NC STATE UNIVERSITY

Urban Stormwater Structural Best Management Practices (BMPs)

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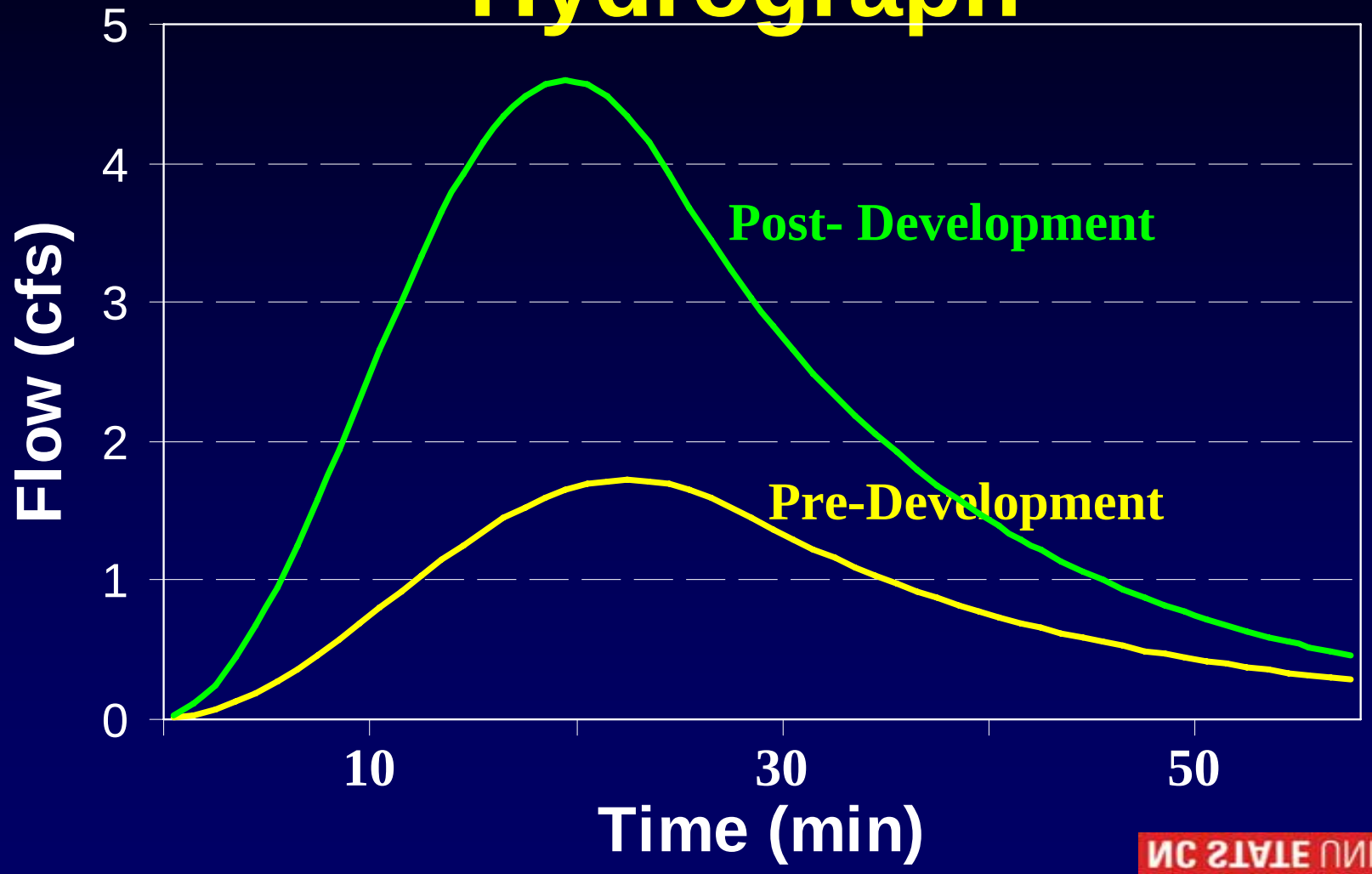
Why the need for BMPs?

Pre & Post Development Hydrograph



What can BMPs do?

- Improve pollutant levels prior to them entering the stream system.
- Reduce discharge rates from stormwater flows so that downstream erosion is reduced.
- Reduce water temperatures entering stream system.
- Increase infiltration so that groundwater recharge is enhanced.

What Pollutants do BMPs remove

- Sediment
- Nitrogen
- Phosphorus
- Heavy Metals
- Pathogens
- Others
- Temp?

