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Traversing Stormwater Treatment Technologies

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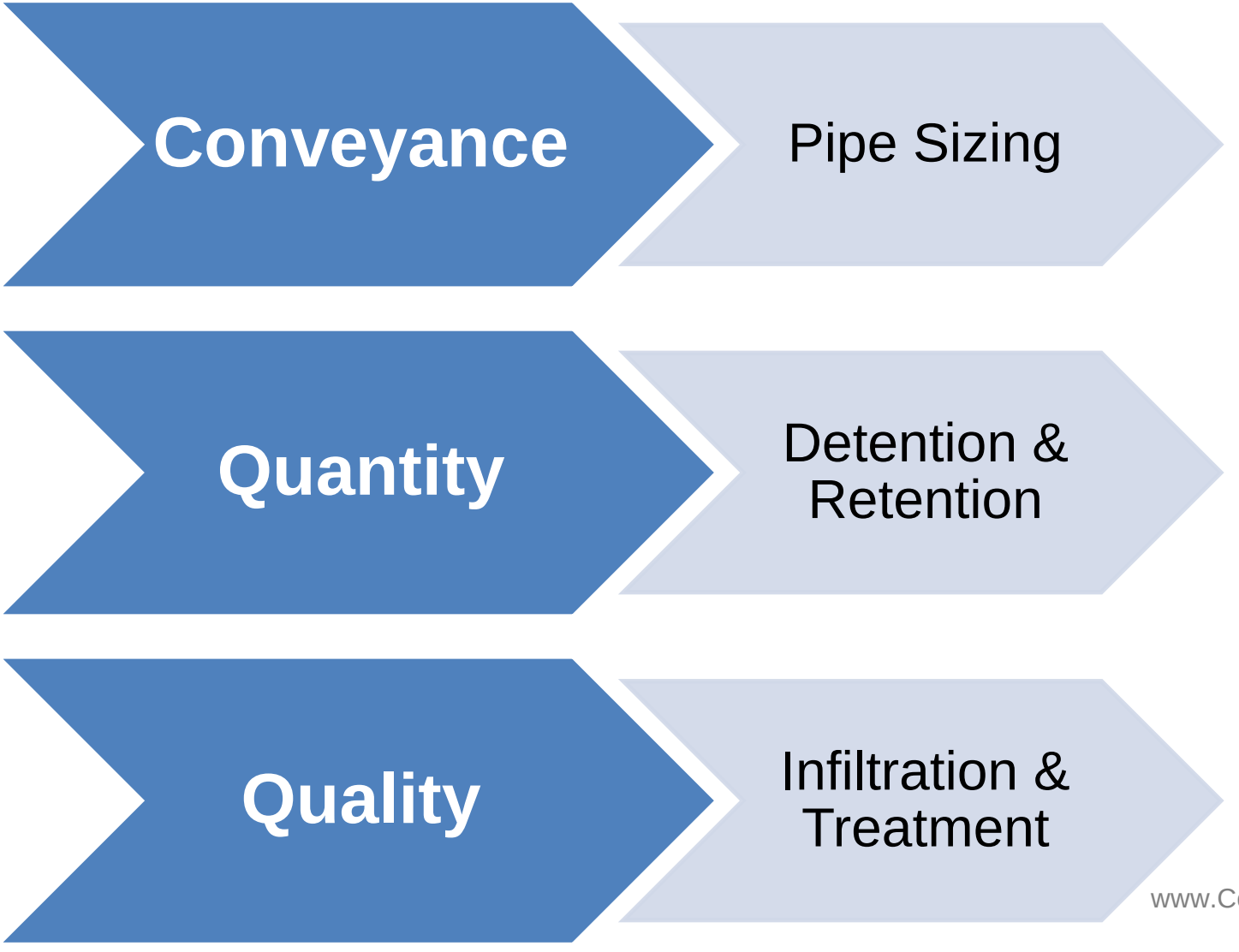
Evolution of Stormwater Management



Navigating Local Stormwater Regulations

Ohio Environmental Protection Agency

Kentucky Division of Water

30th IDEM ANNIVERSARY

DEQ Department of Environmental Quality

Illinois Overview

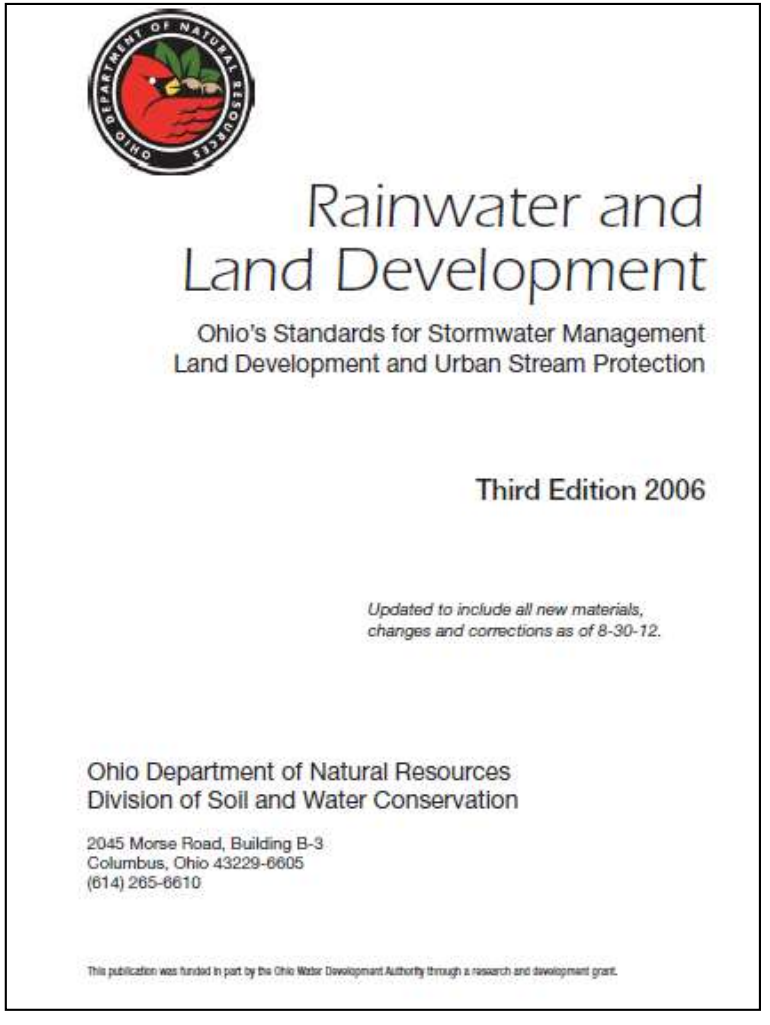
- MS4 Permit renewed in early 2016
- CGP scheduled for renewal in 2018
- General guidance on post-construction practices: preservation, infiltration, quantity & quality control
  - Up to local MS4 to develop & implement post-construction standard
  - Leading MS4s: Lake County & DuPage County
  - Chicago: focus on volume control due to CSOs

