# BMP Crediting Review

MIDS Work Group

November 16, 2012

p-gen3-14r

# Outline

- Background
- Overview of Credit Approaches
- Examples
  - Bioretention and Biofiltration
  - Pervious Pavement
  - Turf

Photo: John Hanson

# Background

# Performance Goal

- Volume control performance goal is SIMPLE

1.1 inch **X**  = Required Retention Volume

- Goal not time dependent (instantaneous)
  - BMP must retain required volume whether it occurs in half hour or 12 hours

# Flexible Treatment Option

- In general:
  - Achieve at least 0.55” volume reduction goal, and
  - Remove 75% of the annual TP load, and
  - Options considered and presented shall examine the merits of relocating project elements

# How to check compliance?
# Calculator

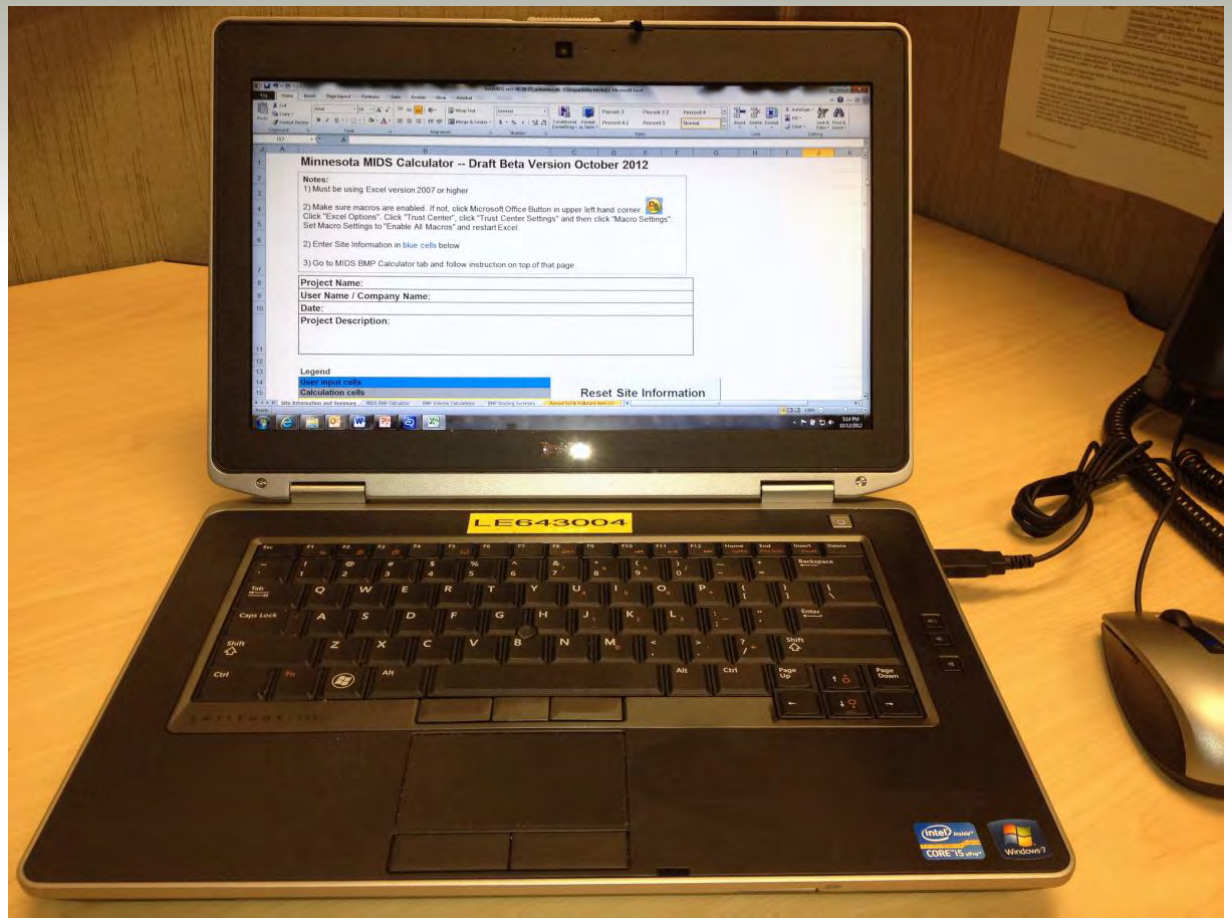



Photo: John Hanson

# Major Purposes of Calculator

- Volume Comparison to Performance Goal(s)
- Annual Volume Reduction
- Annual Pollutant Reductions

# How are credits quantified?

- Method Review

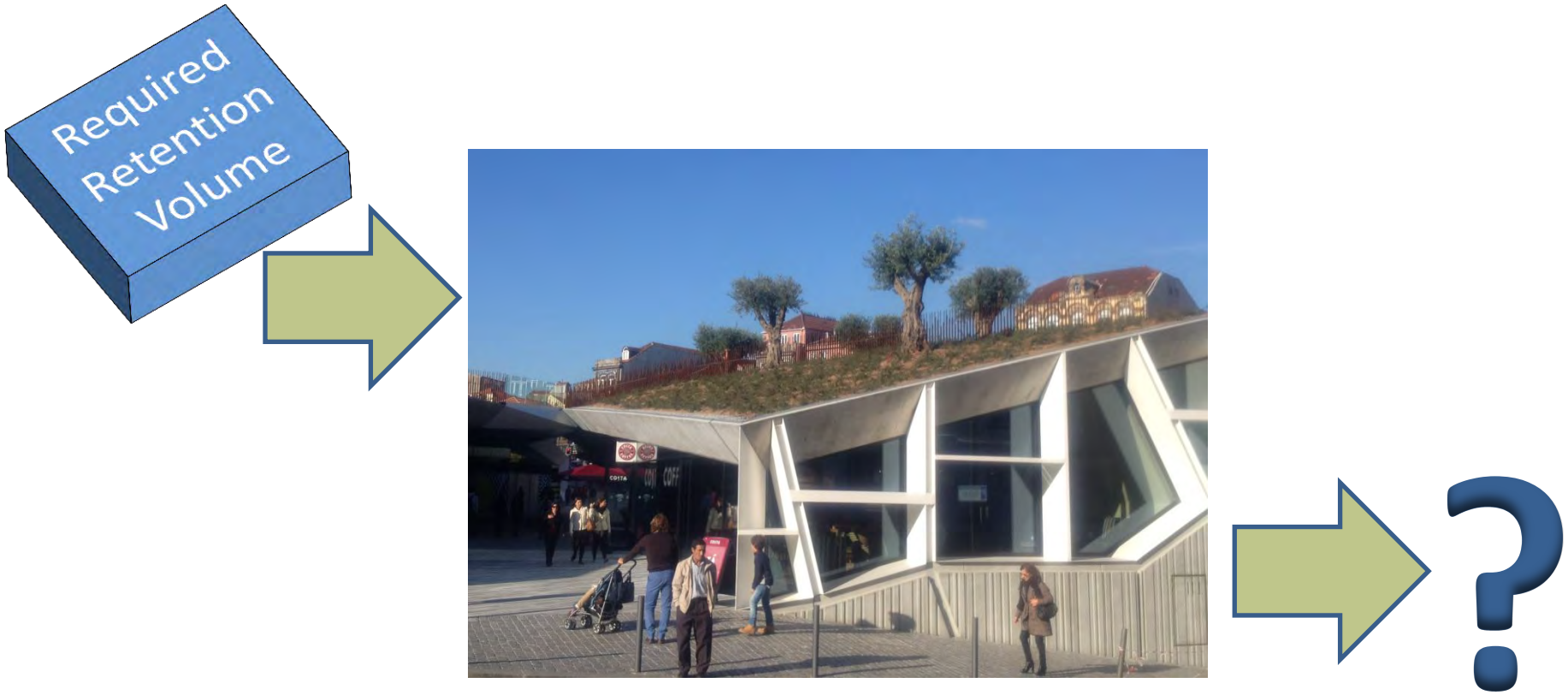



Photo: John Hanson

# Credit Overview/Refresher

# Calculating Pollutant Removal from Volume Control BMPs

- Pollutant removal primarily occurs through the reduction of volume
  - Infiltration
  - Interception
  - Evapotranspiration
  - Rainwater Harvesting

# Calculating Pollutant Removal from Volume Control BMPs

- Assume 100% Pollutant Removal from Volume Retained

- For Volume NOT retained by BMP, assume 0-100% Pollutant Removal
  - Depending on BMP
  - Depending on if BMP is designed online or offline