Types of Structural BMPs

- Conveyances
- Infiltration devices
- Storage Devices
- Filters
- Proprietary devices
- Others

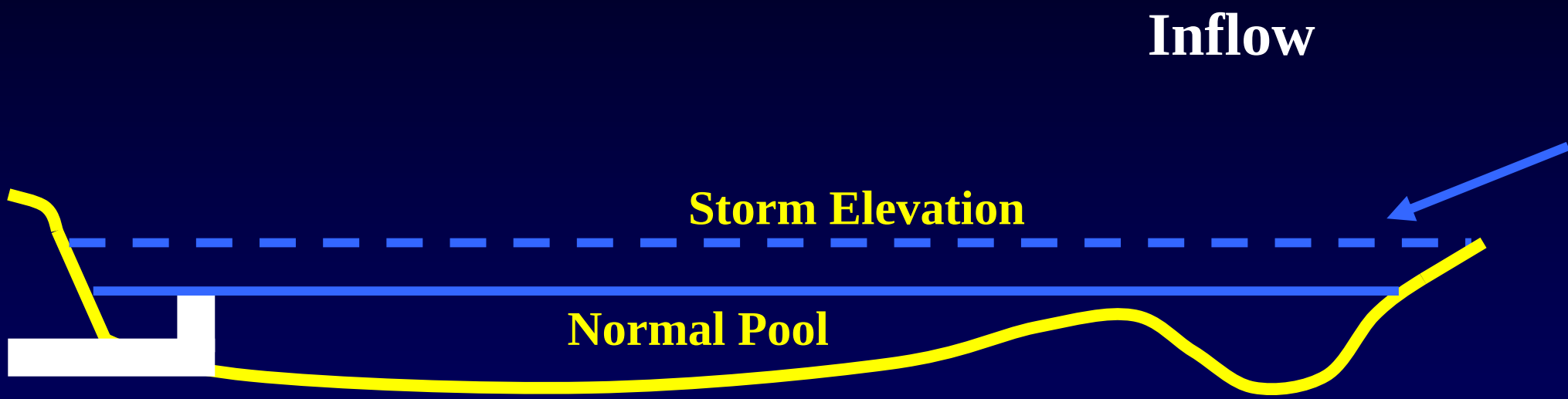
Specific BMPs

- Wet Detention Ponds
- Bio-retention/Rain Gardens
- Stormwater Wetlands
- Sand Filters
- Level Spreaders/ Buffers
- Pervious Pavements
- Others

