSOs), retrofit existing urban areas, and protect reservoir watersheds. The compact size of tree box filters allows volume and water quality control to be tailored to specific site characteristics. Tree box filters provide the added value of aesthetics while making efficient use of available land for stormwater management. Typical landscape plants (for example, shrubs, ornamental grasses, trees and flowers) are an integral part of the bioretention system. Ideally, plants should be selected that can withstand alternating inundation and drought conditions and that do not have invasive root systems, which may reduce the soil's filtering capacity.

- **Vegetated filter strips**

  Filter strips are bands of dense vegetation planted downstream of a runoff source. The use of natural or engineered filter strips is limited to gently sloping areas where vegetative cover can be established and channelized flow is not likely to develop. Filter strips are well suited for treating runoff from roads and highways, roof downspouts, very small parking lots, and impervious surfaces. They are also ideal components for the fringe of a stream buffer, or as pretreatment for a structural practice.

- **Green roofs**

  Green roofs consist of an impermeable roof membrane overlaid with a lightweight planting mix with a high infiltration rate and vegetated with plants tolerant of heat, drought, and periodic inundations. In addition to reducing runoff volume and frequency and improving runoff water quality, a green roof can reduce the effects of atmospheric pollution, reduce energy costs, and create an attractive environment. They have reduced replacement and maintenance costs and longer life cycles compared to traditional roofs.

APPENDIX D: MODEL ORDINANCE FOR STORMWATER MANAGEMENT

500.01 – Stormwater Management

An Ordinance to preserve and beautify the landscapes and to mitigate and prevent stormwater runoff in _____ , Minnesota.

Section 1. Name. This Ordinance shall be known as the Stormwater Management Ordinance

Section 2. Definitions.

A. **Runnells:** semi-permeable channels built into sidewalks and patios to facilitate and direct water away from impermeable surfaces.

B. **Vegetative Swale:** (aka grassed channel, dry swale, wet swale or biofilter) open-channel drainage ways lined with plant life used to absorb and filter stormwater runoff; an alternative to traditional storm pipes

C. **Rain garden:** a planted depression or a hole that allows absorbtion and filtration of rainwater runoff from impervious areas like roofs, driveways, walkways, parking lots, and compacted lawn areas

D. **Rain barrel:** a container used to collect and store rainwater to be used in future irrigation

E. **Green Roofs:** the roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproof membrane.

F. **Permeable Pavement**: pavement which is porous and allows stormwater to move through it rather than over it; helps to trap suspended solids and filter pollutants.

G. **Green Infrastructure**: the interconnected network of open spaces and natural areas — greenways, wetlands, parks, forest preserves, and native plant vegetation — that naturally manages stormwater, reduces the risk of floods, captures pollution, and improves water quality.

H. **Turf Grass:** a type of grass that causes the upper layer of soil bound by its roots to form into a think mat; often used for sod and in landscaping instead of natural grasses because of its uniformity and ease of care (e.g. Kentucky Bluegrass, perennial rye grass, etc.)

I. **Native Plants:** plant species that are naturally found to grow and thrive in the existing environment if the land was left undeveloped or undisturbed

J. **Best Management Practices (BMPs)**: erosion and **sediment control** and water quality management practices that are the most effective and practicable means of controlling,

preventing, and minimizing degradation of **surface water**, including avoidance of impacts, construction-phasing, minimizing the length of time soil areas are exposed, prohibitions, and other management practices.

K. Sediment Control: methods employed to prevent sediment from leaving the site. Examples of current sediment control practices include silt fences, sediment traps, earth dikes, drainage swales, check dams, subsurface drains, pipe slope drains, storm drain inlet protection, and temporary or permanent sedimentation basins.

L. Stormwater Pollution Prevention Plan: a plan for stormwater discharge that includes **erosion prevention** measures and sediment controls that, when implemented, will decrease soil erosion on a parcel of land and decrease off-site nonpoint pollution.

