

Indiana Water Environment Association 2010 Annual Conference

Public Official and Engineer

Low Impact Development

Interactive Web-based Education Tool



17 September 10





- **What is Low Impact Development?**
- **How does/will this fit with all the upcoming watershed issues, NPDES changes and local ordinances?**
- **Intent to use interactive education tool to begin to bring LID Design consistency to both Developers and Municipalities (and their respective engineers.)**





Conventional Stormwater Management - Quantity

Development takes water from a disturbed site and moves it as quickly away as possible, usually via an engineered storm system (pipes), to a centralized facility (basin, pond, stream, etc.). Typically the water from smaller, more frequent storms flow in and out of these basins directly into the rivers and lakes carrying all pollutants it has collected along the way.

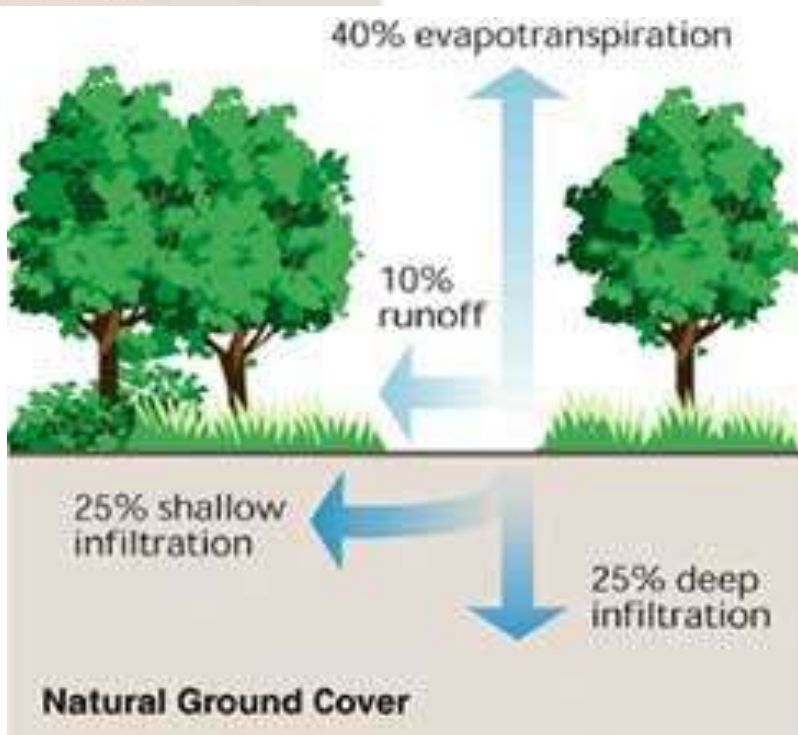
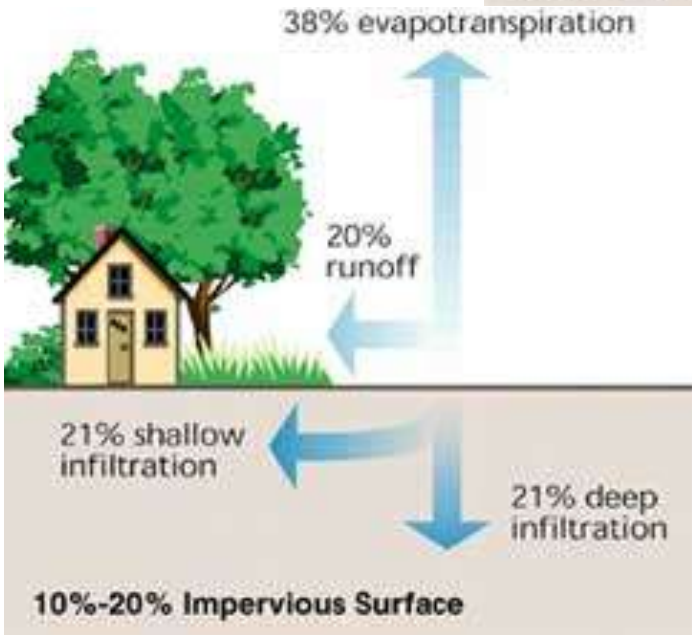
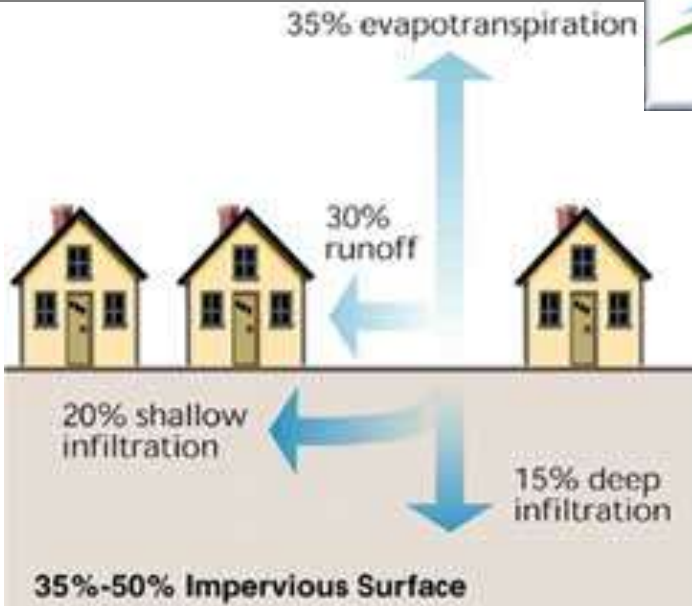
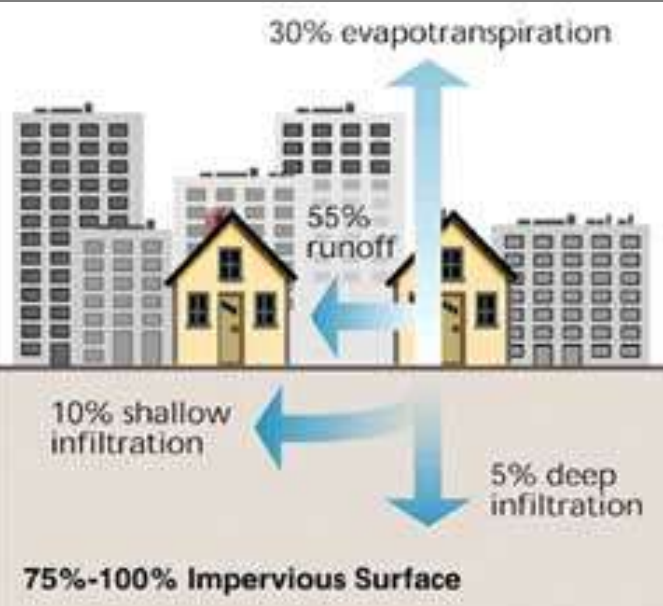
Think Large Storm Flood Control/Protection. > 1 in. rain

