STORMWATER LANDSCAPE MAINTENANCE Training Program

Brought to you by the White River Alliance & the following cities:

Noblesville • Carmel • Cicero • Fishers • Westfield

• Zionsville • Hamilton County • Pendleton • McCordsville

WELCOME!

Our Agenda for the Day

1. State of the Waters
2. Stormwater Infrastructure: Gray vs. Green
3. You Bought a Utility
4. Using Native Plants in the Landscape
5. Installation and Maintenance
6. Lunch & Learn: Let's Talk about Lawns
7. Pond Maintenance

Big thanks to our friends!

Eco Logic

Heartland Dredging
ECO-FRIENDLY SERVICES

HAMILTON COUNTY
Soil & Water
CONSERVATION DISTRICT

ValentiHeld
CONTRACTOR/DEVELOPER

VS ENGINEERING
Civil • Structural • Transportation • Environmental
www.vsengineering.com

THE STATE OF OUR WATERS

Why Are We Here Today?

PROTECTING & IMPROVING WATER RESOURCES IN CENTRAL INDIANA

Jill Hoffmann
Executive Director

WHITE RIVER ALLIANCE

OUR ACTIVITIES AND IMPACT -
Empowering A Community To Act!

Choose Clean Water
LEARN MORE

Let Me

Individual Opportunities for Action

Clear Choices Clean Water

STORMWATER LANDSCAPE MAINTENANCE Training Program

Teach Me

STORMWATER TRAINED INDIVIDUAL Contractor Certification

Technical Resources, Training, Stormwater Education

Workshops, Assessments, & Tools

Healthy Ample Water

WHITE RIVER festival

Engaged Community

The White River Festival

Reach Me

WHITE RIVER DRAGON BOAT RACE & FESTIVAL

On-the-Ground Project Installation

Cost-share funds to landowners

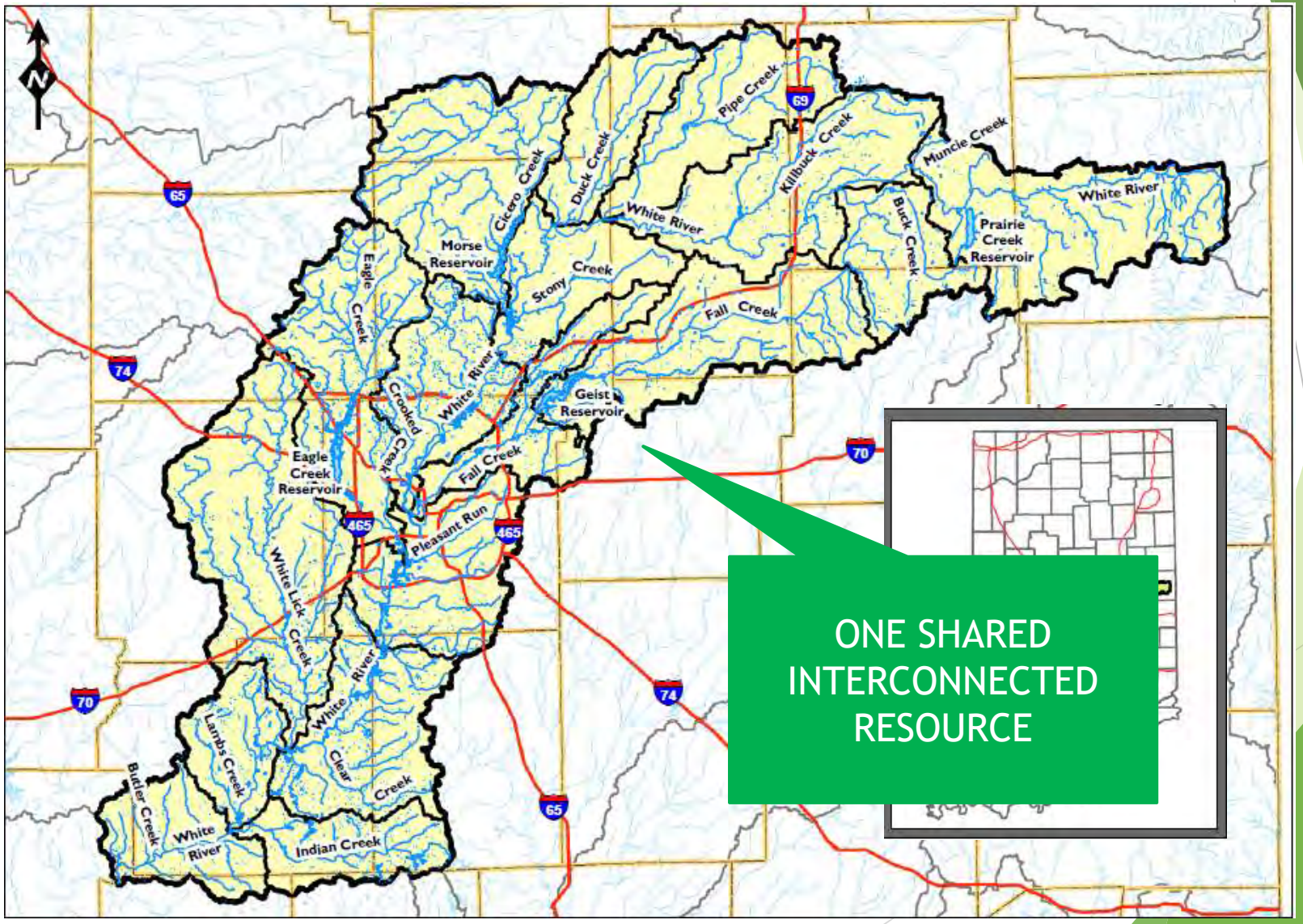
Healthy Shores INITIATIVE
Doing My Part for Cleaner Water

Help Me

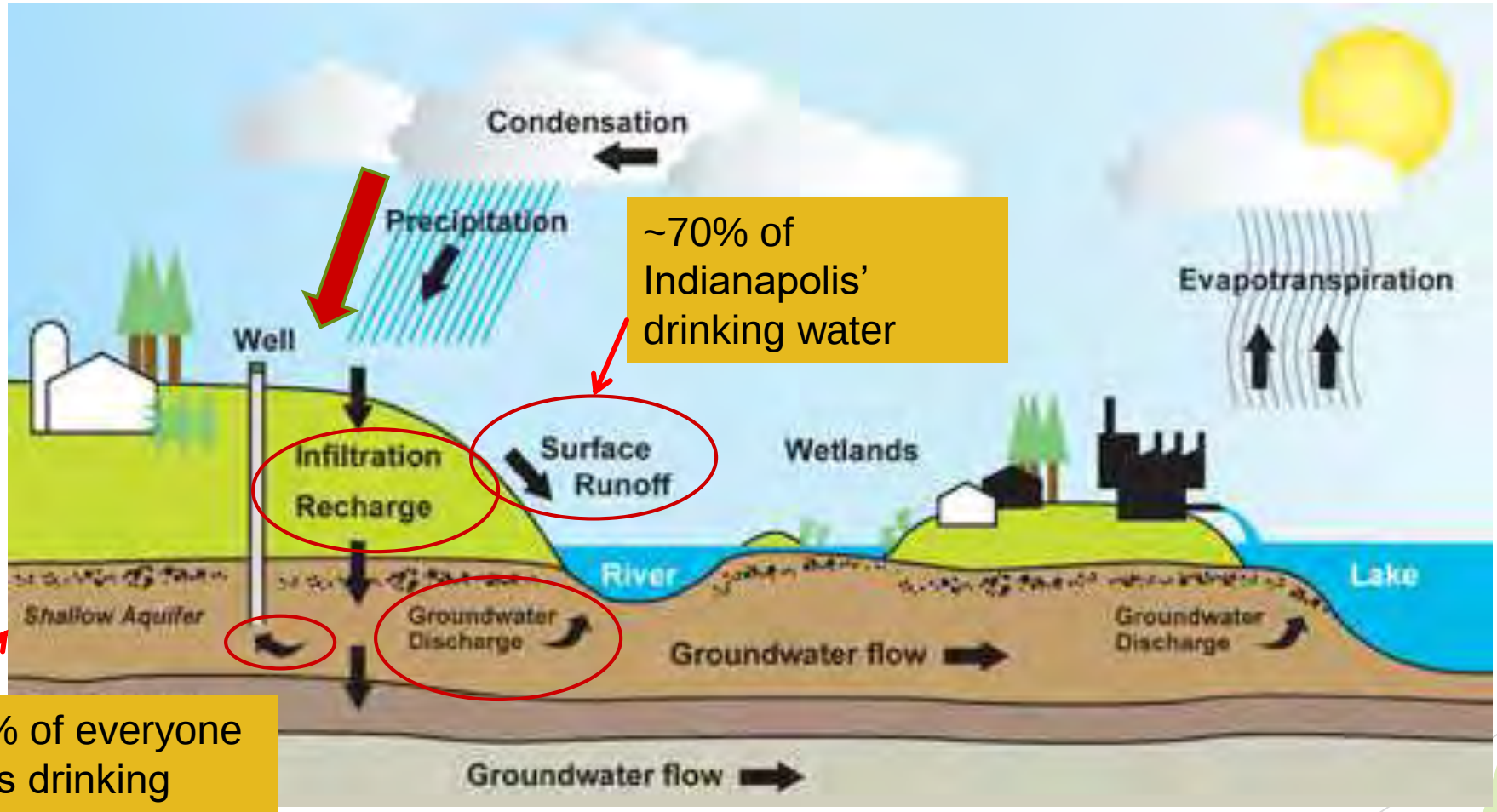
THE WHITE RIVER WATERSHED:

the area that impacts central indiana's water supply

- ✓ 1.7 million acres
- ✓ 4 major reservoirs
- ✓ 15 major tributaries
- ✓ Home to 1/3 of IN's population and its primary economic engines