Michigan Overview

- Individual Permits for all MS4s
  - Renewals for several communities still in progress
  - Over 300 MS4s
- Water Quality Volume
  - Target treatment of 1” storm event
- DEQ updating state BMP Manual
- Great Lakes Commission Tech Transfer Initiative

Ohio Stormwater Regulations

- Water Quality Volume
  - 0.75 inches
  - Consistent across state
- Large Construction Activities
  - ≥ 5 acres
  - Table 2 BMPs
- Small Construction Activities
- Redevelopment Activities
  - Treat 20% of WQv
  - Reduce impervious by 20%



Ohio Updates

- ODNR merges with OEPA
  - Technical resource and support

- Permit Renewal
  - Watershed-specific permits
  - 2018

- ODOT/OEPA/OSU Partnership
  - Ohio roadway runoff study

Kentucky Stormwater Regulations

- Water Quality Volume
  - 80th Percentile Storm Event
  - Varies across municipalities
- No specificity of accepted BMPs
  - Treat, filter, flocculate, infiltrate, screen, evapo-transpire, harvest and reuse stormwater runoff, or otherwise manage the stormwater runoff quality
- Allows for options of off-site mitigation and payment-in-lieu
- More specific maintenance requirements

Kentucky Updates

- Phase II Permit Renewal
  - Current permit expired in 2015
  - Awaiting renewal
- LFCUG
  - Permit renewed in 2015
  - Stormwater Regulation Updates
- Louisville MSD
  - Permit expired July 2016
  - Green Infrastructure Manual Update

Indiana Stormwater Regulations and Updates

- Water Quality Volume or Flow Rate
  - Municipalities report to IDEM, but municipalities further define their own water quality regulations
  - IDEM working towards pulling regulations from state statute and issuing permits
- Many communities follow City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide (“Indy List”) for approved rates of manufactured BMP’s, or NJDEP Certification
  - Water Quality flow rate calculation methods vary among communities siting Indy List or NJDEP for rates

Indiana Stormwater Regulations

- City of Indianapolis
  - SQU shall be determined using the SCS runoff methodology
  - 0.3 inch storm using the appropriate Huff, 50% rainfall distribution, quartile is duration dependent as outlined in Appendix I of Indy list
- Cities of Carmel, Fishers, Noblesville, and Hamilton Co.
  - Reference Indy List rates, but flows are TR-55 SCS Type II distribution for the 1” in 24 hr storm
- Cities of Greenwood, Whitestown, Hendricks Co.
  - NJDEP certified rates (50% removal for HDS)
  - TR55 SCS Type II distribution for 1” in 24 hr storm
- City of Valparaiso
  - 80% removal of 50 – 125 micron, 3rd party testing
  - TR-55 SCS Type II distribution for the 1” in 24 hour storm

How do I comply with water quality regs?

- Low Impact Development & Green Infrastructure
- Design methodology that utilizes Integrated Management Practices (IMPs) for Stormwater Management
- Intent is to mimic predevelopment hydrology
- Examples:
  - Natural areas
  - Rain gardens
  - Bioswales
  - Porous pavements

Manufactured Treatment Devices

- Complement traditional LID practices
  - Pretreatment
  - Enhance longevity
  - Polishing BMP
- WQ solutions for sites with design constraints
  - Low permeability soils
  - Potential contamination of groundwater
  - Steep slopes
  - Maximize space
- Verified performance

Key Considerations

- What are the pollutants of concern?
  - TSS
  - Nutrients
  - Metals
- What are the treatment goals?
  - 50% TSS vs 80% TSS
  - Treatment or Infiltration
- Maintenance Considerations

