

**Proposed revisions to Hamilton County and
Communities Stormwater Standards to incorporate
Channel Protection Volume and LID**

By:

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**Proposed Changes to Post-Construction Stormwater
Management Chapter of Technical Standards**

- Add the requirement for Channel Protection Volume to control impacts of smaller flood events
- Add language requiring the treatment of additional Pollutants causing a receiving water to be listed as 303d
- Allow the Post-Construction requirements to be addressed by either “conventional” or “LID” approach, with Incentives for Use of LID Approach
- Add provisions for requiring pre-treatment for Hot Spots
- Add New Appendices containing New BMP Fact Sheets, Plant Lists, BMP Materials, Infiltration Test Protocol, Maintenance Checklist, and Maintenance Agreement

Existing stormwater management controls in Typical Stormwater Ordinance/Standards

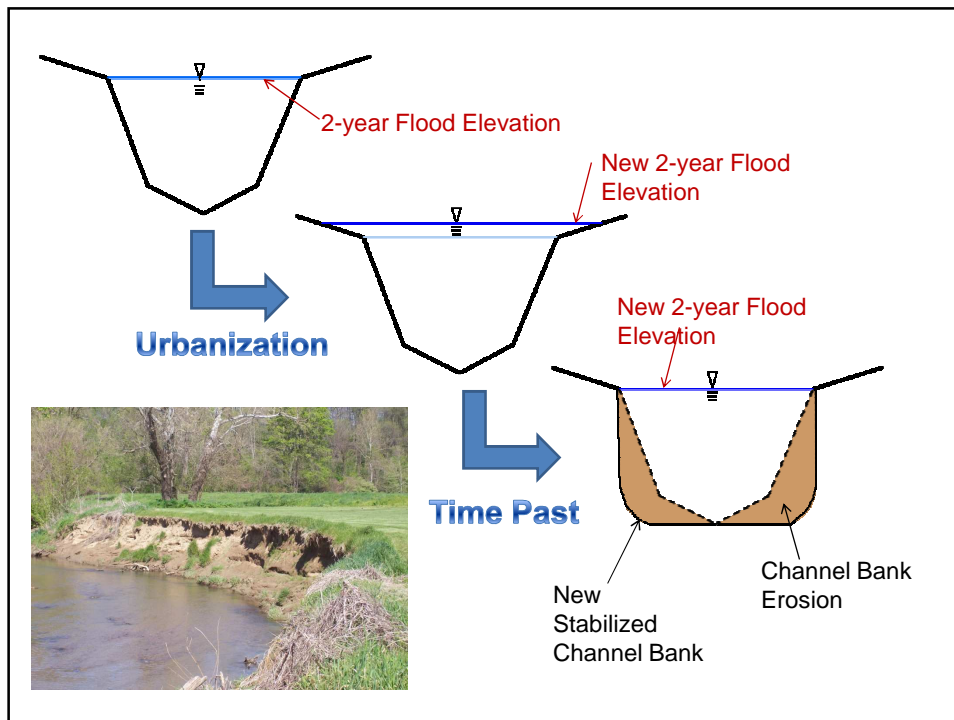
- Requirement for post-construction on-site detention with variable unit (cfs/acre) allowable Release Rates for control of 2-yr to 100-yr peak flow rates from the site
- Requirement for post-construction stormwater quality treatment for the “first flush” from the site, adopted as the first inch of rainfall
- There is a “gap” in the above control mechanisms that, if not addressed, may lead to increased streambank erosion in receiving channels. This “gap” is caused by neglecting to control the increase of runoff as a result of development for smaller flows generally resulting from rainfalls ranging from 1 inch to 2-year frequency event (about 2.8 inches within 24 hours)



What Is The Problem?

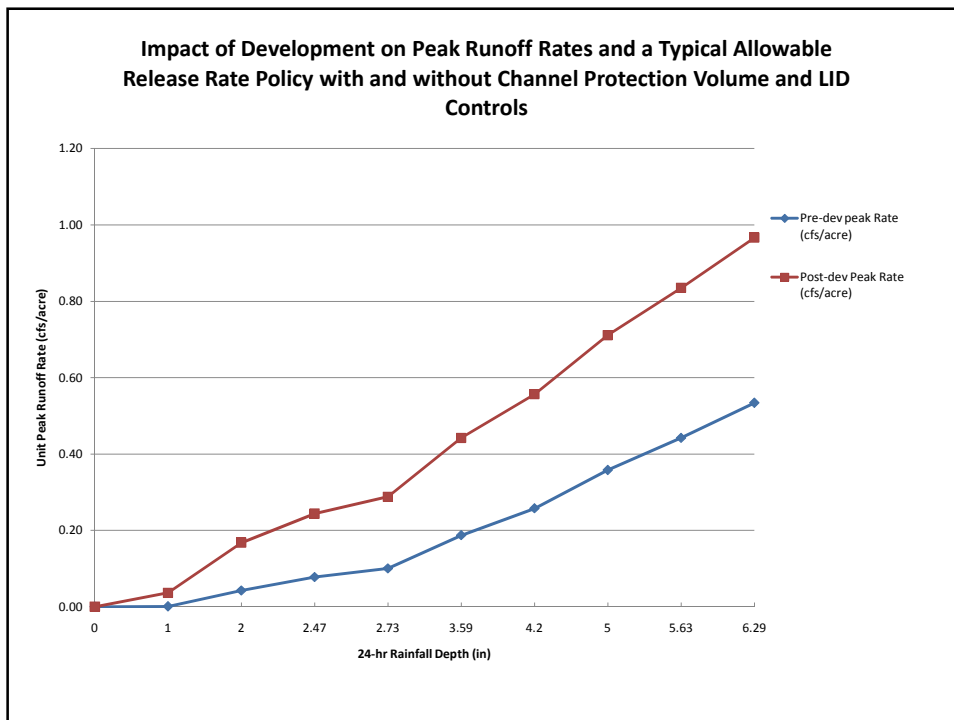
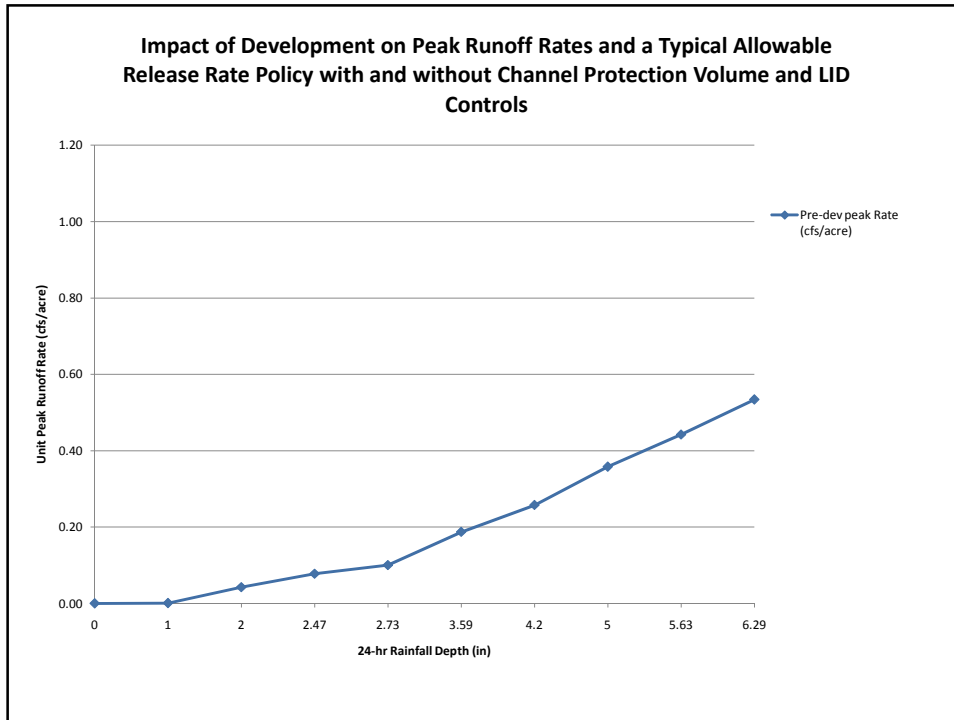
- The problem is that increased, sustained runoff for channel-forming events (1-yr to 2-yr events) resulting from new upstream development causes the channel to seek a new shape through eroding its banks

