

A photograph of a stormwater drain on a wet street. The drain is a rectangular grate with a grid of circular holes, showing some rust and debris. Water is being poured from the left, creating a splash. In the background, three cars (a silver SUV, a white SUV, and a silver sedan) are parked on the street. The scene is overcast and wet, suggesting a recent rain.

Asking the Right Questions in Stormwater Review

Why are we here?

The approval of a developer's stormwater management plans lies **solely** with the municipality.

Municipalities are **required** under their *Municipal Stormwater General Permit* to enforce statewide basic requirements for post-construction stormwater management in new development and redevelopment.

What happens to the rain?



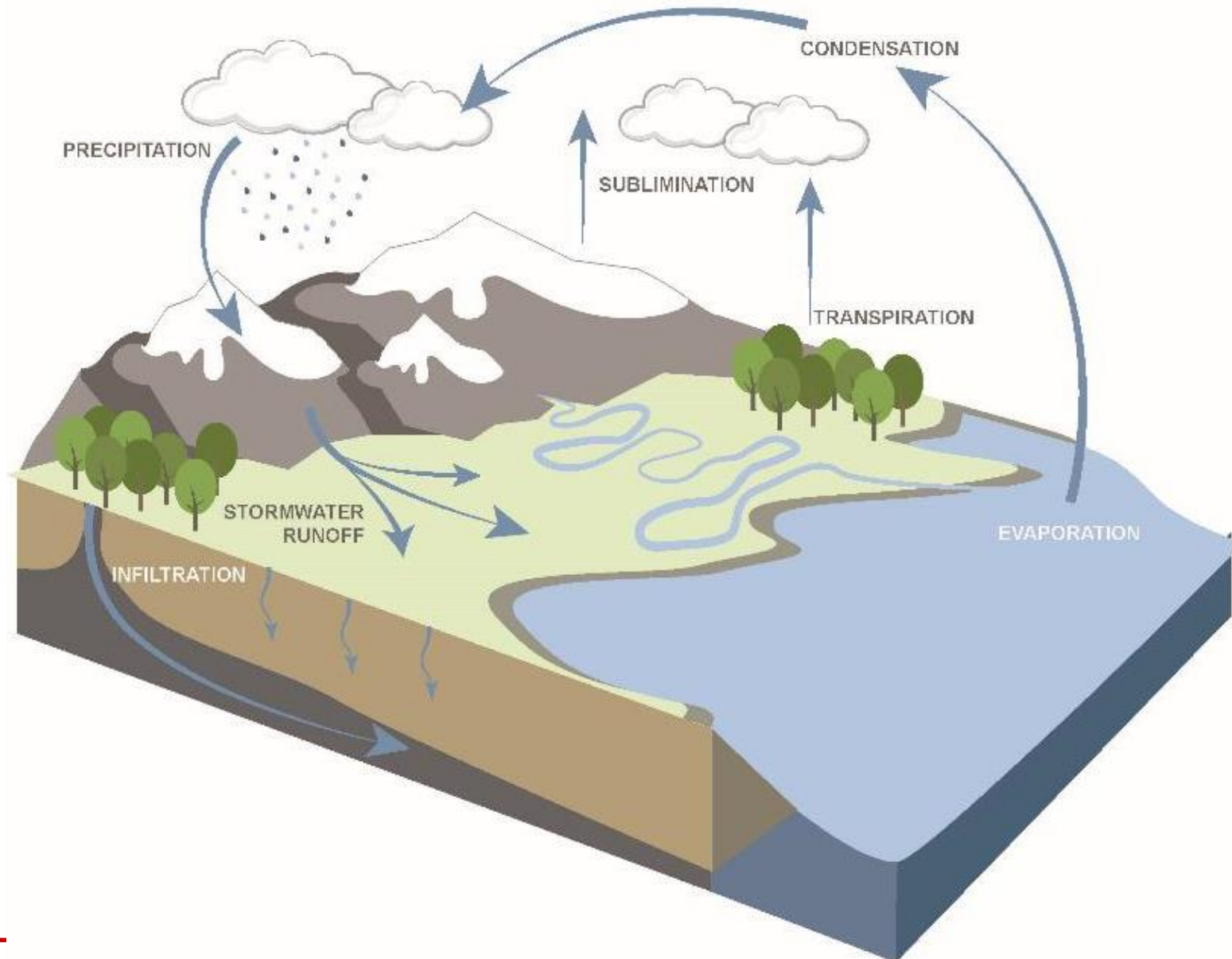
It runs off of rooftops and pavement...

What is stormwater?

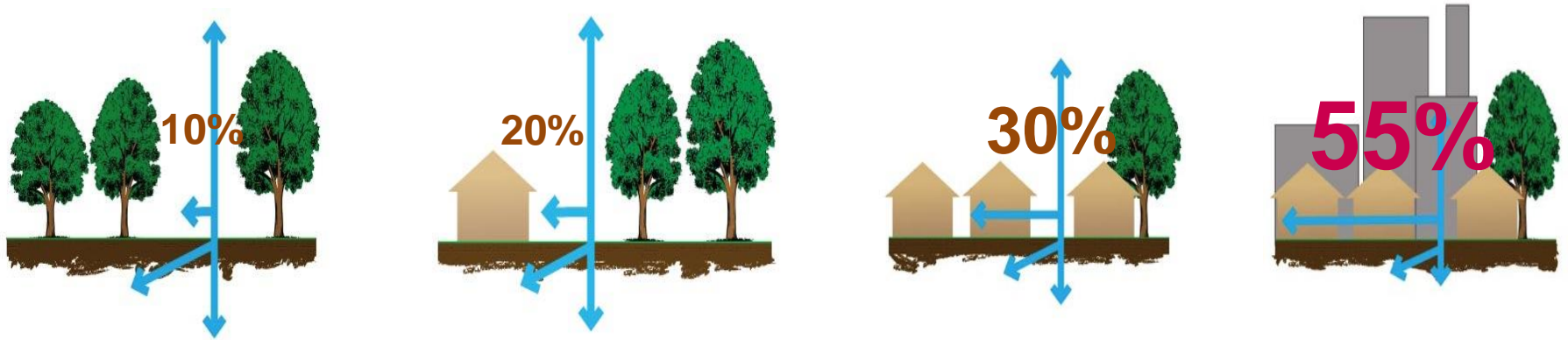


Stormwater is the water from rain or melting snows that can become “runoff,” flowing over the ground surface and returning to lakes and streams.