Ground & Surface Water Connections

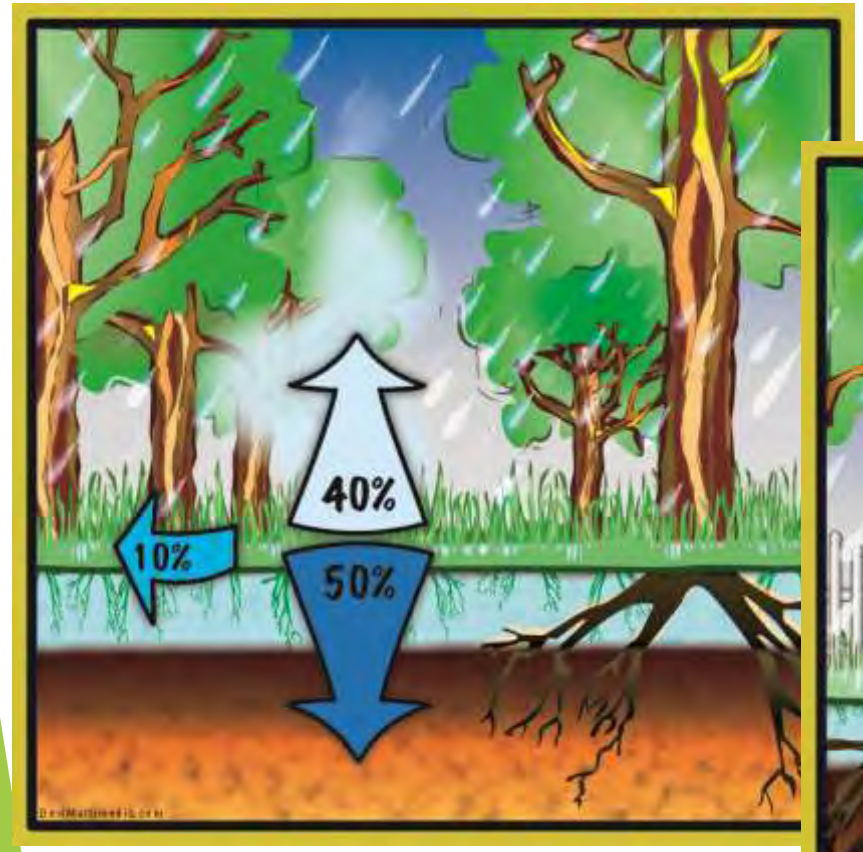


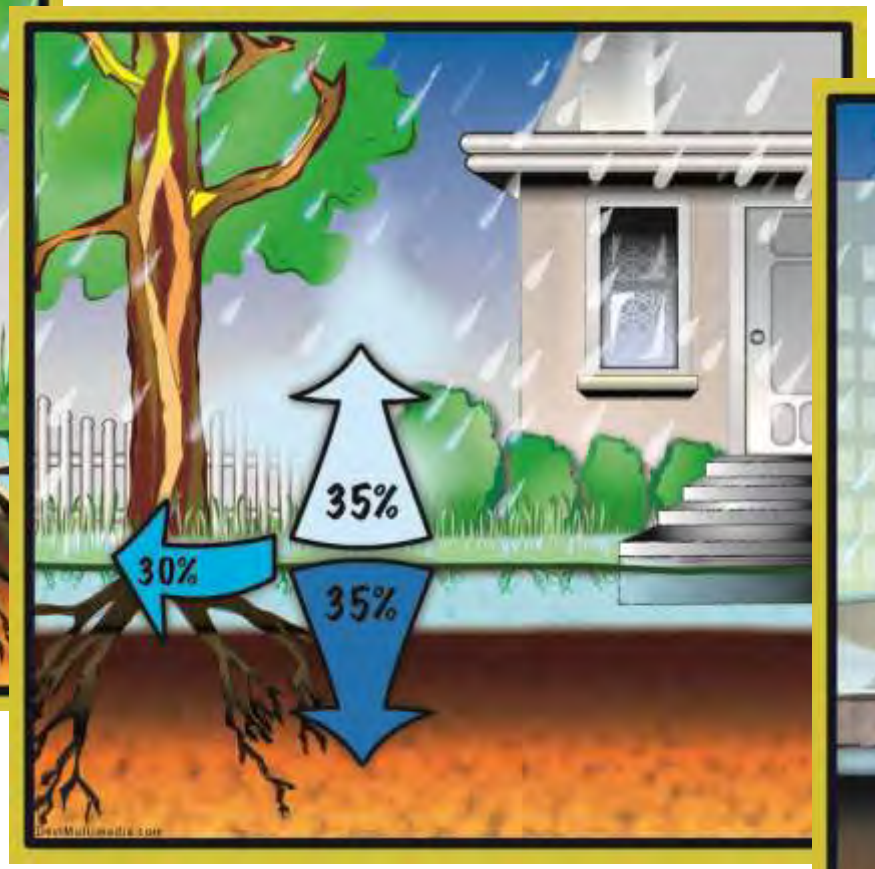
~70% of Indianapolis' drinking water

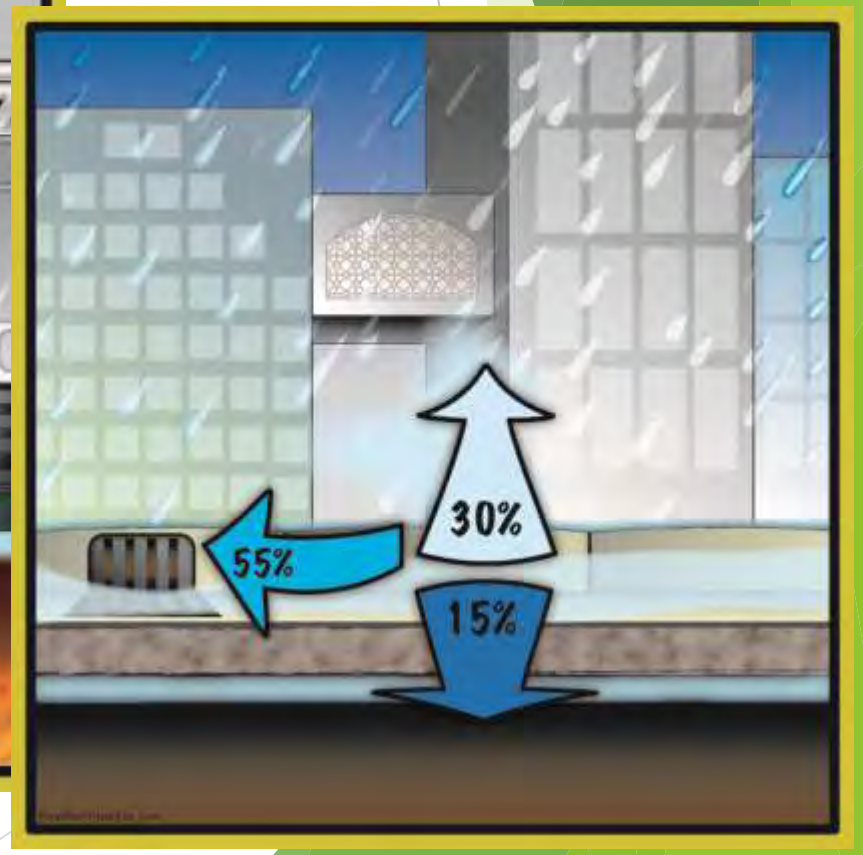
~90% of everyone else's drinking water

Impact of Development

PROBLEM # 1
Loss of a critical groundwater infiltration

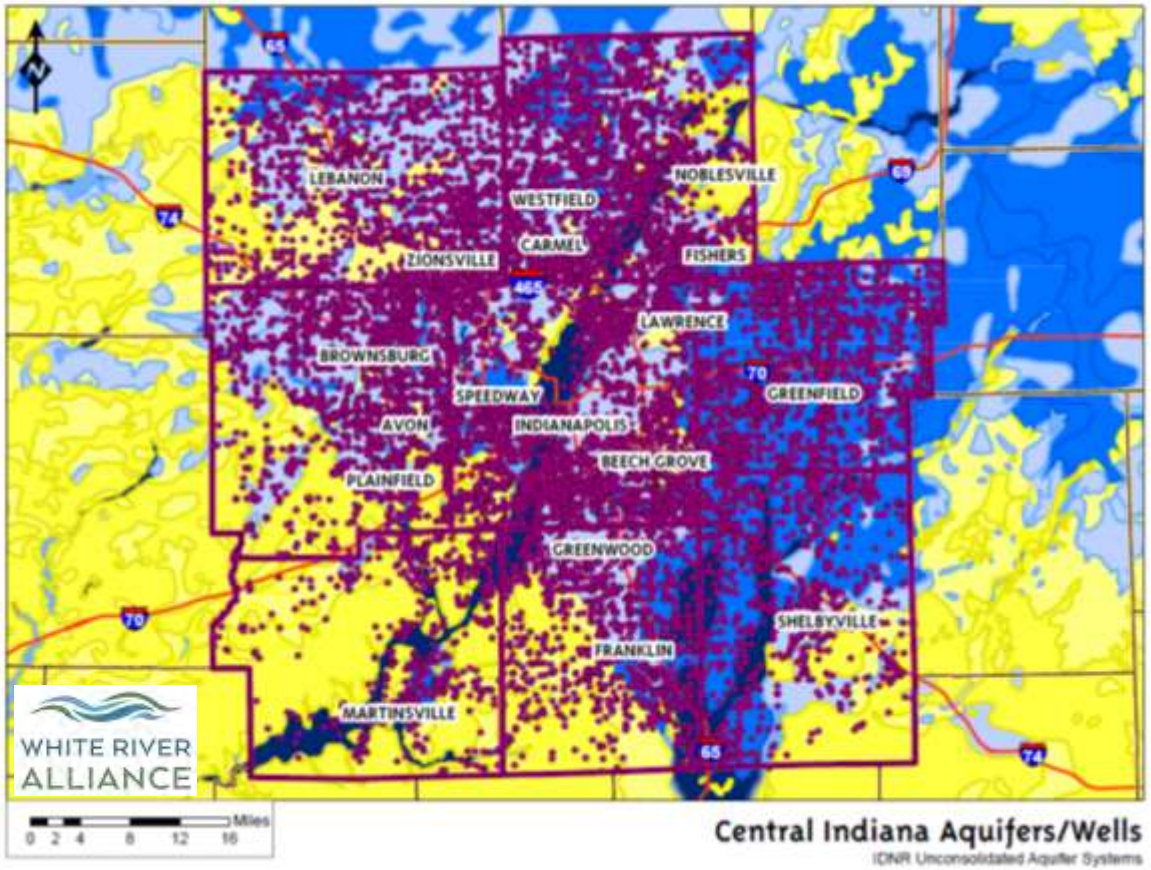






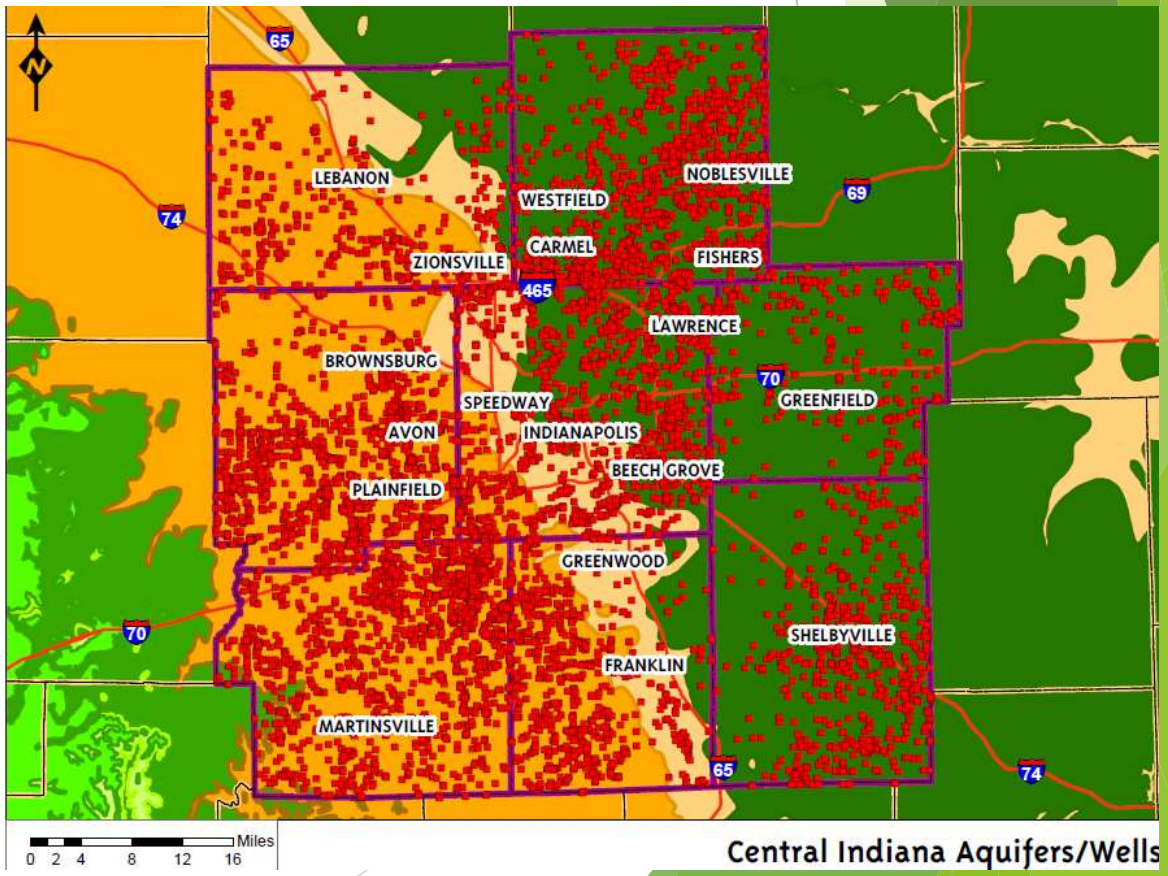
Individual and Industrial Wells Drawing on Groundwater

Shallow aquifers



Deep aquifers

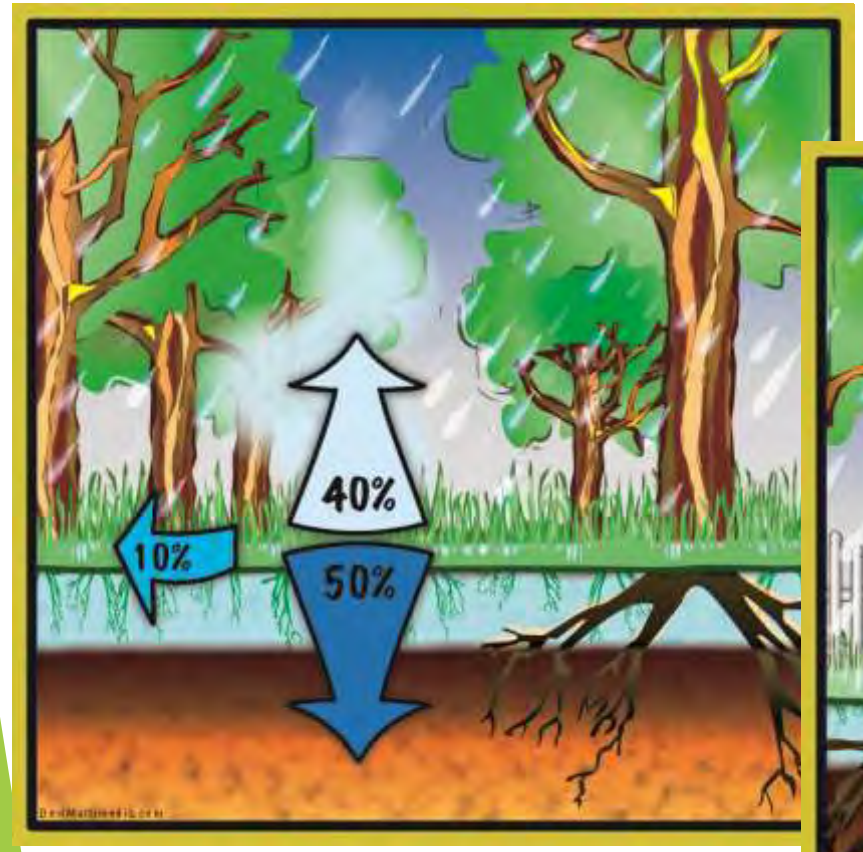
~ 70,000 wells

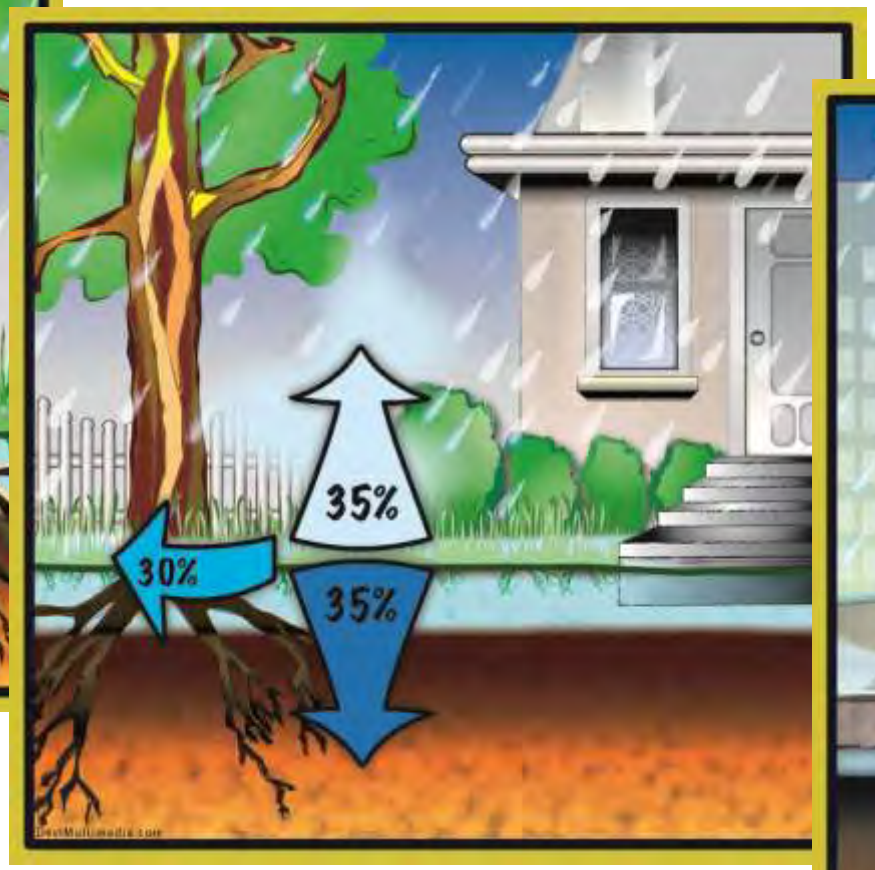


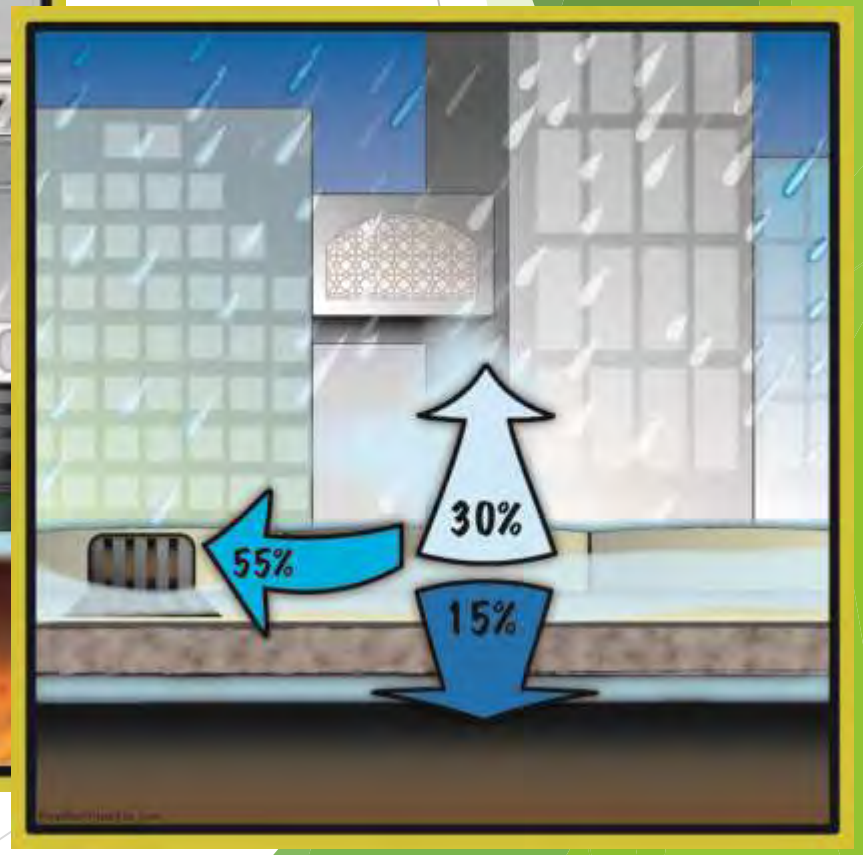
Impact of Development

PROBLEM # 1
Loss of a critical groundwater infiltration

PROBLEM #2 Increased pollution to surface water







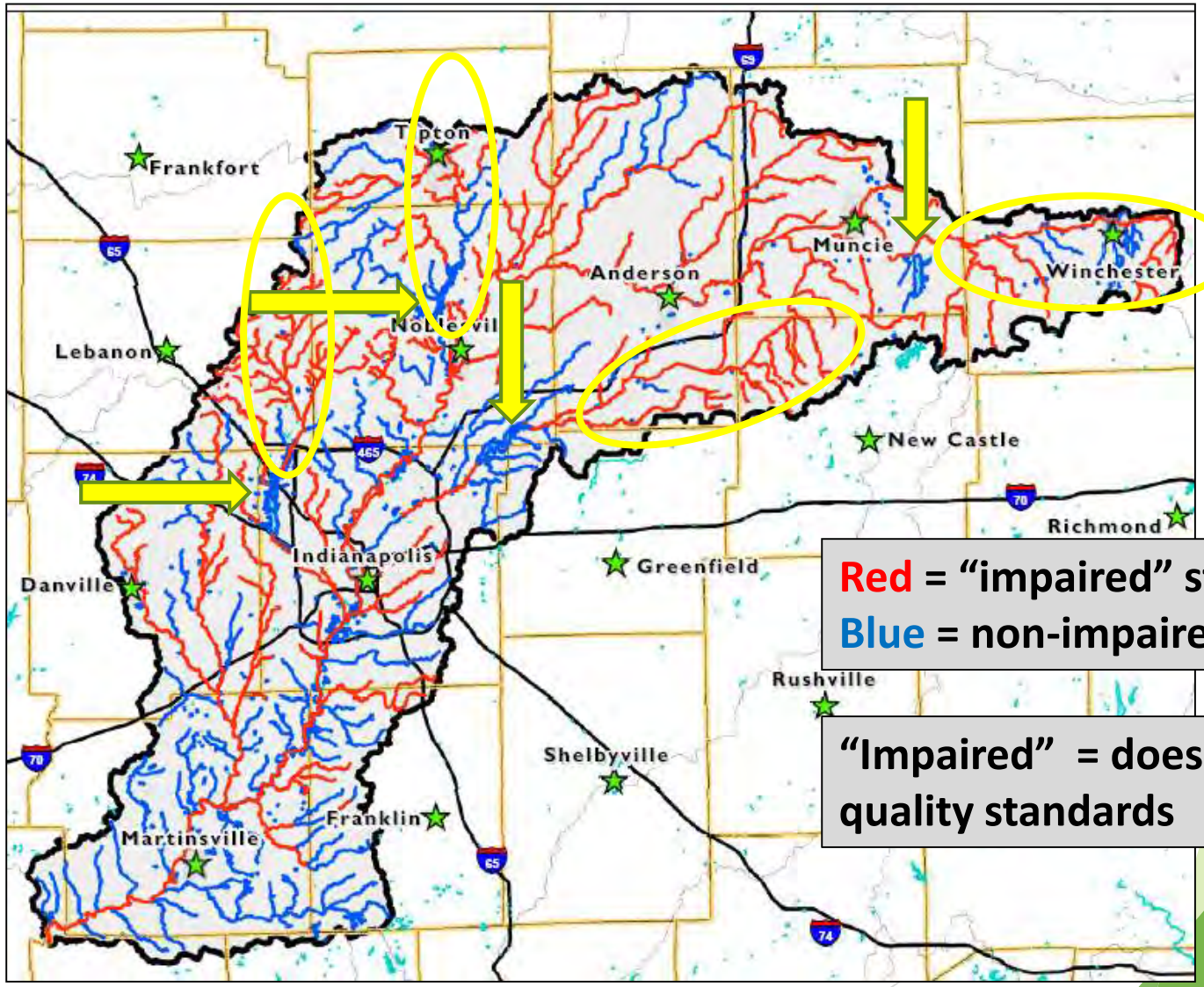
IT'S *JUST* RAIN…

1. Bacteria
2. Fertilizer
3. Pesticides
4. Sediment
5. Oils & Grease


GovBeat
Ohio's water crisis is a warning to all states
By Neena Satija, The Texas Tribune August 4
Advertisement

Water Quality Conditions & Threats

- Sediment
- Nutrients
- Bacteria & other pathogens
- Heavy metals
- Pharmaceuticals & other products
- Harmful algal blooms



Red = "impaired" streams
Blue = non-impaired or not monitored

"Impaired" = does not meet State water quality standards

Three Key Challenges

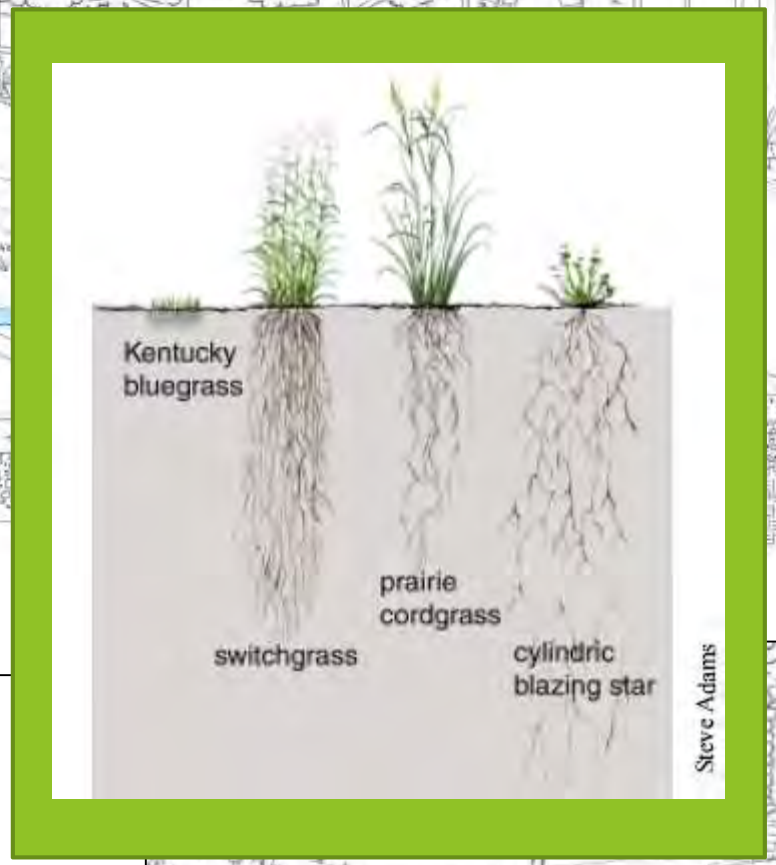
#1. Shortages are forecasted as early as 2030 without actions to the contrary