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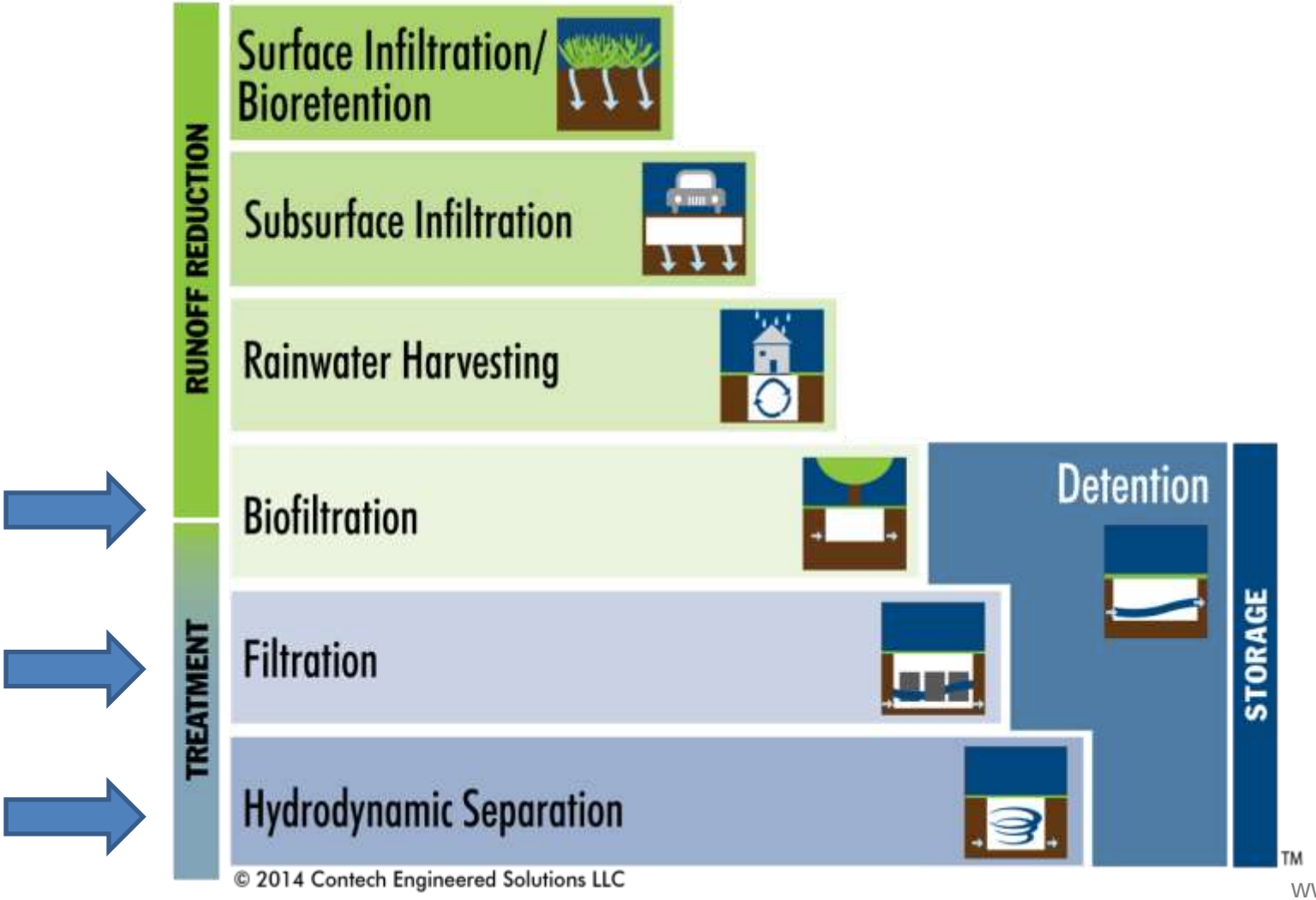
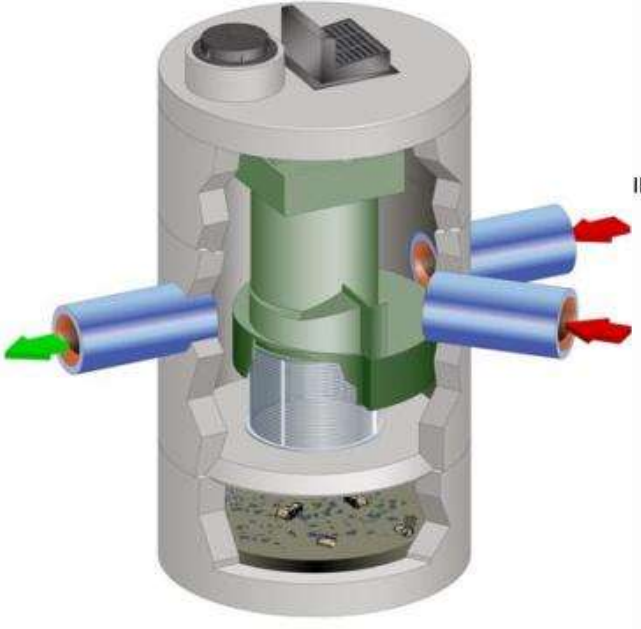
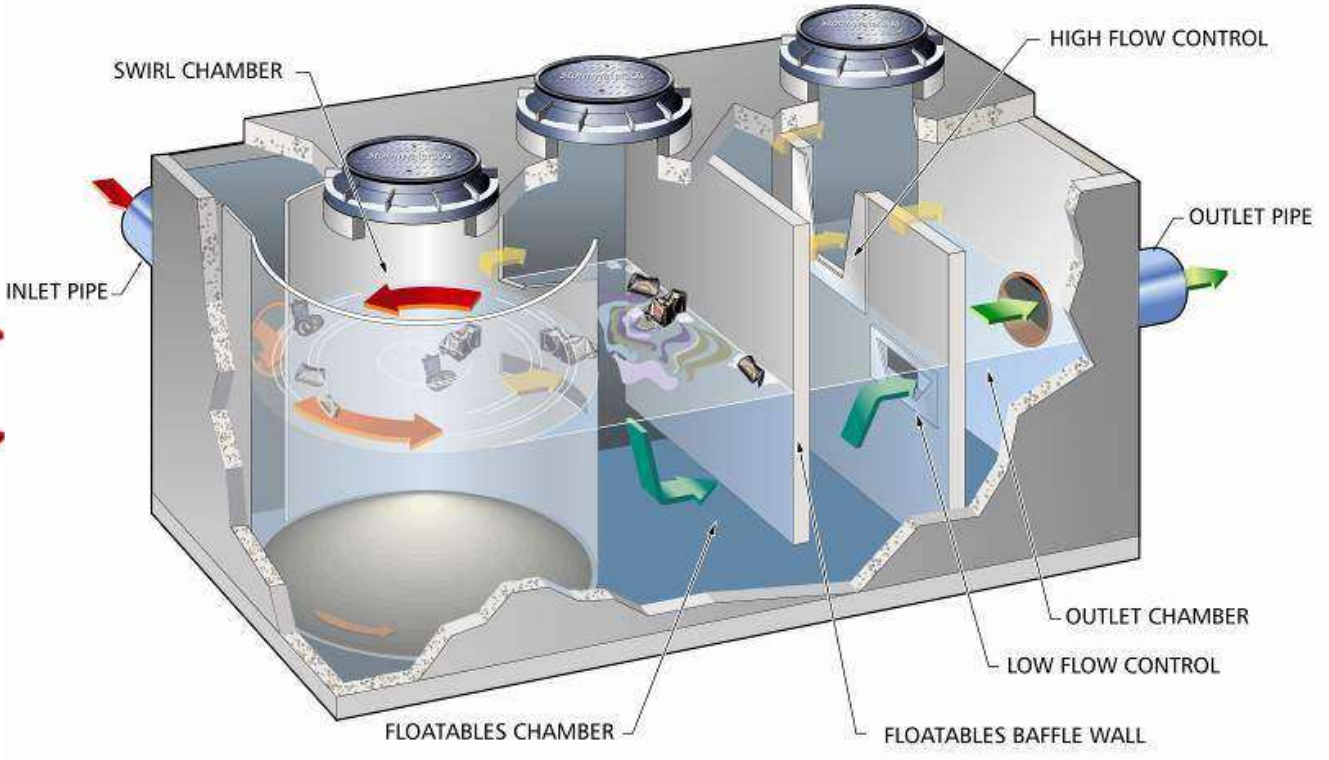
Stormwater Solutions Staircase