The Natural Hydrologic Cycle



The Impact of Development on Stormwater Runoff



More development



More impervious surfaces



More stormwater runoff



What is impervious cover?

Roads, rooftops, parking lots, and other hard surfaces that do not allow stormwater to soak into the ground.



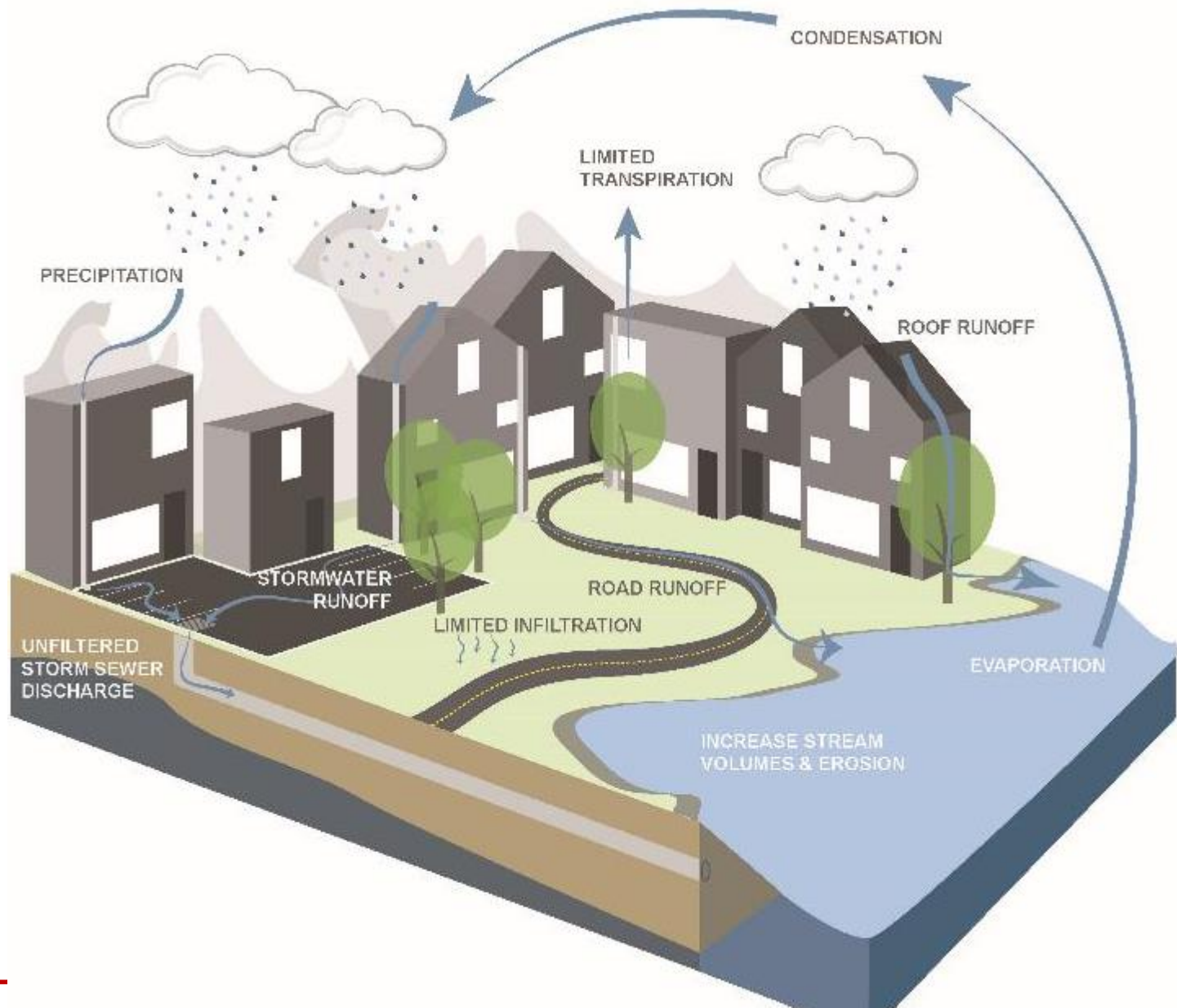
- provides a surface for accumulation of pollutants
- leads to increased polluted runoff and flooding
- inhibits recharge of groundwater

Increases in Impervious Cover Leads to:

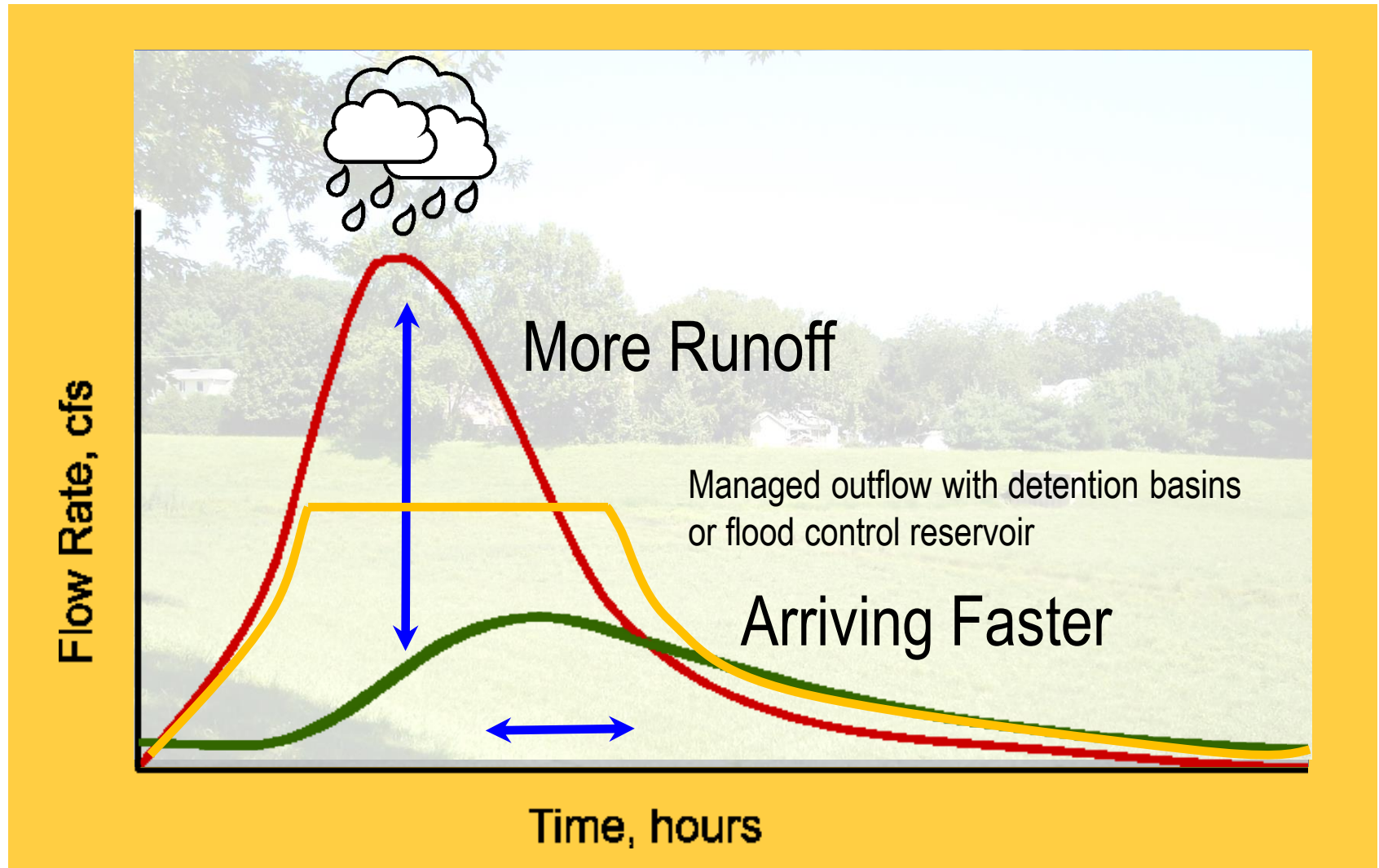
- More stormwater runoff volume
- Higher peak stormwater runoff rates
- Increased nonpoint source pollution
- Less groundwater recharge



The sub/urban Hydrologic Cycle



The Science of Stormwater





History of Stormwater Management



1st Attempt at Stormwater Management

Capture all runoff, pipe it, and send it directly to the river . . . prior to mid 1970's



2nd Iteration of Stormwater Management

Capture runoff, detain it, release it slowly to the river...mid 1970's to 2004

- Detain peak flow during large storm events
- Reduce downstream flooding during major storms
- Use concrete low flow channels to minimize erosion, reduce standing water, quickly discharge low flows
- Does not manage runoff from smaller storms
- Directly discharges stormwater runoff to nearby stream, waterway, or municipal storm sewer system (at a controlled/managed rate)



3rd Generation of Stormwater Management

- Reduce peak flows
...and....
- Maintain infiltration and groundwater recharge
- Reduce pollution discharged to local waterways



How NJ's regulations change the way we manage stormwater

ASLAVIDEO

Video by the American Society of Landscape Architects

Play

Stormwater Management

Key Objectives

- Use nonstructural management strategies
- Protect communities from increases in stormwater volume and peak flows as a result of new development
- Maintain groundwater recharge
- Protect waterways from pollution carried in stormwater runoff



New Jersey Stormwater Management Rules

- Rules apply to any “Major Development” defined as a project disturbing more than 1 acre or increasing impervious surfaces by ¼ acre or more
- Design and Performance Standards established in NJAC 7:8-5, for:
 - Nonstructural Stormwater Management Strategies
 - Stormwater Quantity
 - Groundwater Recharge
 - Stormwater Quality
 - Stormwater Maintenance Plan

Nonstructural Strategies

- Plan the project using Low Impact Development (LID) Principles
- Collect, infiltrate and where possible reuse stormwater near its source
- Capture runoff from small storm events in vegetated systems to protect water quality and promote recharge
- Minimize and disconnect impervious surfaces

Water Quantity Performance Standards

Water Quantity

- Demonstrate that post-development 2, 10, and 100-year storm event hydrographs do not exceed pre-development hydrographs
- or**
- Demonstrate that hydrograph peaks will not increase and that increase in volume or change in timing won't increase flood damage downstream
- or**
- Design BMPs so that 2, 10, and 100-year pre-development hydrographs are reduced to 50%, 75%, and 80%, respectively
 - 2-year rainfall (3.3 inches)
 - 10-year rainfall (5.0 inches)
 - 100-year rainfall (8.3 inches)

Groundwater Recharge Performance Standards

Groundwater Recharge

- Maintain 100% of average annual groundwater recharge volume

or

- Infiltrate increase in the post development runoff volume for the 2-year storm

Water Quality Performance Standards

Water Quality

- Install BMPs to reduce at least 80% of total suspended solids (TSS) loads
- Install BMPs to provide nutrient removal to maximum extent feasible

<u>BMP</u>	<u>TSS Removal Rate</u>
Bioretention	90%
Constructed Wetlands	90%
Forested Buffers	70%
Extended Detention Basin	40-60%
Infiltration Structure	80%
Sand Filter	80%
Vegetative Filter Strip	50%
Wet Pond	60-90%