# Calculating Pollutant Removals

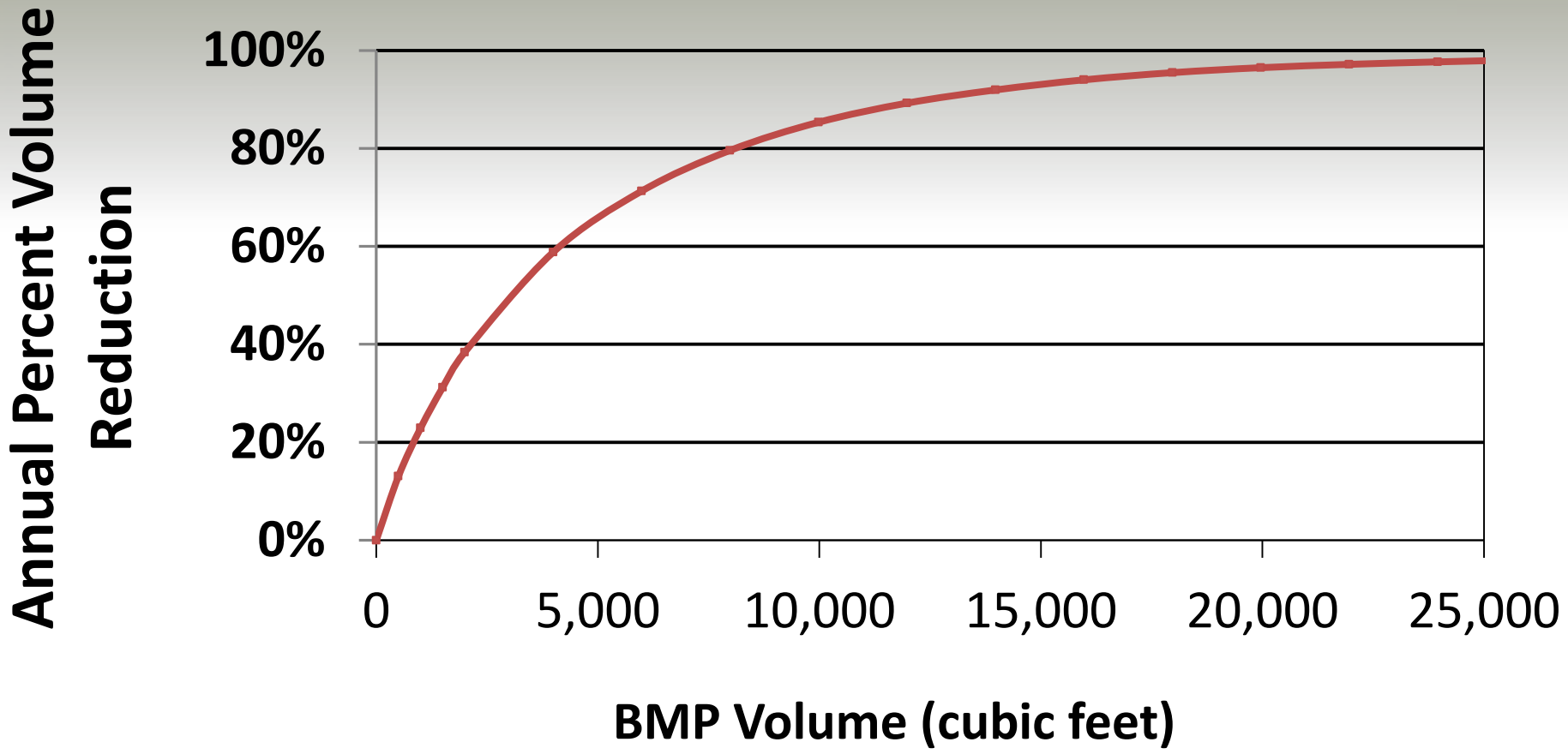
$$\text{Total \% Pollutant Removal} = \%RVR + [(100 - \%RVR) \times \%PR]$$

Where,

%RVR = % Annual Runoff Volume Retained

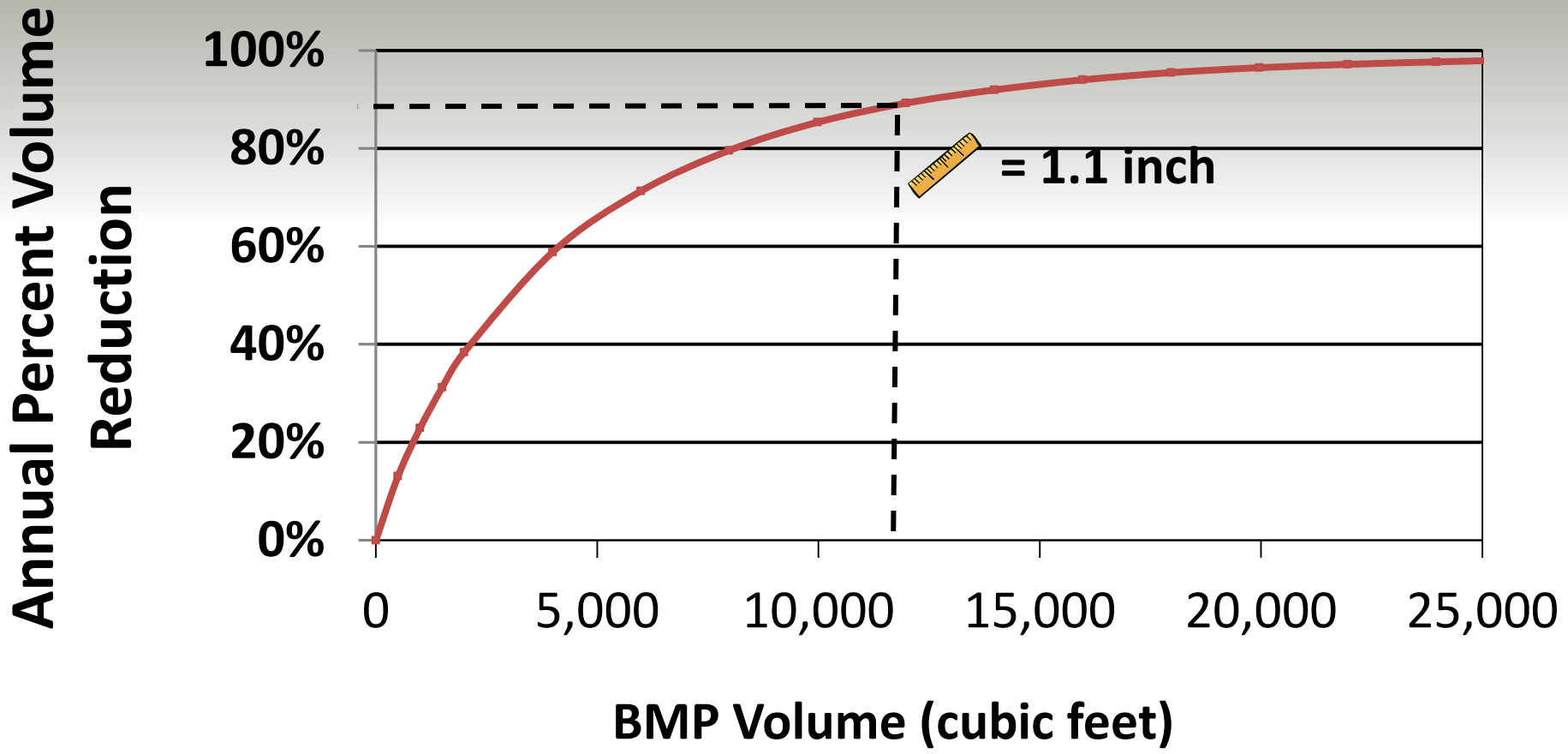
%PR = % Pollutant Removal

# Performance Curves Determine Annual Volume Retained



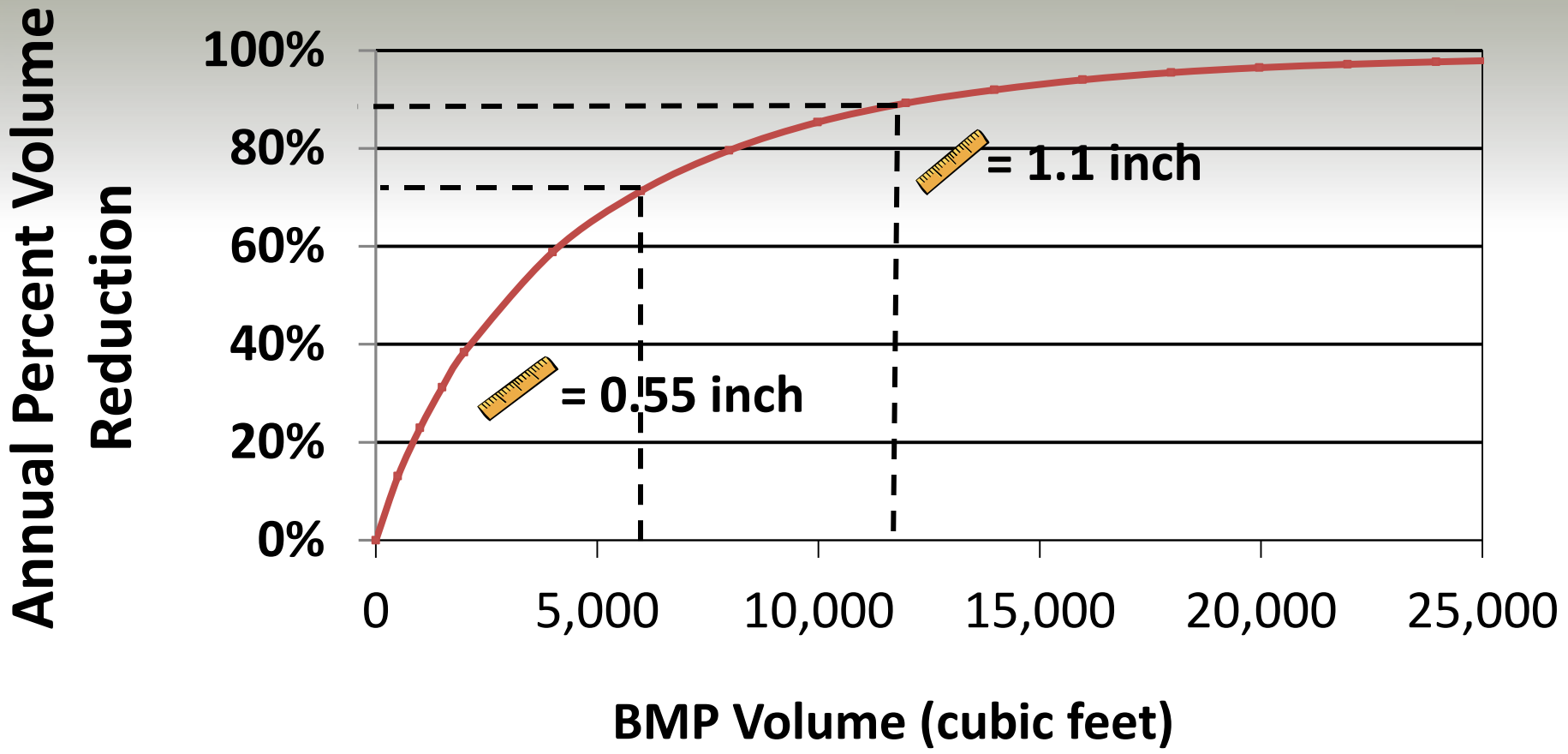

Note: Performance curve is for a 10 acre site, 30% impervious

# Performance Curves Determine Annual Volume Retained




Note: Performance curve is for a 10 acre site, 30% impervious

# Curves Also Convert Annual Volume Reduction to Percentage of Performance Goal Volume




Note: Performance curve is for a 10 acre site, 30% impervious

# How to Calculate % Annual Volume Removed?

- Using performance curves to relate BMP volume to annual volume reduction where possible
  - Curves generated for multiple soil types and imperviousness scenarios