HDS Key Features



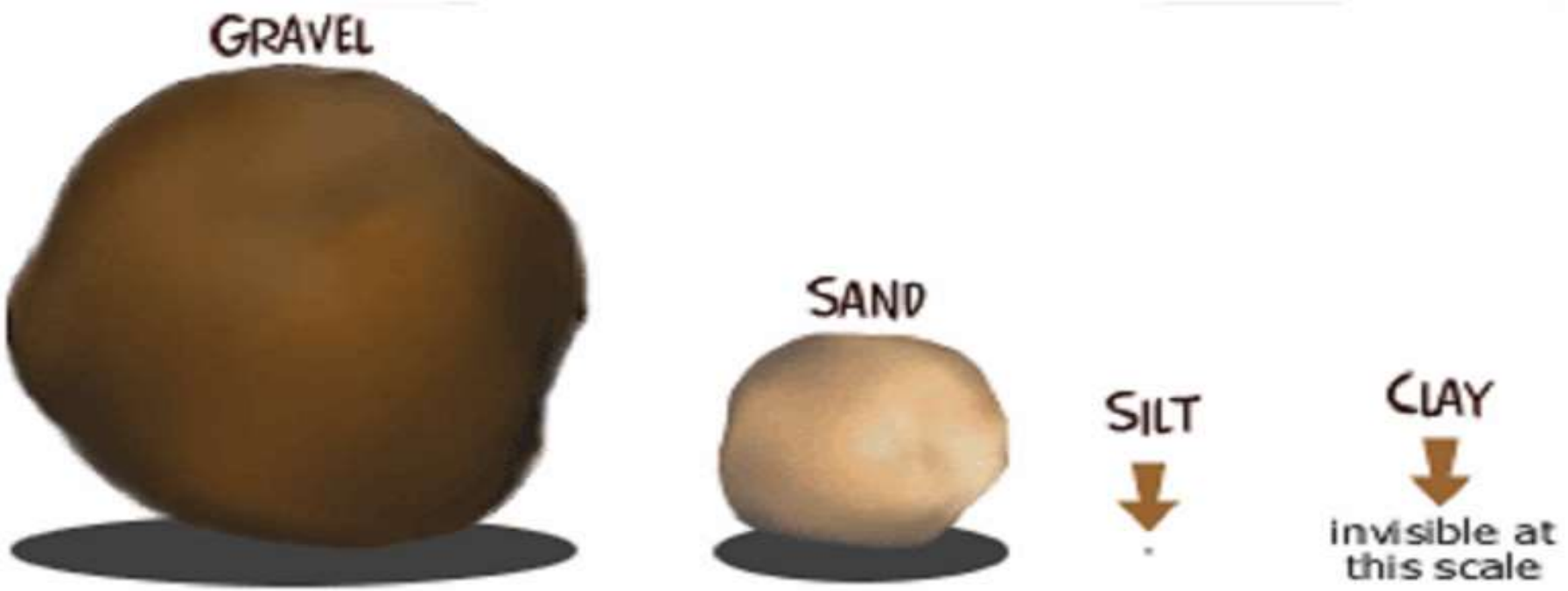


TSS: Treatment Efficiency Evaluation

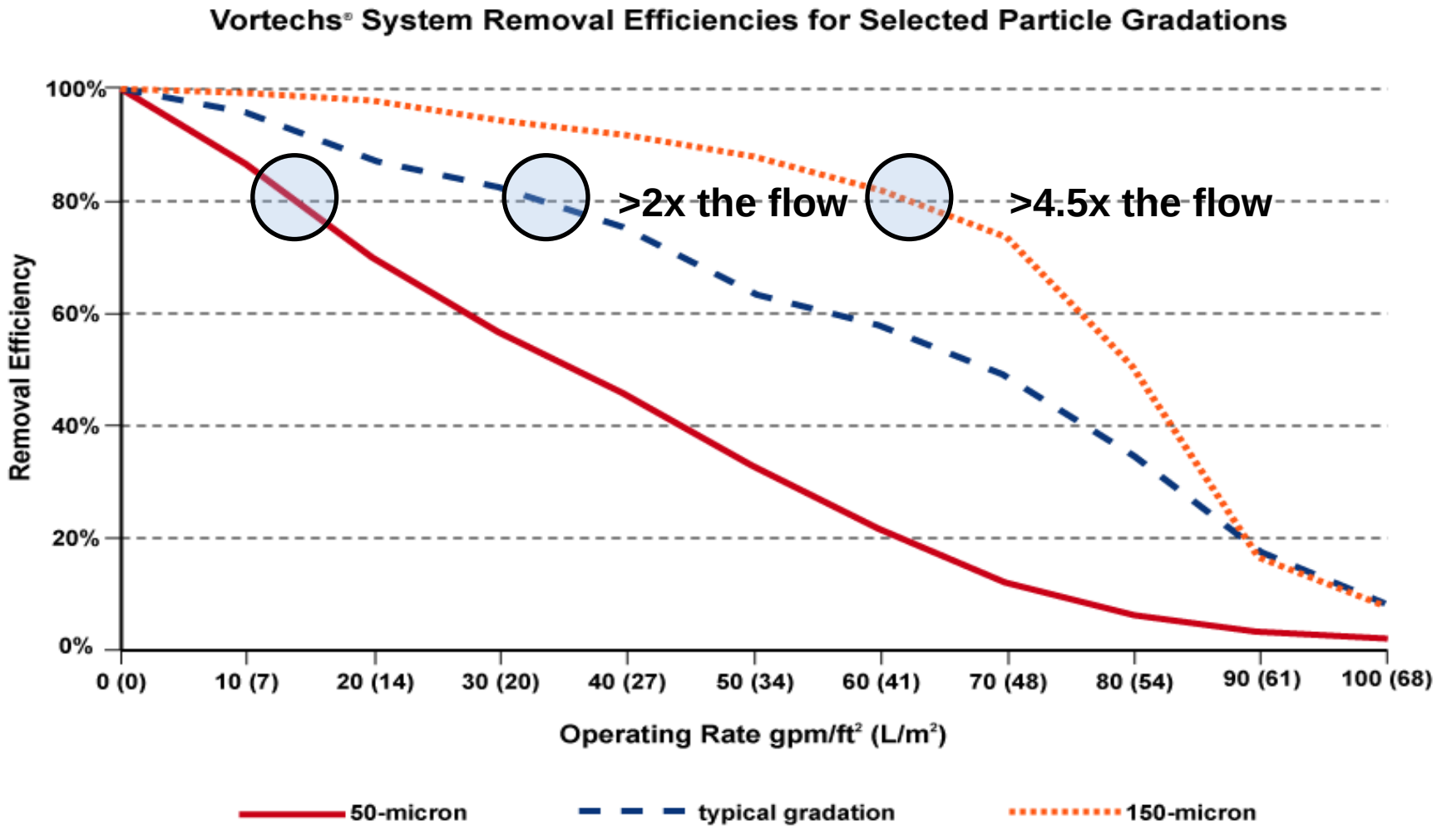
- Pollutant Concentration
  - High concentrations are easier to reduce
  - Typical SW TSS concentration is 50-300 mg/l
  - Testing should use similar concentrations
- Flow rate
  - Treatment efficiency increases as flowrate decreases
  - System should be tested across full range of design flows
- Particle size
  - Large particle sizes are easier to remove than small ones
  - An “apples to apples” product comparison must use the same Particle Size Distribution (PSD)