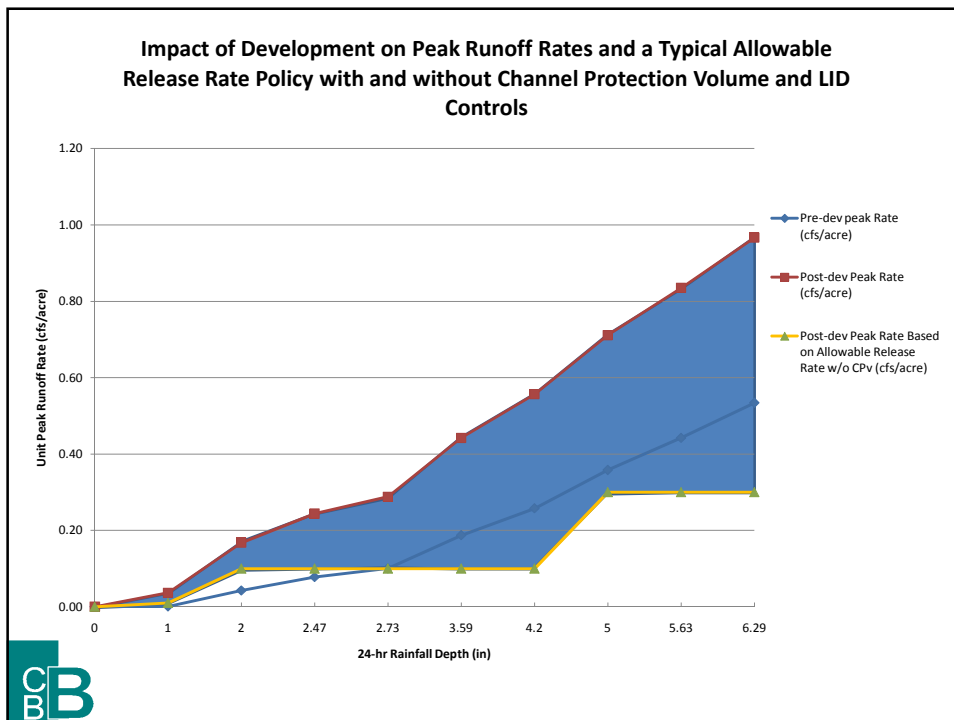
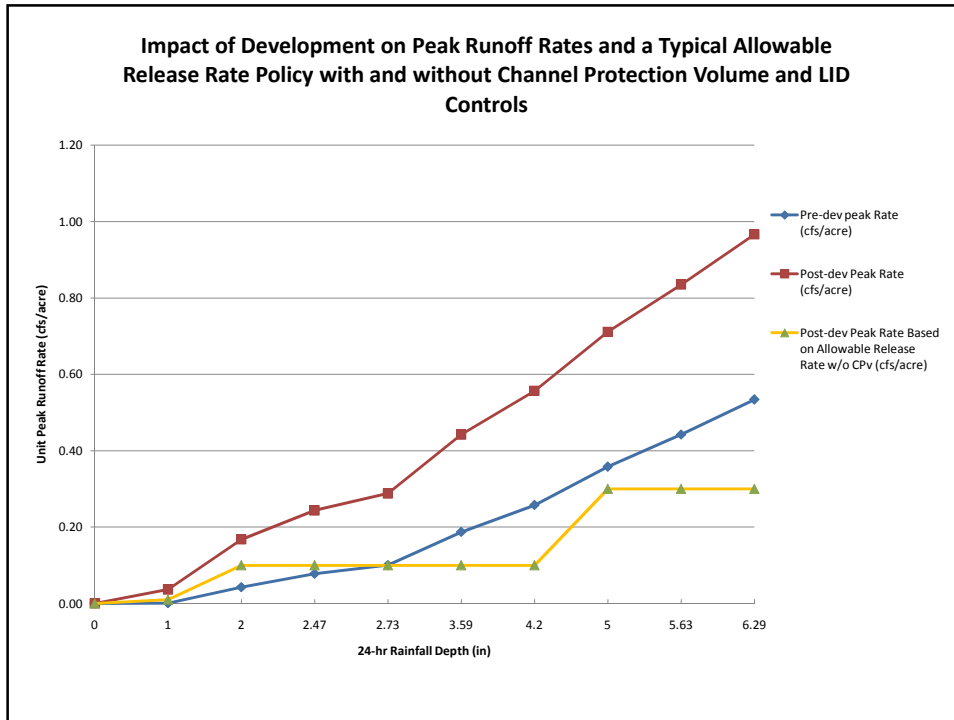