- For other volume control BMPs, where development of performance curves not a good fit, using other methods (e.g., turf)

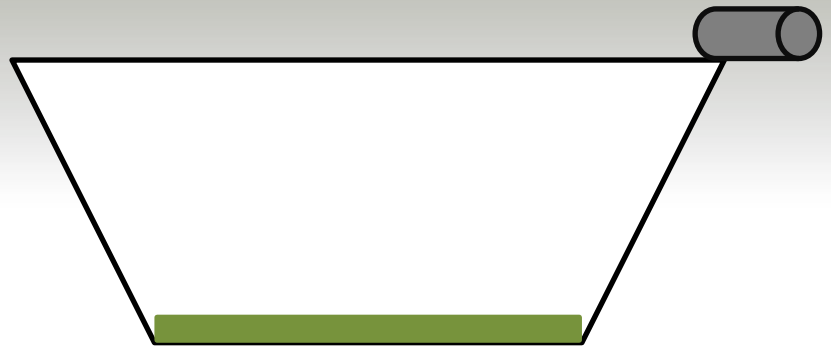
Photos: John Hanson

# Examples


Photo: Barr Engineering Company

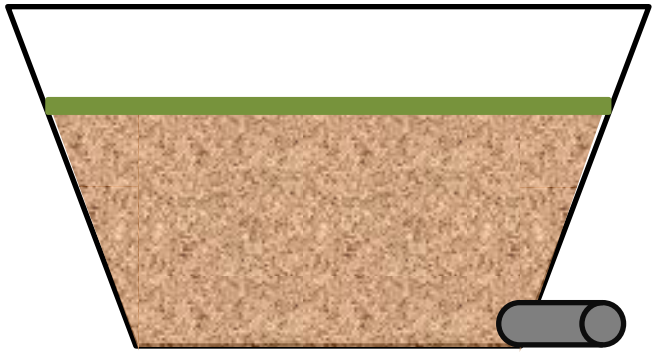
# Bioretention/Biofiltration

# Bioretention Variations



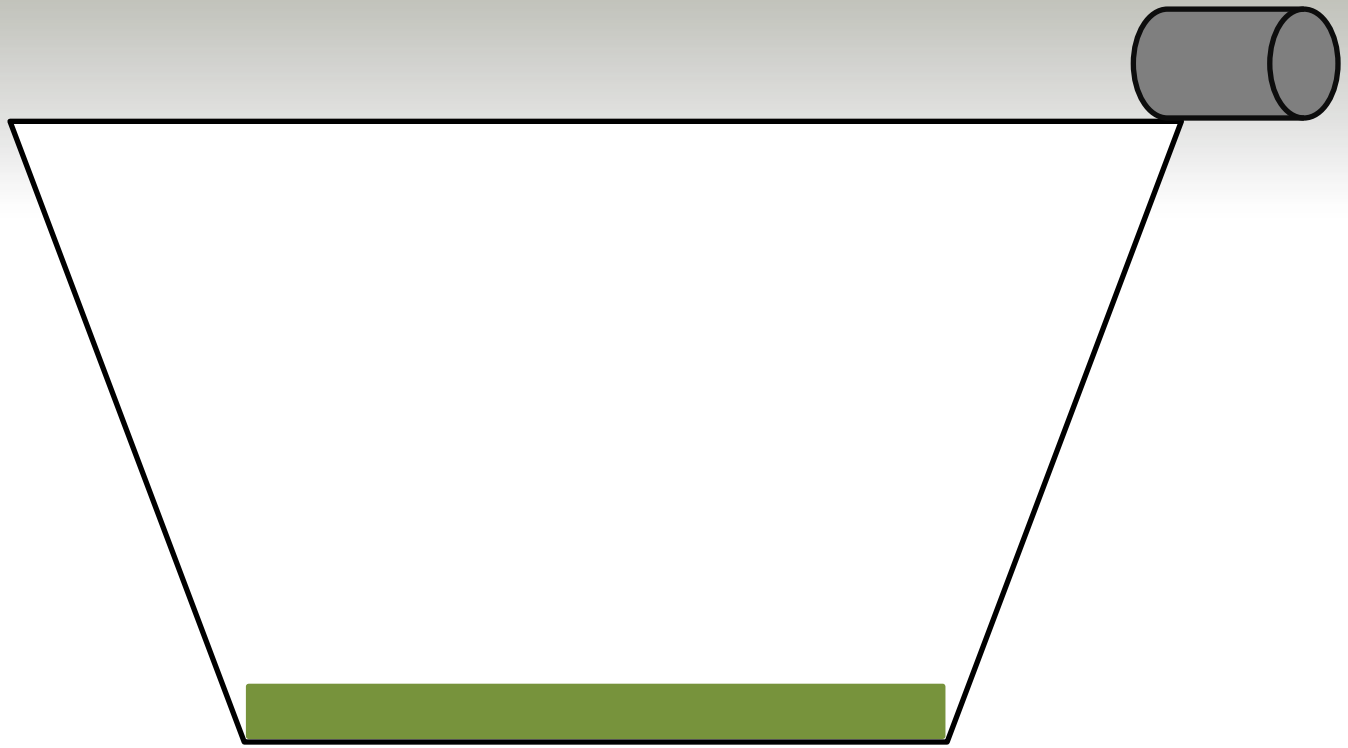
No Drain Tile

Elevated Drain Tile

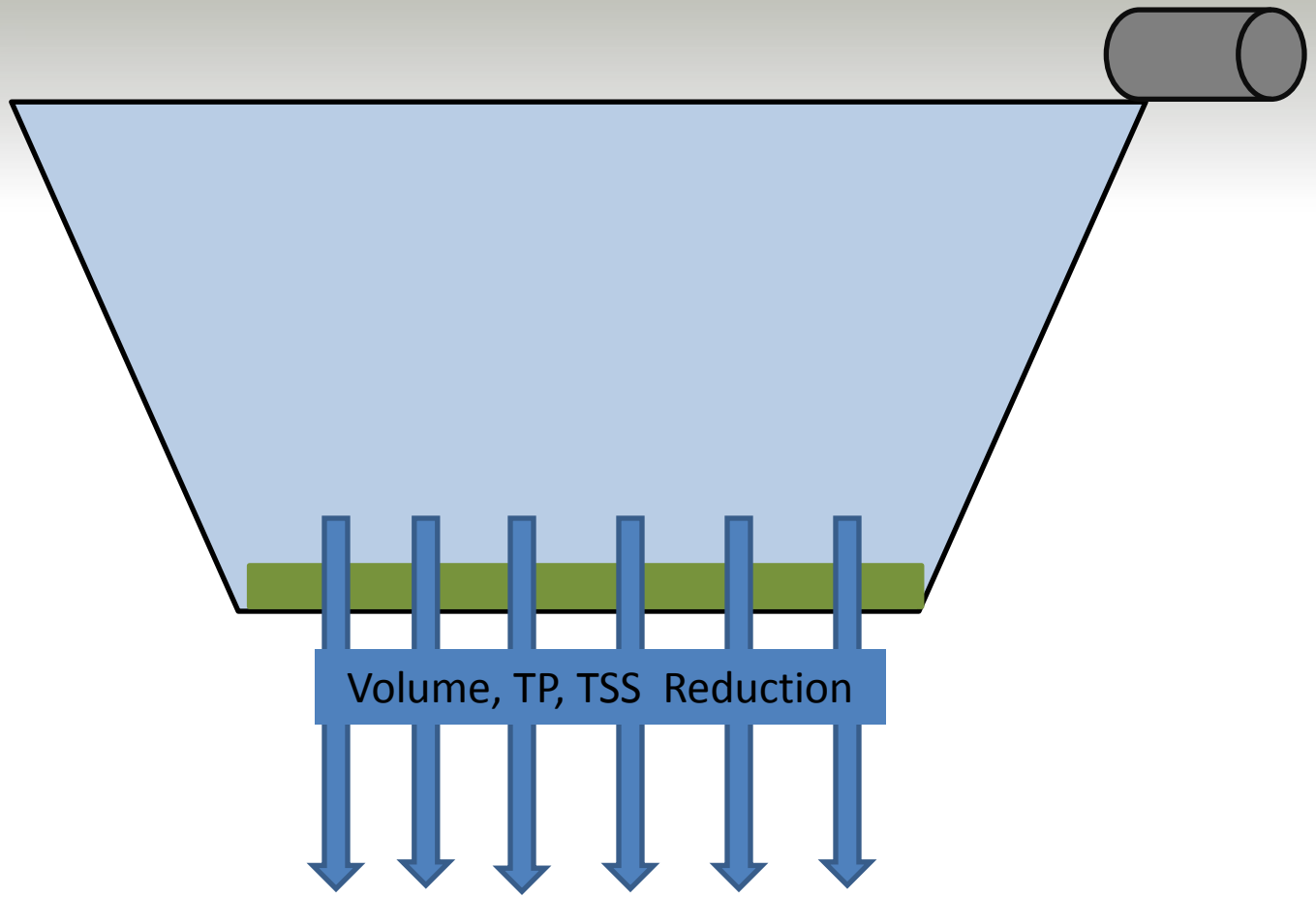


Bottom Drain Tile (Biofiltration)