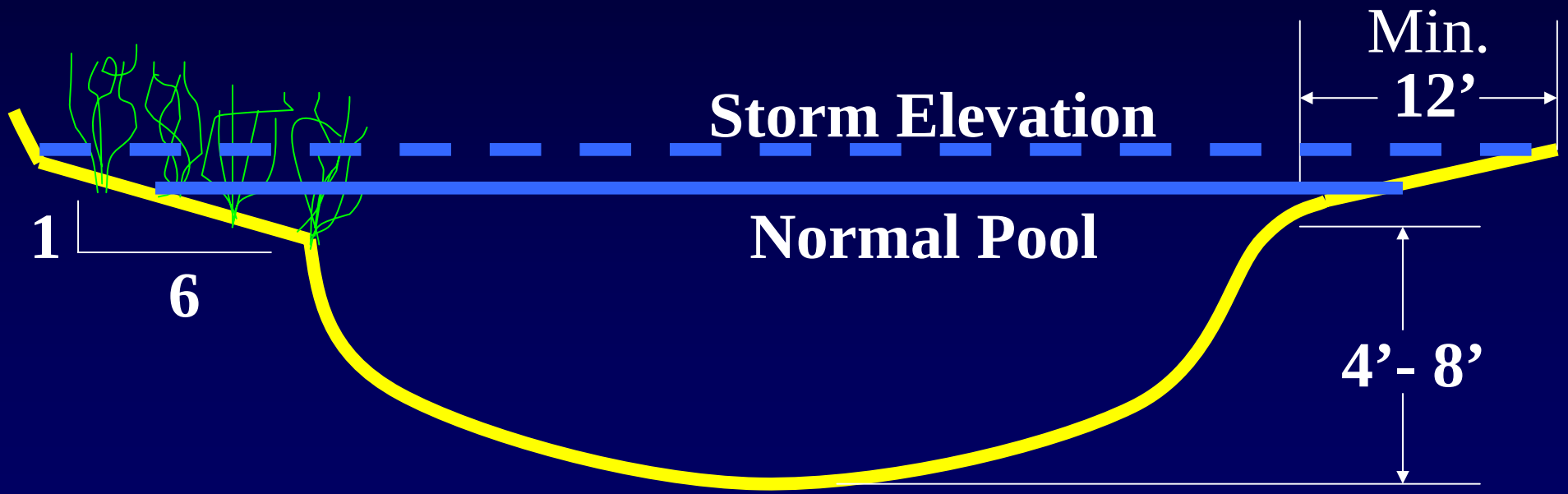
Wet Detention Ponds

- High TSS removal

Wet Detention Pond Schematic



Wet Detention Pond Cross Section With Littoral Shelf



Wet Detention Ponds

Advantages

- Traditional
- Can double as recreational facility

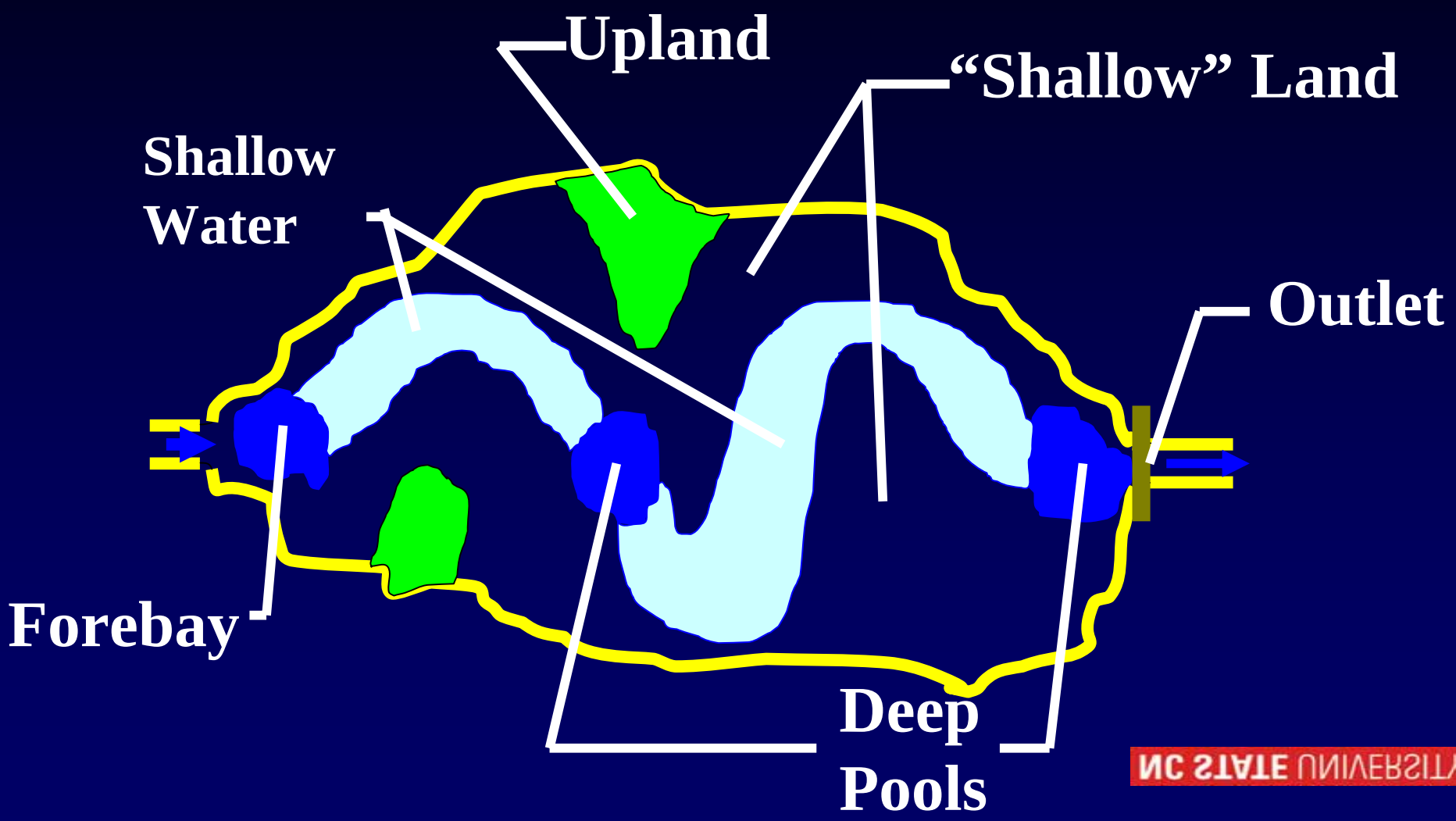
Disadvantages

- Relatively land intensive
- Safety issues
- Aesthetics