Low Impact Development (LID) - Water Quality

The attempt to minimize site disturbance and manage rainfall at the source using uniformly distributed decentralized site-scaled controls. The goal is to mimic a site's pre-developed drainage patterns and hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source.

Think Small Storm First Flush Control/Collection. < 1 in. rain

Man-Made Impact Levels – LID Mitigation Opportunities





- **Bioretention (Distributed Storage)**
 - Vegetated Swales (Rain Gardens in Series, conveyance, storage & BMP!)
 - Rain Gardens
 - Bioretention Areas
 - Streetscape Integration
- **Permeable Pavement – This one is still getting stronger!**
- **Water Harvesting**
- **Green Roofs**
- **Watercourse Buffers (Urban Restoration)**
- **Stormwater Wetlands**



Permeable Pavement – Perhaps the Next BMP



Permeable Interlocking Concrete Pavers (PICP)



Concrete Grid Pavers (CGP)



Pervious Asphalt



Soil Filled for Grass Growth



Pervious Concrete

Pervious Concrete w/ Hose Photo by Greg McKinnon from Puget Sound Online

Invisible Structures™ Plastic Reinforcing Grid



Gravel Filled

The porosity allows pavement infiltration rate up to 400 in/hr. (Pilat, 2002)

The fear of catastrophic failure after proper construction is fictional, for any anticipated rain event. (Hunt, 2007)



- **We are all now well versed in MS4 Erosion and Sediment Control for Construction Activities.**
- **Now Focus Turns to Post Construction Water Quality. (& Construction Site Compliance?)**
- **It has been shown that increased volume of runoff and increased pollutant loads degrade stream quality. The essence of TMDL's and 303(d) listings.**
- **Traditional stormwater controls typically provide flood control for large storms but may not reduce or eliminate impact from smaller more frequent storms.**
- **Majority of Water Quality Ordinances deal solely with Sediment.**





- **Ordinances are beginning to recognize green BMP's as an acceptable alternative to conventional stormwater management. Most do not actively promote them, yet.**
- **Communities that want to promote LID techniques are beginning to provide developers with incentives**
 - **Flexibility in traditional stormwater requirements**
 - **Faster Permit Approval Process**
- **Many communities have concerns about long-term maintenance and effectiveness of pervious pavement, bioretention basins, and other LID BMP's.**
 - **Who maintains? Who Funds? HOA? Home owners?**
 - **Can Public BMP's be located on private property?**



BMP Choices



COST OF LAND



SOILS
INFILTRATION



SLOPE



GROUNDWATER
DEPTH



CONSTRUCTION
COST

Bioretention

Bioretention with Underdrain

Rain Gardens

The BMP Selection Tool is intended to help educate site designers and developers about some of the important factors associated with the selection of post-construction stormwater BMPs for a given site.

Volume control, groundwater protection, and pollution reduction are growing concerns in Central Indiana. Each of these, as well as other factors make some BMPs more applicable to certain sites and more successful tools for water quality protection.

LID BMPs Are SITE SPECIFIC! There is no “one size fits all”!