SOURCE: NJ Stormwater Management Rules
and BMP Manual

NJ Stormwater Guidance



Tier A

Municipal Stormwater Guidance Document
NJPDES General Permit No NJ0141852



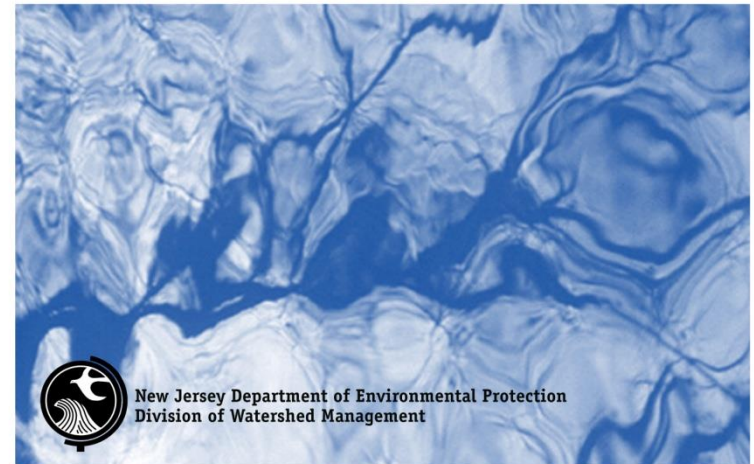
New Jersey Department of Environmental Protection
Division of Water Quality
Municipal Stormwater Regulation Program



New Jersey

Stormwater

Best Management Practices Manual



New Jersey Department of Environmental Protection
Division of Watershed Management

For more information, visit: www.njstormwater.org

The approval of a
developer's stormwater
management plans lies
solely with the
municipality.

As municipal officials...what is NOT your responsibility...

- You do NOT need to know how to meet required nonstructural management strategies
- You do NOT need to know how to design or use BMPs
- You do NOT need to know how to maintain BMPs

The Role of Municipal Officials...

- You need to know how to ask the right questions of the professionals and the applicant
- Clearly understand that all applicants have to satisfy standards for:
 - Nonstructural Stormwater Management Strategies
 - Stormwater Quantity
 - Groundwater Recharge
 - Stormwater Quality
 - Stormwater Maintenance Plan
- Have confidence that your questions have been adequately answered by the professionals and the applicant so that approval can be given

Who approves a developer's stormwater management plan?

The approval of a developer's stormwater management plans lies **solely** with the municipality.

A permit from NJDEP is **not** an approval of the applicant stormwater management plan.

ONLY the municipality can approve a developer's stormwater management plan.

Bottom line - what does the developer really need to do?

1. Maintain groundwater recharge on the site
2. Reduce sediment and nutrient runoff from the site
3. Reduce the peak stormwater runoff rates from the site

How should a developer do this?

- 1st Use Nonstructural Strategies to achieve 1, 2, and 3

Nine Nonstructural Strategies

1. **Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss**
2. **Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces**
3. Maximize the protection of natural drainage features and vegetation
4. Minimize the decrease in the "time of concentration" from pre-construction to post-construction
5. **Minimize land disturbance including clearing and grading**
6. Minimize soil compaction
7. **Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides**
8. **Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas**
9. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site to prevent or minimize the release of those pollutants into stormwater runoff

9 Strategies to 4 Categories

1. Vegetation and Landscaping

- ✓ Preservation of natural areas (forested areas, riparian corridors, high recharge areas)
- ✓ Native ground cover (limit turf grass areas)
- ✓ Vegetative filters and buffers (protect them or plant new ones)

2. Minimizing Site Disturbance

- ✓ Fit the development into the terrain
- ✓ Minimize clearing and grading
- ✓ Minimizing soil compaction
- ✓ Build on low permeability soil areas

3. Impervious Area Management

- ✓ Minimum street widths and sidewalks
- ✓ Limit parking and driveway areas
- ✓ Use pervious paving materials
- ✓ Disconnect impervious surfaces from draining directly to waterways
- ✓ Vegetated roofs