Importance of Particle Size

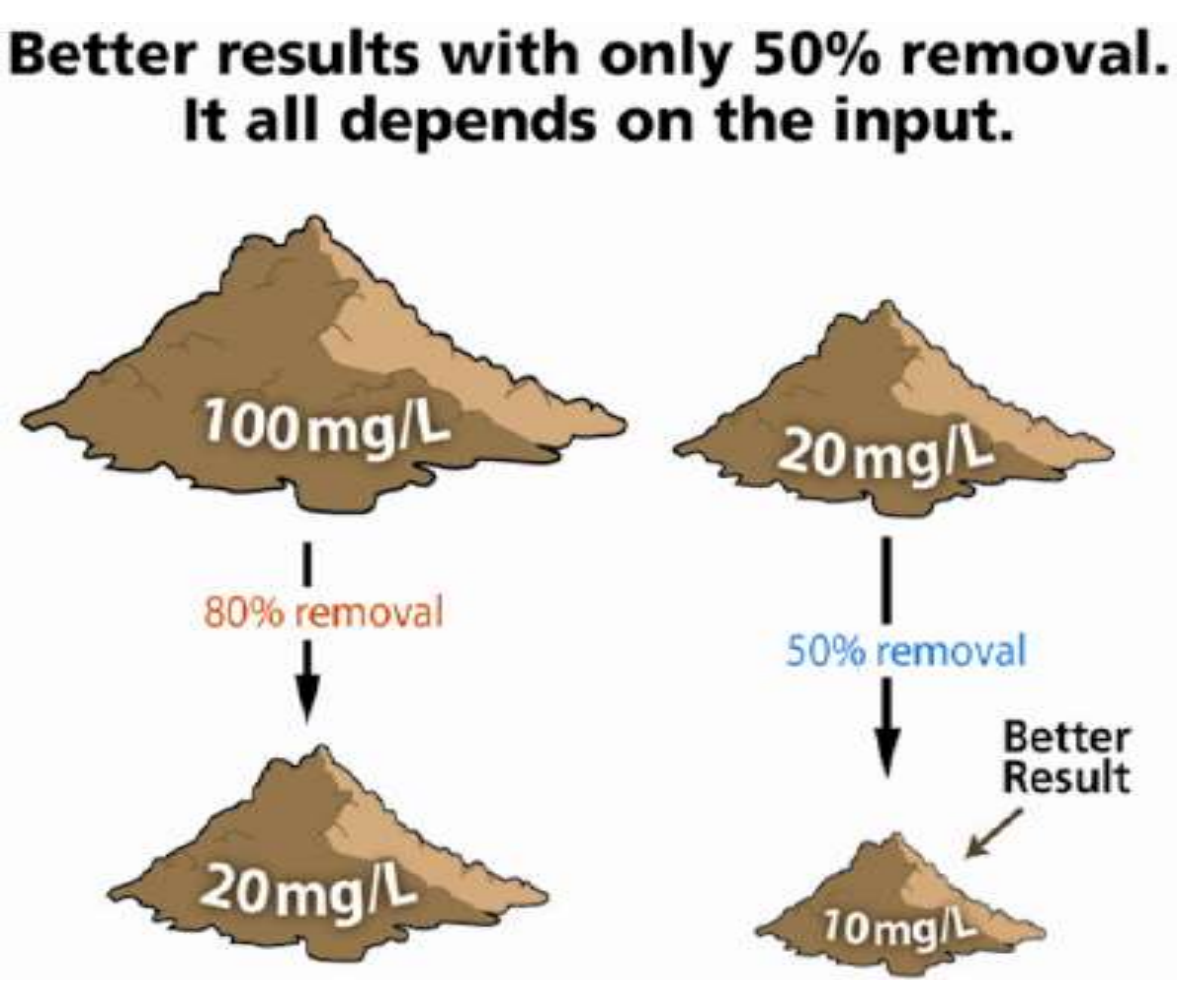
- Presently omitted by many regulations
- Smaller particles harder to separate & more easily transported, carry more pollutants, cause turbidity & can lead to anaerobic conditions.
- Many HDS target larger particles (e.g. >100-150*u*m)



The Influence of Particle Size



Pollutant Concentration and Percent Removal



ODOT Requirements

- SS - 995
  - Establishes performance requirements for approved BMPs to be utilized on roadway projects
- Performance Criteria
  - Offline configuration
  - **80% TSS capture of water quality flow (third party testing)**
    - **Influent concentration of 450mg/L or less**
    - **OK110 or F110 particle distribution**
  - Capture all floatable free oil

Moving Beyond TSS

- TSS initially thought to be a good surrogate for all stormwater pollutants
- Good control of TSS translates to good control of other pollutants of concern
- We have since realized 80% TSS removal is not enough to address nutrients, metals etc. in impaired watersheds
- Solids removal does not address soluble (dissolved) pollutants

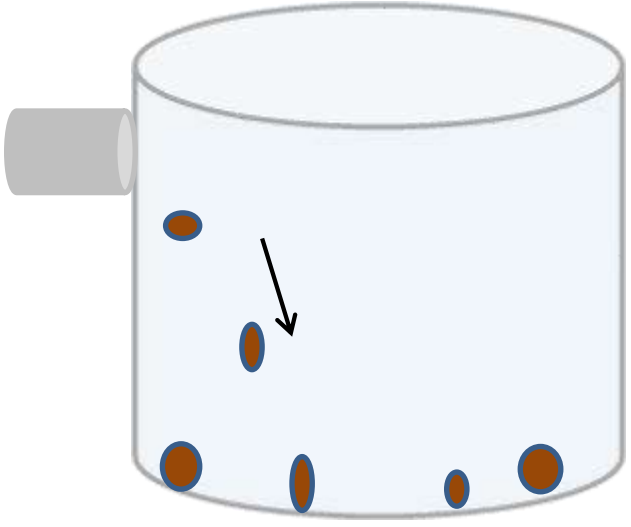
Phosphorus in Stormwater

- Phosphorus is often present in both solid and soluble forms
- Much of solid phosphorus tends to be associated with finer particles
- Ratio of solid/soluble is often variable.
- Research suggests 50/50 split is a reasonable estimate
- Previously captured solid form can be leached as soluble P

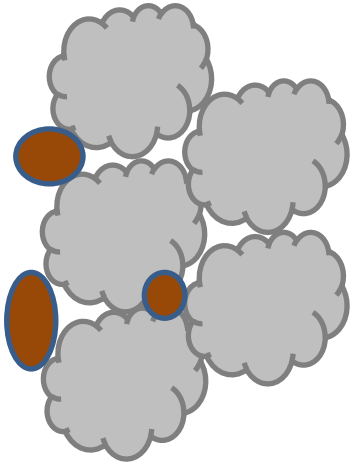
Filtration Mechanisms

- Three primary mechanisms to removal Phosphorus from runoff:

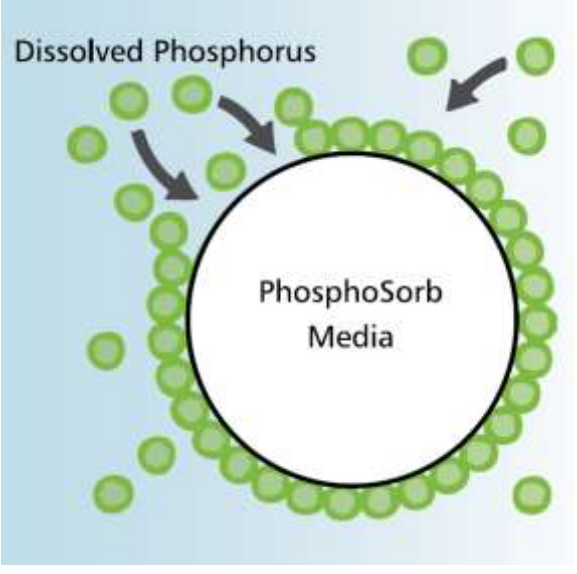
Sedimentation



Physical Filtration

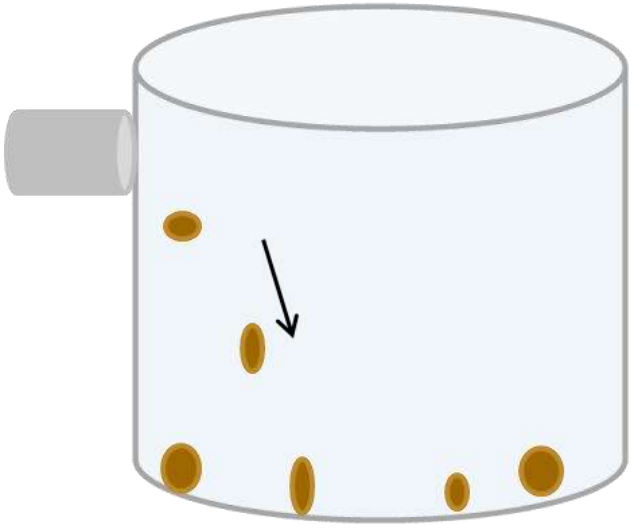


Reactive Filtration



Sedimentation

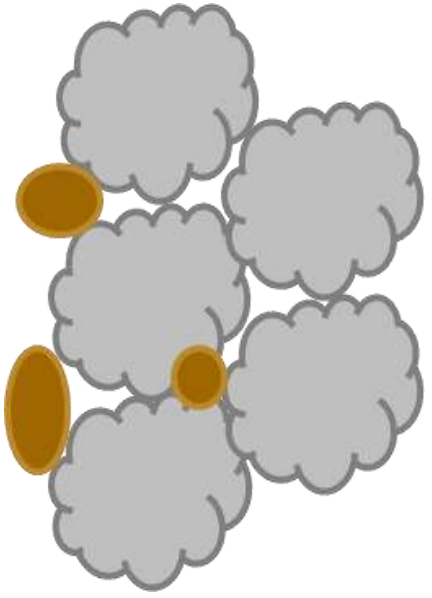
- Slow water down and allow solids to settle
- Longer residence time = finer particles captured
- Phosphorus removal often tied to residence time
- No capture of dissolved/soluble P
- Leaching possible



Examples: Ponds, Detention Systems, Hydrodynamic Separators

Physical Filtration

- Physical barrier to solid particles
- Good control of TSS and attached pollutants
- Good removal of particulate metals and phosphorus
- No removal of dissolved/soluble pollutants
- Leaching possible
- Longevity must be considered



Examples: Screening, Media Filters, Sand Filters, Biofilters

Innovative Membrane Filtration

Pleated Membrane Filter

Jellyfish Filter

Reactive Filtration

- Often works in parallel with physical filtration and/or sedimentation
- Target pollutant is bound to media via adsorption, ion exchange etc.
- Effective removal of soluble/dissolved pollutants
- Boosts overall pollutant load reduction
- Prevents leaching

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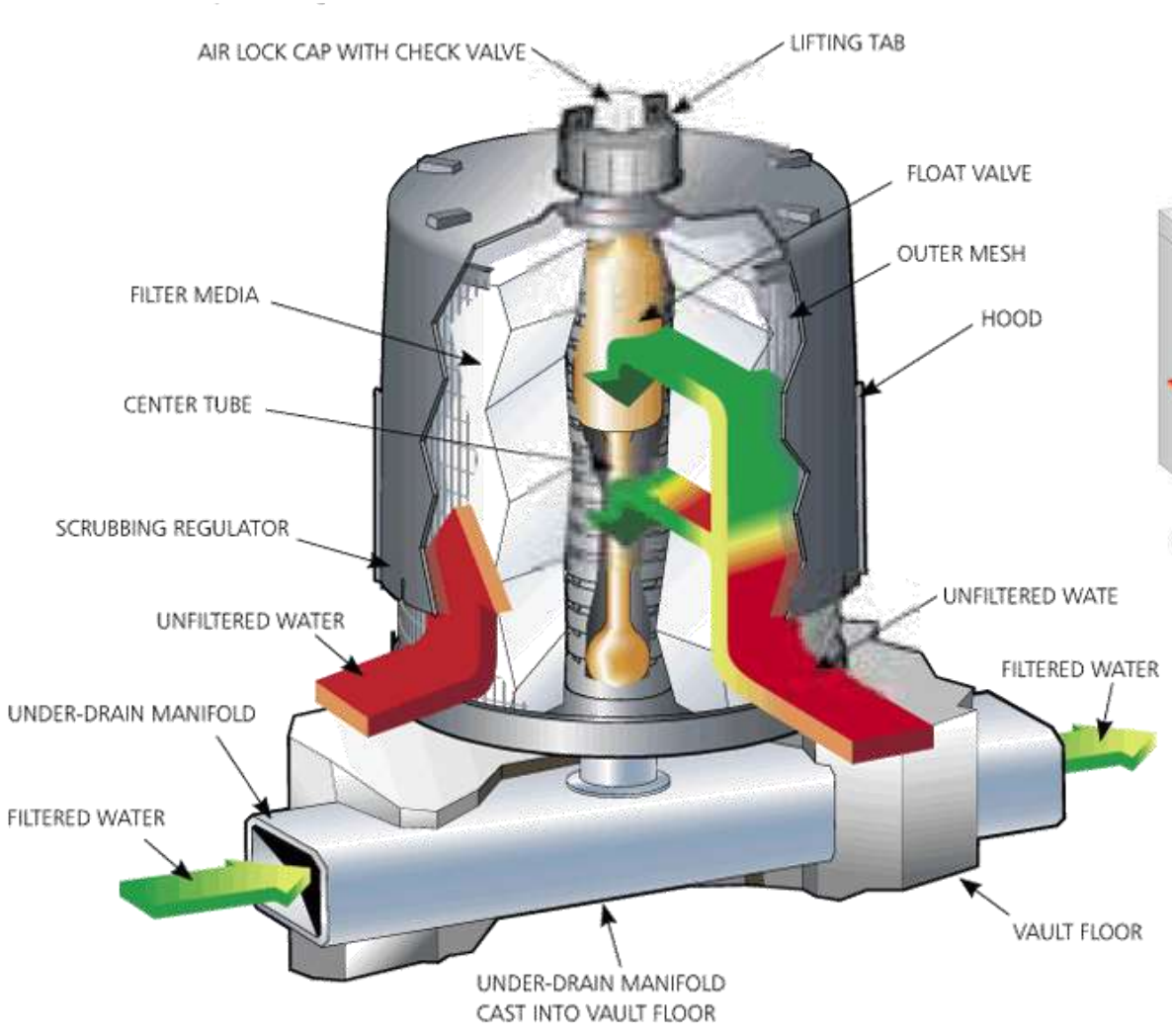
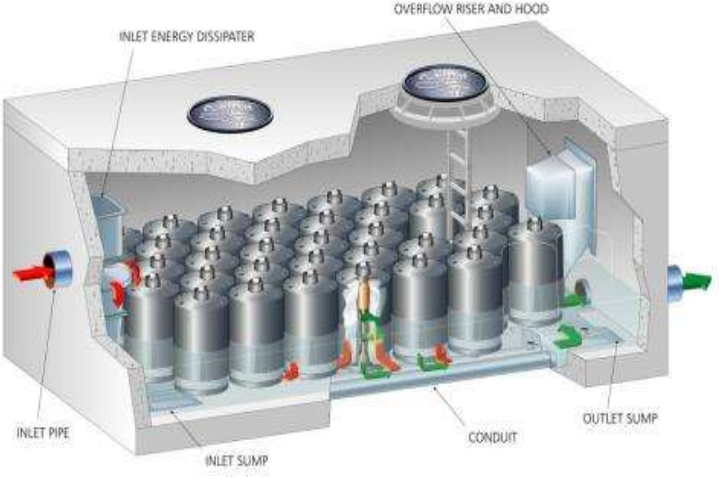
Stormwater Management StormFilter®