DETAILS



DETAILS



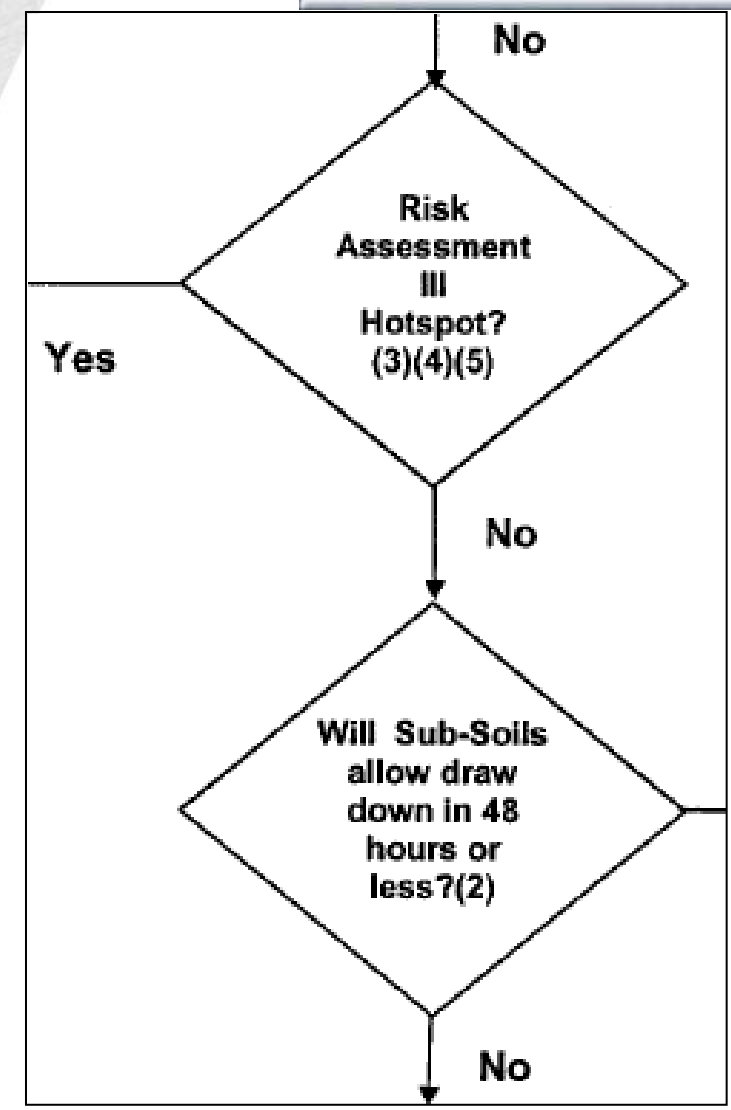
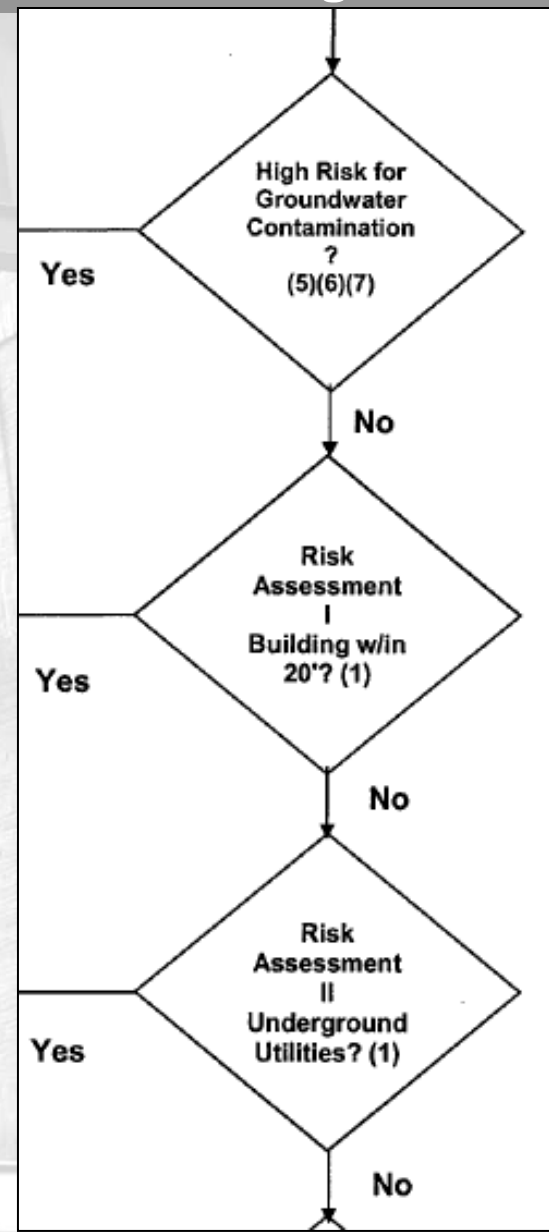
DETAILS