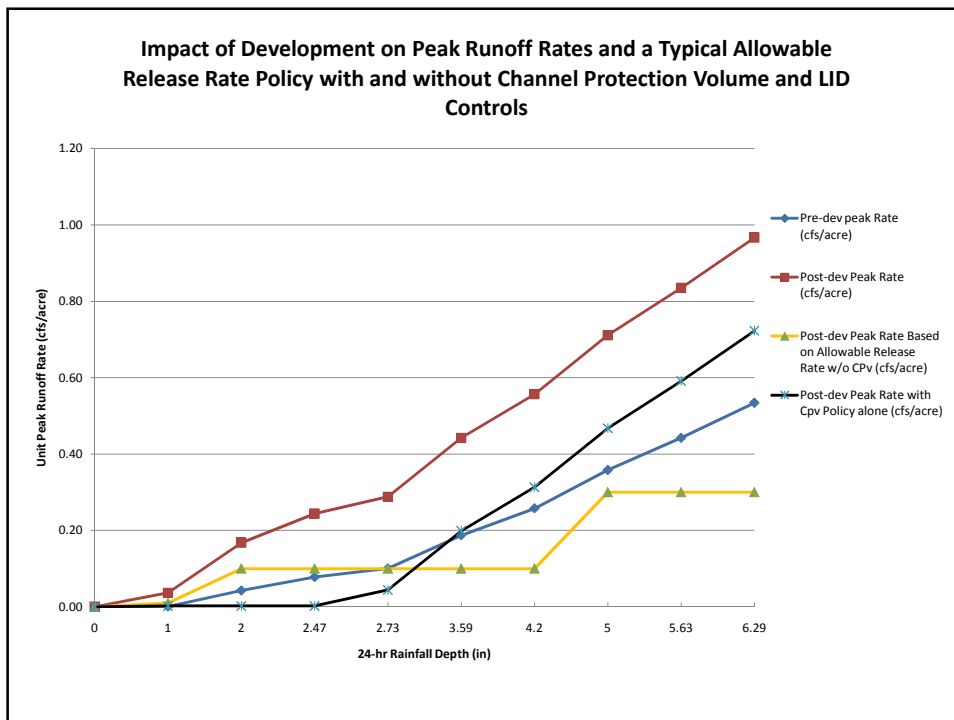
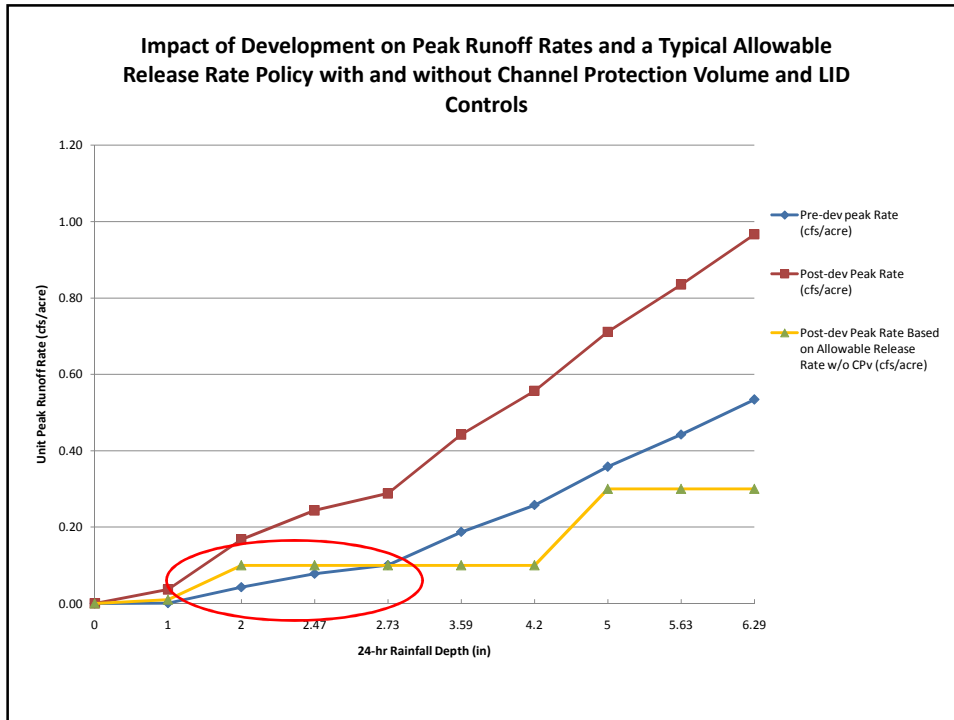