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Media vs. Membrane




	PhosphoSorb™	Perlite	CSF® Leaf Media	ZPG
Sediments	■	■	■	■
Phosphorous	■			■
Oil and Grease	■	■	■	■
Soluble Metals	■		■	■
Organics			■	■
Nutrients	■	■	■	■

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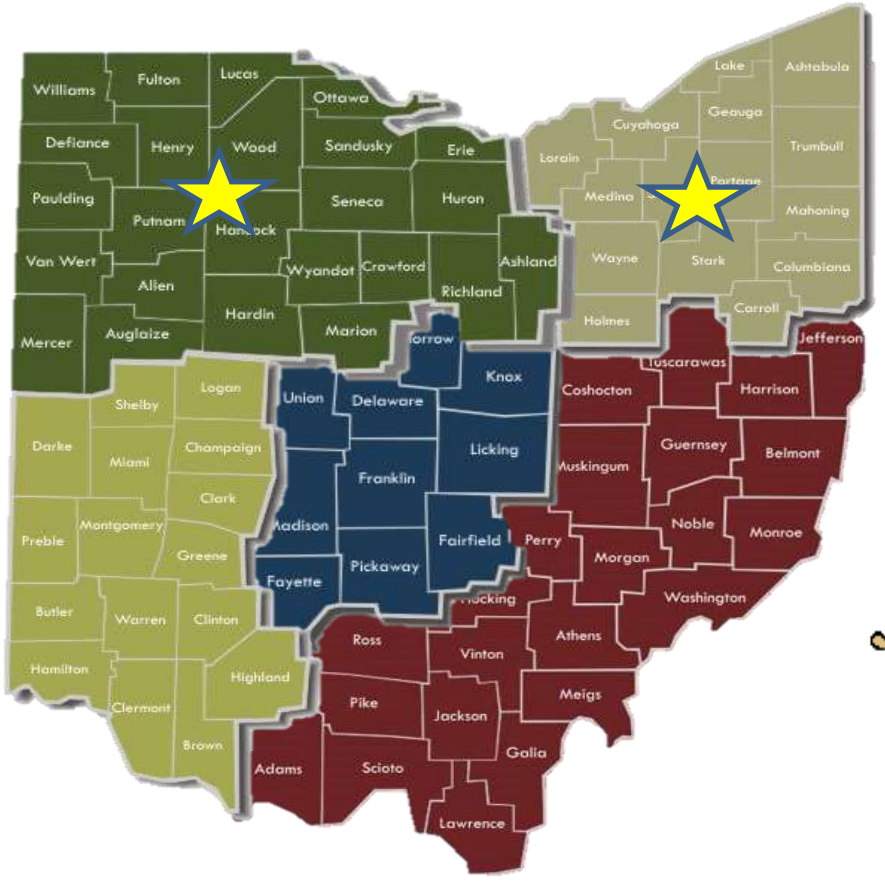
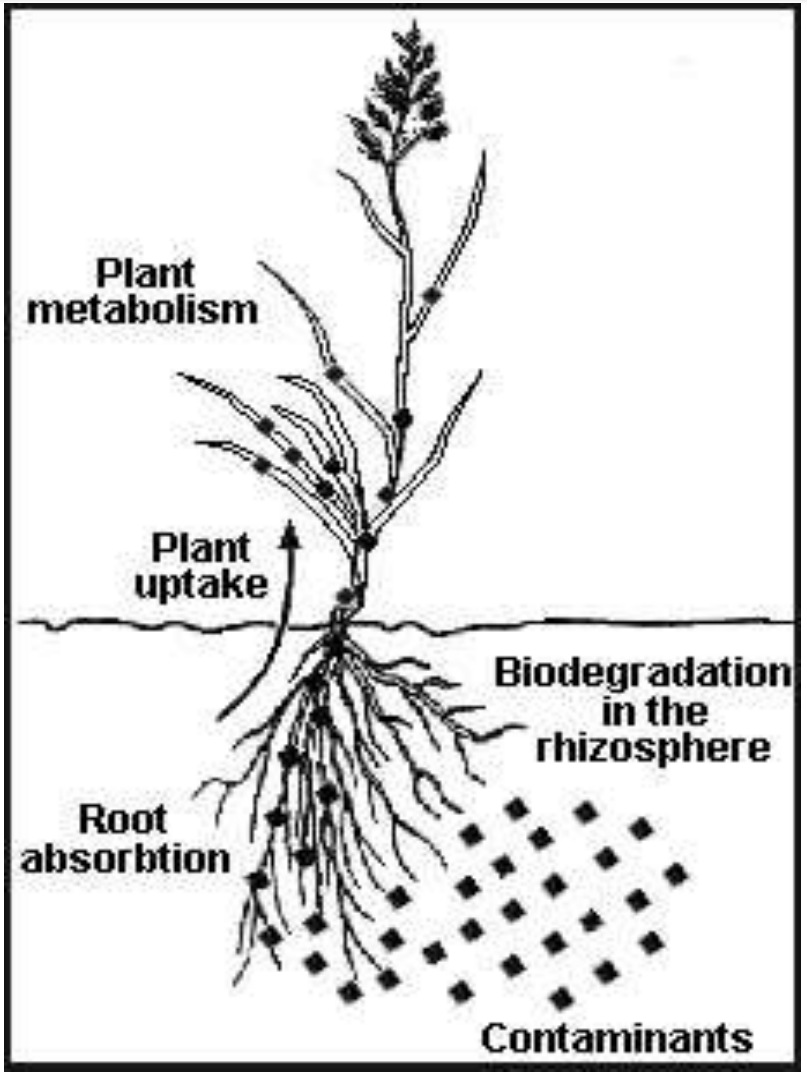
Filtration: Where is it?