4. Time of Concentration Modifications (slow down runoff)

- ✓ Surface roughness changes
- ✓ Slope reduction
- ✓ Vegetated conveyances

#1 Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss





Vegetative Buffers



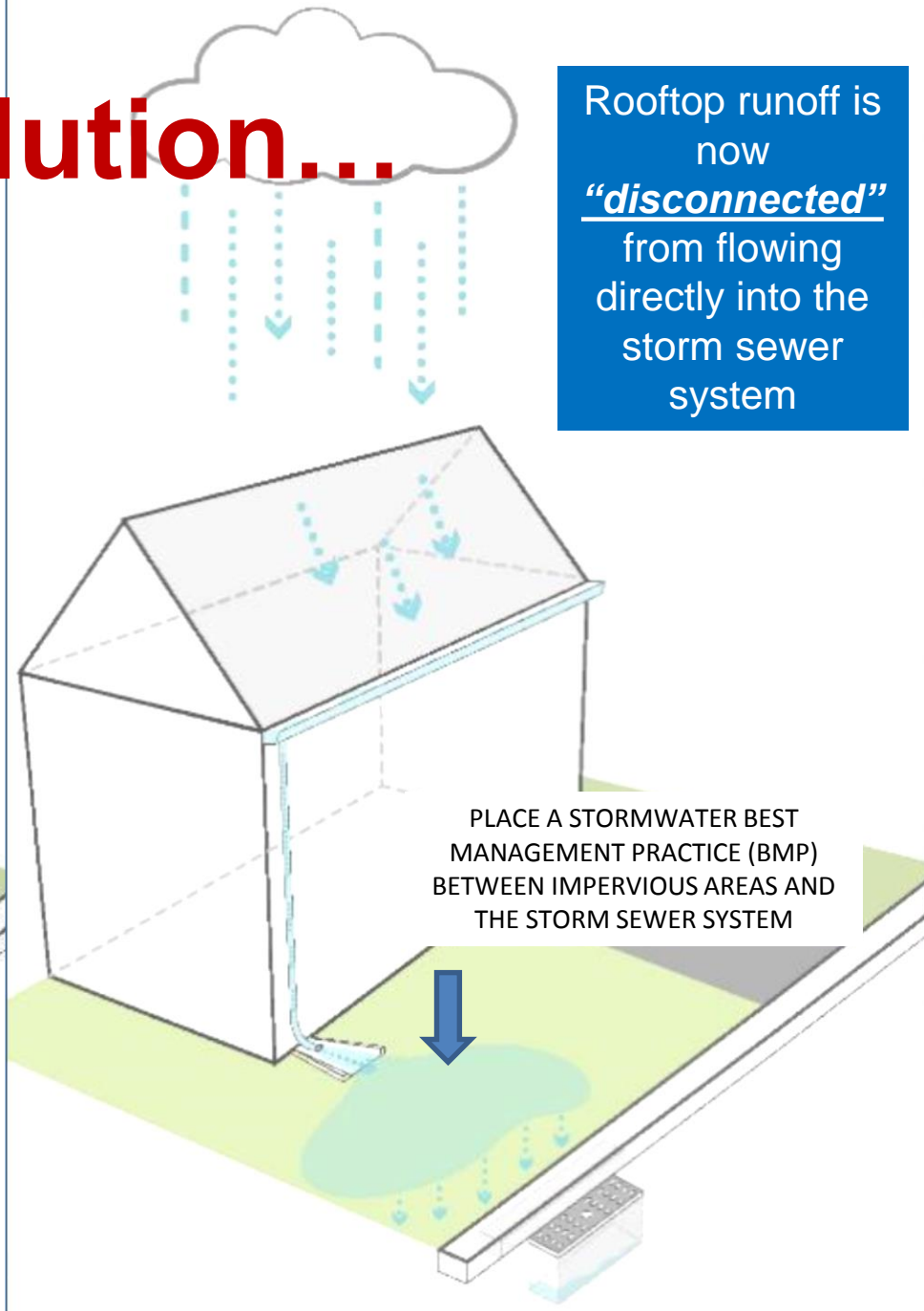
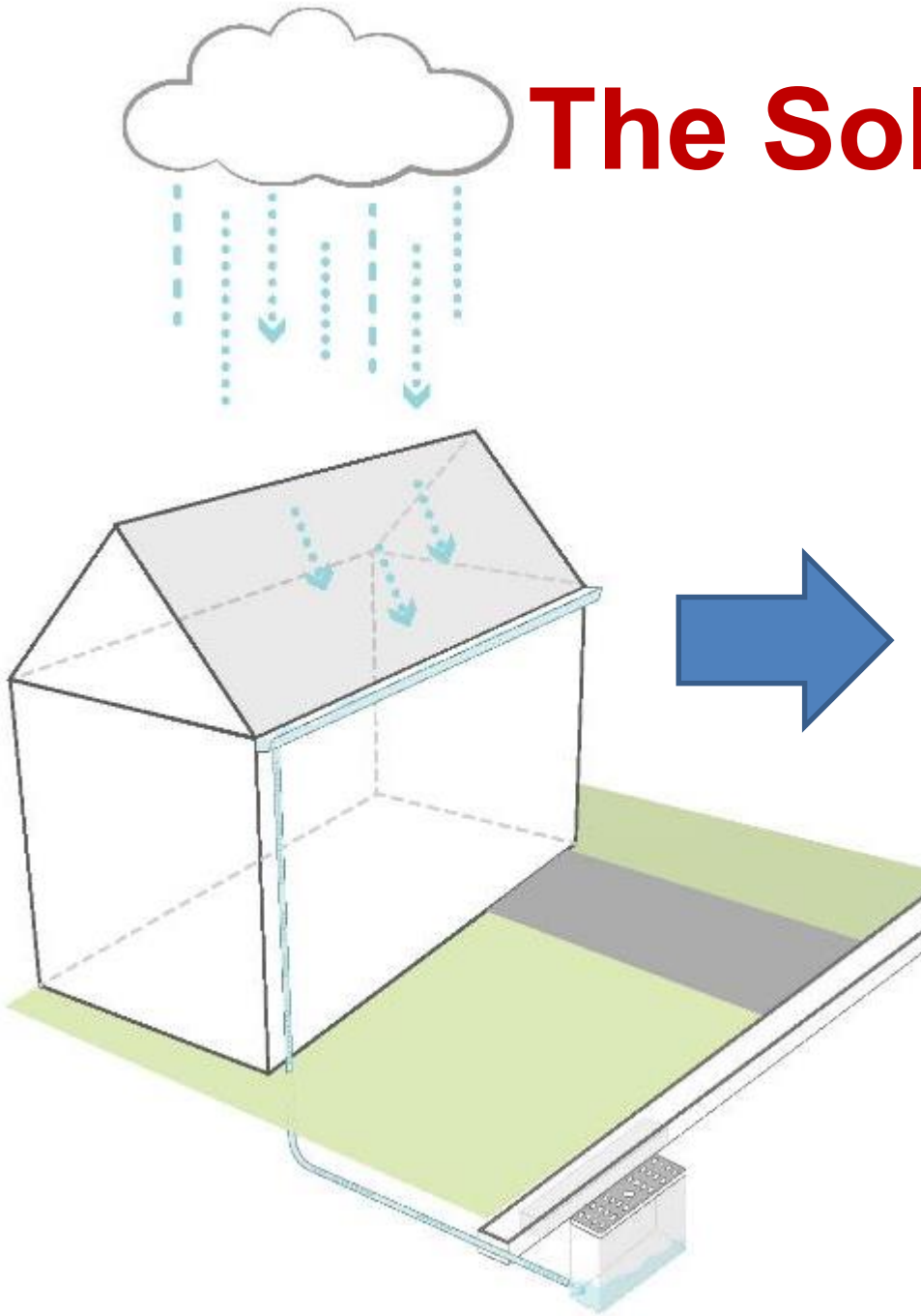
#2: Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces



Disconnected Impervious Surfaces



The Solution...