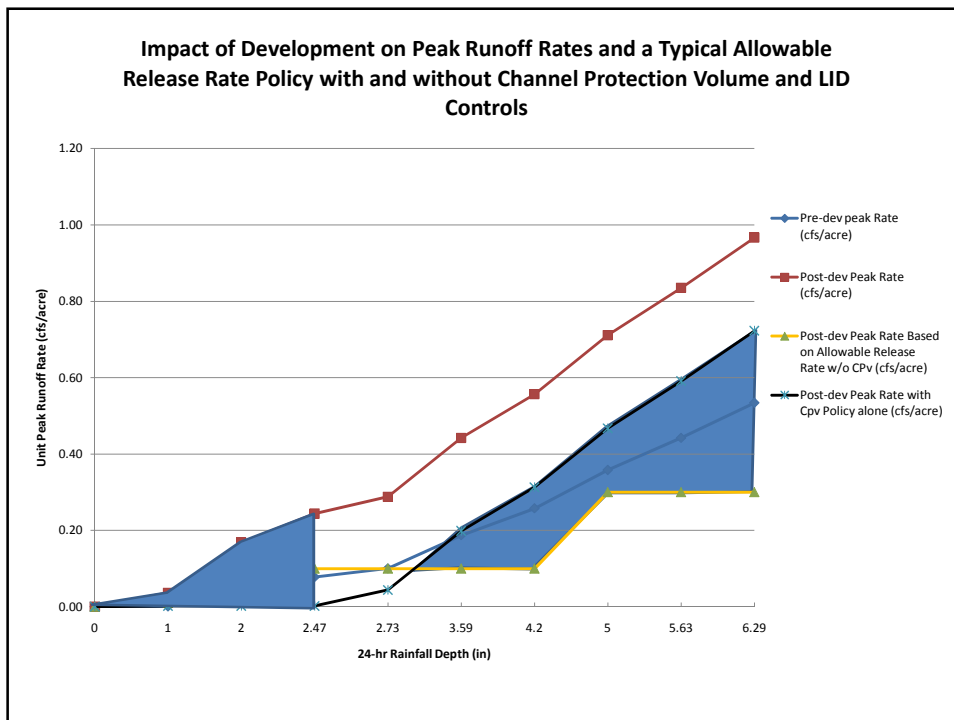
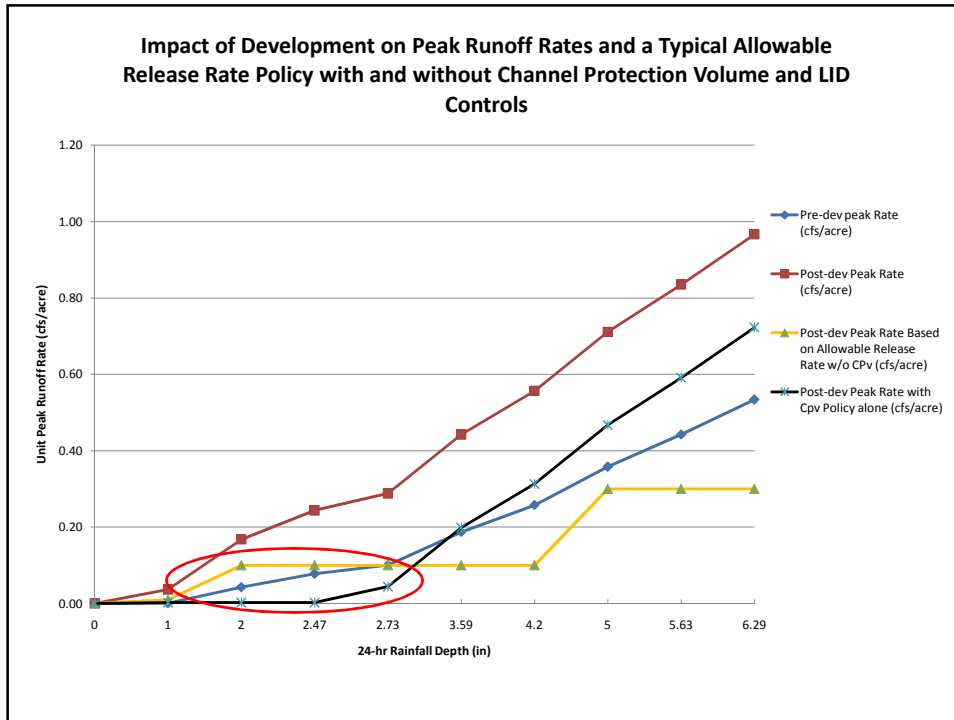
The Case for Channel Protection Volume

- The proposed fix is to retain (preferably) through distributed storage/infiltration BMPs or at a minimum provide extended detention of the 1-year, 24-hour event (generated by about 2.5 inches of rainfall) to prevent increased erosion in the receiving channel. This is known as "**Channel Protection Volume**".









CONVENTIONAL APPROACH

- A two-Step Process is utilized:
 - Provide Channel Protection Volume through Extended Detention
 - If needed, provide an additional BMP to treat any remaining untreated Pollutants of Concern



CONVENTIONAL APPROACH - STEP 1

Provide Channel Protection Volume

- Receiving channel protected through extended detention of the 1-year, 24-hour storm event at each outlet
- Both wet and dry extended detention may be used as long as 90% of detained volume is released between 24 and 48 hours
- Design with extra capacity for sediment accumulation
- Since 90% of original volume will be available within 48 hours, the volume associated with channel protection may be assumed empty for detention purposes
- Channel protection volume could also be used as a water quality BMP provided the facility meets design criteria for a water quality BMP



CONVENTIONAL APPROACH - STEP 2

Provide Additional Water Quality Treatment BMPs

- Based on proposed land use and information on the site's SWPPP, determine POC for proposed condition
- Add any other POC based on knowledge of future land use and by listing any POC that would have put the receiving stream on the 303(d) list (unless can show no contribution from site)
- Based on removal rates for various BMPs (table provided), determine treatment train necessary to reduce POC to MEP (subject to a minimum removal of TSS by 80%, TP by 75%, TN by 50%, and Metals by 75%).
- A minimum of two BMPs will be needed to accomplish the above, providing for a fail-safe mechanism.



Pre-Approved Post-Construction BMPs for Conventional Approach

BMP ^A	Typical % Removal Efficiency ^B				Maintenance Easement Requirements
	TSS	TP	TN	Metals	
Bioretention	90 ^C	60 ^C	50	77	25 feet wide along the perimeter
Constructed Wetland	67 ^C	49 ^C	28 ^D	50	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet
Underground Detention	70	NA	NA	NA	20 feet wide strip from access easement to tank's access shaft & 30 feet wide along centerline of inlet and outlet
Extended Detention/Dry Pond	72	57	39	56	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet
Infiltration Basin	87	60	57	74	25 feet wide along the perimeter
Infiltration Trench	90 ^C	60 ^C	60 ^C	90 ^C	25 feet wide along the perimeter
Constructed (Sand) Filter	70 ^C	56	32 ^D	56	25 feet wide along the perimeter
Water Quality Device	NA ^E	NA ^E	NA ^E	NA ^E	20 feet wide strip from access easement to chamber's access shaft
Vegetated Filter Strip	78 ^C	74 ^C	67 ^C	41	25 feet wide along the length on the pavement side
Vegetated Swale	81 ^C	52	25	45	25 feet wide along the top of bank on one side
Wet Ponds/Retention Basin	80	57	39	56	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet



LID Approach

- Multi-Step Implementation Approach Guides the Designer from Simpler, Less expensive Non-structural BMPS to More Complex, More Expensive Structural BMPs
- Incentives for non-disturbance, restoration of disturbed areas, minimizing imperviousness, infiltration practices, and extended detention are provided throughout by providing recognition/ credit towards meeting water quality, channel protection, and even water quantity requirements
- Various Non-Structural and Structural BMPs are Encouraged, but not All are Recognized for Meeting Requirements
- In order to receive LID recognition/credit, the LID features should be:
 - Within common areas
 - Protected by permanent easements
 - Have periodic maintenance and inspection assured through permanent O&M Escrow accounts or other means of financial assurances