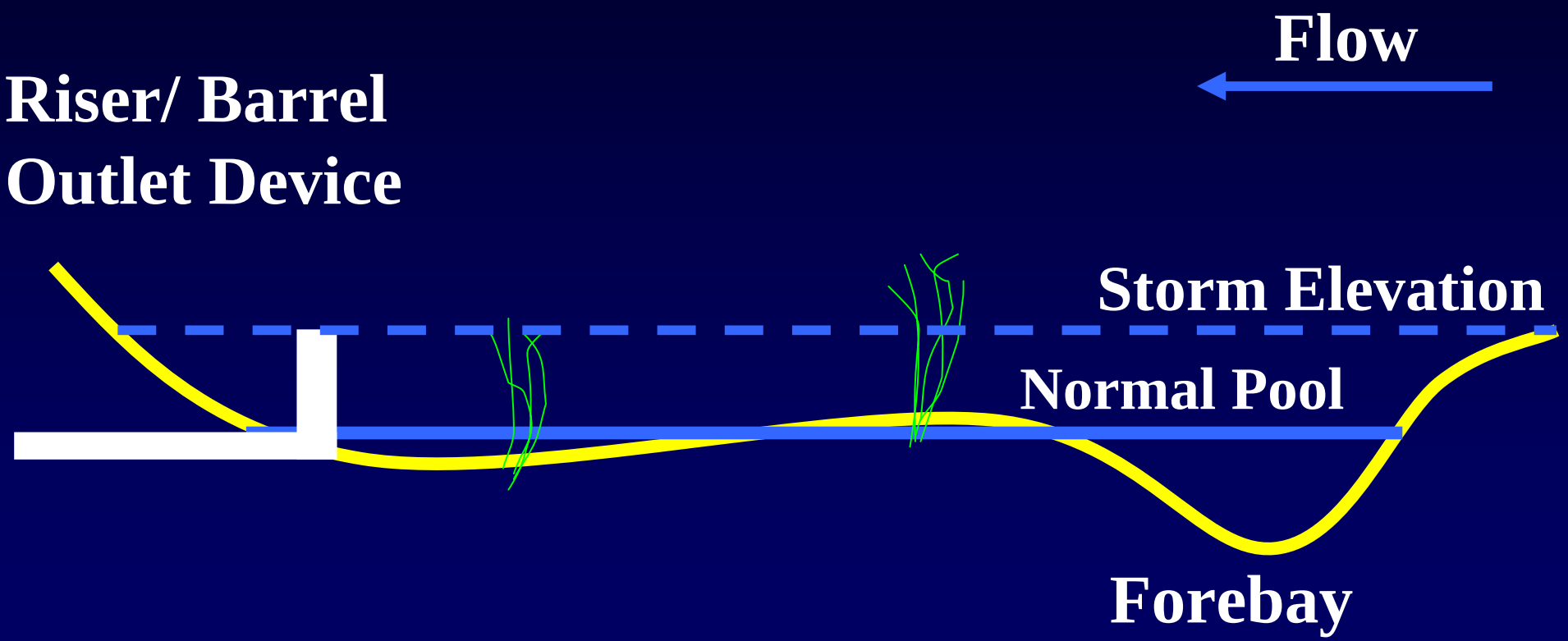
Stormwater Wetlands

- “natures filters”
- Highest pollutant removal efficiencies
- Can be aesthetically pleasing

Stormwater Wetland Features



Stormwater Wetland Schematic



Treatment Mechanisms for Stormwater Wetlands

- Sedimentation and Filtration
- Adssorption
- Plant uptake
- Microbial Processes
- Exposure to sunlight