Rooftop runoff is now “disconnected” from flowing directly into the storm sewer system

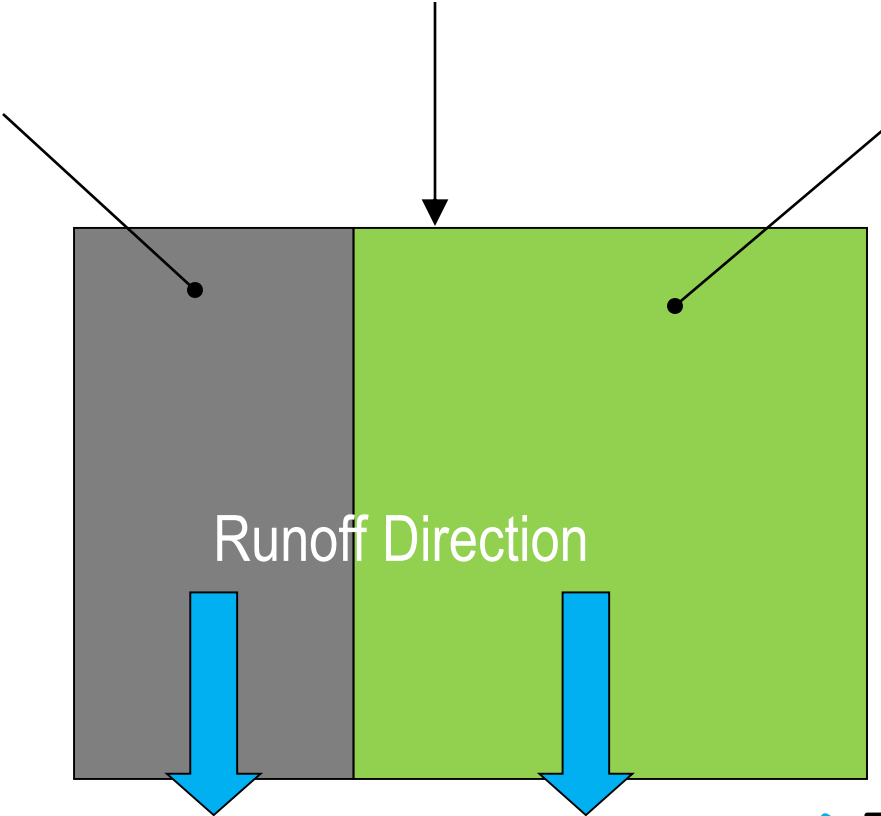
PLACE A STORMWATER BEST MANAGEMENT PRACTICE (BMP) BETWEEN IMPERVIOUS AREAS AND THE STORM SEWER SYSTEM

For 1.25 inch storm, 3,811 cubic feet of runoff = **28,500 gallons**

Total drainage area = 3 acres

1 acre directly connected impervious cover

2 acres pervious cover



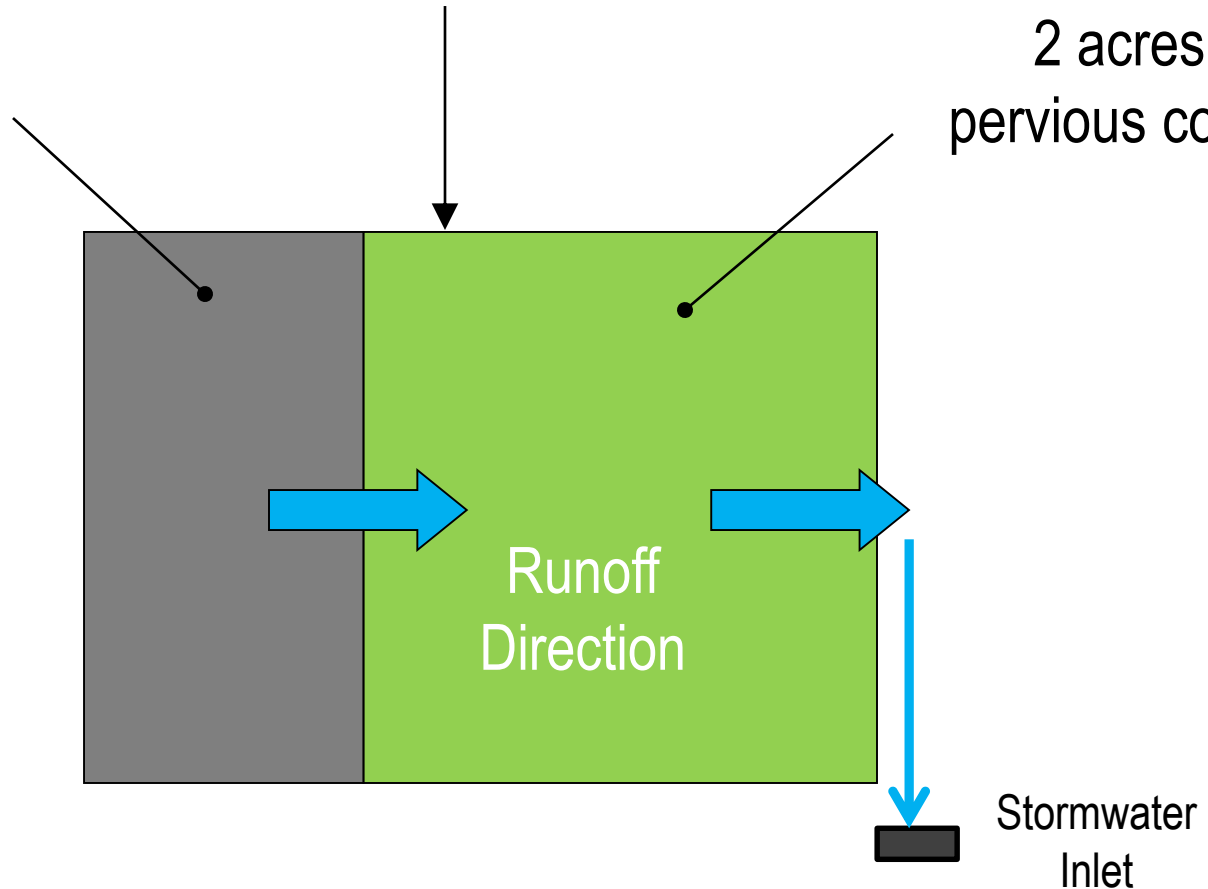
Stormwater Inlet

For 1.25 inch storm, 581 cubic feet of runoff = **4,360 gallons**

Total drainage area = 3 acres

1 acre directly
connected
impervious cover

2 acres
pervious cover



Design Storm	Volume of Runoff		Percent Difference
	Connected (gallons)	Disconnected (gallons)	
1.25 inches (water quality storm)	28,500	4,360	85%