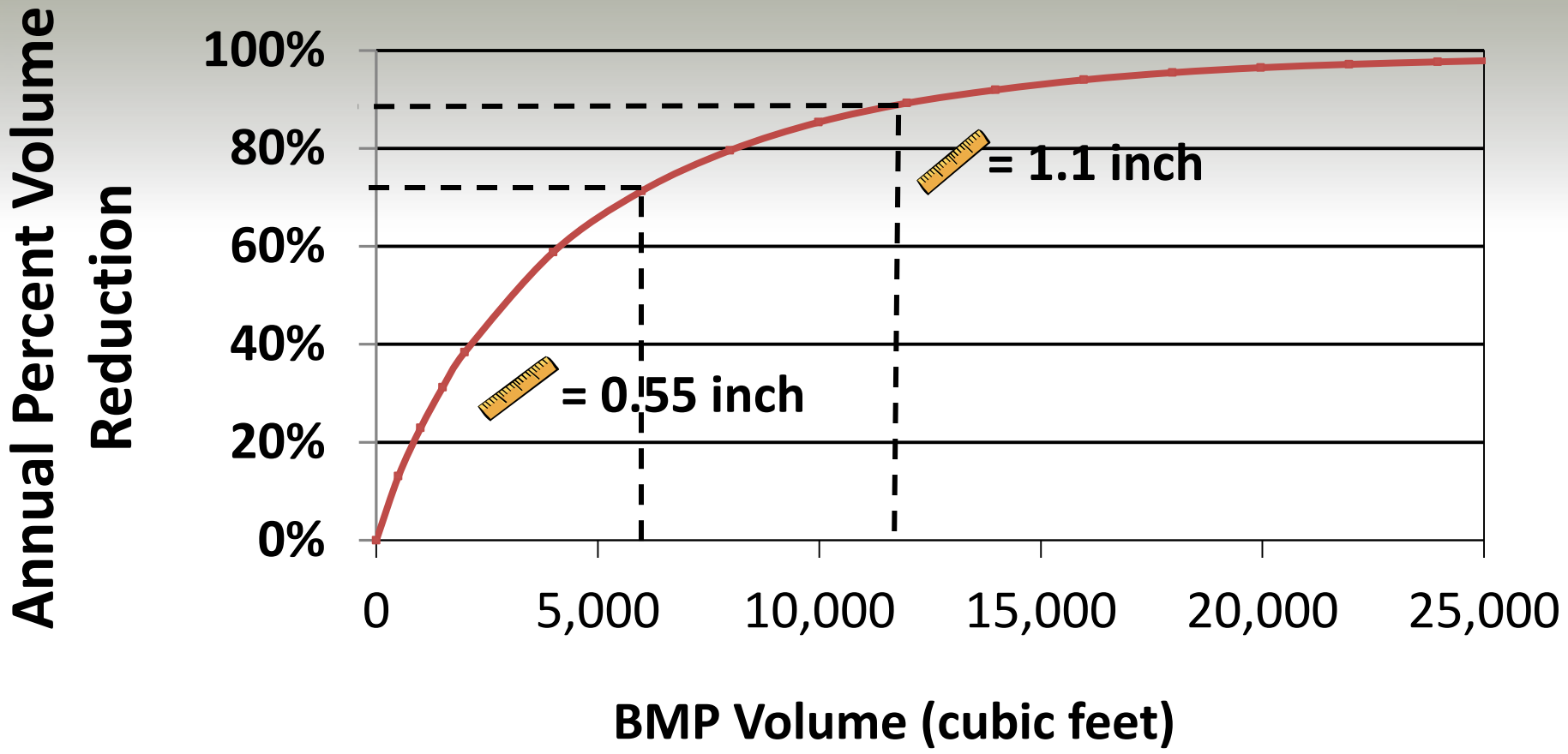
# Bioretention Basin without Drain Tile



# Bioretention Basin without Drain Tile

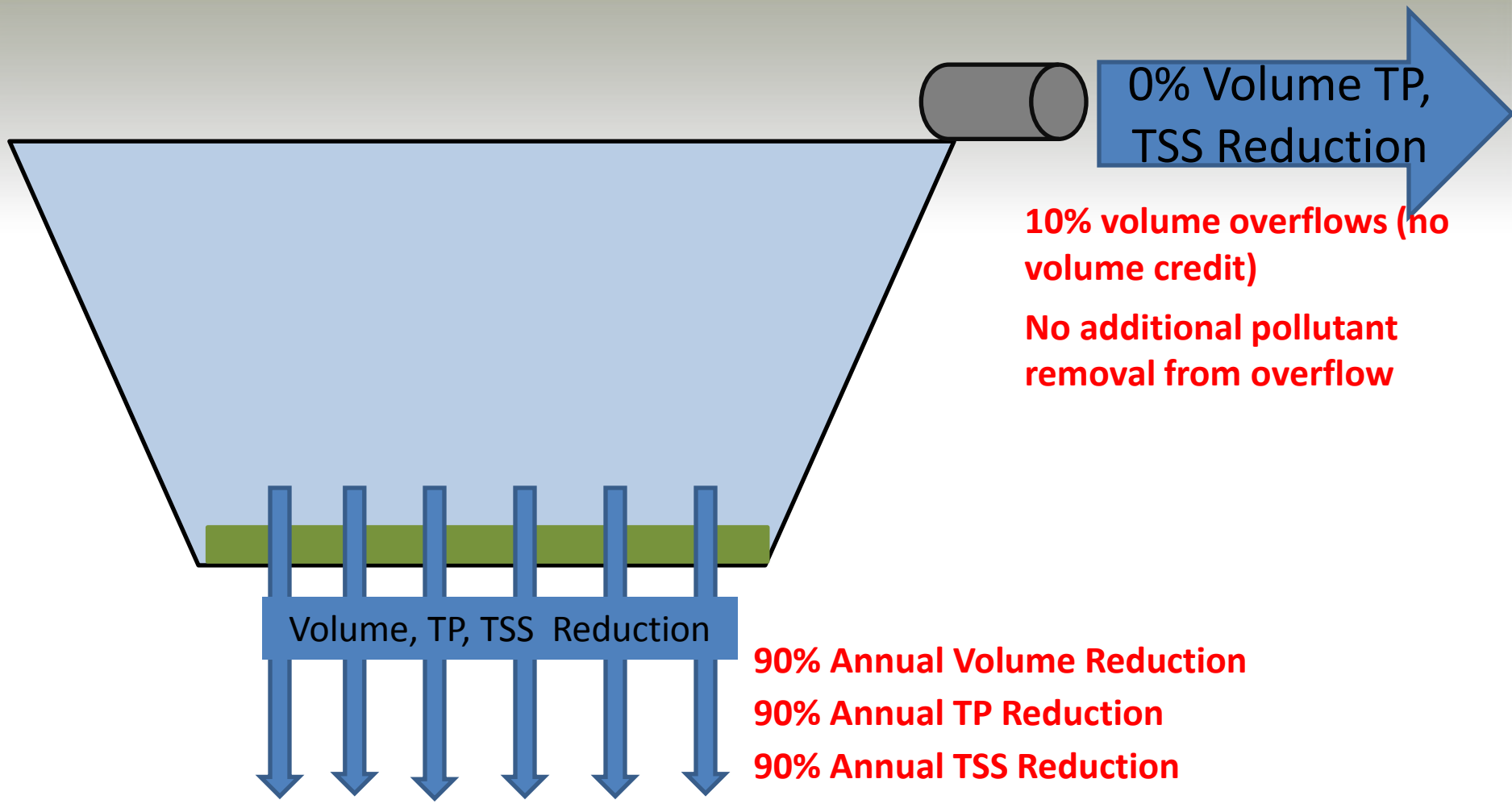


# Annual vs. Performance Goal Volumes




Note: Performance curve is for a 10 acre site, 30% impervious

# Bioretention Basin without Drain Tile




**10% volume overflows (no volume credit)**

**No additional pollutant removal from overflow**

**90% Annual Volume Reduction**

**90% Annual TP Reduction**

**90% Annual TSS Reduction**

# Calculating Pollutant Removals

Total % Pollutant Removal = %RVR + [(100- %RVR) x %PR]