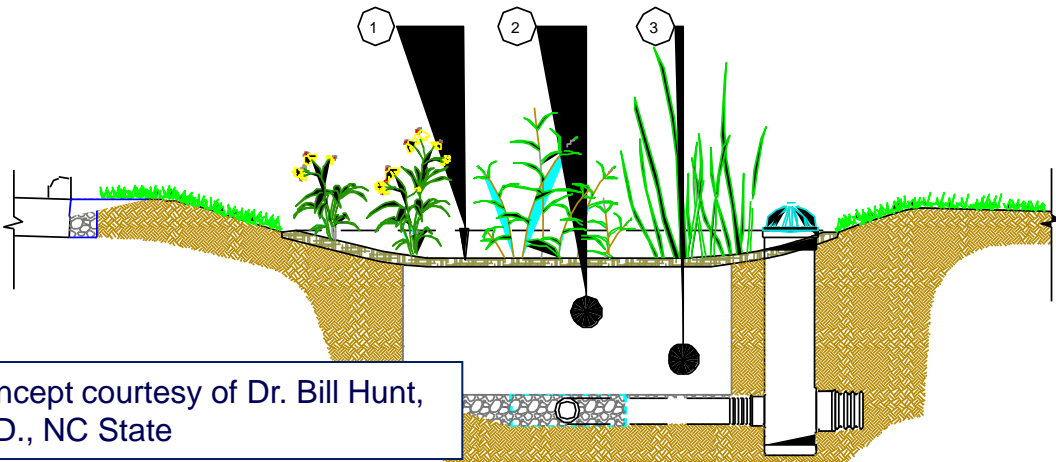
Infiltration BMP Selection Process Schematic Example

Basis For the UWRWA online interactive education tool

Originated from the UWRWA Technical Committee



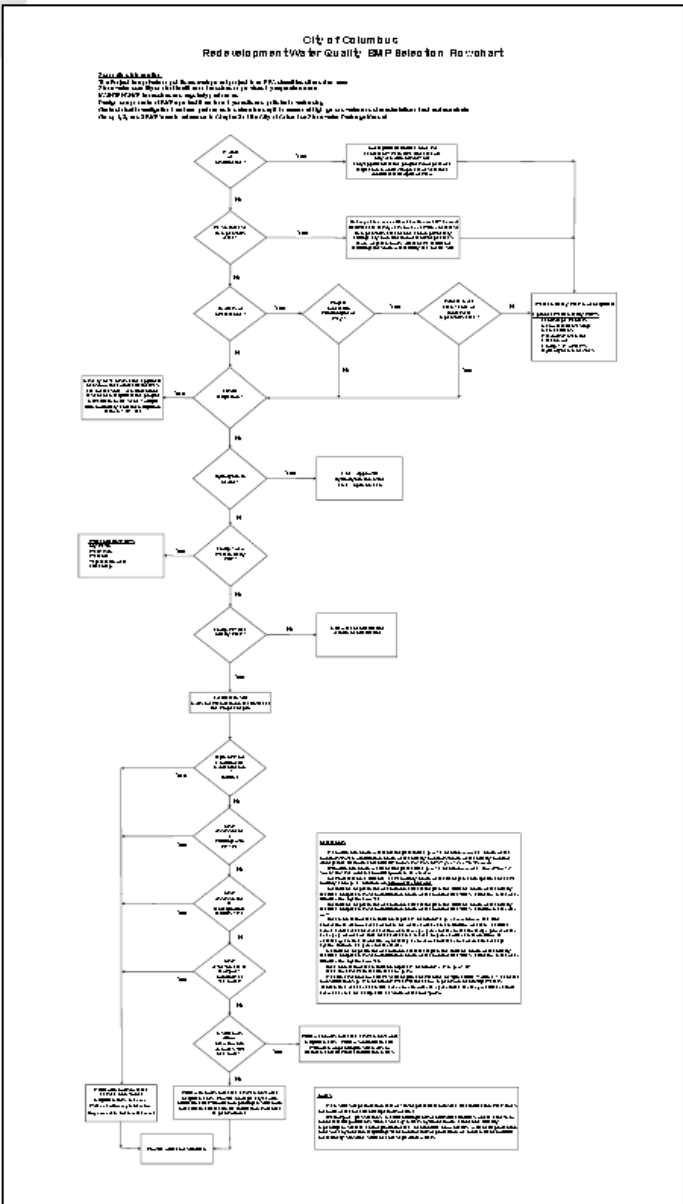
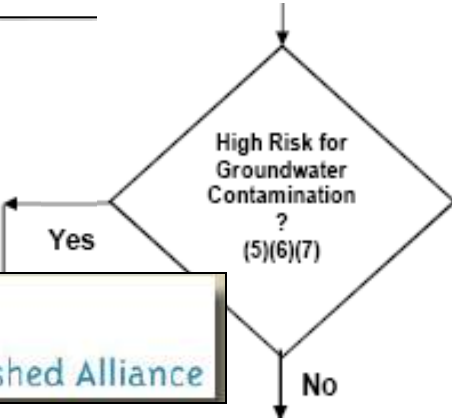
Due Diligence for your Design – Design Consistency For Municipalities