Stormwater Wetlands

Advantages

- Highest pollutant removal efficiency
- Aesthetically pleasing

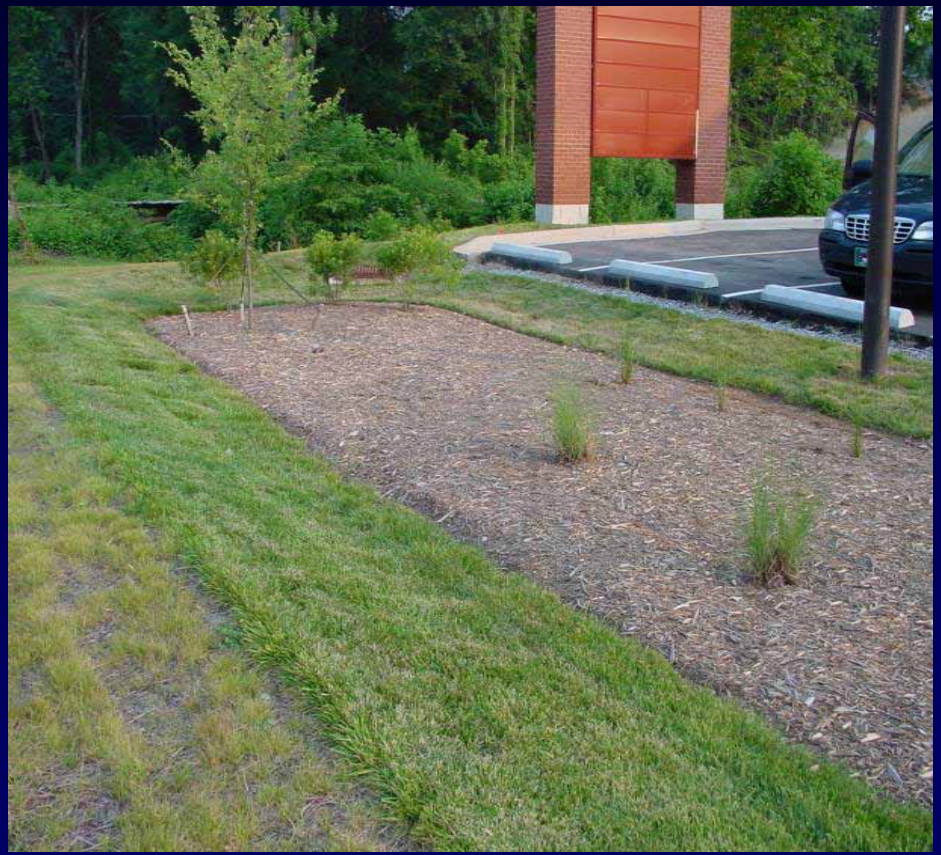
Disadvantages

- Higher land requirements than other BMPs
- Public opinion may be negative
- Biological concerns!

Siting considerations for wetlands

- Hydrology (excavate to Water Table?)
- Large watershed
- Citizen Concerns
- Safety