= 90% + 10% x 0%

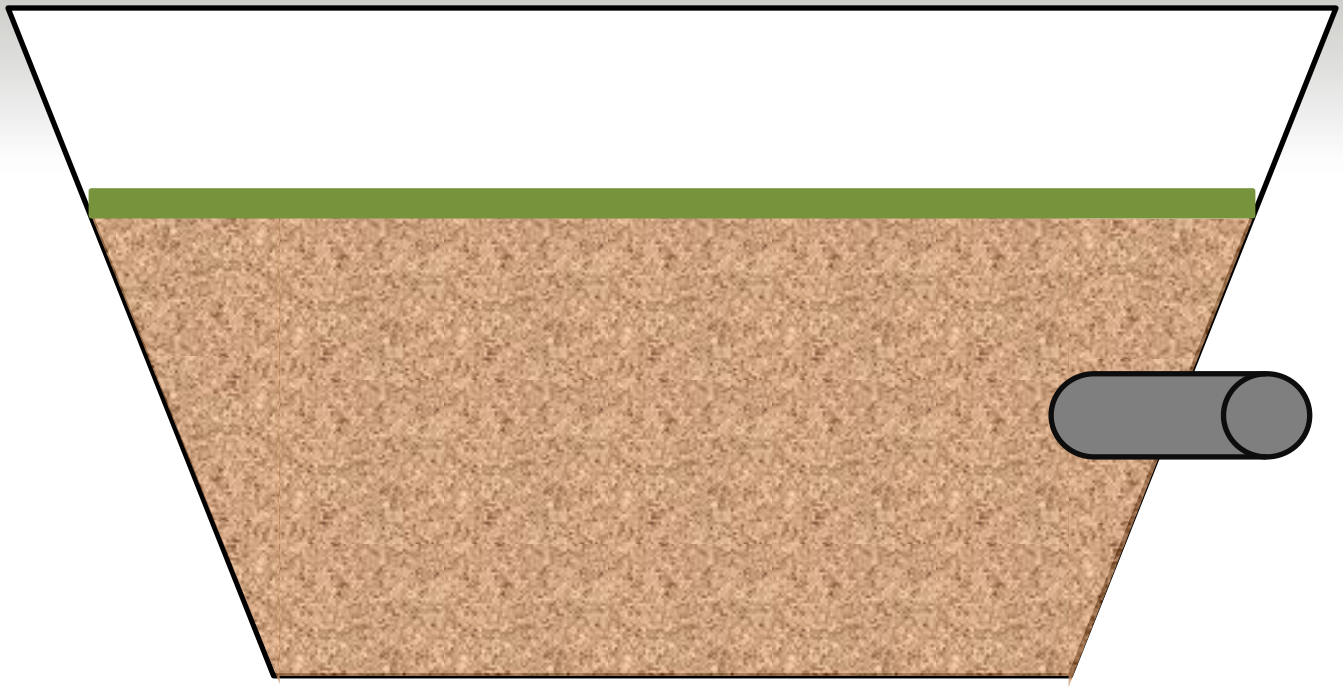
= 90%

Where,

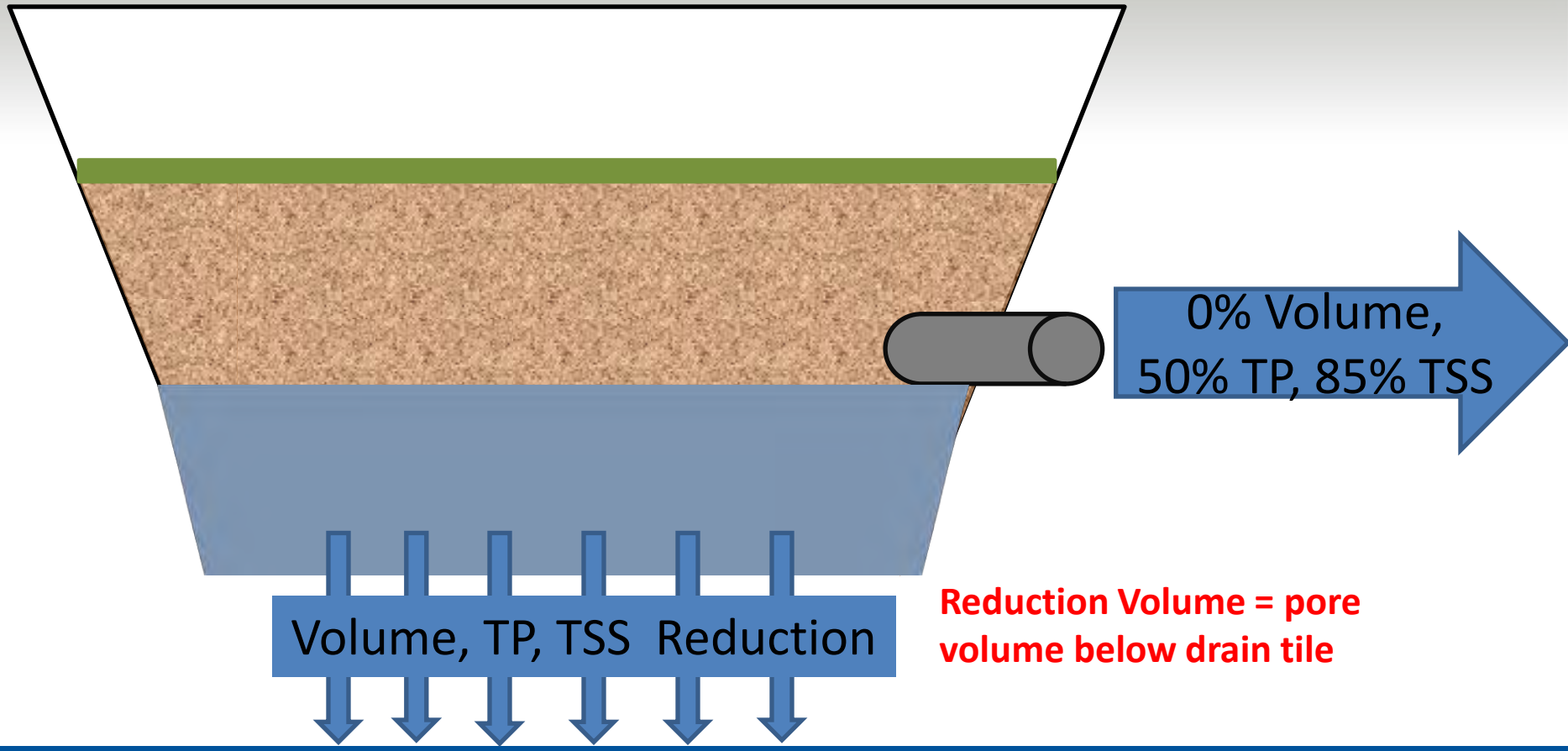
%RVR = % Annual Runoff Volume Retained

%PR = % Pollutant Removal

# Bioretention Basin with Elevated Drain Tile

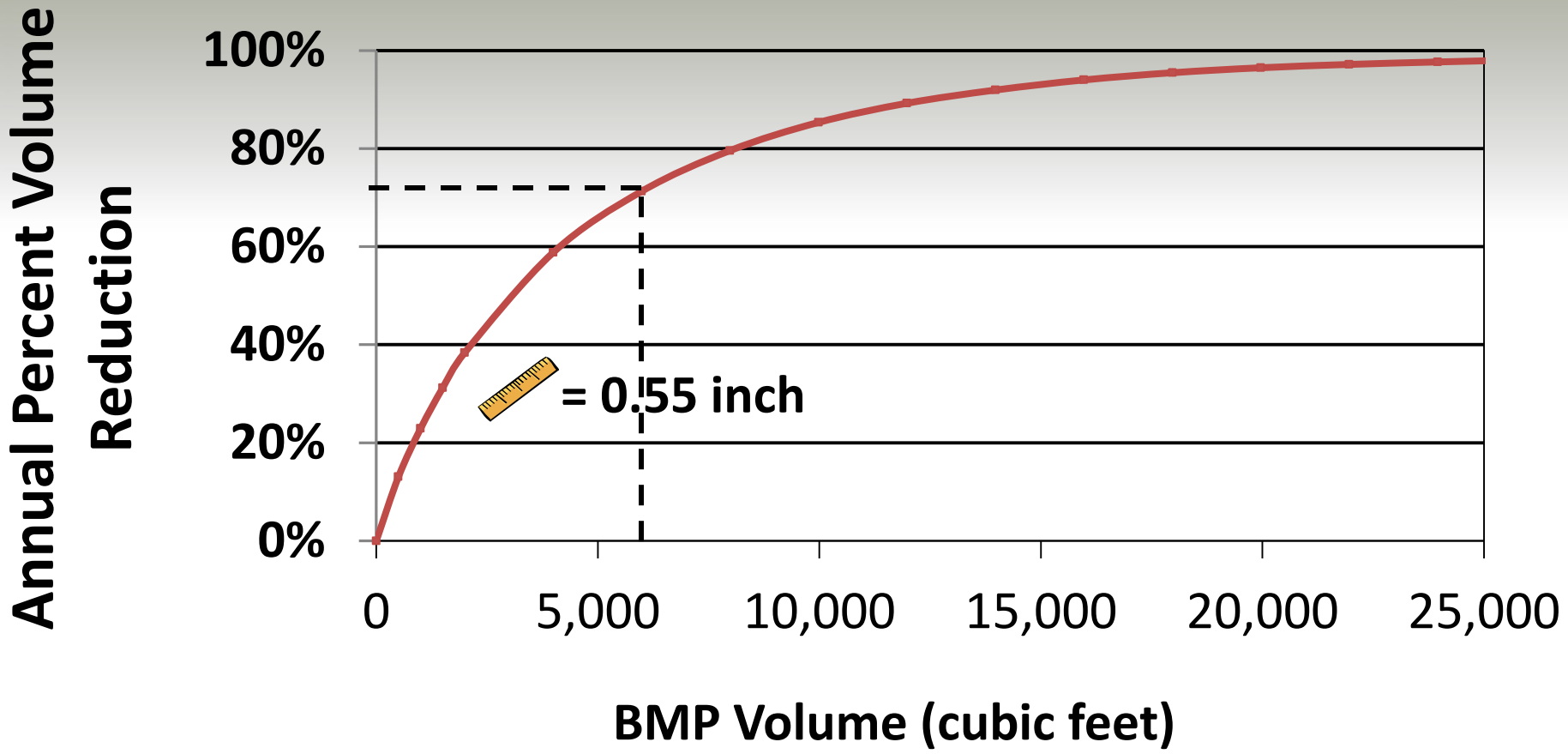


# Bioretention Basin with Elevated Drain Tile



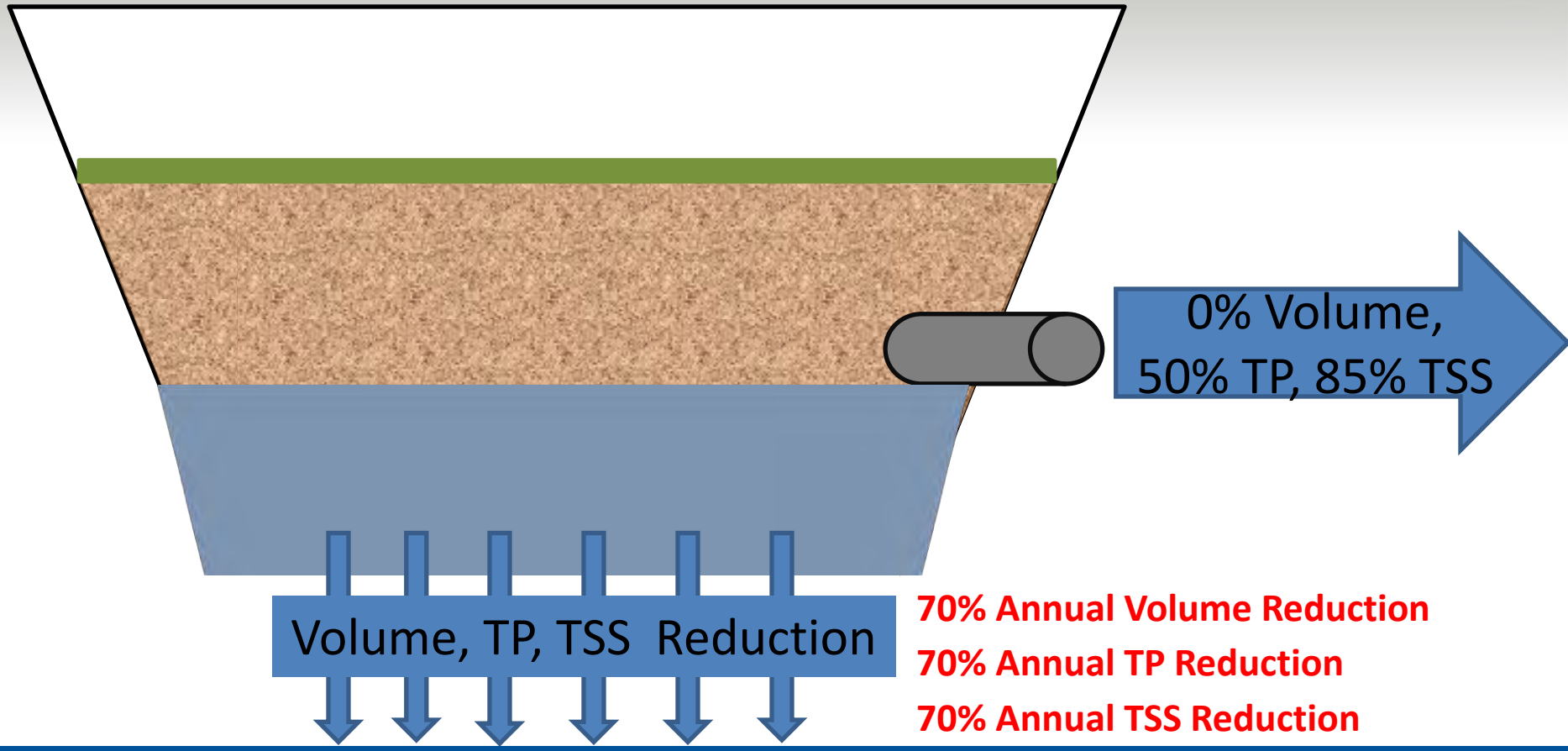

**Reduction Volume = pore volume below drain tile**

# Annual vs. Performance Goal Volumes




Note: Performance curve is for a 10 acre site, 30% impervious

# Bioretention Basin with Elevated Drain Tile

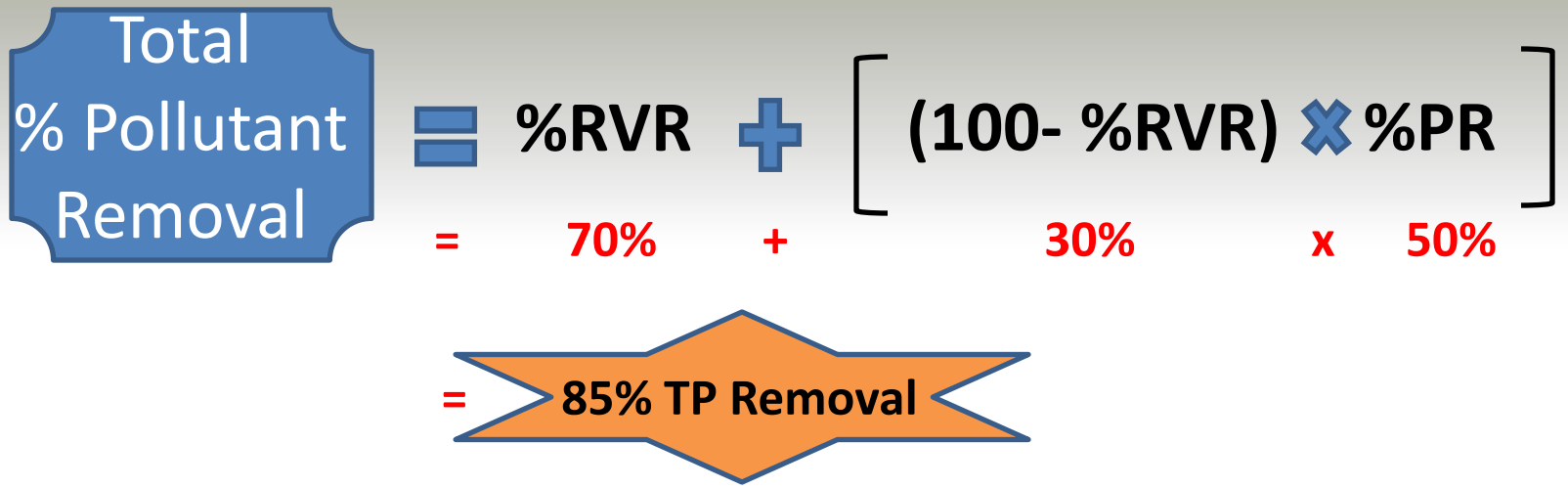