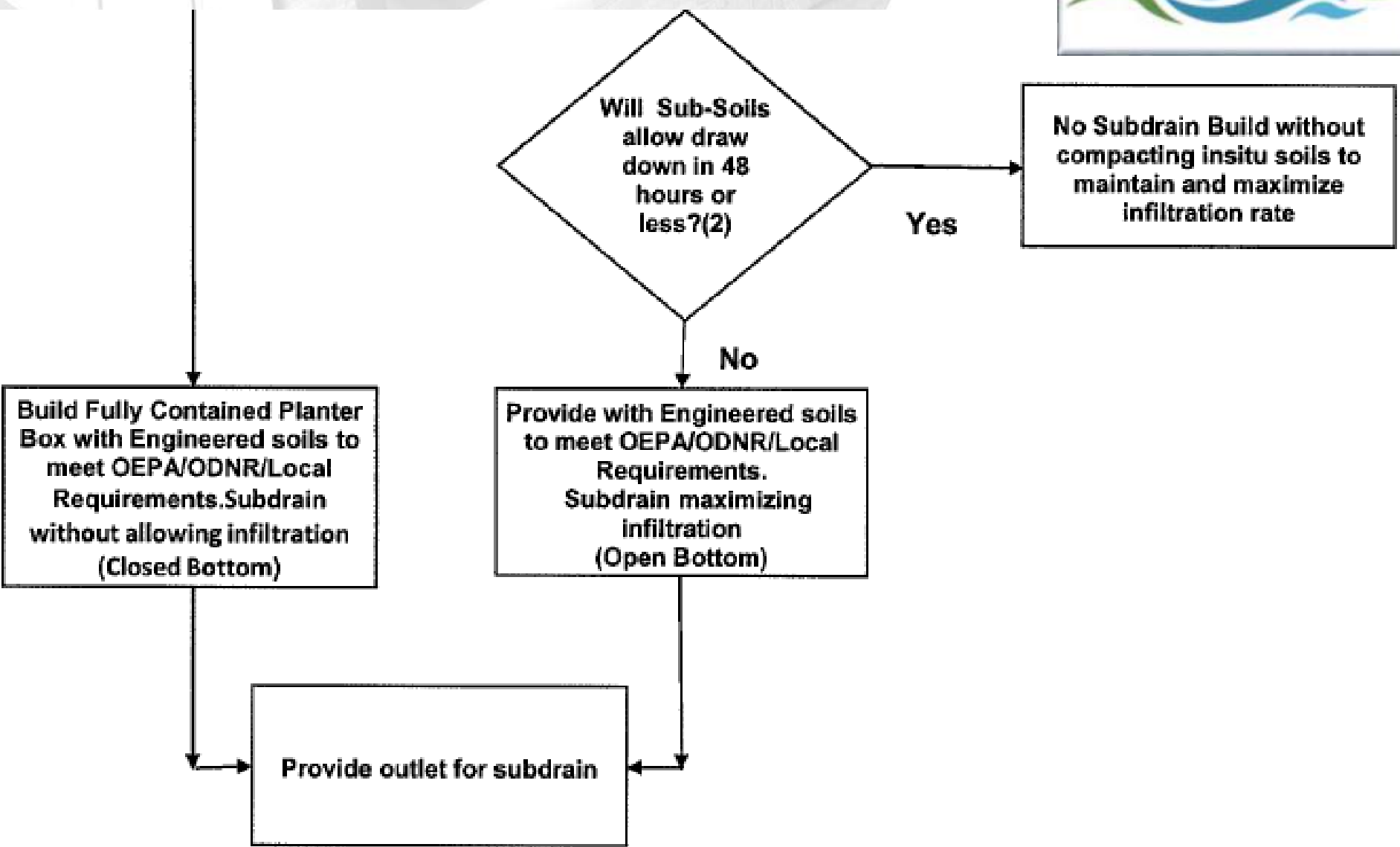


Concept courtesy of Dr. Bill Hunt, PhD., NC State

BIORETENTION / RAIN GARDEN BMP SECTION

- 1 SURFACE - TSS, OILS & GREASE
- 2 SUB-SURFACE (0-12") - PATHOGENS, PHOSPHORUS, METALS
- 3 SUB-SURFACE (30"-36") - NITROGEN, TEMPERATURE



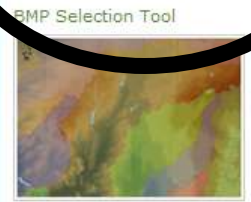


 Search

- HOME
- EXPLORE THE WATERSHED
- LEARN WHO WE ARE
- GET YOUR FEET WET
- ENJOY THE RIVER
- FIND YOUR PLACE

NOW AVAILABLE

PAGE HIGHLIGHTS



RECENT NEWS

WATER COLUMN V22
CNN - Minnesota farmer battles Gulf 'dead zone'
Grand Lake Sickens
Celina Man, Kills Family Pet
State Chemist's recent decision (Jan. 25) to deny a permit sought by Steuben County for the county's July 2007 ban on phosphorus-containing lawn fertilizers...
more news....