LID APPROACH – STEP 1

Pre-approved BMPs with Treatment Area Reduction


Recognitions for LID Approach

BMP ^A	Runoff Reduction Recognition ^B
Protect Sensitive Areas	Area (acres complying with the requirements of this BMP) can be subtracted from site development area for Channel Protection Volume and Water Quality Volume/Rate calculations.
Protect Riparian Buffers	Area (acres complying with the requirements of this BMP) can be subtracted from site development area for Channel Protection Volume and Water Quality Volume/Rate calculations.
Minimize Total Disturbed Area	Area (acres complying with the requirements of this BMP) can be subtracted from site development area for Channel Protection Volume and Water Quality Volume/Rate calculations.
Reduce Impervious Surfaces	Area (acres complying with the requirements of this BMP) can be subtracted from site development area for Channel Protection Volume and Water Quality Volume/Rate calculations.
Protect Natural Flow Pathways	Area (acres complying with the requirements of this BMP) can be subtracted from site development area for Channel Protection Volume and Water Quality Volume/Rate calculations.
Cluster-Type Development	Area (undisturbed acres complying with the requirements of this BMP) can be subtracted from site development area for Channel Protection Volume and Water Quality Volume/Rate calculations.




LID APPROACH - STEP 2
Pre-approved BMPs with Runoff Reduction Recognitions for Restoring Disturbed Areas as Part of LID Approach

BMP ^A	Runoff Reduction Recognition ^B
Minimize Soil Compaction	Area (acres complying with the requirements of this BMP) can be assigned a CN based on the Pre-developed soil group conditions instead of the normal requirement of assigning the post-development CN according to the next lower infiltration soil group.
Protection of Existing Trees within disturbed areas (part of Protect Sensitive Areas)	Trees protected under the requirements of this BMP can be assigned a CN based on the Pre-developed soil group conditions at a rate of 800 square feet per tree instead of the normal requirement of assigning Post-developed CN according to the next lower infiltration soil group for the acres covered by the tree area.
Soil Amendment and Restoration	Area (acres complying with the requirements of this BMP) can be assigned a CN based on the Pre-developed soil group conditions instead of the normal requirement of assigning the post-development CN according to the next lower infiltration soil group.
Native Revegetation	Proposed trees and shrubs to be planted under the requirements of this BMP can be assigned a CN based on the Pre-developed soil group conditions at a rate of 200 square feet per tree and 25 square feet per shrub instead of the normal requirement of assigning Post-developed CN according to the next lower infiltration soil group for the acres covered by the existing land use area.
Riparian Buffer Restoration	Proposed trees and shrubs to be planted under the requirements of this BMP can be assigned a CN based on the Pre-developed soil group conditions at a rate of 200 square feet per tree and 25 square feet per shrub instead of the normal requirement of assigning Post-developed CN according to the next lower infiltration soil group for the acres covered by the existing land use area.



LID APPROACH - STEP 3
Pre-approved BMPs with CN Reduction Recognition for Reducing Imperviousness as Part of LID Approach

BMP ^A	Runoff Reduction Recognition ^B
Porous Pavement	Area covered by Porous Pavement with a minimum of 8 inch washed aggregate base may be assigned a weighted CN value of 87 (instead of CN of 98 normally used for impervious surfaces) for the purpose of Channel Protection Volume calculations. Use a weighted CN of 74 for the purpose of Water Quality Volume calculations, if needed. Note: If this BMP is specifically designed to provide permanent volume reduction through infiltration or through providing detention storage within the aggregate void, the volume reduction recognition discussed in Step 5 should be pursued instead of the CN reduction credit, assuming CN of 98.
Vegetated Roof	Vegetated roofs are designed to reduce runoff volumes. However, the volume reduction is highly dependent on the media and planting used, with the calculation methods very complex at times. In lieu of calculating the volume reduction benefits, the roof area with vegetated roof with a minimum media depth of 4 inches and a void ratio of 0.3 (as described in the fact sheet) may be assigned a weighted CN of 87 (instead of CN of 98 normally used for impervious surfaces) for the purpose of Channel Protection Volume calculations. Use a weighted CN of 74 for the purpose of Water Quality Volume calculations, if needed.



LID APPROACH - STEP 4

Determine Channel Protection Volume

- Determine the 1-year 24-hour rainfall from the provided Table
- Delineate subbasins in a manner that, at a minimum and to the extent possible, the pervious and impervious surfaces are in different subbasins
- Determine the disturbed drainage area for each subbasin by subtracting the protected area determined in Step 1 from total contributing drainage area.
- Assign CN to each cover type and land use, using “credited CN” for areas treated in Steps 2 and 3 instead of normal post-development CN that is determined based on the proposed land use and the next less infiltrating underlying soil group, when applicable.



LID APPROACH - STEP 5

Pre-approved Structural BMPs with Permanent Volume Reduction Recognition for Channel Protection as Part of LID Approach

BMP ^A	Channel Protection Volume Reduction Recognition ^B
Infiltration Practices (Infiltration Basin, Subsurface Infiltration Bed, Infiltration Trench, and Dry Well)	Volume reduction is achieved by surface storage volume (if included in the design), subsurface volume (if included in the design), and infiltration volume as described in the fact sheet. If an underdrain has to be used due to soil conditions, no credit is granted for the “infiltration volume” portion.
Bioretention	Volume reduction is achieved by surface storage volume, soil storage volume, and infiltration bed volume as described in the fact sheet.
Vegetated Swale	Volume reduction is achieved by surface storage volume (if included in the design through inclusion of check dams) and active infiltration volume during the storm (when infiltration is expressly designed for as a purpose) as described in the fact sheet.



Conditions for Recognizing Permanent Removal of Volume through Distributed Storage/Infiltration BMPS

- To Be Recognized, the BMP Must:
 - Be constructed on A or well-drained B soils, or on amended soils with underdrains if located in areas with poorly-drained B soils or any type C or D soils.
 - Be constructed in an area where the depth of seasonal high water table and any bedrock is more than a minimum of two to four feet from ground elevation.
 - Be constructed in a manner that any infiltration practices are adequately separated from basement foundations (50 feet up gradient, 10 feet down gradient), on-site septic systems/drainfields (50 feet), wells (100 feet), and other building elements that could be affected by infiltration systems.
 - Be constructed outside of any 1-year (Zone 1) or 5-year (Zone 2) time of travel areas to public water supply wells, as defined by a modeled wellfield delineation performed in compliance with 327 IAC 8-4.1. When such delineation is not available, said practice must be at least 3,000 feet from the nearest public water supply well (unless applicant can prove, based on groundwater modeling, that the proposed practice will have no impacts on the water quality of the water supply well).
 - Final construction should be completed after the contributing drainage area has been stabilized.
 - Must contain erosion-protection features at the inflow to prevent scouring.
 - Must contain a maintenance area near the inlet to collect large debris. Examples include small concrete aprons, catch basin inserts, or similar durable maintenance point.