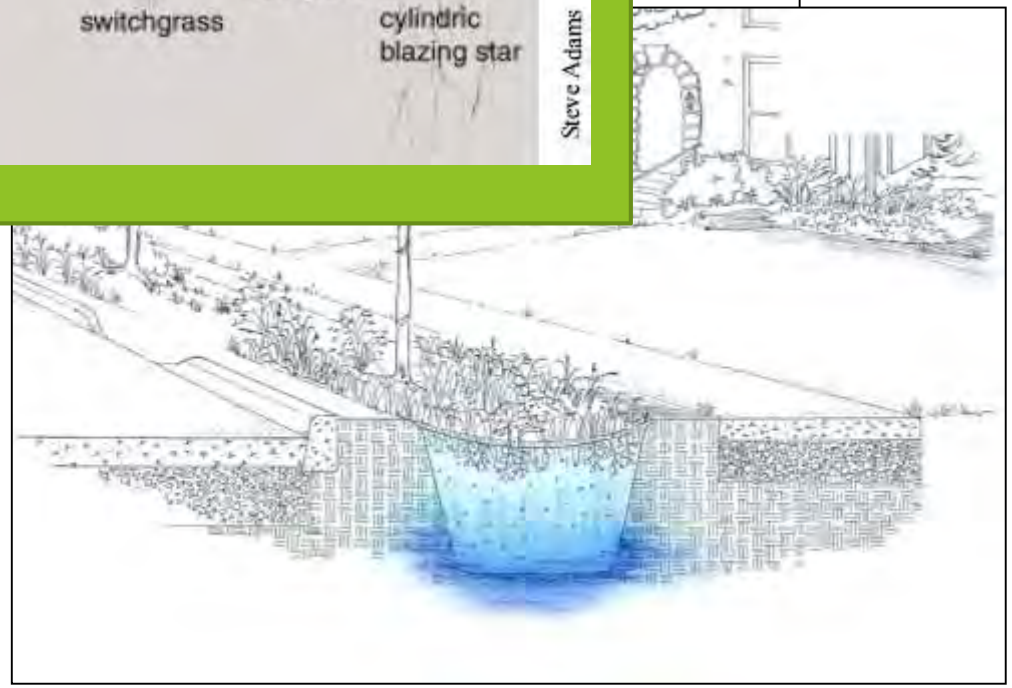
#2. Lots of people utilizing the surface water and groundwater resources with few policies protecting or coordinating them

#3. Current conditions presents risks to public health, flooding, water treatment costs, reduced supply, and recreational use limitations.

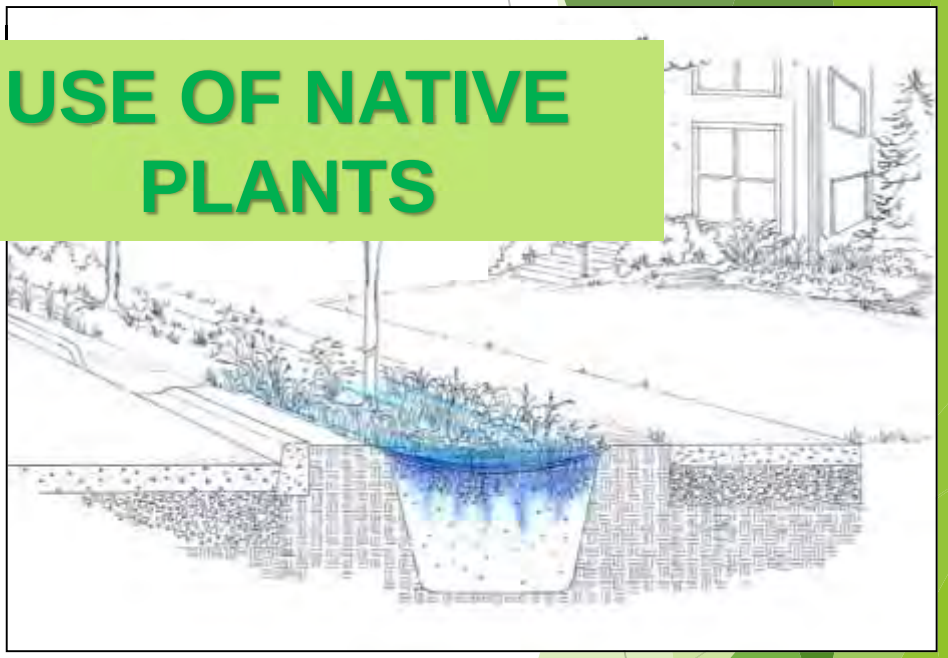
Sustainable Solutions Require Many People and Many Landscapes

Green Infrastructure





USE OF NATIVE PLANTS



Recharging Ground Water via Infiltration Practices

Sustainable Solutions Require Many People & Many Landscapes

WE NEED YOU TO DO YOUR PART…

now is the time for widespread landscape and social change!

RESOURCES FOR THE INDIVIDUAL RESIDENT

Thank You!

YOU BOUGHT A UTILITY

Maintenance, Inspection, and Regulatory Issues

Regulatory stuff

“BIG Picture” federal, state & local mandates

What is your part to be in compliance

Federal and State Regulations "Clean Water Act"

Circa 2004

New construction projects shall provide treatment to their stormwater runoff

A. Grey Infrastructure (BMP)
B. Green Infrastructure (BMP)

IDEM Requires Local Oversight

IDEM requires Cities, Towns & Counties to;

A. Map & track each BMP installed
B. Ensure routine maintenance is performed BY THE OWNER to safeguard proper function of the BMP.

IDEM

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

EPA

Who Does the Maintenance?

Maintenance, Inspection, and Regulatory Issues

Green Space & Common Areas

1. Storm water infrastructure
2. = > 2005, 2006 construction

Likely a Regulated BMP

Contact Local Stormwater Staff

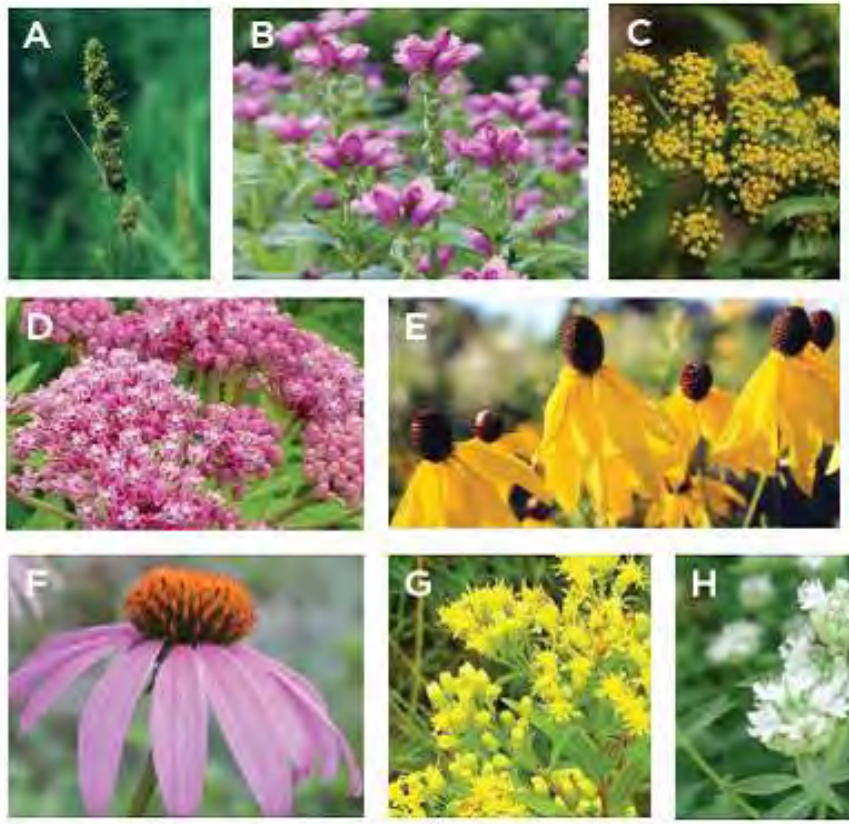
Jason Armour
Stormwater Engineer/MS4 Coordinator
City of Fishers
317-595-3461
armourjt@fishers.in.us

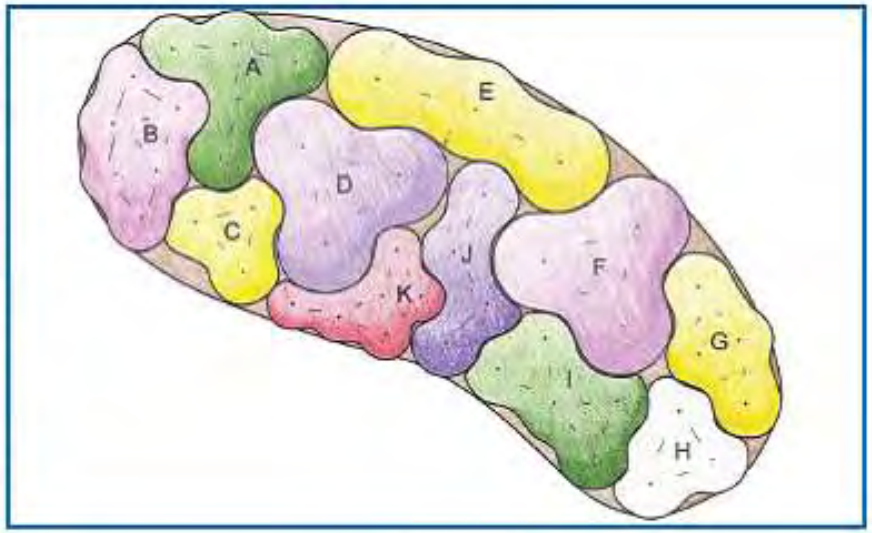
John Thomas
Storm Water Administrator
City of Carmel
317-571-2441
jthomas@carmel.in.gov

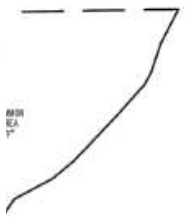
Tim Stottlemyer
MS4 Program Manager
City of Noblesville
(317) 776-6330 x 2615
Tstottlemyer@noblesville.in.us

Zionsville Street and Stormwater Department
(317) 873-4544
Stormwater@zionsville-in.gov

Green Infrastructure O&M MANUAL







Revised August 18, 2014
Revised October 22, 2014

NO SCALE

Green Infrastructure O&M MANUAL

BMP OPERATIONS AND MAINTENANCE MANUAL

NOBLE EAST
SECTION 1
NOBLESVILLE, INDIANA

Prepared for:

Boomerang Development
11911 Lakeside Drive
Fishers, IN 46038
(317) 849-7607

Schneider

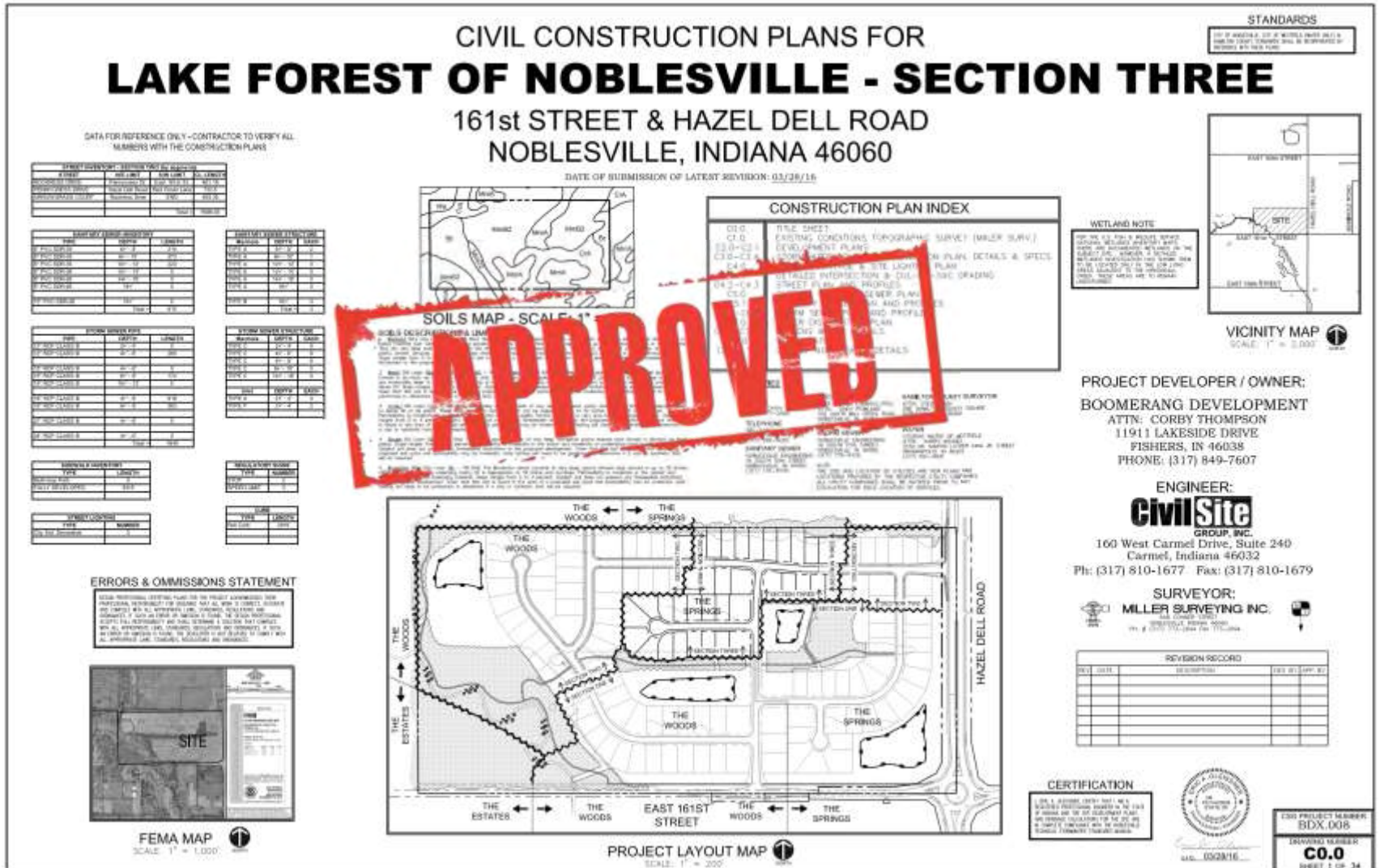
THE SCHNEIDER CORPORATION
Historic Fort Harrison
8901 Otis Avenue
Indianapolis, IN 46216-1037
317-826-7100

June 30, 2014
Revised August 18, 2014
Revised October 22, 2014

Post Construction BMP Inspection and Maintenance Program

Maintenance Item	Inspection Frequency	Maintenance
Pond Embankments and Emergency Spillways		
1) Vegetation	Annually and after major storm events	Reseed, fertilize and mow as needed. Mowing shall not blow excess clippings into the detention area. Remove invasive vegetation when it adversely affects the ability of the system to perform as a water quality control device.
2) Embankment	Annually and after major storm events	Repair erosion. Contact an engineer if leaks or seeps are noted on the embankment or abutments. Contact an engineer if bulging, sliding or cracking is noted.
3) Animal burrows	Annually	Remove animals and fill burrows when it adversely affects the ability of the system to perform as a water quality control device.
4) Under Drains	Annually	Clear blockages if any.
5) Emergency spillway	Annually	Remove obstructions. Repair erosion.
Outfall Pipe and Principal spillway		
Type: Reinforced concrete		
1) Outfall concrete end section	Annually and after major storm events	Remove blockage, debris, and sediment that collects in front of trash racks and end sections.
Treatment Areas		
1) Wet Detention	Monthly	Remove collected debris as needed. Remove sediment from retention area when it adversely affects the ability of the system to perform as a water quality and storm water runoff control device. For example, remove sediment in ponds when pond depths are 6 feet or less (designed pond depth is 8 feet).
Rip-Rap		
1) Rip-Rap	Semi-Annually and after major storm events	Remove collected debris and any vegetation in rip rap. Replace any rip rap that has been lost.

Green Infrastructure approved construction plans



Detention Pond Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Embankment and emergency spillway		
Healthy vegetation with at least 85% ground cover.		
No signs of erosion on embankment.		
No animal burrows.		
Embankment is free of cracking, bulging, or sliding.		
Embankment is free of woody vegetation.		
Embankment is free of leaks or seeps		
Emergency spillway is clear of obstructions.		
Vertical/horizontal alignment of top of dam "As-Built"		
2. Riser and principal spillway		
Low flow outlet free of obstruction.		
Trash rack is not blocked or damaged.		
Riser is free of excessive sediment buildup		
Outlet pipe is in good condition.		
Control valve is operational		
Outfall channels are stable and free of scouring.		

Green Infrastructure INSPECTIONS

Post-Construction BMP Inspection Checklist Detention pond

Detention Pond Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Embankment and emergency spillway		
Healthy vegetation with at least 85% ground cover.		
No signs of erosion on embankment.		
No animal burrows.		
Embankment is free of cracking, bulging, or sliding.		
Embankment is free of woody vegetation.		
Embankment is free of leaks or seeps		
Emergency spillway is clear of obstructions.		
Vertical/horizontal alignment of top of dam "As-Built"		
2. Riser and principal spillway		
Low flow outlet free of obstruction.		
Trash rack is not blocked or damaged.		
Riser is free of excessive sediment buildup		
Outlet pipe is in good condition.		
Control valve is operational		
Outfall channels are stable and free of scouring.		