Bioretention/Raingardens



- Filtering device
- Depressed areas
- Very new practice

Bioretention

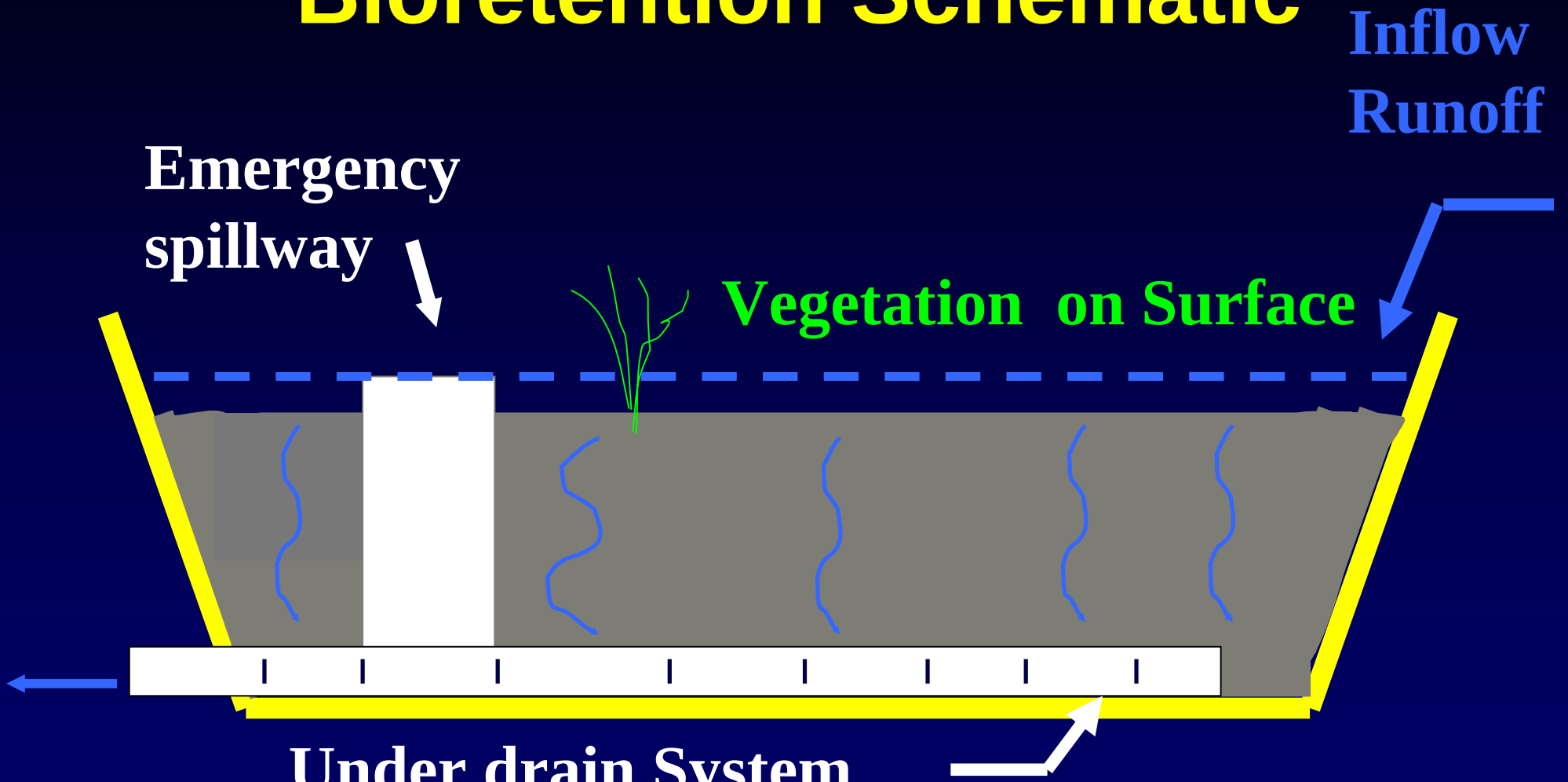
Advantages

- Aesthetically pleasing
- May satisfy local landscaping requirement
- Can be incorporated into parking medians

Disadvantages

- New practice with little data
- Sediment may cause clogging

Bioretention Schematic



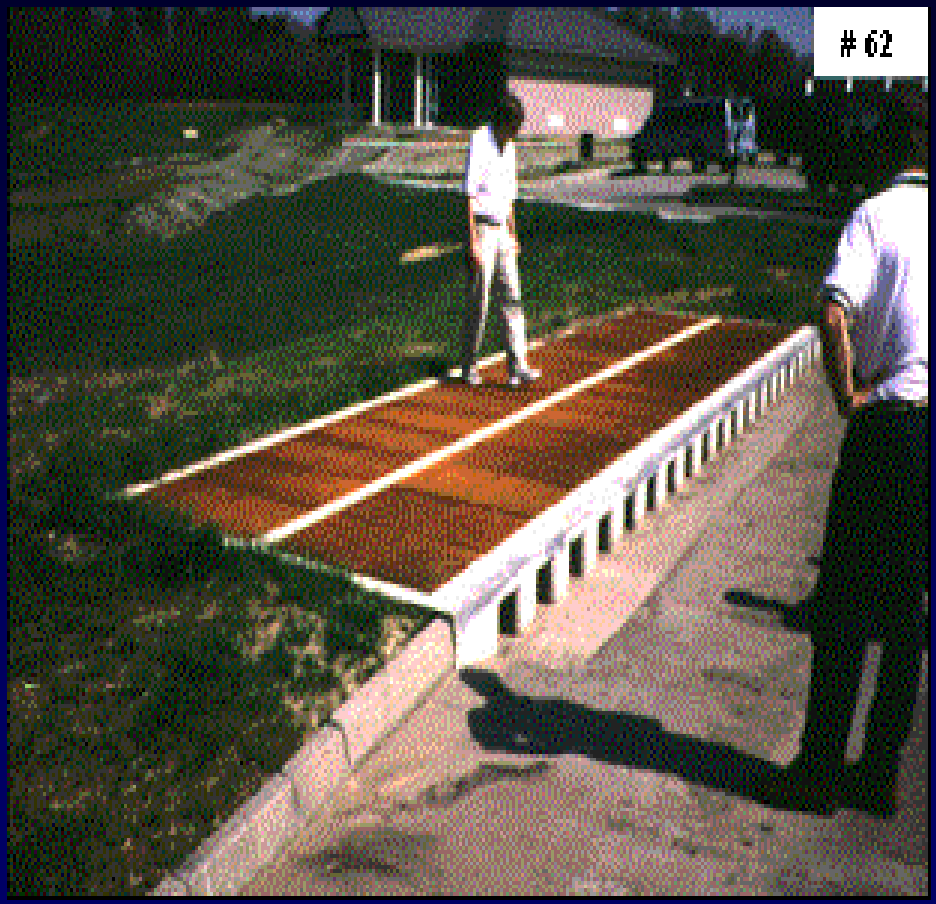
Treatment processes for Bioretention

- Filtration
- Microbial Processes
  - Nitrification
  - Denitrification
- ?