LID APPROACH - STEP 6

Pre-approved BMPs with Additional, As-needed Extended Detention Runoff Reduction Recognitions for Channel Protection as Part of LID Approach

BMP ^A	Runoff Reduction Recognition ^B
Constructed Wetland	The volume of the supplementary extended detention, in lieu of permanent volume reduction, is credited towards meeting Channel Protection Volume requirements so long as only 10% of the maximum stored volume is left in the basin after 36 hours from maximum storage time and no more than 40% from the maximum stored volume is released within the first 12 hours.
Extended Detention Wet/Dry Pond	The volume of the supplementary extended detention, in lieu of permanent volume reduction, is credited towards meeting Channel Protection Volume requirements so long as only 10% of the maximum stored volume is left in the basin after 36 hours from maximum storage time and no more than 40% of the maximum stored volume is released within the first 12 hours.



LID APPROACH - STEP 7

Determine water quality volume and Provide, As needed, Additional Water Quality BMPs

- When the channel protection volume is controlled with BMPs that also remove expected pollutants, often no additional calculation or BMP implementation is necessary. If the channel protection volume is not controlled through practices that also remove expected pollutants, calculate the water quality volume that provides for the treatment of the first inch of rainfall on the site's disturbed areas.
- Select BMPs from the list provided in Table 8-1/702-1 that will meet the performance criteria noted earlier.
- Design the BMPs in conjunction with any detention control that is needed for peak rate control of larger floods (100-year), if possible.



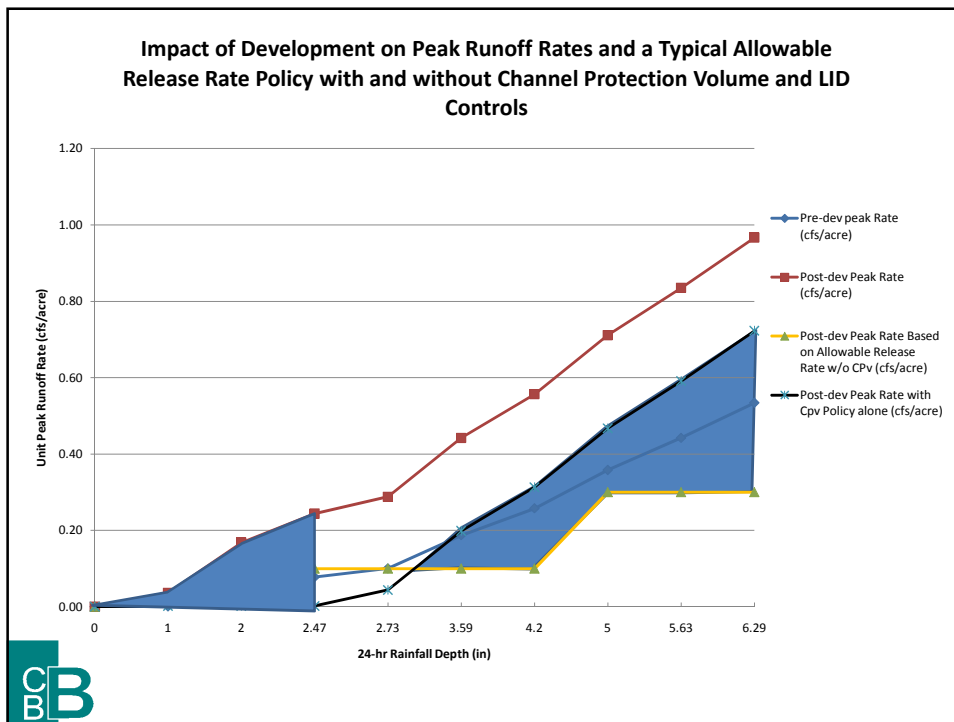
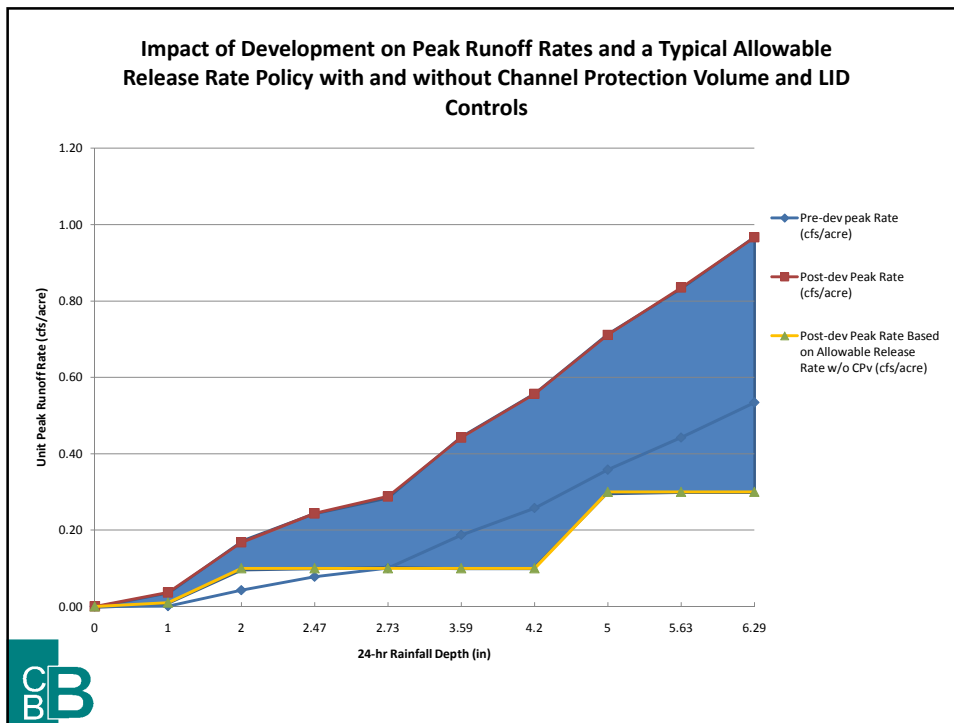
LID APPROACH – STEP 8