- Identify items that are Unsatisfactory or Marginal
- Schedule appropriate maintenance or corrective action for unsatisfactory
- Re-Inspect and Document that the BMP is back in compliance
- Submit Annual Reports to Local Jurisdiction

QUESTIONS?

NEXT PRESENTATIONS

Gavin Merriman

Traditional Stormwater Infrastructure

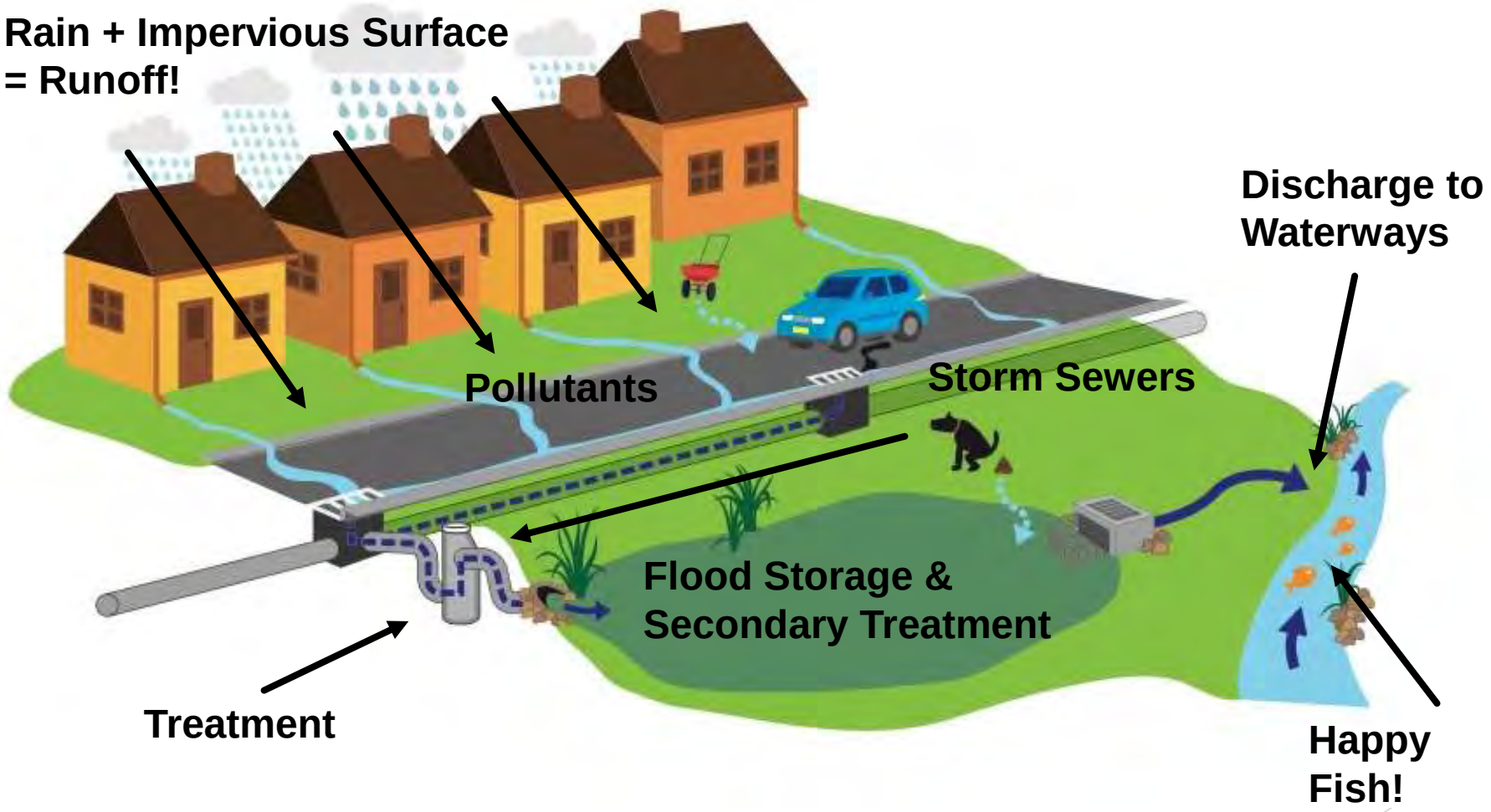
John Thomas

Green Infrastructure

TRADITIONAL STORMWATER MANAGEMENT

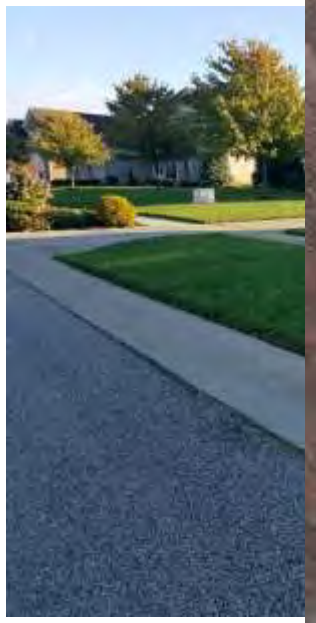
Gray Infrastructure = Pipes & Ponds

PIPES TO POND – HOW IT WORKS



PIPES TO POND – HOW IT WORKS

PIPES TO P
PUTTING T



PIPES TO POND – SWALES

Ponds – Wet and Dry

NOT ALL PONDS ARE BMPS

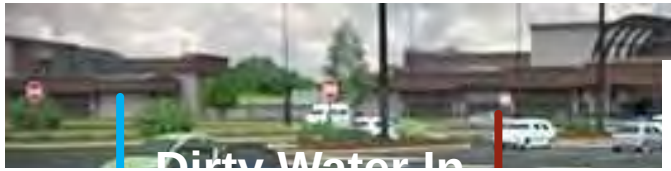
FOREBAYS AND SEDIMENT PRETREATMENT

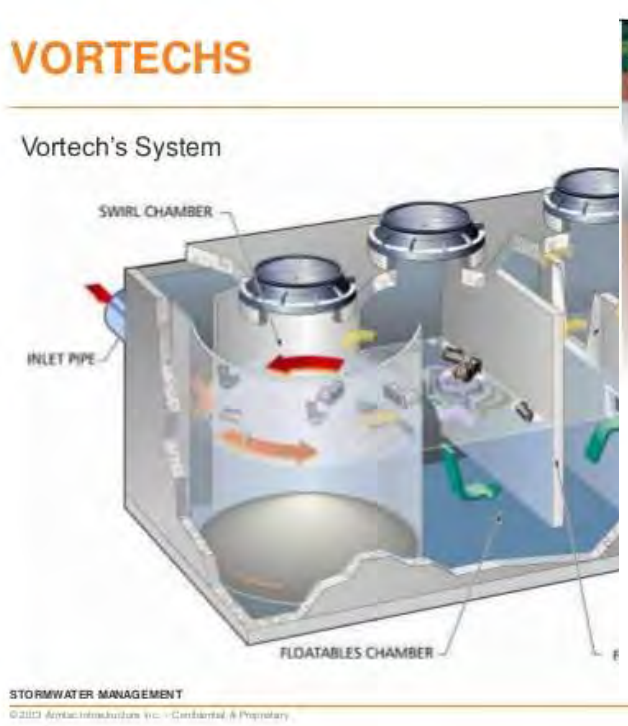
PIPES TO POND: COMMON MAINTENANCE ISSUES

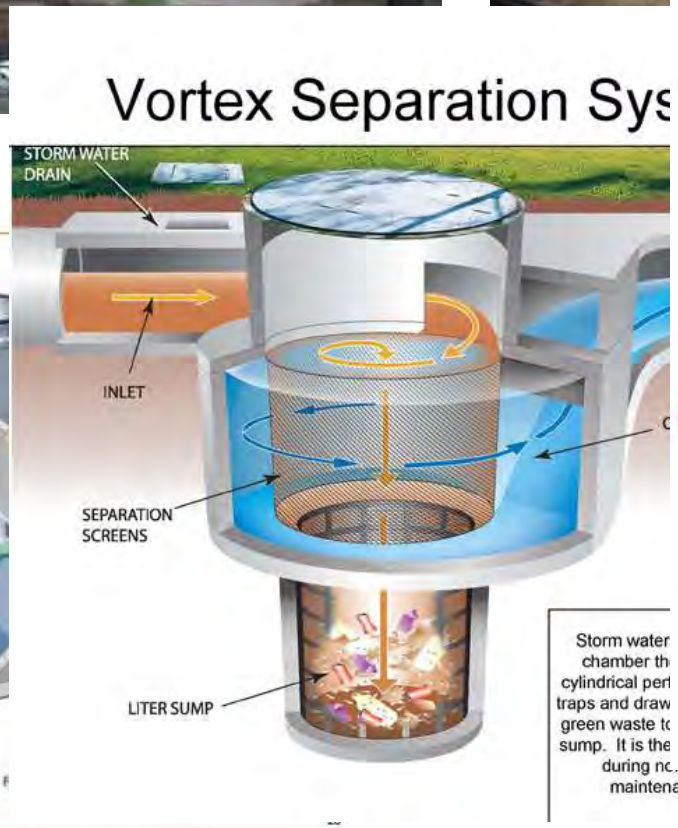
MAINTENANCE

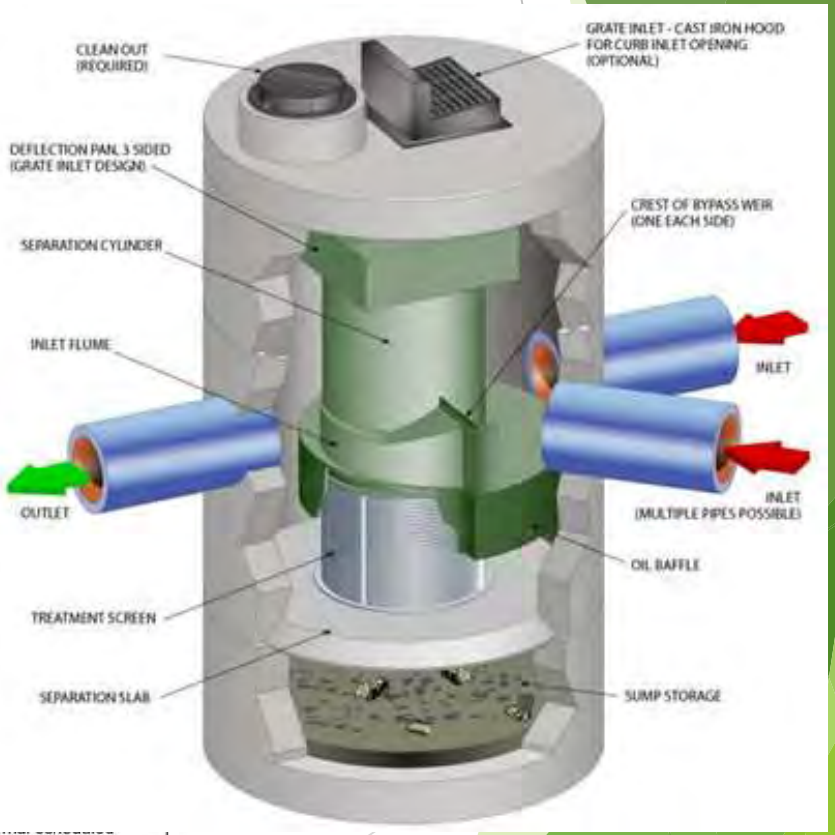
- Weeds and algae
- Bank erosion
- Sedimentation

PIPES TO POND – MECHANICAL UNITS









PIPES TO POND – MECHANICAL UNITS

PIPES TO POND:
MECHANICAL UNIT INSPECTION

PIPES TO POND: MECHANICAL UNIT INSPECTION

PIPES TO POND:
MECHANICAL UNIT REPAIR

NON-TRADITIONAL STORMWATER MANAGEMENT

Green Infrastructure = Plants & Pervious Surfaces

TYPES OF GREEN INFRASTRUCTURE

- Naturalized Detention Basins / Swales
- Naturalized Buffers
- Infiltration Trenches
- Permeable Pavement and Pavers

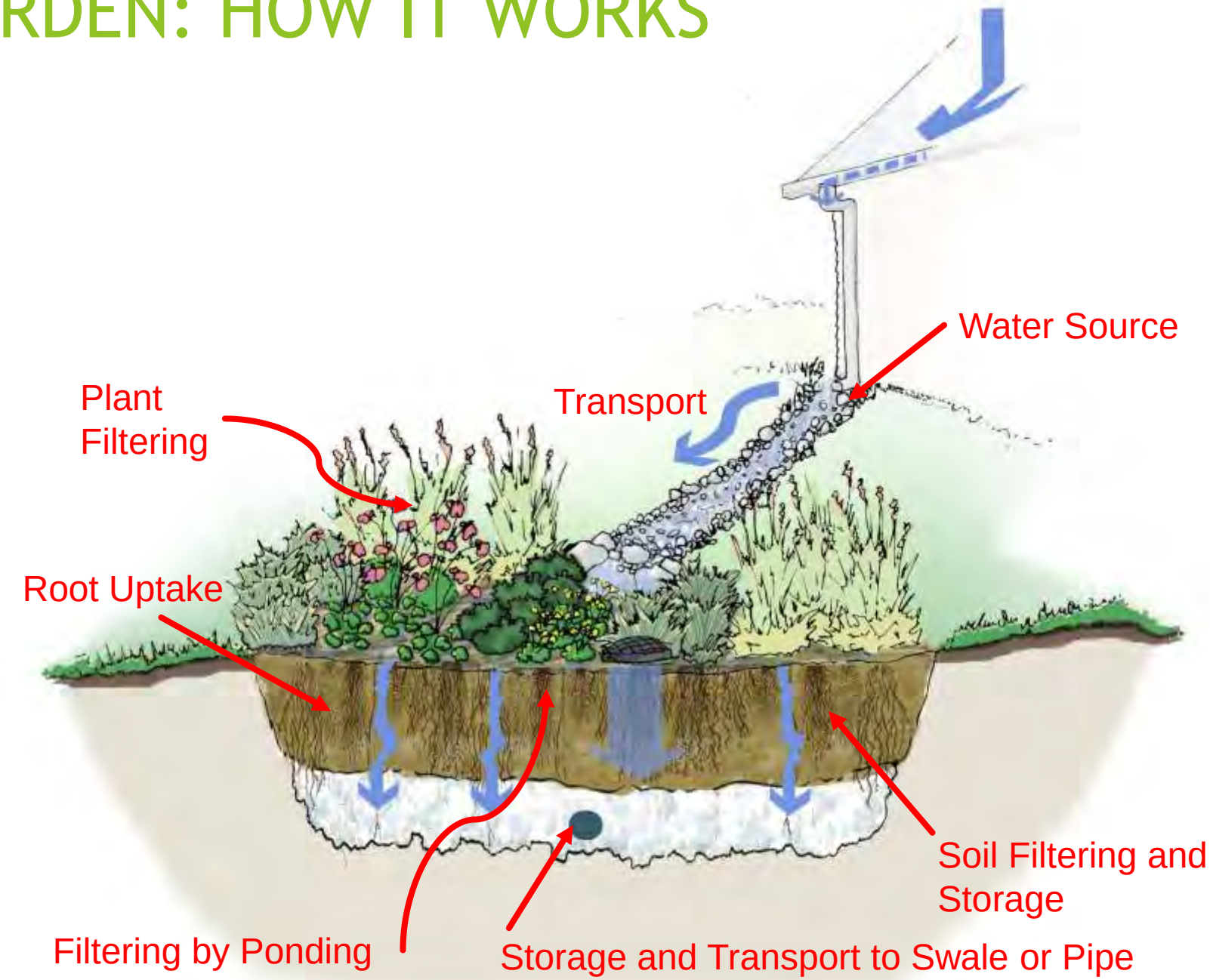
NATURALIZED DETENTION BASINS

- RAIN GARDENS
  - Smaller basins used often on residential lots or park settings
- BIO-RETENTION
  - Larger basins used in large commercial and residential developments as the main storage and treatment practice for the development
- BIO-SWALES
  - Designed and constructed drainage flow paths along roadways or through properties that treat and transport rain runoff