**70% Annual Volume Reduction**

**70% Annual TP Reduction**

**70% Annual TSS Reduction**

# Calculating TP Removals

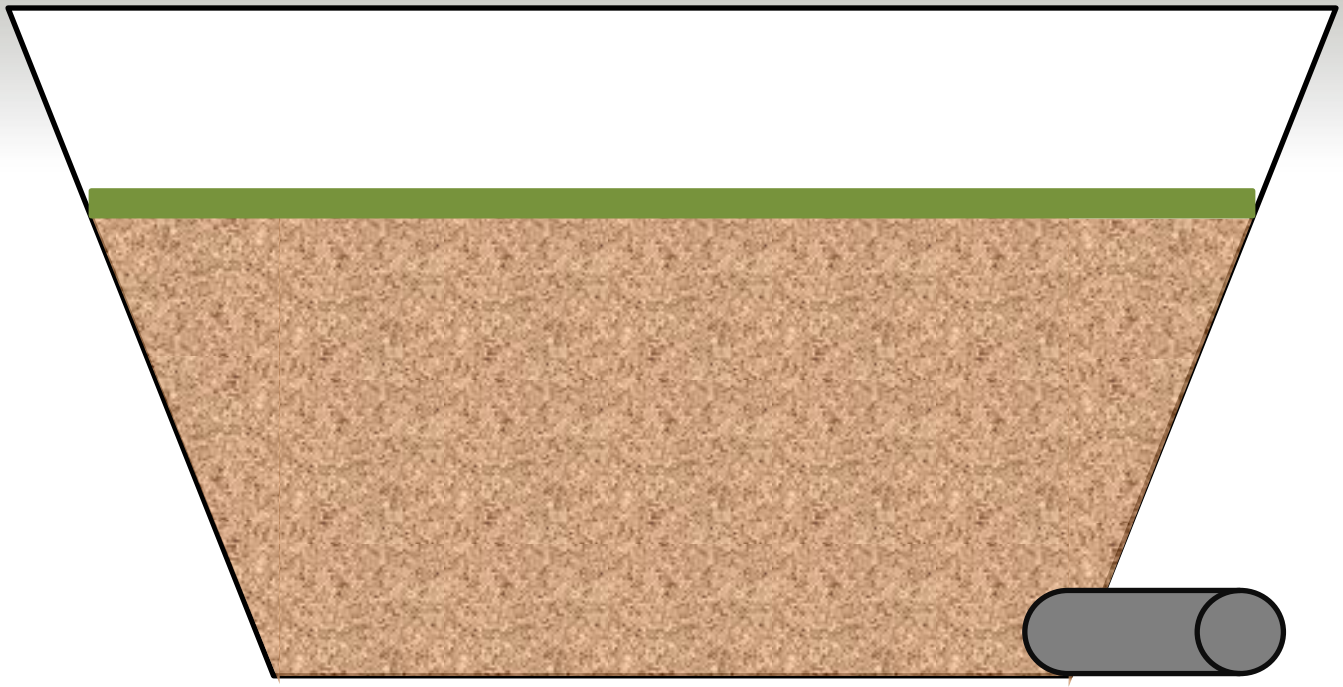



Where,

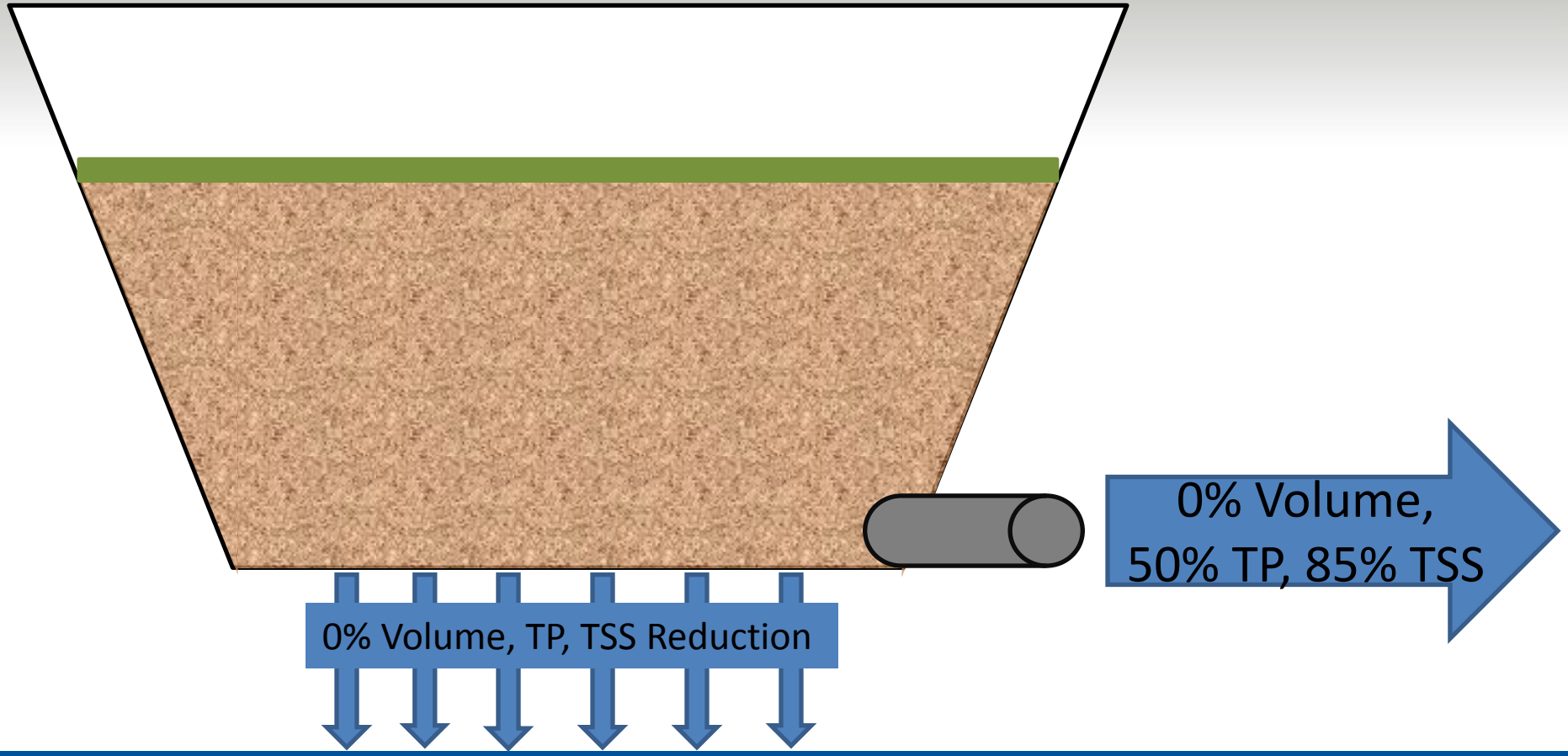
%RVR = % Annual Runoff Volume Retained

%PR = % TP Removal

# Biofiltration
## (Bioretention Basin with Bottom Drain Tile)



# Biofiltration
## (Bioretention Basin with Bottom Drain Tile)



# Calculating TP Removals

Total % Pollutant Removal = %RVR + [(100- %RVR) x %PR]

= 0% + 100% x 50%

= 50% TP Removal

Where,

%RVR = % Annual Runoff Volume Retained