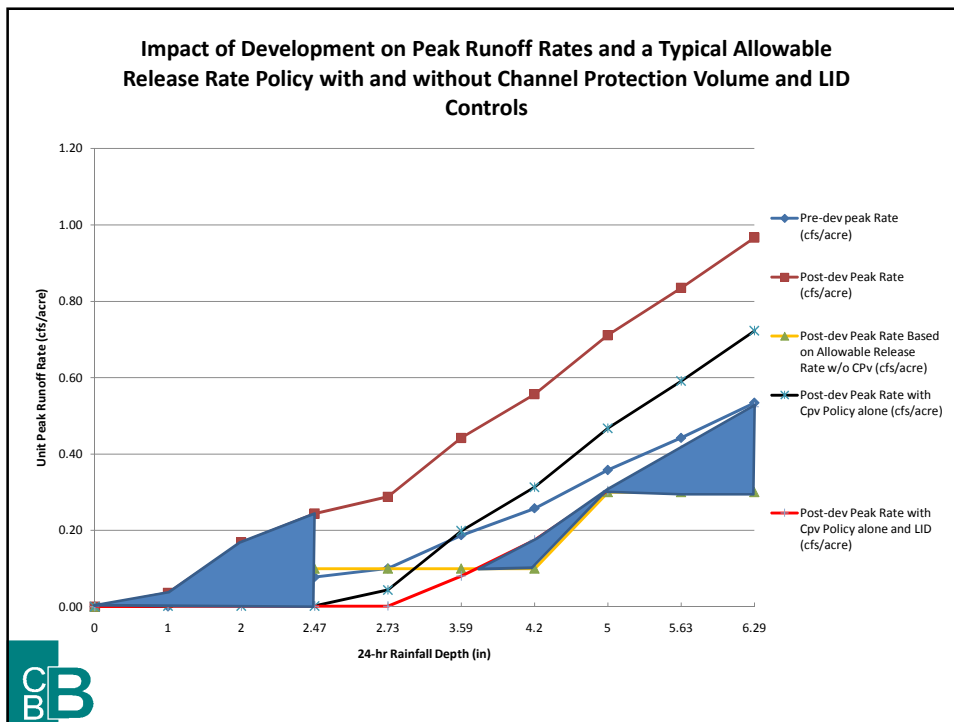
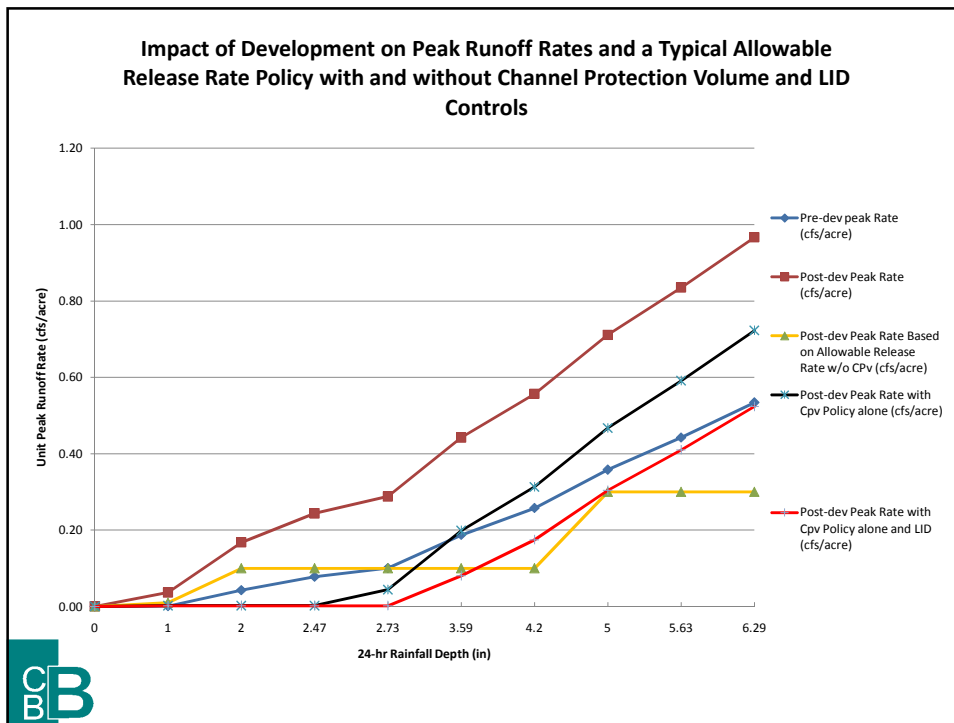
LID Approach Utilization Summary Form

Project Information				
Project Name	Developer			
Project Address	Developer's Address			
Engineer	Developer's Telephone No.			
This worksheet is a tool to allow both the regulatory agency and the Developer to reference various LID measures implemented within the development in order to meet the development's Post Construction Stormwater Management requirements.				
Site Specific Information				
Total Site Area: _____sf				
Proposed Earth Disturbance Area: _____sf				
Existing Impervious Area: _____sf				
LID Measure Category	Potential BMPs	Total Surface Area (sf) of LID Measure	Plan Pg # of LID Measure	Pg # of Calculations for LID Measure
Minimize Disturbed Areas	Protect Sensitive Areas			
	Protect Riparian Buffers			
	Protect Natural Flow Pathways			
	Minimize Total Disturbed Area			
	Reduce Impervious Surfaces			
Restore Disturbed Areas	Cluster-Type Development			
	Minimize Soil Compaction			
	Protect Trees in Disturbed Areas			
	Soil Amendment and/or Restoration			
	Native Revegetation			
Minimize Imperviousness	Riparian Buffer Restoration			
	Porous Pavement			
Provide Distributed Retention/Infiltration Practices	Vegetated Roof			
	Infiltration Practices*			
	Bio-retention			
	Vegetated Swale			
Total Surface Area of LID Measures (sf)				
Proposed Final Impervious Surface Area				
Percent of Total Site Area Covered by LID				
Note: Not all LID measures are necessary or appropriate for every site. It is imperative that proper site assessments and due diligence is completed by the Developer and/or Engineer prior to design.				