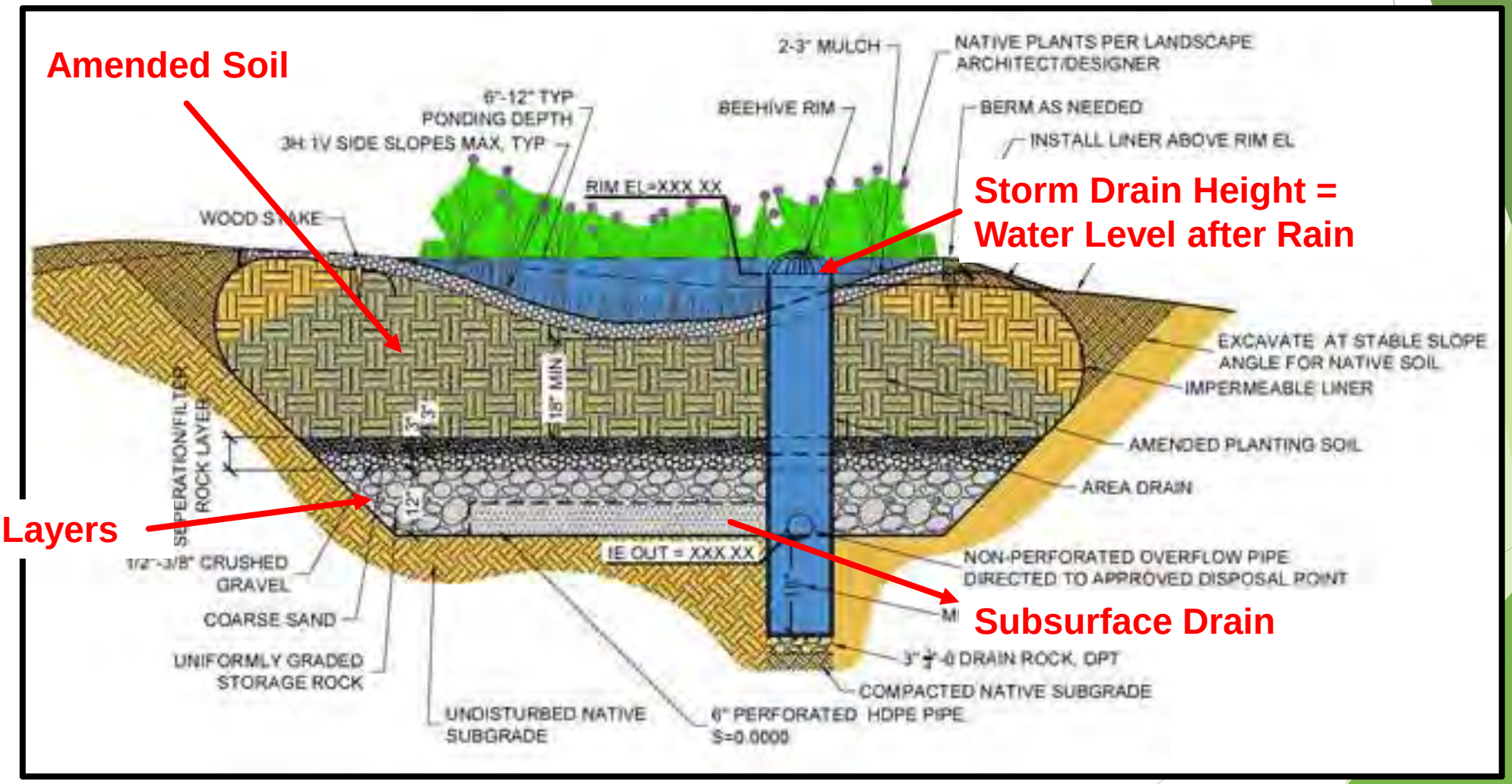
RAIN GARDENS

RAIN GARDEN: HOW IT WORKS

Primary Function: Treatment and Storage



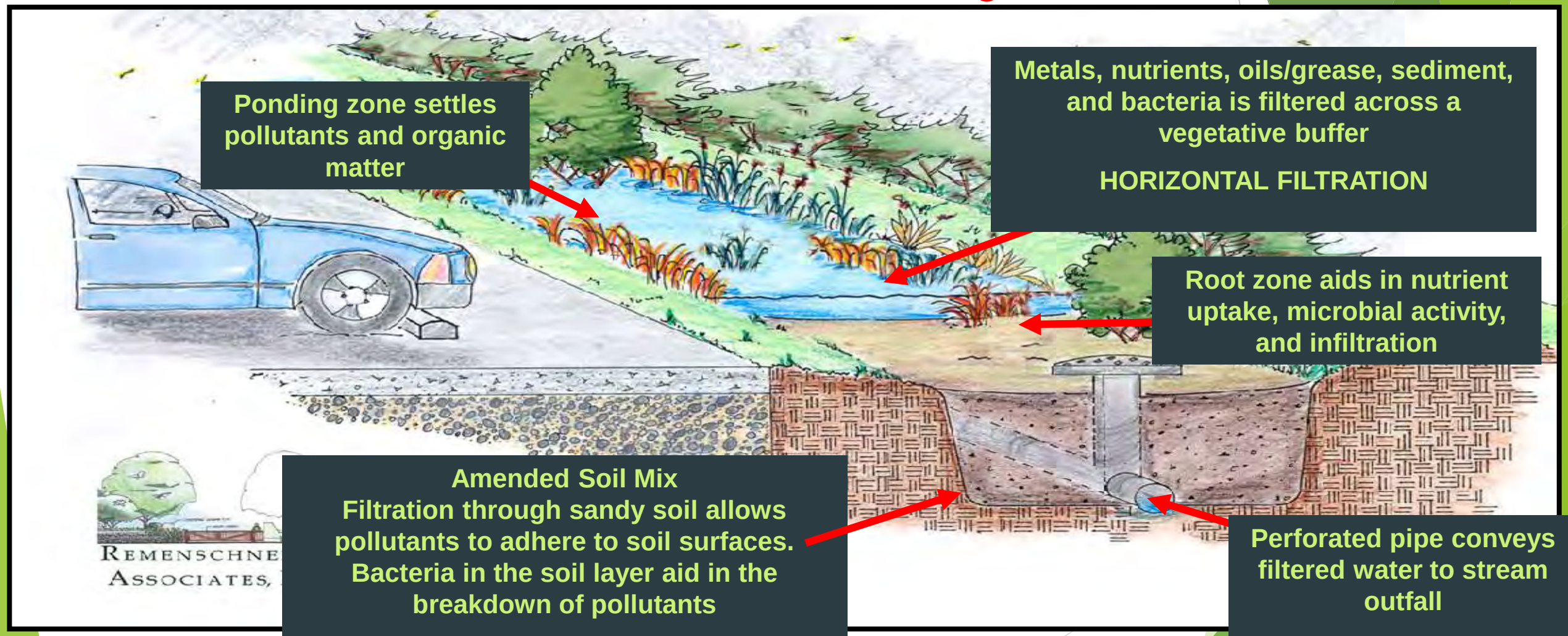
RAIN GARDEN SIDE VIEW



BIORETENTION

BIORETENTION: HOW IT WORKS

Primary Function: Treatment and Storage



Ponding zone settles pollutants and organic matter

Metals, nutrients, oils/grease, sediment, and bacteria is filtered across a vegetative buffer

HORIZONTAL FILTRATION

Root zone aids in nutrient uptake, microbial activity, and infiltration

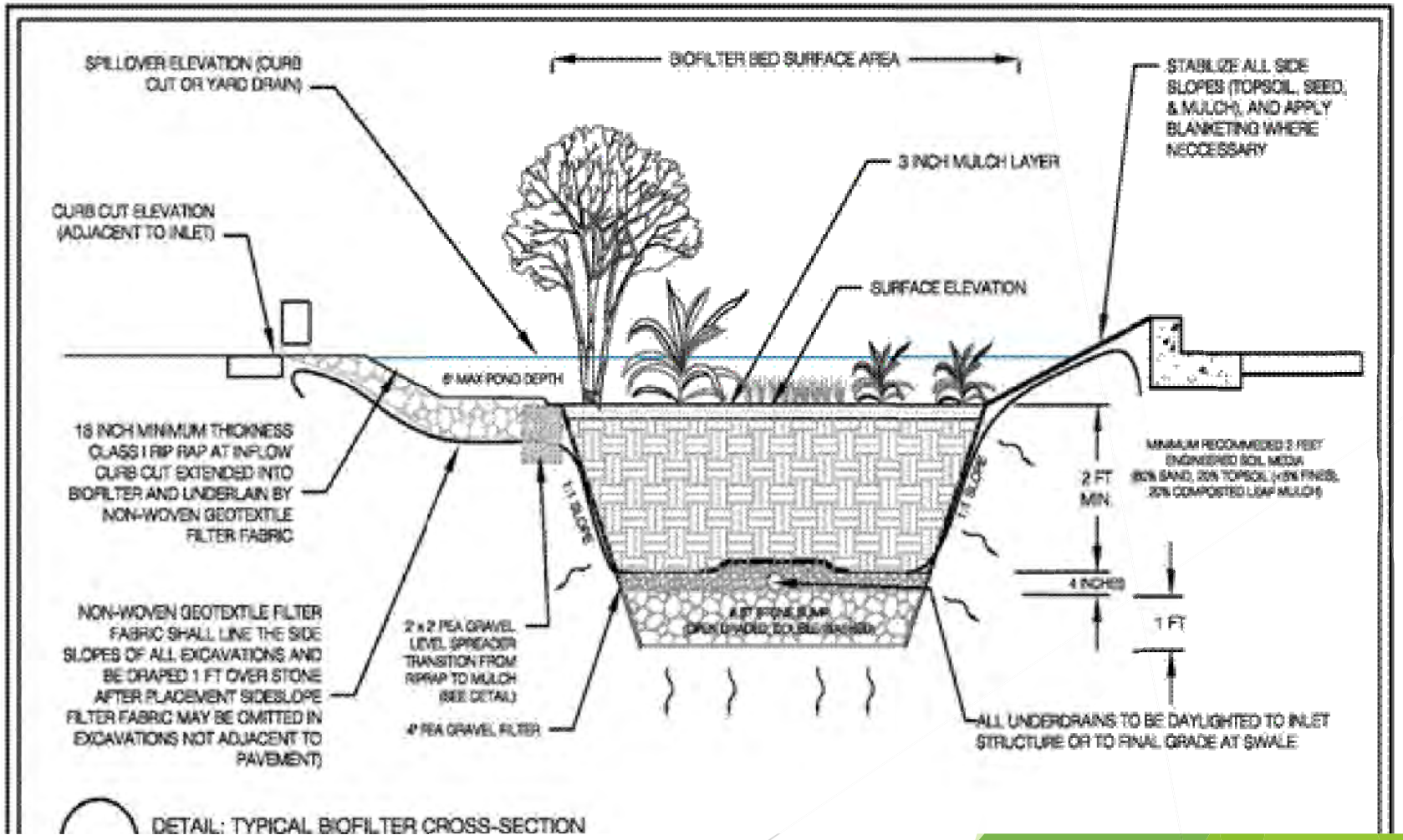
Amended Soil Mix
Filtration through sandy soil allows pollutants to adhere to soil surfaces. Bacteria in the soil layer aid in the breakdown of pollutants

VERTICAL FILTRATION

Perforated pipe conveys filtered water to stream outfall

BIORETENTION SIDE VIEW

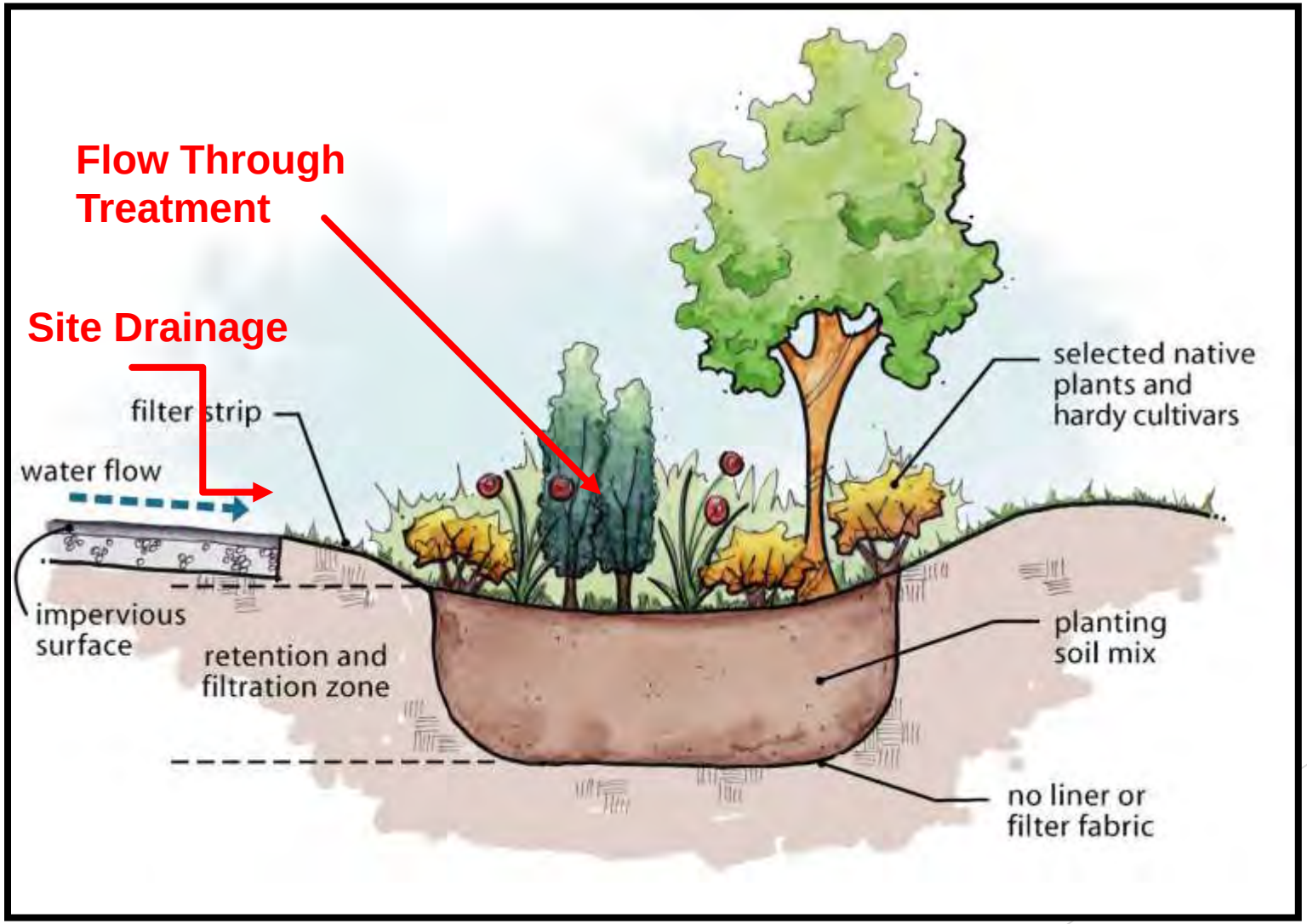
- **Construction Plans / O& M Manual Details**
  - **Provide these details to maintenance Contractors for guidance**



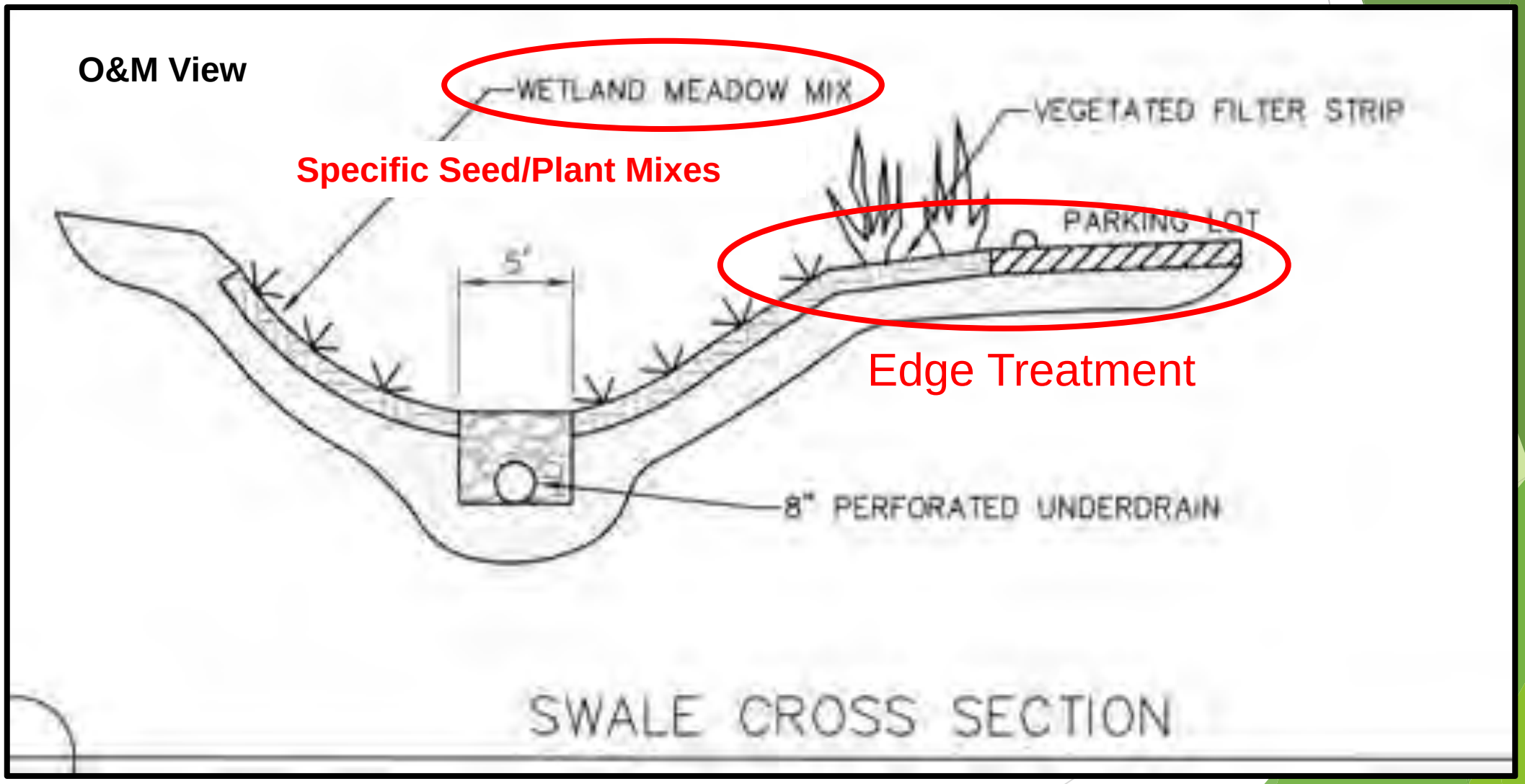
BIOSWALES IN THE LANDSCAPE

BIOSWALES: HOW IT WORKS

Primary Functions: Treatment and Flow Conveyance



BIOSWALE SIDE VIEW

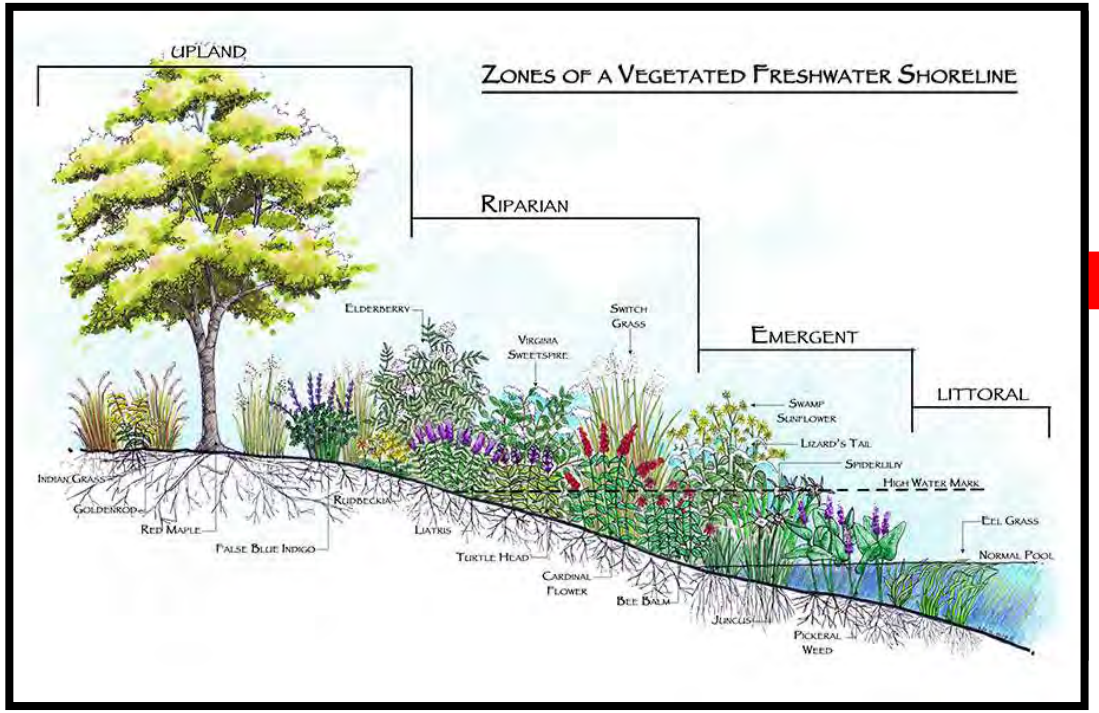


Naturalized Basin Maintenance

- **Vegetation Management**
  - Invasive Species
  - Replant
  - Planting Zones
  - Remove excess organic matter
  - Trash
- **Sediment Buildup - Fix Cause**
  - Basin Erosion
  - Drainage Area Inputs
  - Upstream BMP needs maintenance