QUICK LINKS

- Blue-Green Algae Updates!
- Gallery from Clean up! Eagle Creek Watershed Alliance
- Geist/Fall Creek Subwatershed
- Morse/Cicero Creek Subwatershed
- Partners
- Green Infrastructure Fact Sheet
- Watershed Studies
- Stormwater Presentations

ARE YOU A...?



Agricultural Producer



Business Owner



Educator/Teacher



Engineer/Planner



Landowner/Resident



Stormwater Manager



Community Volunteer

UPCOMING EVENT



Clear Choices for Clean Water is a campaign to increase awareness about lawn care and its impact on our streams. Lawn care includes practices such as using phosphorus-free fertilizer, landscaping with native plants, managing yard and more...

How to get directly to the Education Tool

GET TO KNOW US

Welcome to the UWRWA! We are on our way to becoming the principal regional watershed leader in Indiana by creating resources, educational programs and partnerships, that promote, protect, and enhance the biological, chemical, and physical integrity of the White River ecosystem. Our watershed is home to critical drinking water supplies, some of Indiana's biggest industry and economic drivers, and the largest, most diverse population centers in the state.

CALENDAR

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

View UWRWA Calendar of Events



So How Do We Get Every One on the Same Page?



Best Management Practice Selection Tool

The BMP Selection Tool is intended to help educate site designers and developers about some of the important factors associated with the selection of post-construction stormwater BMPs for a given site. Volume control, groundwater protection, and pollution reduction are growing concerns in Central Indiana. Each of these, as well as other factors make some BMPs more applicable to certain sites and more successful tools for water quality protection.

Assumptions & Details Behind this Tool

STORMWATER VOLUME REDUCED

DETAILS

GROUNDWATER DEPTH

CONSTRUCTION COST

STORMWATER STORAGE

REDUCES TIME OF CONCENTRATION

REMOVES TRASH

REMOVES TSS

BMP Choices

- Bioretention
- Bioretention with Underdrain
- Rain Gardens
- Rain Gardens with Underdrain
- Infiltration Basin
- Infiltration Basin with Underdrain
- Trench
- Trench with Underdrain
- Permeable Pavement
- Permeable Pavement with Underdrain
- Filter Strip
- Sand Filter
- Organic Filter
- Manufactured Products
- Open Space Preservation &/or Restoration
- Vegetated Swale
- Dry Detention Basin
- Wet Detention Basin
- Stormwater Wetlands
- Green Roof

To better understand the role of the various factors shown as icons, click the 'Details' box.

Information will appear to help you understand whether it is something you need/want to consider.

<http://www.uwrwa.org/bmpTool/>
Google

Convert Select

Norton Norton Safe Search Search Cards & Logins

Favorites Untitled Document

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Criteria

Are you trying to reduce stormwater volume leaving your site and/or discharging to local water?

LID stormwater volume reduction techniques are typically the best means to achieve channel protection requirements associated with some stormwater ordinances. Reducing volumes to local streams also protects receiving waters from down-cutting and erosion. Other important benefits to reducing volume via increasing infiltration include: reduced storage requirements, groundwater recharge, and potentially more developable land. Some 'pass-through' BMPs treat, but do not reduce stormwater volume or rate of discharge.

- Don't forget about groundwater separation requirements and/or techniques when using infiltration practices.



[Close Details](#)

ool
Details
Tool

you need/wan
the lat narrow
for that BMP
it pressing. Try

rain
drain
erdrain

Trench
Trench with Underdrain

\$\$\$

WITHIN 10FT

STORMWATER VOLUME

STORMWATER

REDUCES TIME



Take the Pledge!

Criteria

Do you want to (or need to) remove phosphorus from your stormwater?

Phosphorus is a common pollutant from residential sources such as lawn fertilizers and detergents. It is responsible for negative impacts such as algal blooms and associated toxins, and is often the limiting nutrient in water bodies. Because phosphorus compounds easily combine with soil particles (it is often not treated or removed by mechanical, sediment separator

- Non-structural BMPs (e.g. lawn care) should reduce the use of phosphorus-rich products and should therefore be prioritized over structural BMPs.



REMOVES NUTRIENTS (P)

DETAILS

any common phosphorus sources such as lawn fertilizers and detergents. It is often the limiting nutrient in water bodies. Because phosphorus compounds easily combine with soil particles (it is often not treated or removed by mechanical, sediment separator



Close Details

 COST OF LAND DETAILS <input type="checkbox"/>	 SOILS INFILTRATION DETAILS <input type="checkbox"/>	 SLOPE DETAILS <input type="checkbox"/>	 GROUNDWATER DEPTH DETAILS <input type="checkbox"/>	 CONSTRUCTION COST DETAILS <input type="checkbox"/>
 MAIN COST DETAILS <input type="checkbox"/>	<p>A given BMP's ability to address that particular factor will be reflected by its presence/absence in the BMP remaining in the list on the right.</p>			 REDUCES TIME TO CONCENTRATE DETAILS <input type="checkbox"/>
 DOUBLES AS LANDSCAPE REQUIREMENT DETAILS <input type="checkbox"/>				 REMOVES TSS DETAILS <input type="checkbox"/>
 REMOVES OIL AND/OR GAS DETAILS <input type="checkbox"/>	 REMOVES BACTERIA DETAILS <input checked="" type="checkbox"/>	 REMOVES THERMAL DETAILS <input type="checkbox"/>		