Summary of Recognition/Credits for Pre-approved BMPS Used in the LID Approach					
LID BMP GROUP	DESCRIPTION	POTENTIAL BMPS	RUNOFF REDUCTION RECOGNITION FOR POST-CONSTRUCTION WATER QUALITY CALCULATIONS		RUNOFF REDUCTION RECOGNITION FOR WATER QUANTITY (DETENTION AND STORMDRAIN) CALCULATIONS
			WATER QUALITY VOLUME	CHANEL PROTECTION VOLUME	
1	Minimize Disturbed Areas	<ul style="list-style-type: none"> Protect Sensitive Areas Protect Riparian Buffers Minimize Total Disturbed Area Protect Natural Flow Pathways Reduce Impervious Surfaces Cluster-Type Development 	Full recognition through allowing to use "disturbed surface area" only for all calculations	Full recognition through allowing to use "disturbed surface area" only for all calculations	Full recognition through allowing CN for the undisturbed, protected area to be calculated based on pre-developed underlying soil types
2	Restore Disturbed Areas	<ul style="list-style-type: none"> Minimize Soil Compaction Protection of Existing Trees within disturbed areas (part of Minimize Total Disturbed Area) Soil Amendment and Restoration Native Revegetation Riparian Buffer Restoration 	Full recognition through allowing CN for the restored/protected area to be calculated based on pre-developed underlying soil types	Full recognition through allowing CN for the restored/protected area to be calculated based on pre-developed underlying soil types	Full recognition through allowing CN for the restored/protected area to be calculated based on pre-developed underlying soil types
3	Minimize Imperviousness	<ul style="list-style-type: none"> Porous Pavement 	Full recognition of perviousness through allowing CN for the application area to be calculated based on a pre-set value (74 instead of 98) AND full recognition of the stored volume (if provided for in the design) and WQ treatment, if designed as a true infiltration practice (no underdrain/ or extended 24-48 hrs release)	Partial (weighted) recognition of perviousness through allowing CN for the application area to be calculated based on a pre-set value (87 instead of 98) AND full recognition of the stored volume (if provided for in the design), if designed as a true infiltration practice (no underdrain/ or extended 24-48 hrs release)	Partial (weighted) recognition of perviousness through allowing CN for the application area to be calculated based on pre-set values (89 for 10-year and 90 for 100-year calculations instead of using 98) and full recognition of the stored volume (if provided for in the design), on a case by case basis, treated as an underground detention
		<ul style="list-style-type: none"> Vegetated Roof 	Full recognition of perviousness through allowing CN for the application area to be calculated based on a pre-set value (74 instead of 98) AND full recognition of the stored volume (if provided for in the design) and/or WQ treatment if designed for	Partial (weighted) recognition of perviousness through allowing CN for the application area to be calculated based on a pre-set value (87 instead of 98)	Partial (weighted) recognition of perviousness through allowing CN for the application area to be calculated based on a pre-set value 89 for 10-year and 90 for 100-year calculations instead of using 98)

Summary of Recognition/Credits for Pre-approved BMPS Used in the LID Approach (cont.)					
LID BMP GROUP	DESCRIPTION	POTENTIAL BMPS	RUNOFF REDUCTION RECOGNITION FOR POST-CONSTRUCTION WATER QUALITY CALCULATIONS		RUNOFF REDUCTION RECOGNITION FOR WATER QUANTITY (DETENTION AND STORMDRAIN) CALCULATIONS
			WATER QUALITY VOLUME	CHANEL PROTECTION VOLUME	
4	Provide Distributed Infiltration Practices (or Filtration Practices, if underdrains have to be provided) in Common Areas	<ul style="list-style-type: none"> Infiltration Practices (Infiltration Basin, Subsurface Infiltration Bed, Infiltration Trench, and Dry Well) Bioretention Vegetated Swale 	Full recognition of perviousness through allowing CN for the application area to be calculated based on cover type and underlying soil AND full recognition of the retained volume (if provided for in the design) and/or WQ treatment if designed for	Full recognition of retained volume if designed as true infiltration practice (on appropriate soil and no underdrain/ or extended 24-48 hrs release)	Limited recognition of retained volume (up to the Channel Protection Volume) if designed as true infiltration practice (on appropriate soil and no underdrain/ or extended 24-48 hrs release)
5	Provide, as-needed, Extended Detention Practices in Common Areas	<ul style="list-style-type: none"> Constructed Wetland Extended Detention Wet/Dry Pond 	Full recognition of the stored volume (with extended 24-48 hrs release) and/or WQ treatment if designed for	Full Recognition of stored volume (with extended 24-48 hrs release)	Full Recognition of stored volume (with extended 24-48 hrs release)
6	Provide, As needed, Additional Water Quality BMPs	<ul style="list-style-type: none"> Pre-approved BMPs noted in Table 702-1 for conventional method 	Full recognition of WQ treatment	N/A	N/A





Pre-Treatment Options for Stormwater Hot Spots

Stormwater Hot Spots	Minimum Pre-Treatment Options
Vehicle Maintenance and Repair Facilities	A, E, F, G
Vehicle Fueling Stations	A, D, G
Drive-through Restaurants, Pharmacies, Convenience Stores	B, C, D, I, K
Outdoor Chemical Mixing or Handling	G, H
Outdoor Storage of Liquids	G
Commercial Nursery Operations	I, J, L
Other Uses or Activities Designated by Appropriate Authority	As Required

Minimum Pre-Treatment Options	
A	Oil/Water Separators / Hydrodynamic Separators
B	Sediment Traps/Catch Basin Sumps
C	Trash/Debris Collectors in Catch Basins
D	Water Quality Inserts for Inlets
E	Use of Drip Pans and/or Dry Sweep Material under Vehicles/Equipment
F	Use of Absorbent Devices to Reduce Liquid Releases
G	Spill Prevention and Response Program
H	Diversion of Stormwater away from Potential Contamination Areas
I	Vegetated Swales/Filter Strips
J	Constructed Wetlands
K	Stormwater Filters (Sand, Peat, Compost, etc.)
L	Stormwater Collection and Reuse (especially for irrigation)
M	BMPs that are a part of a Stormwater Pollution Prevention Plan (SWPPP) under a NPDES Permit

Post-Construction Stormwater BMP Appendices

- Stormwater BMP Fact Sheets
 - Part 1: Nonstructural BMPs for LID Approach
 - Part 2: Structural BMPs for LID and Conventional Approaches
- Recommended Plant Lists for Best Management Practices
- Recommended Materials
- Soil Infiltration Testing Protocol
- Maintenance Inspection Checklists
- Stormwater Management Practices Maintenance Agreement



QUESTIONS?

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