- **Excessive Ponding - Standing Water for more than 4 or 5 days**
  - Sedimentation – Clay
  - Amended Soil Issue
  - Compaction
  - Clogging - Subsurface Drain/Underdrain/French Drain
    - Access from clean out or outlet structure
  - High/Low Spots
  - Blocked Outlet
  - Filter Fabric

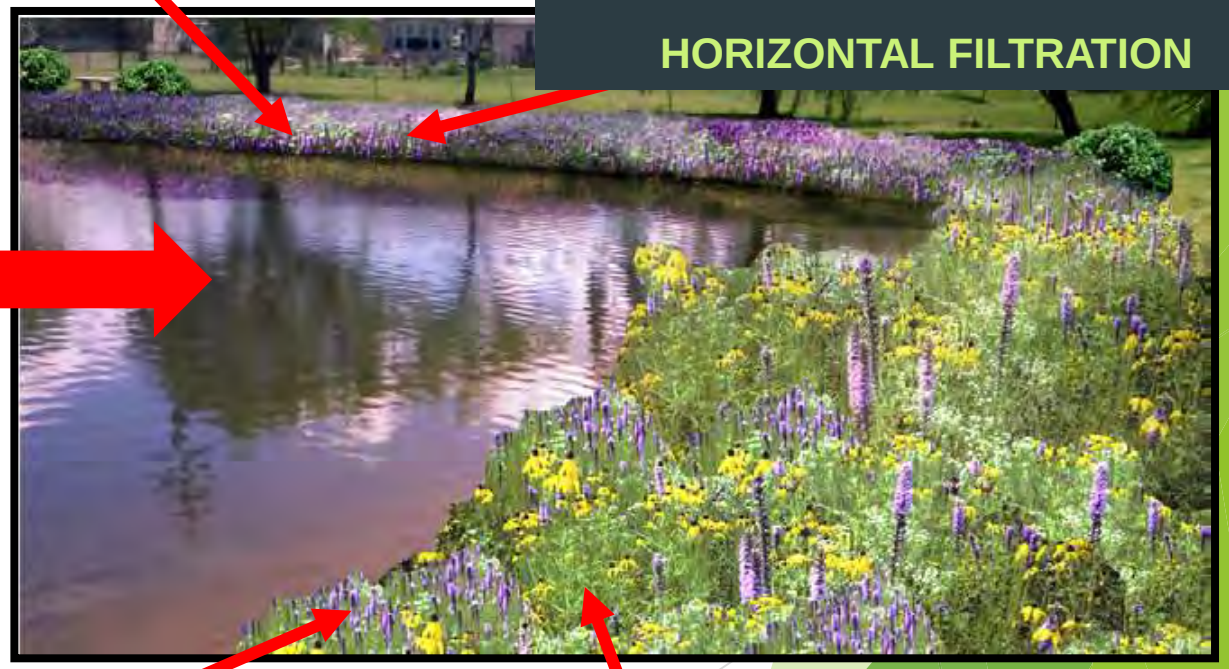
NATURALIZED BUFFERS: HOW THEY WORK



Shoreline protected with deep roots and reduced wave action

Metals, nutrients, oils/grease, sediment, and bacteria is filtered across a vegetative buffer

HORIZONTAL FILTRATION

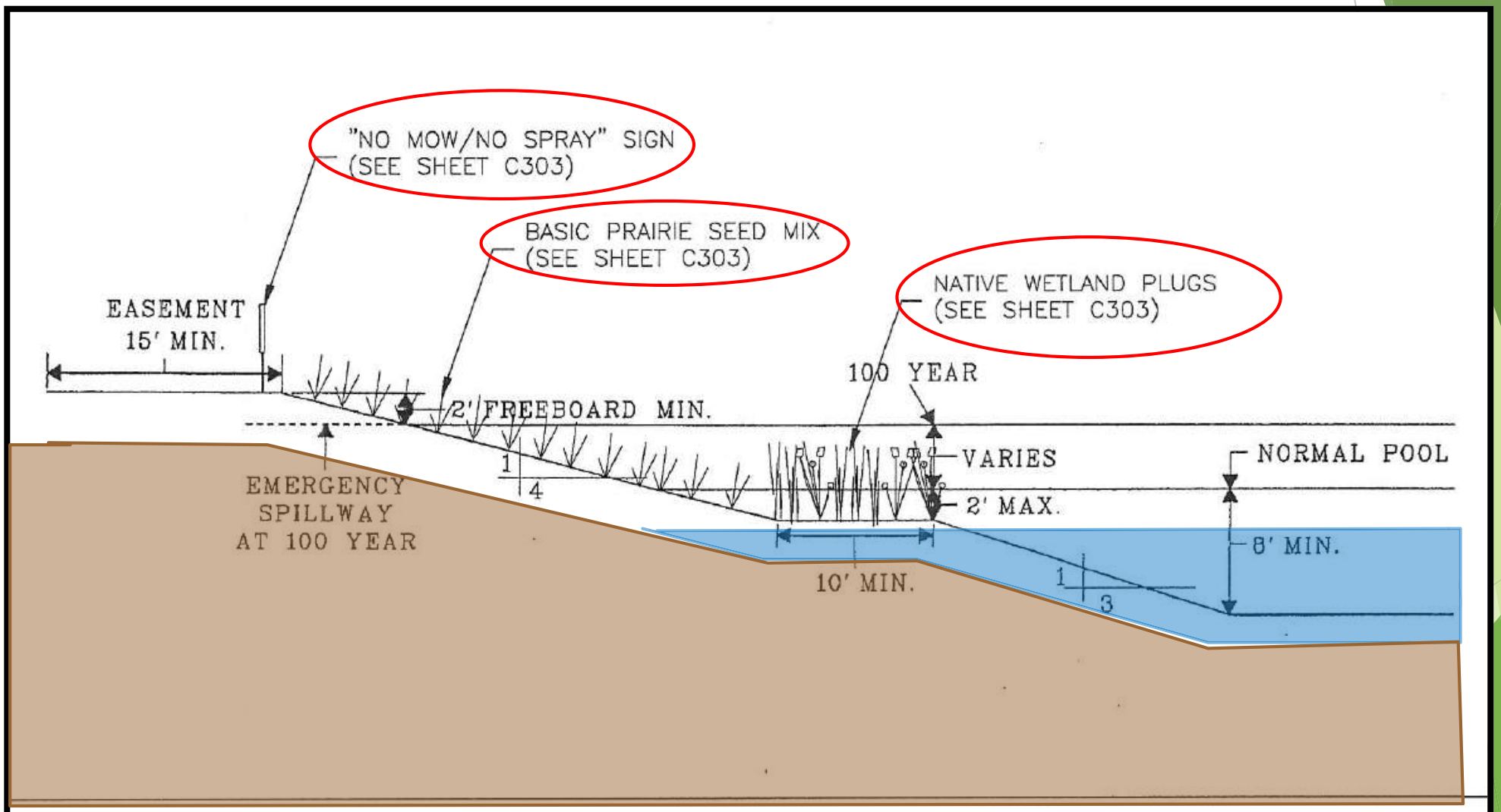


Rough edge deters geese (plays on fear of predators)

Root zone aids in nutrient uptake, microbial activity, and infiltration

NATURALIZED BUFFERS IN THE LANDSCAPE: PONDS & STREAM BANKS

NATURALIZED BUFFER STANDARDS



POST CONSTRUCTION BMP PLANTINGS

NATURALIZED BUFFER PROTECTION

NATURALIZED BUFFER MAINTENANCE

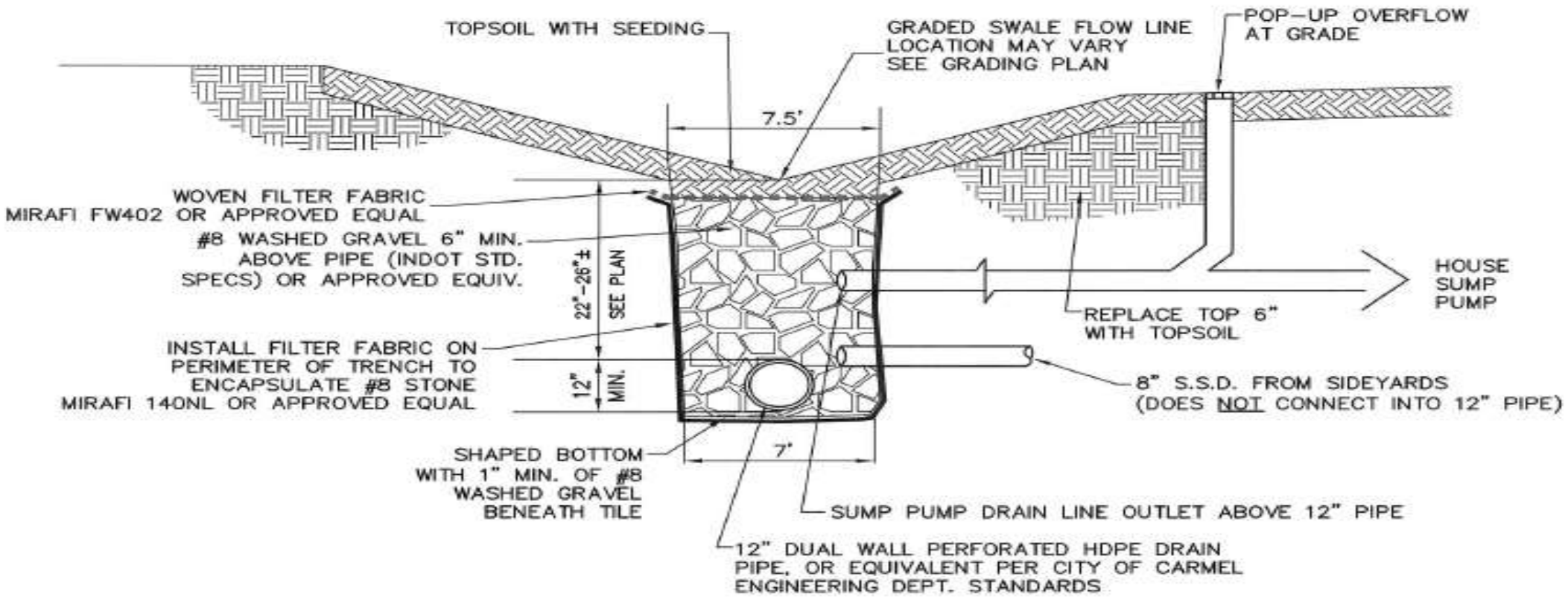
- Remove weeds throughout year
- Mow once per year or prescribed burn
  - Mowing in Spring allows for wildlife habitat through winter
  - Remove cuttings from pond area
  - Make sure mowers are side discharging up the bank
  - Coordinate burn with local fire department

- Ensure protection signage is in place and legible
- Repair erosion spots
- Cattail removal
  - Hand pulling, Rake, Mowing / Cutting, Dredging, Flooding / Freezing

Infiltration Trenches

- Think of a BIG French Drain / Dry Well
  - Large Excavation filled with stone
  - Exposed or Covered

INFILTRATION TRENCH: HOW IT WORKS



Infiltration Trench

INFILTRATION TRENCH

INFILTRATION TRENCH

- Home Connections
  - Sump
  - Roof
  - Area Inlets
  - Cleanouts

O&M MANUAL

Shoshone Drive Residential Redevelopment

SE Corner of Shoshone Drive & Oswego Road
Carmel, Indiana 46032

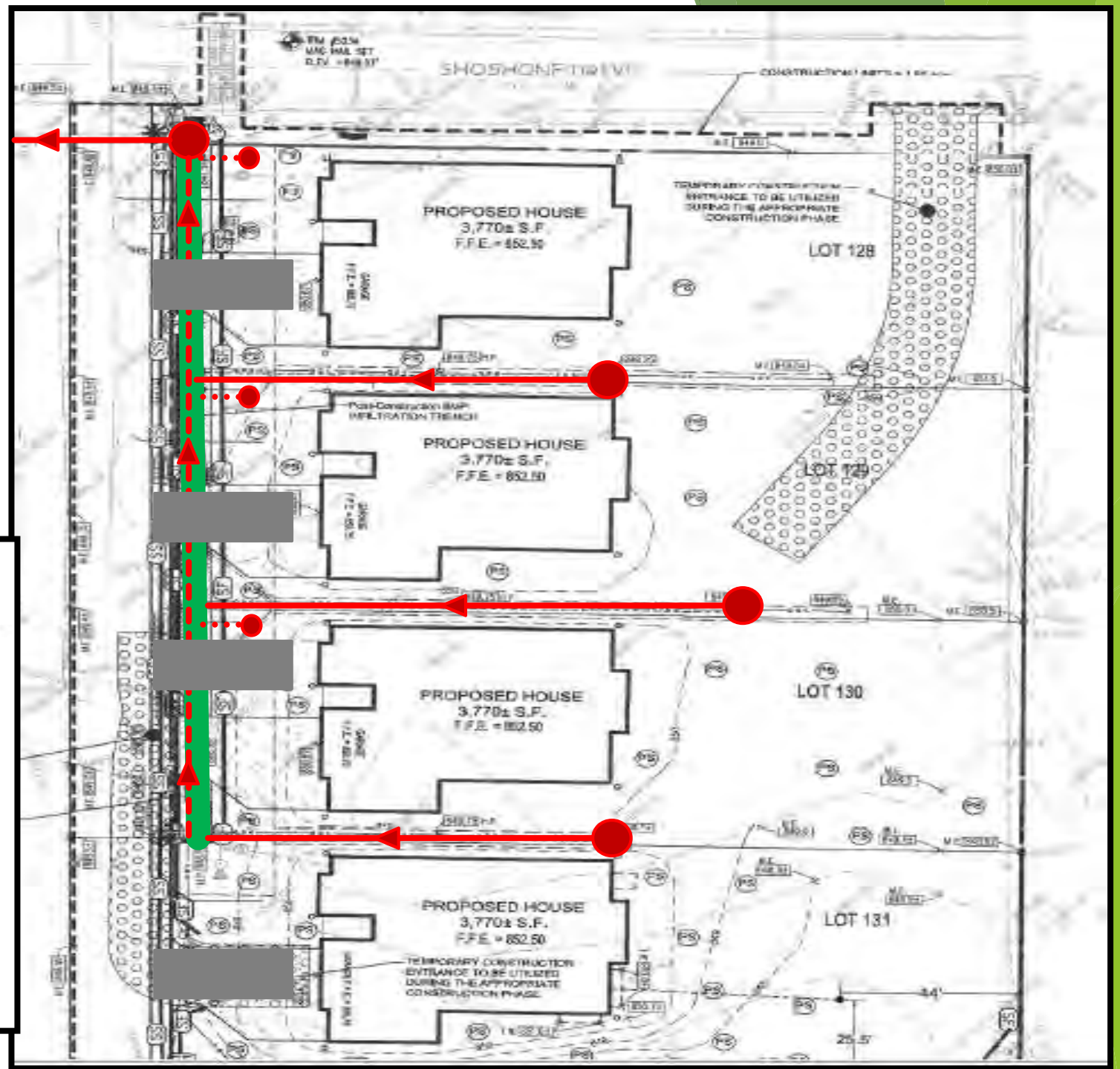
Job #: 08L-001

Date: 10/24/17
Revised: 04/18/17
Revised: 05/03/17
Revised: 05/22/17

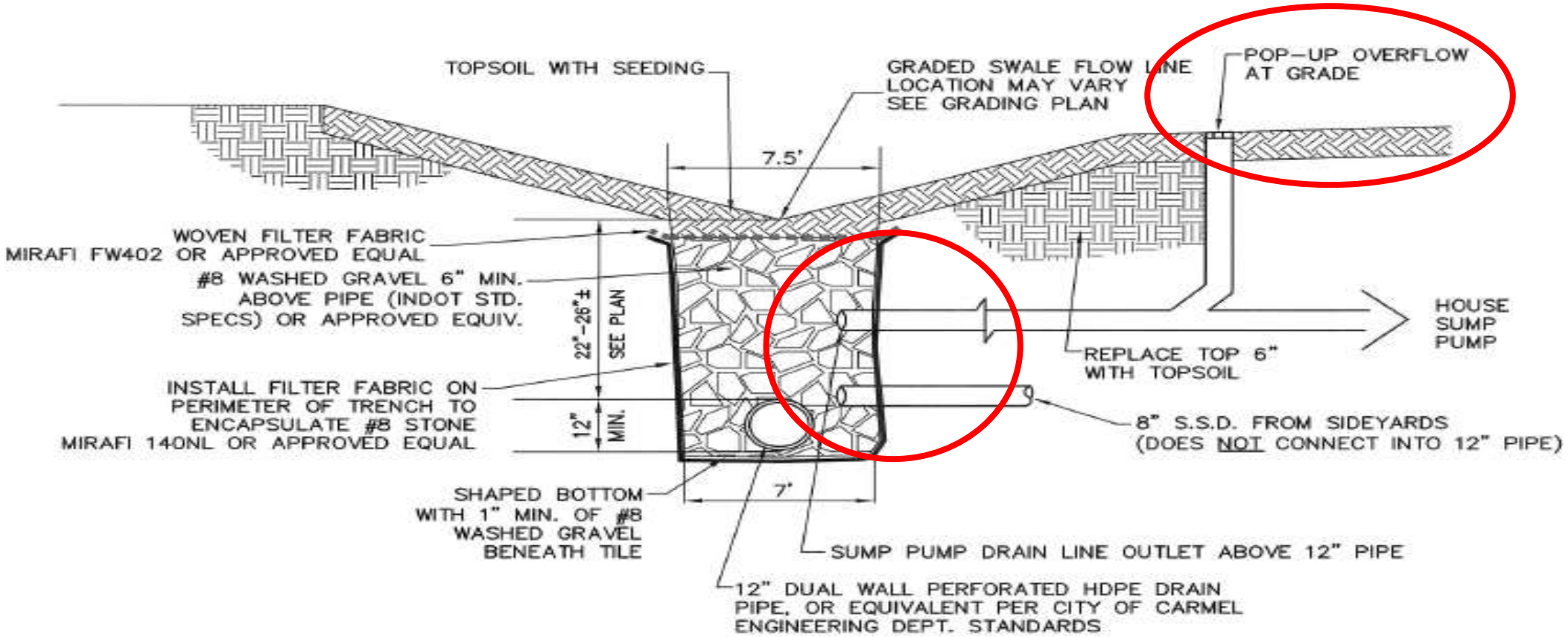
Prepared by: Kyle Blanck
Reviewed by: Brian Cross, P.E.