%PR = % TP Removal

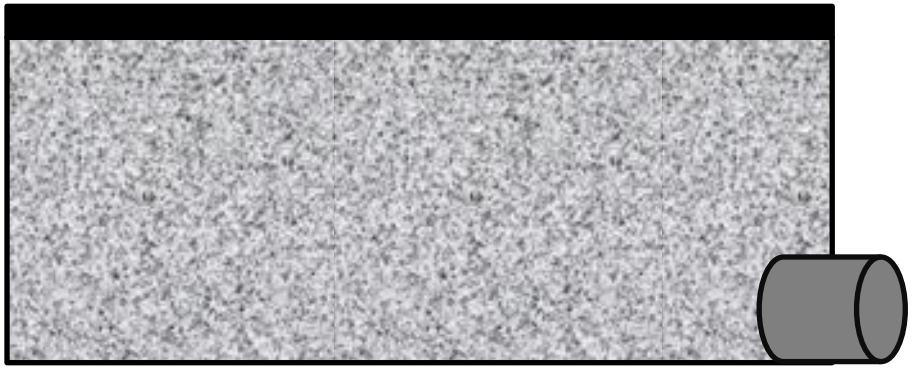

Photos: Barr Engineering Company

# Permeable Pavement

# Permeable Pavement

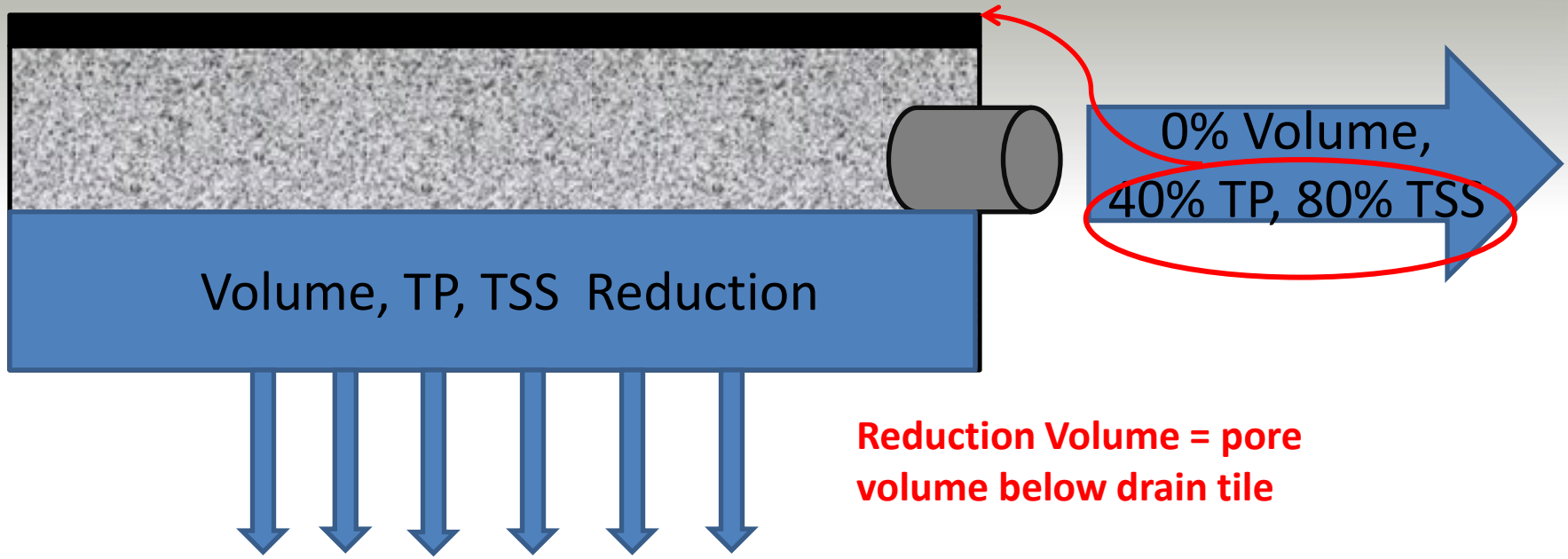
Photo: John Hanson

Typical (Elevated Drain Tile/Outlet)



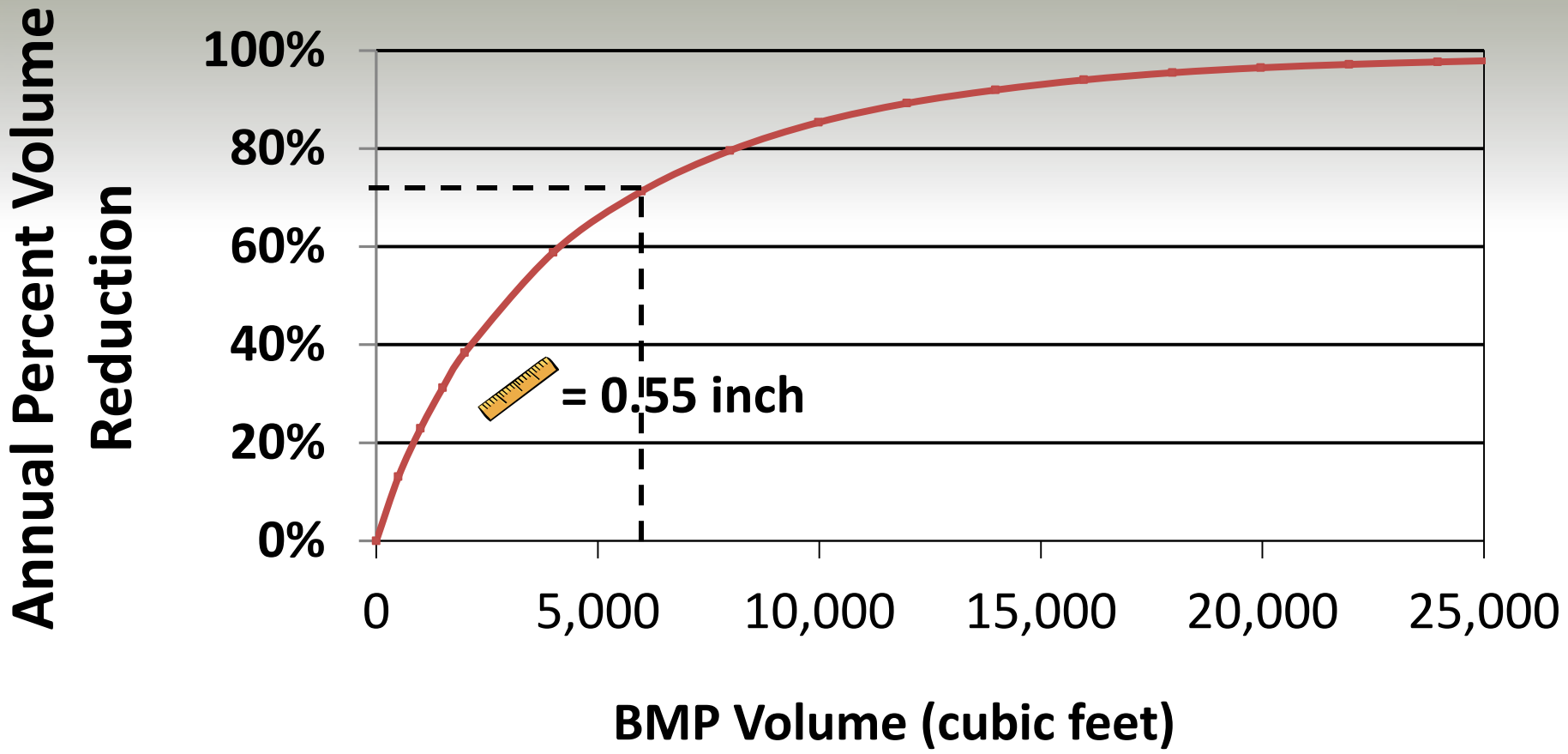
Bottom Drain Tile

# Permeable Pavement
# Elevated Drain Tile




**Reduction Volume = pore volume below drain tile**

# Annual vs. Performance Goal Volumes




Note: Performance curve is for a 10 acre site, 30% impervious

# Calculating TP Removals

Total % Pollutant Removal = %RVR + [(100- %RVR) x %PR]