Impervious area is now “disconnected” from flowing directly into the storm sewer system

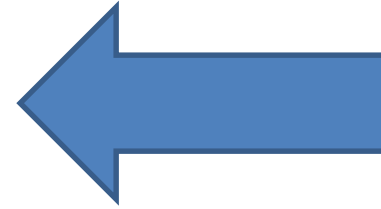




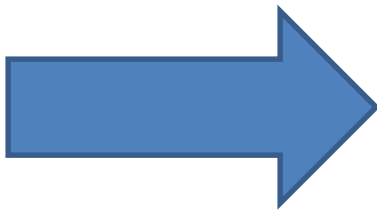
#5 Minimize land disturbance including clearing and grading



Preserving Natural Lands



Not Preserving Natural Lands



#7 Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides





#8 Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas





Vegetated Conveyances



No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss		
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces		
3.	Maximize the protection of natural drainage features and vegetation		
4.	Minimize the decrease in the pre-construction time of concentration		
5.	Minimize land disturbance including clearing and grading		
6.	Minimize soil compaction		
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides		
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas		
9.	Provide preventative source controls		

Explain why any one of these is “NO.” Engineering, environmental and/or safety reasons are only acceptable.

Bottom line - what does the developer really need to do?

1. Maintain groundwater recharge on the site
2. Reduce sediment and nutrients runoff from the site
3. Reduce the peak stormwater runoff from the site

How should a developer do this?

- 2nd Focus on incorporating systems that address water quality and groundwater recharge

Nonpoint Source Pollution (NPS)

- NPS is pollution associated with stormwater runoff
- NPS occurs when runoff collects pollutants on its way to a collection system or water body
- NPS pollution cannot be traced to a direct discharge point such as a wastewater treatment facility



Examples of NPS

- Oil and grease from cars
- Fertilizers
- Animal waste
- Grass clippings
- Septic systems
- Sewage leaks
- Household cleaning products
- Litter
- Agriculture
- Sediment



Impact of NPS

- Fish and wildlife
- Recreational water activities
- Commercial fishing
- Tourism
- Drinking water quality

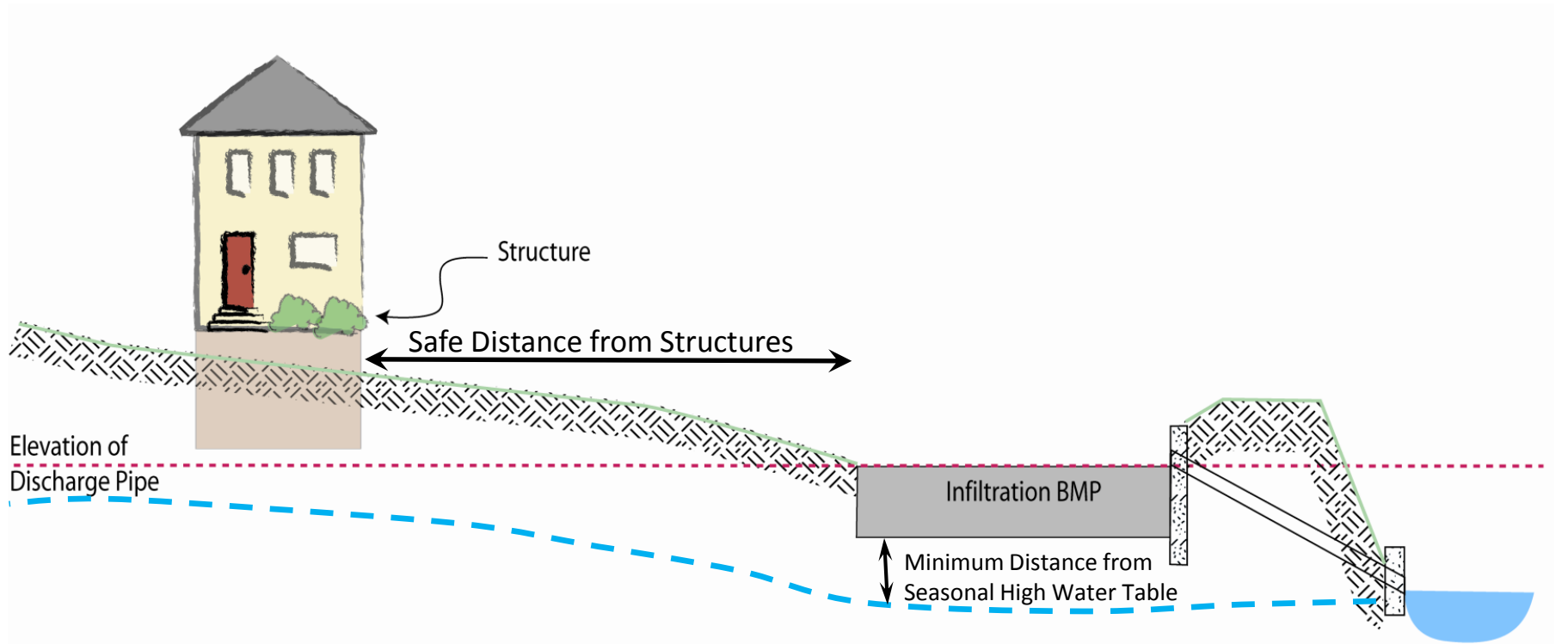


Groundwater Recharge Requires...

- Healthy soils
 - Permeability
 - Hydraulic conductivity
- Vertical separation from seasonable high water table or groundwater table
- Suitable distance from foundations, basements and septic systems



Groundwater Recharge...