CivilSite

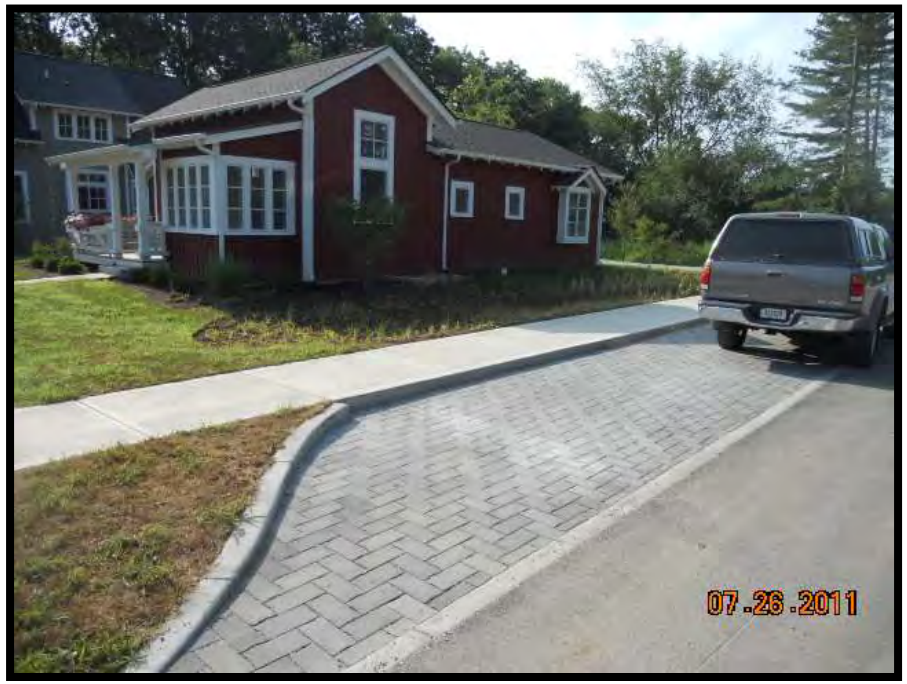
140 West Carmel Drive
Suite 240
Carmel, IN 46032
Phone: 317-810-1877 Fax: 317-810-1879