= 70% + 30% x 40%

= 82% TP Removal

Where,

%RVR = % Annual Runoff Volume Retained

%PR = % TP Removal

# Permeable Pavement
# Bottom Drain Tile

0% Volume,
40% TP, 80% TSS

Photo: http://en.wikipedia.org/wiki/File:SeededfertilizedlawnJPG

# Turf

# Categories of Turf "Credits"

1. Turf (or green space) that captures runoff from impervious surfaces (i.e., impervious surface disconnection)
2. Turf that does not capture impervious runoff, but is installed and maintained to promote infiltration at a higher rate than typical (amended or loosened soils)

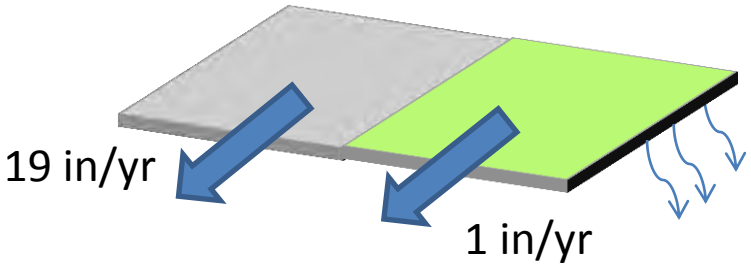
# Credits for **Impervious Surface Disconnection**

- Runoff from impervious areas (sidewalks, parking lots, etc.) is redirected to green space instead of the storm sewer
- Overall site runoff will be reduced
- Reduction will depend on the additional infiltration capacity of the turfed area (annual basis)

Photo: http://www.reporthost.com/a1qual/sample1/

# Credits for **Impervious Surface Disconnection**

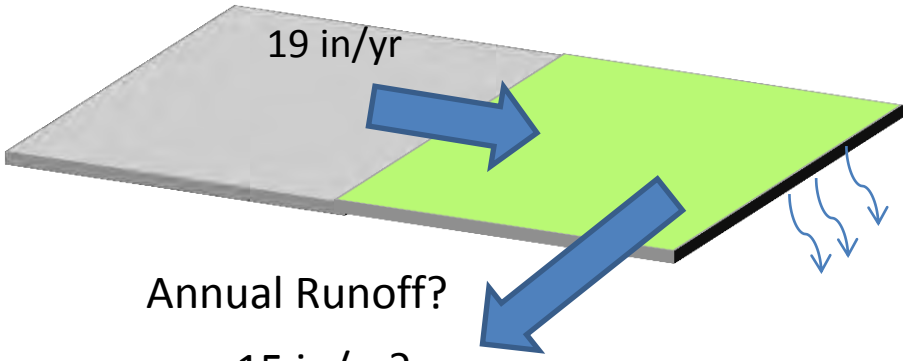
- During most rainfall events, no runoff from pervious surfaces, and full infiltration capacity not utilized




- Redirection of impervious runoff takes advantage of "extra" infiltration capacity of turf, but infiltration of ALL redirected runoff unlikely

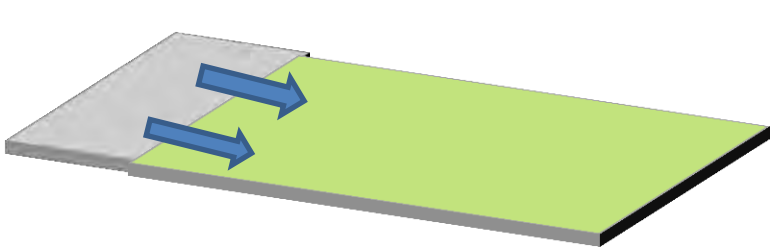
# So how much of the redirected runoff will still runoff?

- Redirection of impervious runoff takes advantage of "extra" infiltration capacity of turf, but infiltration of ALL redirected runoff unlikely

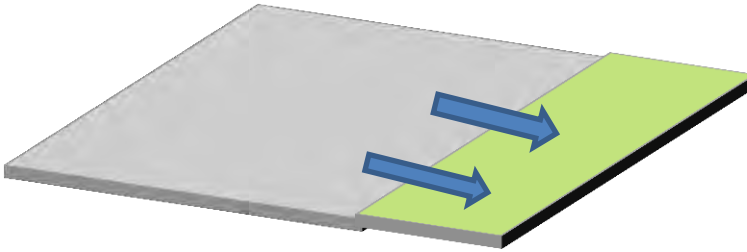


# So how much of the redirected runoff will still runoff?

- Primary factors include:
  - Ratio of Impervious Area to Turf Area



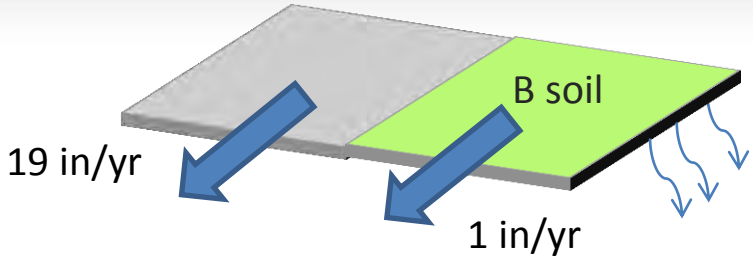
VS.



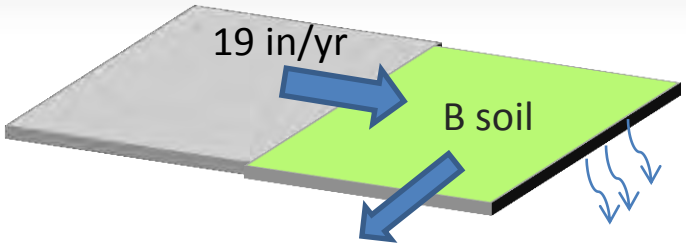
  - Soil type (infiltration capacity)
  - Slope of turfed area

# Quantifying Disconnection "Credit"

- Model various scenarios to determine annual reduction volumes




**Site Runoff = 20 in/yr**



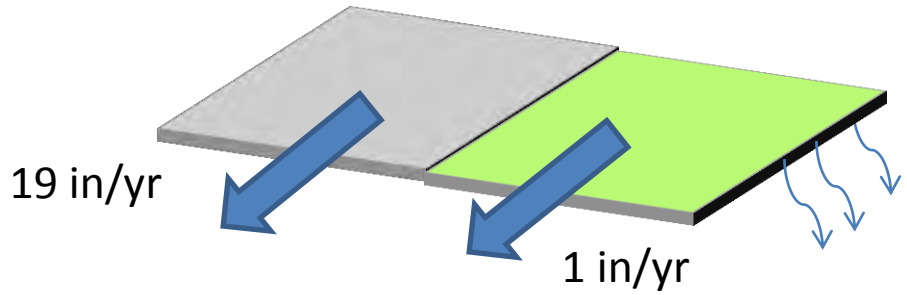

**Site Runoff = 10 in/yr**

- Use results to determined adjusted impervious surface area – which will adjust the performance goal

$$\textbf{Impervious Adjustment} = \frac{\textbf{Post-disconnection Site Runoff}}{\textbf{Pre-disconnection Site Runoff}} = \frac{\textbf{10 in/yr}}{\textbf{20 in/yr}} = \frac{\textbf{1}}{\textbf{2}}$$

# Quantifying "Better" Turf "Credit"

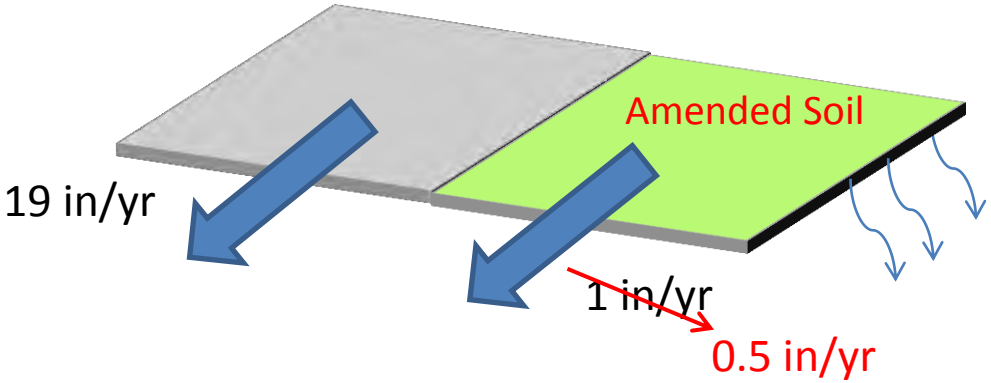
- Small portion of annual runoff to BMPs is from pervious surfaces




**Example: % Annual Runoff from Pervious Area = $\frac{1\ in/yr}{20\ in/yr}$ = 0.05 (5%)**

# Quantifying "Better" Turf "Credit"

- Credit can be determined by quantifying the decrease in annual runoff with "better" turf




**Example: % Annual Runoff from Pervious Area** $= \frac{0.5\ in/yr}{19.5\ in/yr} = 0.025\ (2.5\%)$

# Questions?