M. Surface Water or Waters: all streams, lakes, ponds, marshes, wetlands, reservoirs, springs, rivers, drainage systems, waterways, watercourses, and irrigation systems whether natural or artificial, public or private.

N. Non-Point Source Pollutant/Pollution: A water pollution source usually containing sediment and debris that cannot be defined as originating from discrete points and shall include, but not be limited to, pollutants from agricultural, construction, and urban runoff sources.

O. Organic Fertilizer: fertilizer composed of and derived from natural sources.

Section 3. Purpose of Preamble

The purposes and goals of this ordinance are:

A. To minimize threats to public health, safety, general welfare and resources in the community.

B. To improve and preserve the Surface Waters and groundwater of _____ by controlling the threat of uncontrolled runoff.

C. To protect the water resources that all the counties of the region have identified as priorities.

D. To prevent Non-Point Source Pollution resulting from stormwater runoff.

E. To decrease runoff volume, erosion, frequency and duration of stormwater runoff.

F. To minimize soil disturbance in order to protect Surface Waters.

G. To promote sustainability and responsibility in landscaping plans for all development and redevelopment.

Section 4. Statement of Law.

Section 4.1 General Provisions. The following provisions will apply to all residential, commercial, industrial and agricultural development and re-development.

4.1.1. Stormwater Management Plan. No person shall develop or re-develop any land for residential, commercial, industrial, or institutional uses without having provided a written stormwater management plan to control and manage stormwater from such developments. Stormwater management plans shall include removal of excessive trash and debris and accumulated sediment to maintain or improve function of the stormwater management system.

4.1.2. General Policy on Stormwater Runoff Rates. Site plans for new development of any kind will be assessed by _____ for stormwater quantity control and stormwater quality management. The general policy on stormwater runoff rates is to reduce the impacts of development by maintaining pre-development hydrological conditions.

4.1.3. Use of Exisiting Topography. All new development shall incorporate the use of existing topography. All stormwater runoff from impervious surfaces shall be filtered on-site unless in conducting the development plan review _____ determines it is infeasible because of site conditions or is undesirable because of uncontrollable risks to water quality from such filtration. Such filtration shall be by vegetated surfaces, such as swales, unless otherwise approved by _____ .

4.1.4. Fertilizers, Pesticiedes and Herbicides. Any landscaping should utilize organic fertilizers, pesticides and herbicides whenever possible.

4.1.5. Minimizing Exposed Soil. Development shall be planned and conducted in a manner that will minimize the extent of disturbed areas, runoff velocities, erosion potential, and reduce and delay runoff volumes. Disturbed areas must be stabilized and protected within twenty-four (24) hours, or as soon as possible, and on site facilities or methods shall be used to retain sediment on the site.

4.1.6. Minimizing Impervious Surface Coverage. Total maximum impervious surface coverage of lots must not exceed 25 percent of the lot area.

Section 4.2 Development with Disturbed Land Surface Greater than One (1) Acre. The following landscaping provisions will apply to all development, except for agricultural development/use, where one acre or more of land is/is planned to be disturbed pursuant to the site development plan.

4.2.1. On-site Stormwater Management. All development shall be capable of handling up to 1inch of stormwater maintained on its property through as many natural means as possible. See Appendix attached. for lists of natural means to consider. A combination of several of these means is preferred.

4.2.2. Top Soil Depth. Top soil depth under Turf Grass planted areas shall be 6 inches in depth.

4.2.3. Exposed Soil. All areas of exposed soil shall be covered with at least two (2) inches of mulch.

4.2.4. Parking Lot/Driveway Areas. Vegetative Swales, ditches planted with native plants, and other planted areas shall be used as a buffer zone between any impervious parking or driveway surfaces and the adjoining stormwater management infrastructure in order to filter the stormwater runoff before it enters the stormwater drainage systems. The buffer zone shall be at least one foot in width.