Siting considerations for Bioretention

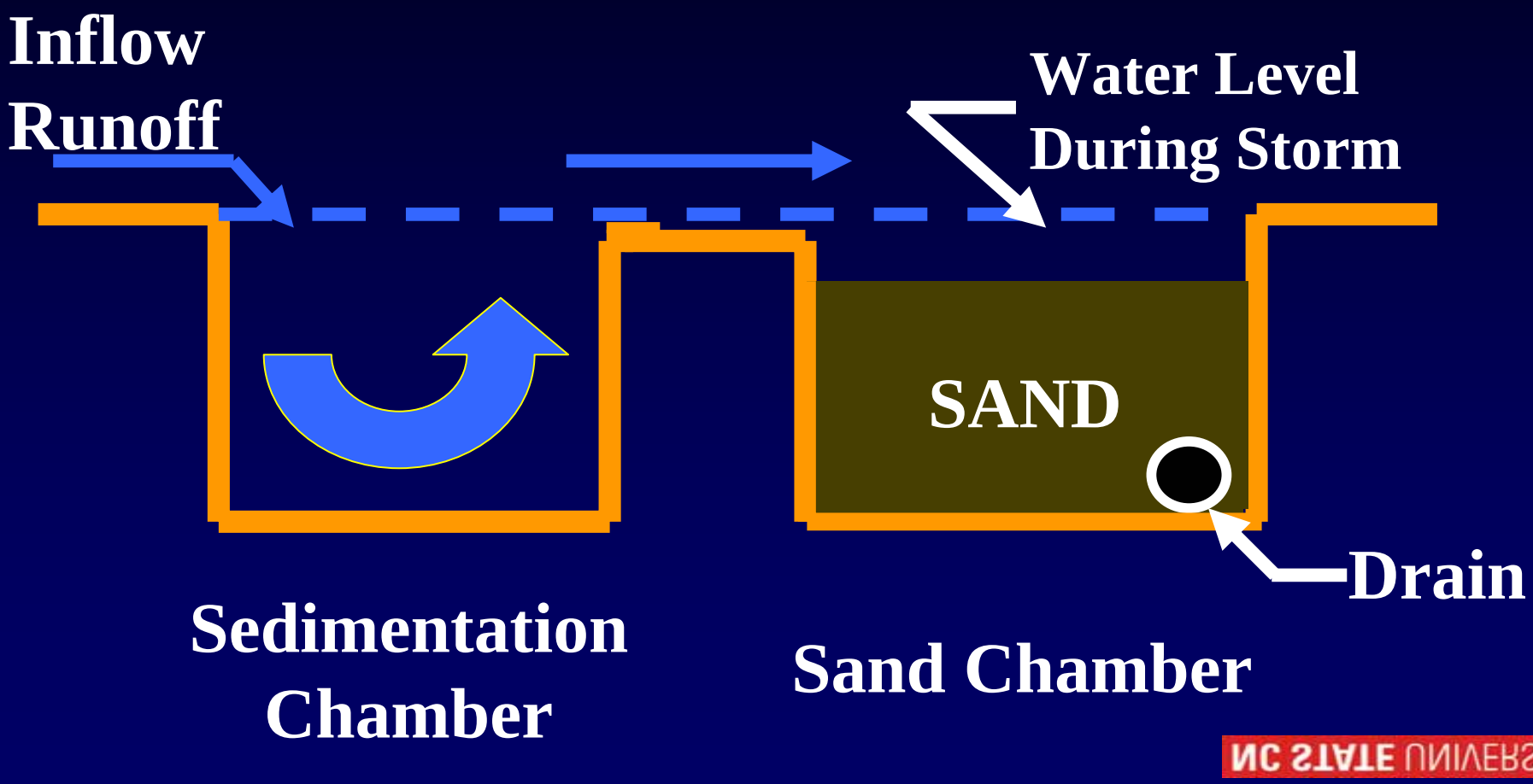
- Best for small sites
- requires low water table
- Ideal for parking medians
- Can satisfy landscaping requirements