Biofiltration Pollutant Removal Mechanisms



- Physical/Chemical Processes
  - Filtration
  - Adsorption/Absorption
  - Cation/Anion exchange
  - Metals complexing
- Biological Processes
  - Degradation/Decomposition
  - Plant/Bacteria uptake

Biofiltration

- High Flow Media
  - Same principles as traditional biofiltration
  - 100+ inches/hr flowrate
  - Reduced footprint – typically 1% of tributary drainage area
  - Quality control of media composition

filterra
Bioretention Systems

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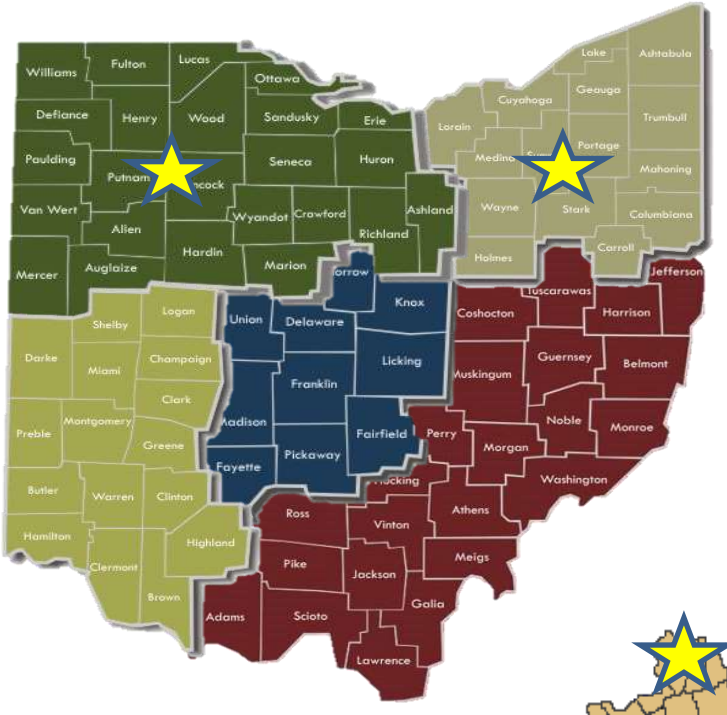
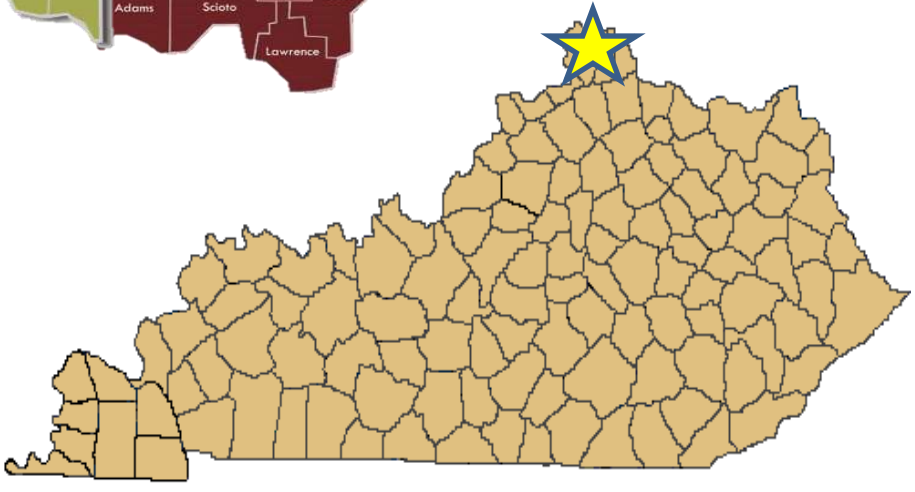
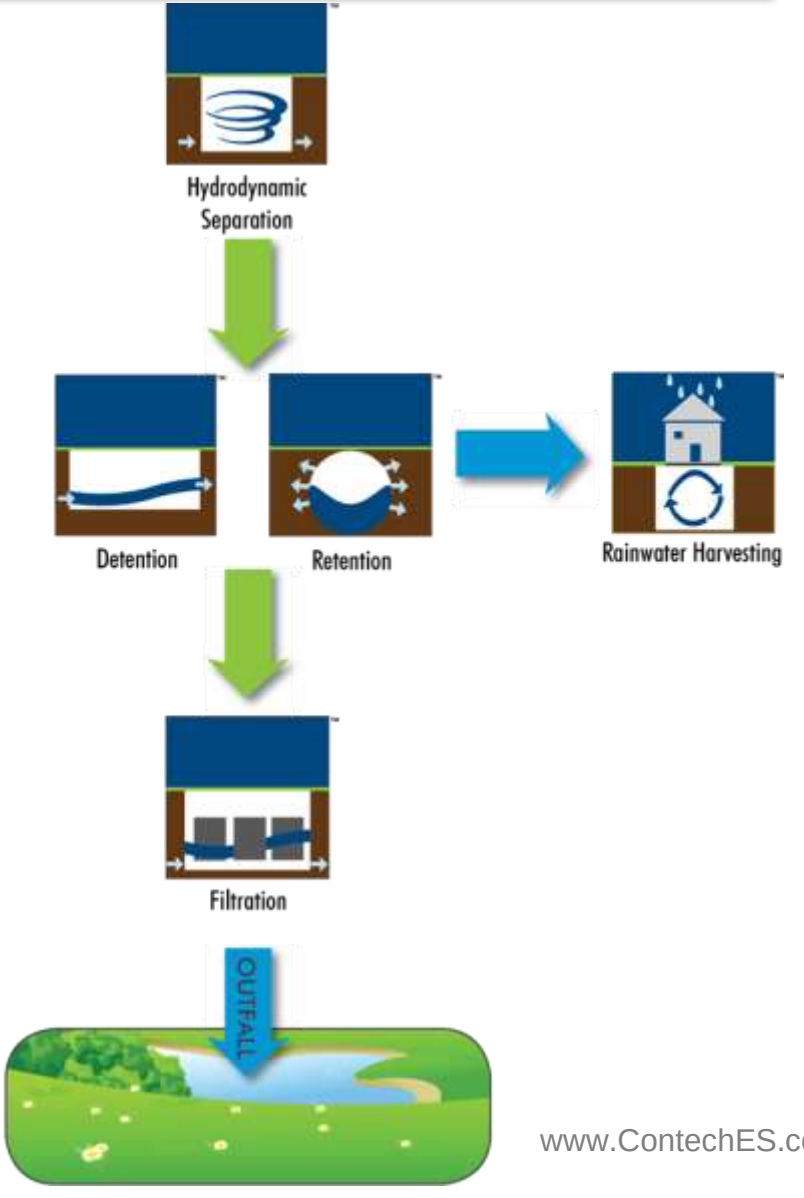
Filterra: Where is it?





Treatment Trains

- Water **quantity control**
  - Minimize downstream erosion and flooding
- Water **quality control**
  - Pretreatment reduces long term maintenance cost
  - Filtration removes fine particle TSS, metals, and nutrients



NJDEP Updates

- Stakeholders worked over a year to develop new lab protocol
- Separate protocols for hydrodynamic/settling devices and filtration BMPs
- HDS: 50% TSS
- Filtration: 80% TSS
- Key Dates
  - All historic interim certifications invalid as of January 25, 2015
  - Any BMPs granted final certifications based on field testing must complete new testing before December 1, 2016
  - All historic certifications revoked after December 1, 2016

STEPP

- Stormwater Testing & Evaluation for Products and Practices
- Led by WEF; task force of vendors, consultants, municipalities and EPA
- Development of a national stormwater testing & evaluation program
- Focus on proprietary devices
- Use existing NJDEP lab process & TAPE field process as initial platform
- Final report released July 2016

Your Stormwater Support team

Questions

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