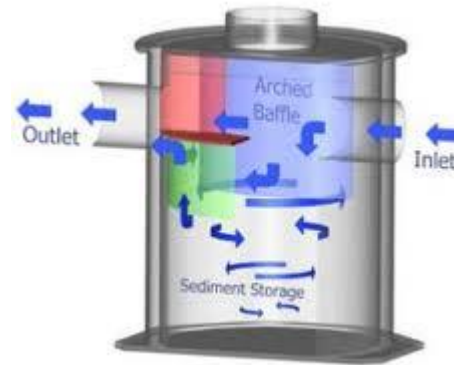




Bioretention Systems



Manufactured Treatment Devices (off-line devices)



<http://www.njstormwater.org/treatment.html>

Table 2: TSS Removal Rates for BMPs

<u>Best Management Practice Removal Rate</u>	<u>TSS Percent</u>
Bioretention Systems	90
Constructed Stormwater Wetland	90
Extended Detention Basin	40-60
Infiltration Structure	80
Sand Filter	80
Vegetative Filter Strip	60-80
Wet Pond	50-90
Manufactured Treatment Device	See N.J.A.C. 7:8-5.7(d)

Bottom line - what does the developer really need to do?

1. Maintain groundwater recharge on the site
2. Reduce sediment and nutrients runoff from the site
3. Reduce the peak stormwater runoff from the site

How should a developer do this?

- 3rd Design systems that reduce peak stormwater runoff rates and meet water quantity requirements.

WATER QUANTITY (NJAC 7.8-5.4(a)3)

- 1. Has the applicant calculated stormwater runoff using NJDEP approved assumptions and factors?**

These assumptions and factors can be found in the regulations under section NJAC 7:8-5.6. The Township Engineer or Review Engineer should be able to verify that the calculations were done correctly.

If yes, go to Question #2. If no, application is incomplete at this time.

WATER QUANTITY (NJAC 7.8-5.4(a)3)

2. Has the applicant calculated the pre and post-construction peak runoff for the 2-year, 10-year, and 100-year storm events?

If yes, has the applicant demonstrated compliance with ONE of the following requirements?

- a. Has the applicant submitted adequate hydrologic and hydraulic analyses demonstrating the post-construction runoff hydrographs (2-yr, 10-yr, and 100-yr) do not exceed the corresponding pre-construction hydrographs?
- b. Has the applicant submitted adequate hydrologic and hydraulic analyses demonstrating that there is no increase as compared to the pre-construction condition in the peak runoff rates leaving the site (2-yr, 10-yr, and 100-yr) and that the increase volume or change in timing will not increase flood damage at or downstream of the project site.
- c. Has the applicant submitted adequate hydrologic and hydraulic analyses demonstrating that the post-construction peak runoff rates (2-yr, 10-yr, and 100-yr) are 50%, 75%, and 80% respectively of the pre-construction runoff rates.

If the applicant has NOT demonstrated compliance with one of the requirements outlined above, the application is incomplete at this time.

Summary

The best way for an applicant to meet the NJ Stormwater Management regulations is to:

1. Incorporate *nonstructural* strategies
2. Address water *quality* and groundwater *recharge* requirements
3. Ensure that proposed designs meet water *quantity* requirements

The Highlands

- 2004 Highlands Water Protection and Planning Act
 - developed the Highlands Planning Area and Highlands Preservation Area
- The priority of this act is to **regulate development** within the Highlands in order to **preserve open space** and **protect** the region's **sensitive environmental resources**
- The act regulates projects designated as Major Highlands Development that lie within the Highlands Preservation Area

Highlands Modifications to Stormwater Control Requirements

- Recharge 125% of the percentage of the average annual pre-construction groundwater recharge volume for the site
- Retain on-site with no discharge the stormwater water quality design storm (1.25 inches of rain over 2-hours)

The Pinelands

- 1979 Pinelands Protection Act
 - Formed a Pinelands Commission and developed the Pinelands Protection Area and Pinelands Preservation Area
 - Encompass the federal Pinelands National Reserve
- The priority of this act is to **regulate land use and development** within the Pinelands in order to **protect surface and groundwater quality**

Pinelands Modifications to Stormwater Control Requirements

- Retain and infiltrate on-site the total runoff volume generated from the net increase in impervious surfaces by a 10-year design storm (5 inches of rain over 24-hours)
- Detailed checklist of stormwater management information

One Last Question:

Who approves the developer's stormwater management plan?

YOU DO!

How do we integrate these tools into the review process?

- All questions should be publicly available for all applicants, review engineers, and residents
- Members of the planning and/or zoning boards and/or environmental commission should **be prepared to ask these questions** of the Township's review engineer and applicant
- Understand that these questions outline the **minimum requirements** as defined in the NJ Stormwater Management Rules

E-learning Tool Available Online

- A **FREE** interactive E-learning tool is available online <http://water.rutgers.edu/E-learning.html>
- The tool is intended to help you understand if a developer is in compliance with the NJ Stormwater Management Regulations so you can be comfortable in approving or rejecting the developer's plan

The screenshot shows a web-based interface for an e-learning tool. At the top, it says "Asking the Right Questions in Stormwater Review" and "Resources". The main content area has a dark background with white text that reads "The 2004 Stormwater Management Regulations Address Four Objectives:". Below this, there are four teal-colored boxes, each containing a white checkbox and a white text label. The objectives are: "Use nonstructural management strategies", "Protect communities from the impact of new development", "Maintain groundwater recharge volumes", and "Protect waterways from pollution carried in stormwater runoff". To the right of these boxes is a photograph of a flooded street with buildings and a water tower in the background. Below the photo, it says "NJ.com, August 28, 2011". At the bottom of the interface, there is a video player control bar with a play button, a progress bar, a refresh button, and "PREV" and "NEXT" buttons.

A photograph of a wet parking lot. In the foreground, a large, rectangular, yellow metal storm drain with a grid of circular holes is partially submerged in water. The water is dark and reflects the sky. In the background, three cars are parked in a row: a silver SUV, a white SUV, and a silver sedan. The ground is wet and reflective. The background shows a line of green trees and a building in the distance.

Questions?