- ### BMP Choices
- Bioretention
 - Bioretention with Underdrain
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 - Sand Filter
 - Organic Filter
 - Manufactured Products
 - Open Space Preservation &/or Restoration
 - Vegetated Swale
 - Dry Detention Basin
 - Wet Detention Basin
 - Storm Water Wetlands
 - Green Roof



When you want to know more about a BMP that appears in the list, click on it.

Fact sheet style information with Design Tips will appear for that BMP including some O&M guidance.

BIORETENTION



4.5 Bioretention (rain gardens)



Bioretention

Bioretention areas typically are features adapted to treat stormwater. Bioretention systems are also known as Prairie Depressions, Rain Gardens, Basins, Infiltration swales, bioretention channels, tree box fill boxes, or streetscapes, to name a few. areas typically consist of a flow structure, a pretreatment element, a soil mix planting bed, vegetation, an regulating structure. Bioretention systems

both water quality and quantity stormwater management opportunities.

Bioretention systems are flexible, adaptable and versatile stormwater management are effective for new development as well as highly urban re-development. Bioretention can readily adapt to a site by modifying the conventional "mounded philosophy to that of a shallow landscape "cup" depression. Such landscape depression and treatment areas fit readily into: parking lot islands; small pockets of open area commercial and industrial campus landscaping; and, urban and suburban green corridors.

BMP Choices

Bioretention

Bioretention with Underdrain

Rain Gardens

Rain Gardens with Underdrain

Infiltration Basin

Infiltration Basin with Underdrain

Trench

Trench with Underdrain

Permeable Pavement

So How Do We Keep Every One on the Same Page?



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Assumptions & Details Behind this Tool

MAKE SELECTIONS | BMPs

COST OF LAND

DETAILS

BMP Choices

- Bioretention
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- Green Roof

If that factor is important to your goals, simply click the small box below to select it.



BMP Choices

- Bioretention
- Bioretention with Underdrain
- Rain Gardens
- Rain Gardens with Underdrain

Continue checking the boxes of other factors that represent your site conditions or objectives and watch the list narrow further.

If you select a combination of factors that leads you to a very narrow list of BMPs or none at all, simply reconsider your selected factors and prioritize those that are most pressing.



- Wet Detention Basin
- Storm Water Wetlands
- Green Roof



COST OF LAND

DETAILS

SOILS INFILTRATION

DETAILS

SLOPE

DETAILS

GROUNDWATER DEPTH

DETAILS

CONSTRUCTION COST

DETAILS

MAIN COST

DETAILS

WITHIN 10FT OF A BUILDING

DETAILS

STORMWATER VOLUME REDUCED

DETAILS

STORMWATER STORAGE

DETAILS

REDUCES TIME OF CONCENT

DETAILS

DOUBLES AS LANDSCAPE REQUIREMENT

DETAILS

REMOVES NUTRIENTS (P)

DETAILS

REMOVES NUTRIENTS (N)

DETAILS

REMOVES TRASH

DETAILS

REMOVES TSS

DETAILS

REMOVES OIL AND/OR GAS

DETAILS

REMOVES BACTERIA

DETAILS

REMOVES THERMAL

DETAILS

BMP Choices

You have selected a set of site criteria that restricts the use of the available BMP applications. Please reconsider your site concerns and/or priorities and try again.

In certain circumstances you may need more than one type of BMP to achieve quality and/or quantity goals. Use the tool to identify those practices that address certain key factors and then consider using more than one BMPs in series.



Best Management Practice Selection Tool

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Assumptions & Details Behind this Tool

MAKE SELECTIONS **BMPs**

<p>COST OF LAND</p> <p>DETAILS</p> <input type="checkbox"/>	<p>SOILS INFILTRATION</p> <p>DETAILS</p> <input checked="" type="checkbox"/>	<p>SLOPE</p> <p>DETAILS</p> <input type="checkbox"/>	<p>GROUNDWATER DEPTH</p> <p>DETAILS</p> <input type="checkbox"/>	<p>CONSTRUCTION COST</p> <p>DETAILS</p> <input type="checkbox"/>
<p>MAIN COST</p> <p>DETAILS</p> <input type="checkbox"/>	<p>WITHIN 10FT OF A BUILDING</p> <p>DETAILS</p> <input type="checkbox"/>	<p>STORMWATER VOLUME REDUCED</p> <p>DETAILS</p> <input type="checkbox"/>	<p>STORMWATER STORAGE</p> <p>DETAILS</p> <input checked="" type="checkbox"/>	<p>REDUCES TIME OF CONCENT</p> <p>DETAILS</p> <input type="checkbox"/>
<p>DOUBLES AS LANDSCAPE REQUIREMENT</p> <p>DETAILS</p> <input checked="" type="checkbox"/>	<p>REMOVES NUTRIENTS (P)</p> <p>DETAILS</p> <input type="checkbox"/>	<p>REMOVES NUTRIENTS (N)</p> <p>DETAILS</p> <input type="checkbox"/>	<p>REMOVES TRASH</p> <p>DETAILS</p> <input type="checkbox"/>	<p>REMOVES TSS</p> <p>DETAILS</p> <input checked="" type="checkbox"/>
<p>REMOVES OIL AND/OR GAS</p> <p>DETAILS</p> <input type="checkbox"/>	<p>REMOVES BACTERIA</p> <p>DETAILS</p> <input checked="" type="checkbox"/>	<p>REMOVES THERMAL</p> <p>DETAILS</p> <input checked="" type="checkbox"/>		