Sand filters



- Little or no land requirements
- Very expensive $

Sand Filter Schematic



Sand Filters

Advantages

- Low land requirement
- Removes pollutants found in parking areas

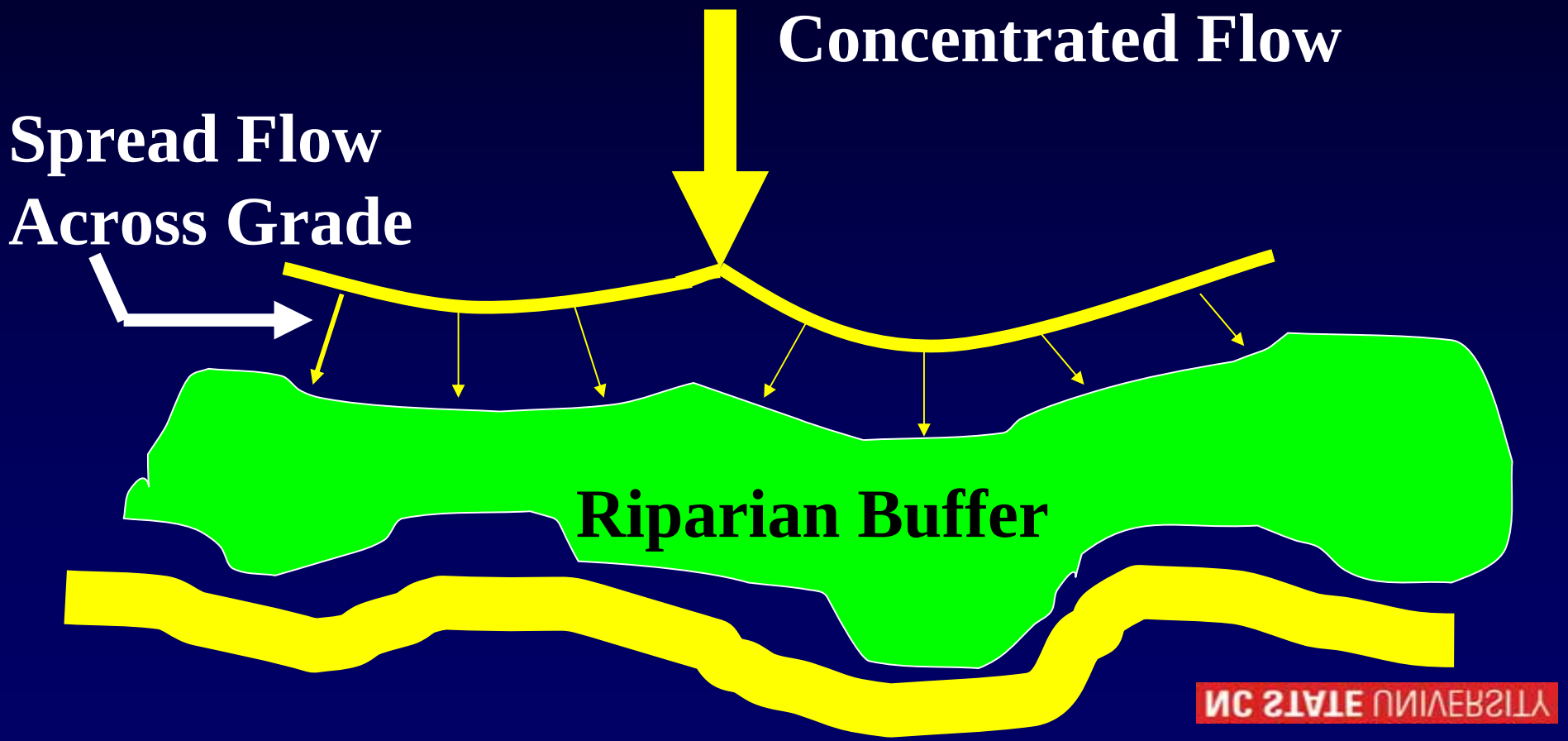
Disadvantages

- High Cost !
- Maintanence

Siting considerations for sand filters

- Highly urbanized sites
- Land Costs typically high to justify high structure cost
- Low sediment loading

Level Spreader Schematic



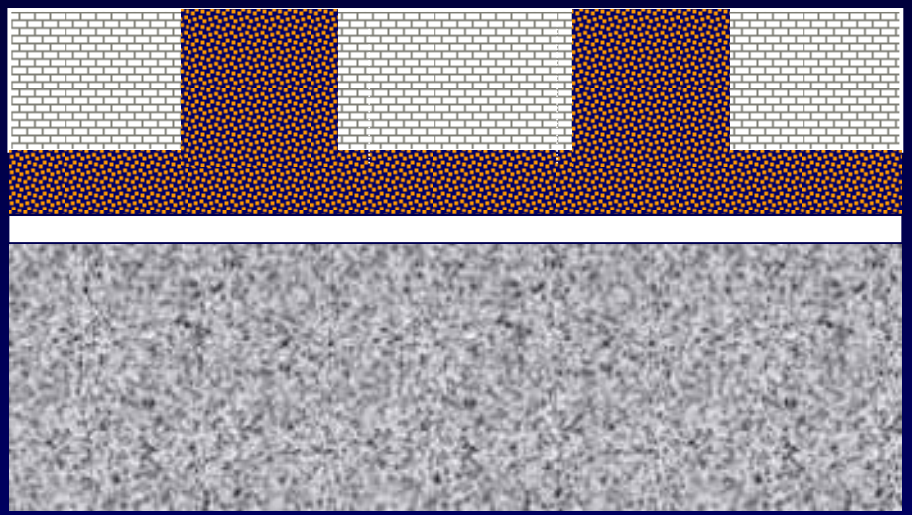
Treatment mechanisms for Buffers/Level Spreaders

- Sedimentation
- Filtration
- Infiltration
  - Denitrification

Siting Considerations for level spreaders

- Adjacent to riparian area
- Level spreader constructed parallel to slope
- groundslope sufficiently low to avoid erosion
- absence of defined channels in buffer

Cross Section of Pavement



Paving Block filled w/Sand over Sand Bed

Permeable Geo-Textile

Washed Stone Base

Siting considerations for pervious pavements

- Soils with high infiltration rates
- flat topography
- Low traffic loading
- low sediment loading
- can maintenance be conducted?

Reinforced Turf Mats

- Can replace rip rap channels
- Provide for sediment and nutrient removal
- Low cost