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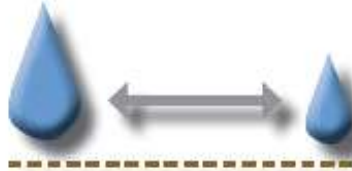


These Are Based on Actual Design Criteria



SOIL
INFILTRATION

+



REDUCED TIME OF
CONCENTRATION

+



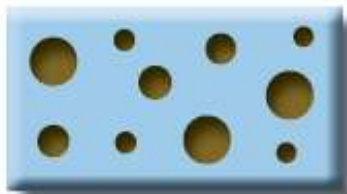
LANDSCAPE
REQUIREMENT

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+

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REMOVES
TSS

+



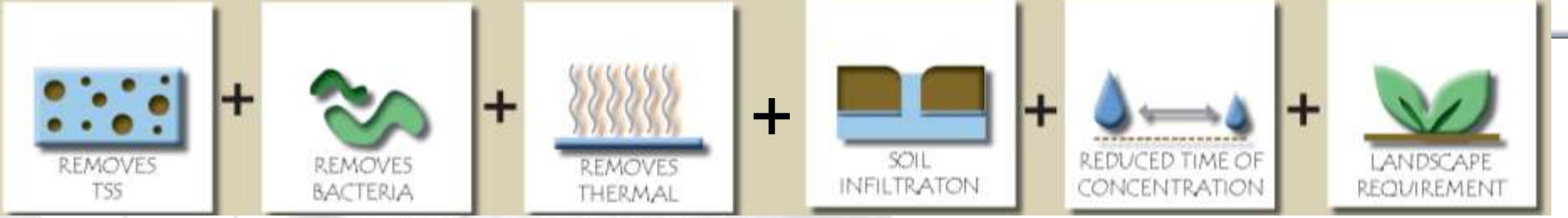
REMOVES
BACTERIA

+



REMOVES
THERMAL

Most of the Results Are Shown From Central Indiana



- ### BMP Choices
- Bioretention with Underdrain
 - Rain Gardens with Underdrain
 - Infiltration Basin with Underdrain
 - Trench with Underdrain
 - Storm Water Wetlands



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Assumptions & Details Behind this Tool

MAKE SELECTIONS

BMPs

 COST OF LAND <input checked="" type="checkbox"/> DETAILS	 SOILS INFILTRATION <input type="checkbox"/> DETAILS	 SLOPE <input type="checkbox"/> DETAILS	 GROUNDWATER DEPTH <input checked="" type="checkbox"/> DETAILS	 CONSTRUCTION COST <input type="checkbox"/> DETAILS
 MAIN COST <input type="checkbox"/> DETAILS	 WITHIN 10FT OF A BUILDING <input checked="" type="checkbox"/> DETAILS	 STORMWATER VOLUME REDUCED <input type="checkbox"/> DETAILS	 STORMWATER STORAGE <input checked="" type="checkbox"/> DETAILS	 REDUCES TIME OF CONCENT <input type="checkbox"/> DETAILS
 DOUBLES AS LANDSCAPE REQUIREMENT <input type="checkbox"/> DETAILS	 REMOVES NUTRIENTS (P) <input type="checkbox"/> DETAILS	 REMOVES NUTRIENTS (N) <input type="checkbox"/> DETAILS	 REMOVES TRASH <input type="checkbox"/> DETAILS	 REMOVES TSS <input type="checkbox"/> DETAILS
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- Green Roof



COST OF
LAND



GROUNDWATER
DEPTH



STORMWATER
STORAGE



WITHIN 10FT OF
BUILDING





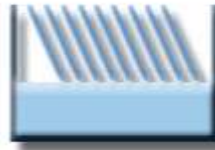
COST OF LAND

+



GROUNDWATER DEPTH

+



STORMWATER STORAGE

+



WITHIN 10FT OF BUILDING

BMP Choices

Permeable Pavement with Underdrain

Open Space Preservation &/or Restoration

Green Roof

PERMEABLE PAVEMENT WITH UNDERDRAIN

OPEN SPACE PRESERVATION/ RESTORATION

GREEN ROOF

Questions / Discussion?



Jill Hoffmann, Empower Results

Brian N. Neilson, PE, LEED AP