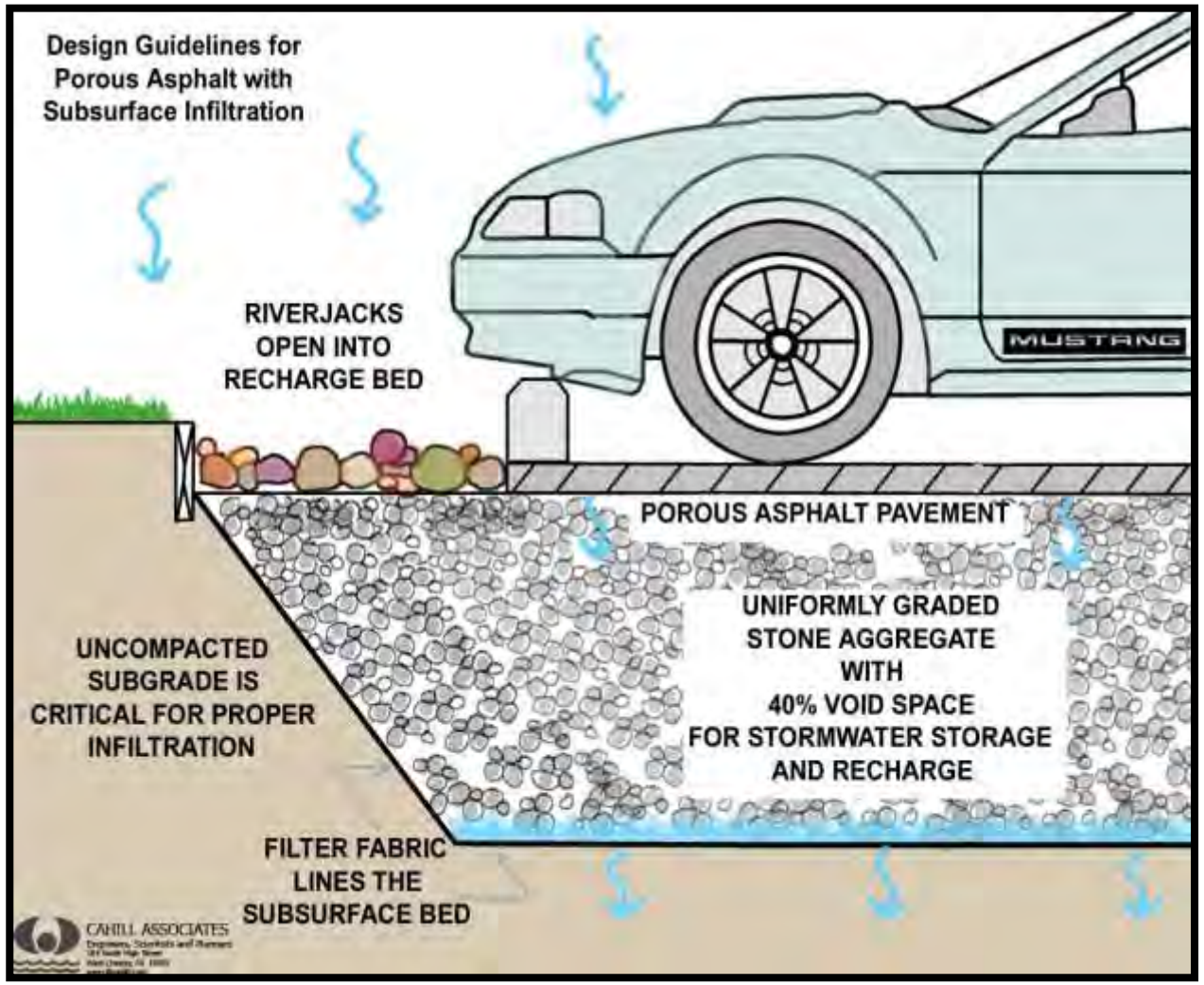
INFILTRATION TRENCH



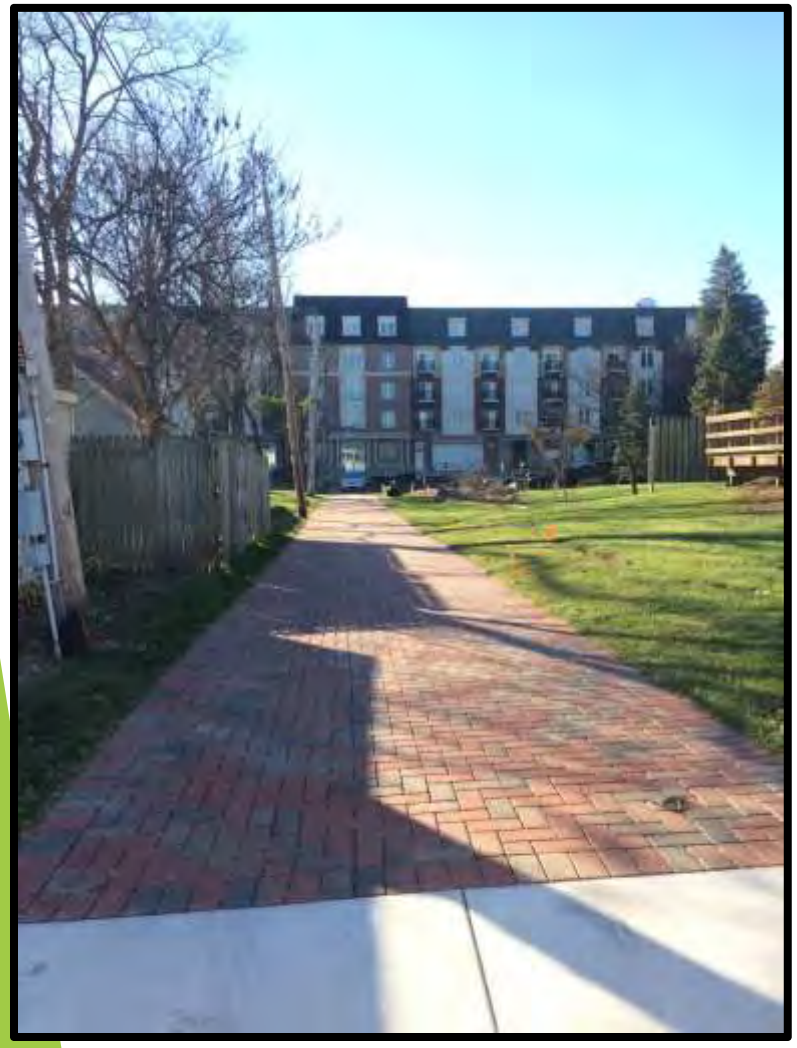
PERVIOUS MATERIALS

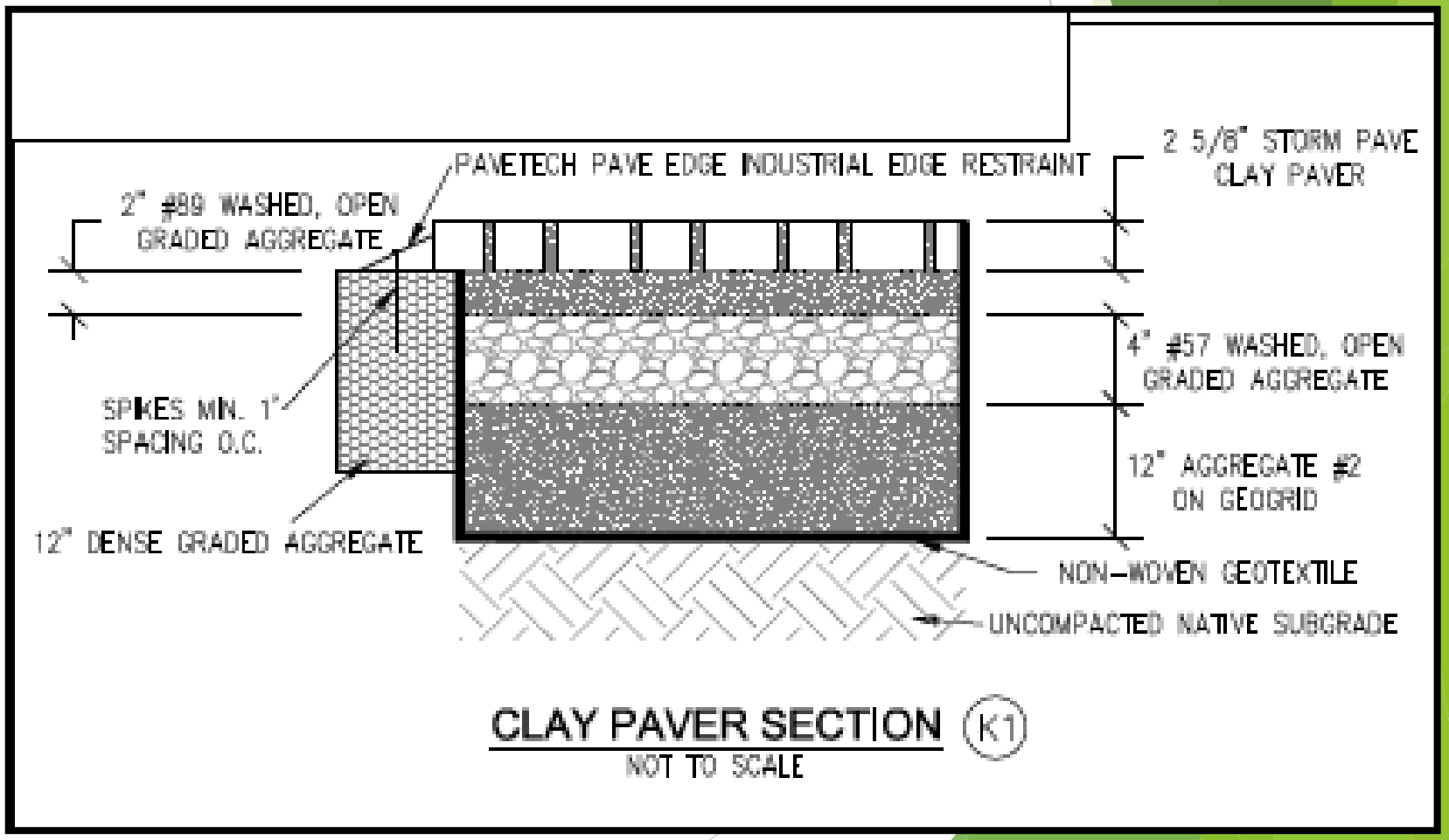


PERVIOUS MATERIALS: HOW THEY WORK



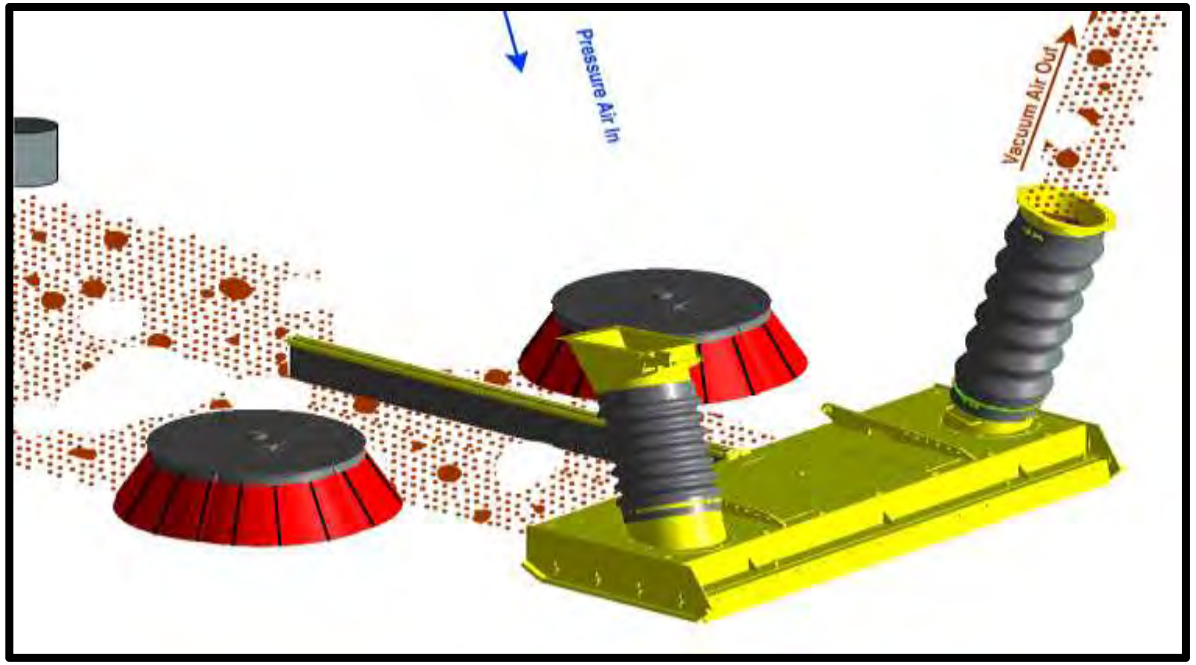
PERVIOUS MATERIALS STANDARDS

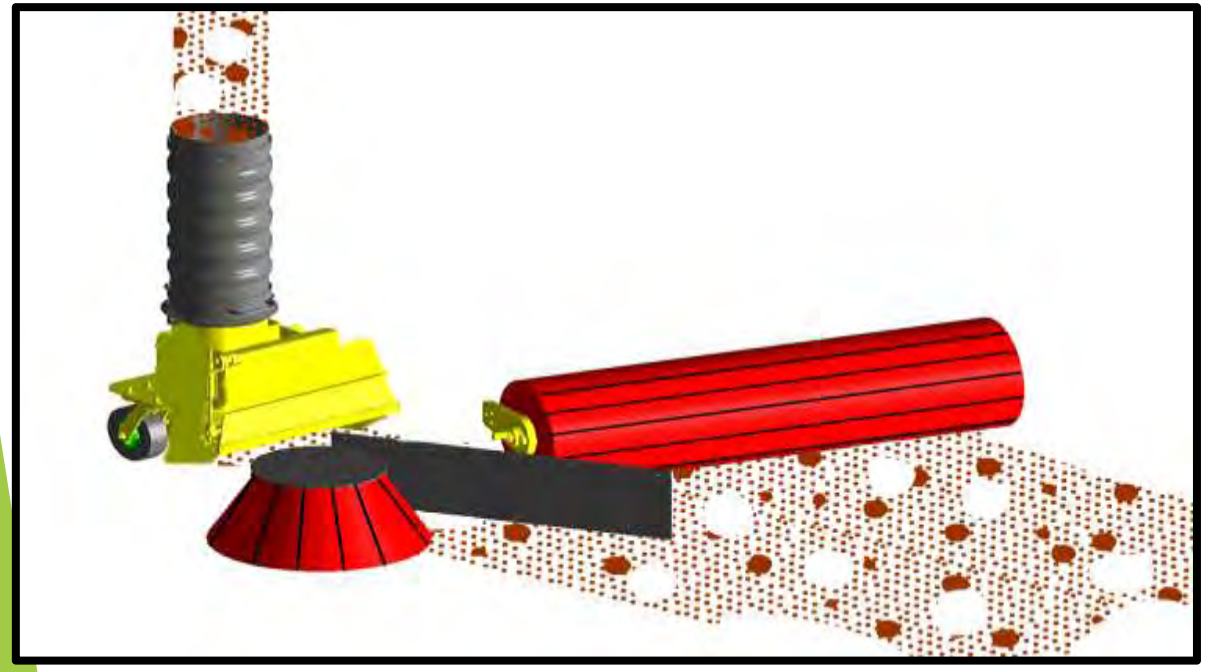


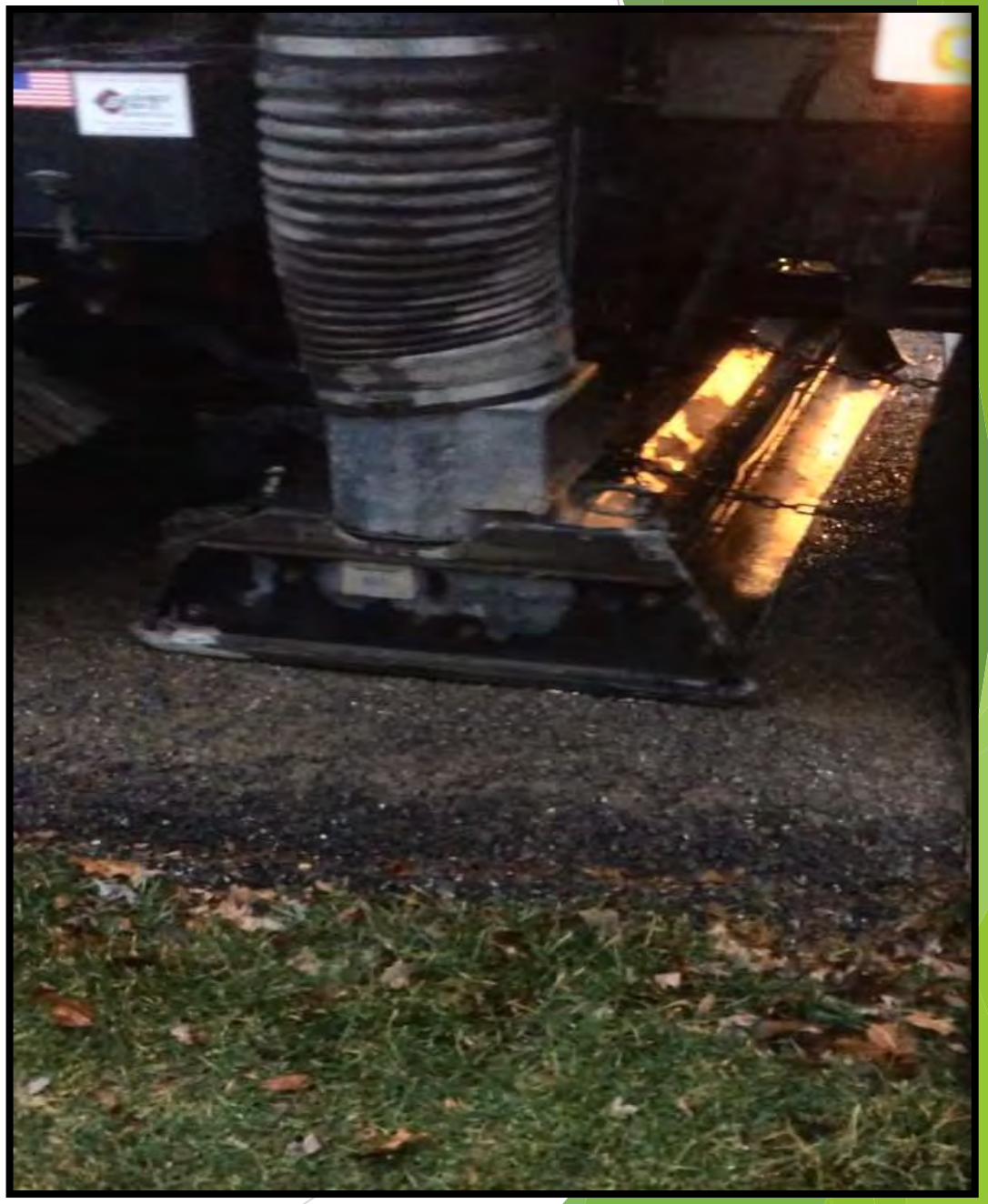


PERVIOUS MATERIALS MAINTENANCE

- Regular Maintenance
  - Regular Street Sweeping
  - Periodic Vac Truck Maintenance
  - Subsurface Drain Inspection
- Long Term Maintenance
  - Paver Filler Stone Replacement
  - Specialized Vac Truck Attachments
- Milling/Resurfacing
- Do not stage materials on them
  - Landscaping
  - Plowed Snow
  - Leaking Vehicles
  - Grass/Lawn Clippings or Waste

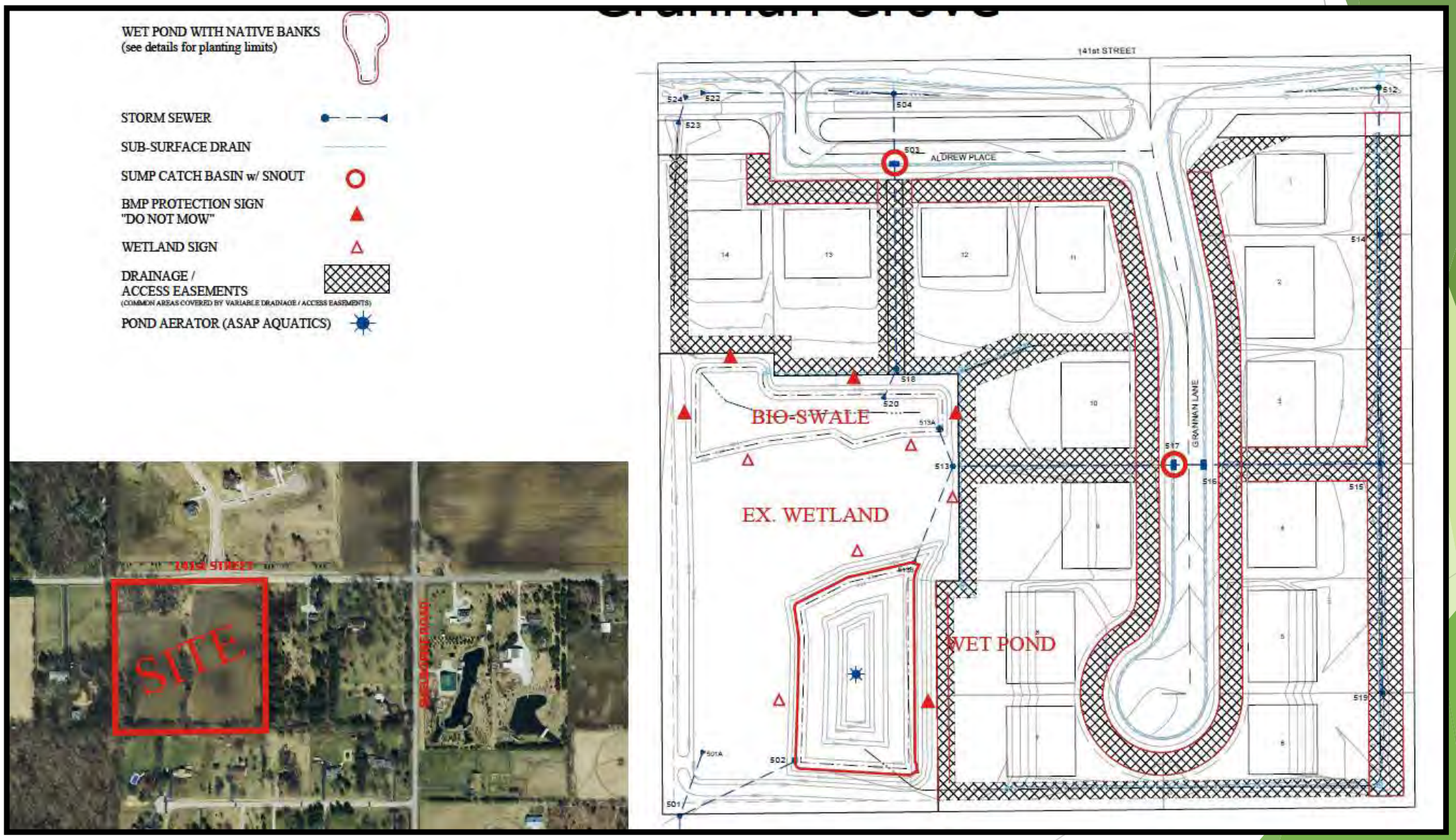




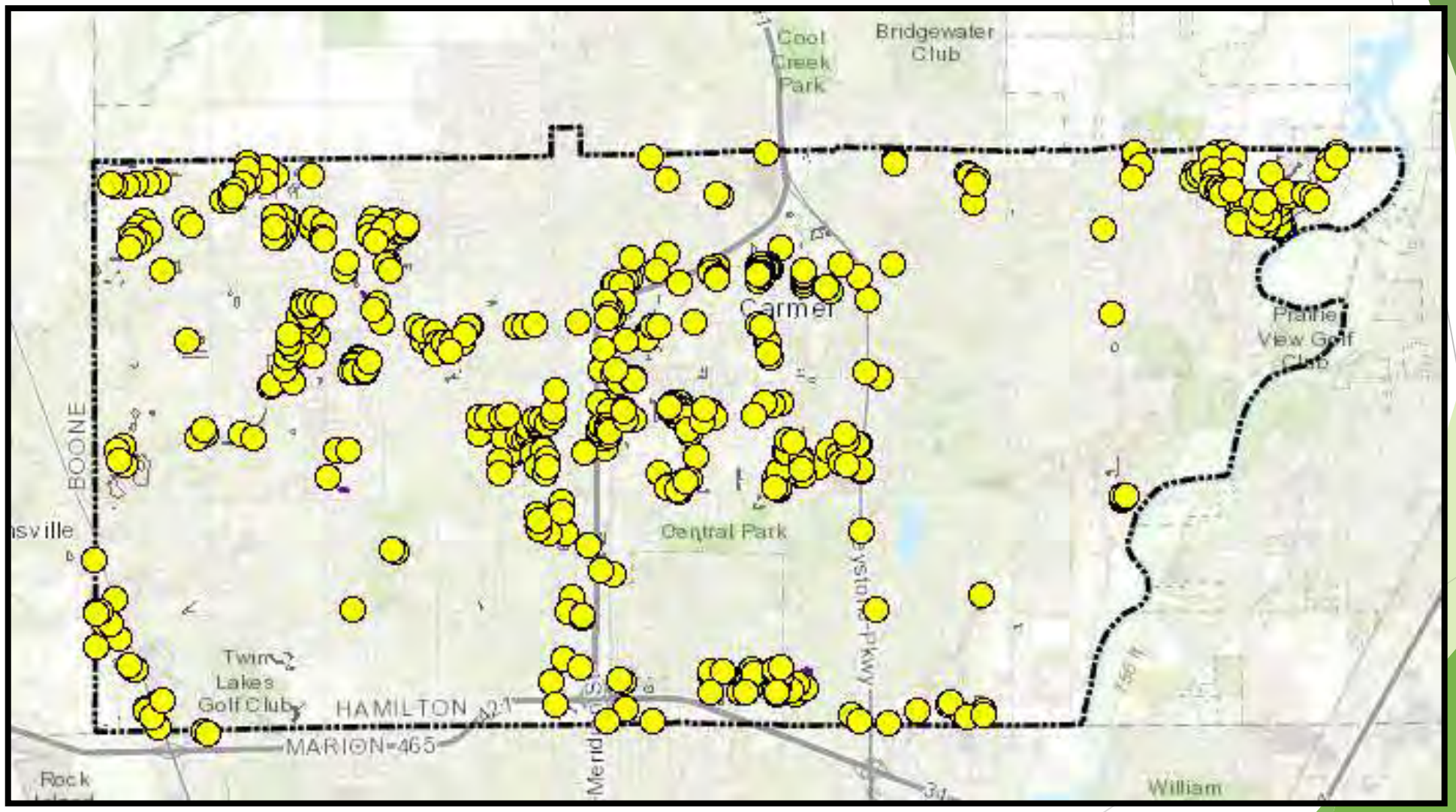


Sweeper Path Images from www.elginsweeper.com

TREATMENT TRAIN: USING MULTIPLE SYSTEMS



Over 1000 BMPS in CARMEL




QUESTIONS?

NEXT PRESENTATIONS

Kevin Tungesvick

Using Native Plants

Scott Minor

Design Basics

Claire Lane

Hamilton County Soil and Water Conservation District Programs

Then Lunch!

NATIVE PLANTS FOR GREEN STORM WATER PRACTICES

Kevin Tungesvick

Senior Ecologist

Eco Logic

Benefits of Native Plants

- Our native flora contains an abundance of species that tolerate alternating wet and dry
- Native plants are adapted to our climate
- Native plants are critical to pollinators
- Native plants support a diversity of desirable wildlife such as songbirds and butterflies
- Non-native plants have the potential to spread seeds via storm water

CLIMATE CHANGE AND STORM WATER

EXTREME RAINFALL

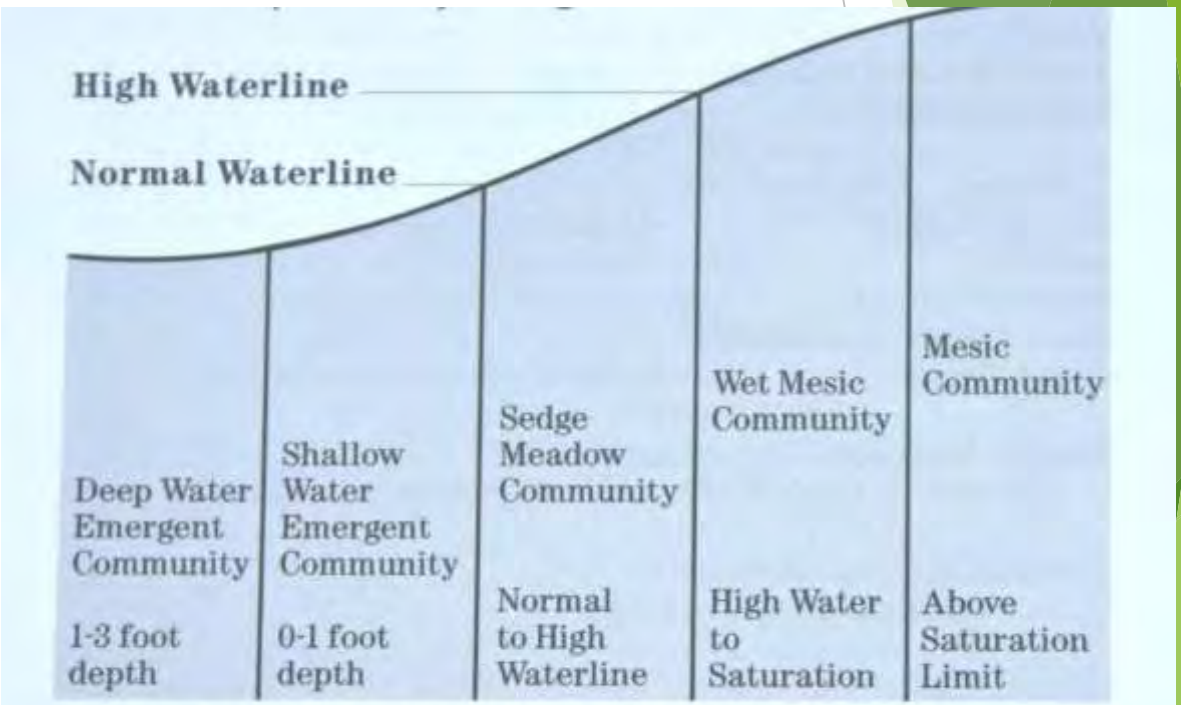
- Increasing frequency of extreme rainfall events including consecutive days of heavy rain that do not allow basins to drain
- More overflows

EXTREME HEAT & DROUGHT

- Increasing frequency of mid-late summer heat waves and drought
- Free draining engineered soil mixes in BMPs become extremely dry during these events

NATIVE PLANT COMMUNITIES UTILIZED IN STORM WATER BMPS

- Floating Leaf/Submerged Community
- Shallow Water Emergent Community
- Sedge Meadow Community
- Wet Mesic Prairie



(See "Our Suggested Species for Shoreline Communities" following.)

Plants for Rain Gardens and Swales

GRASSES AND SEDGES

- Important to prevent weed invasion
- Dense fibrous root systems improve infiltration with time
- Generally more tolerant of unexpected hydrology than forbs (wetter or drier than expected)
- Provide winter interest

Carex annectans var xanthocarpa (Yellow Fox Sedge)

- Wet to moist soil
- Sun
- Grow 2 to 3 feet
- Attractive Yellow Seedheads in early summer
- More dry tolerant than most wetland sedges

Carex emoryi (Riverbank Tussock Sedge)

- Wet to moist soil
- Sun to partial shade
- 2 ft in height
- Spreads by rhizomes to form a sod
- Overly aggressive for a small rain garden
- Best species for swales and flowing water

Carex frankii (Frank's Sedge)

- Wet to moist soil
- Full sun to partial shade
- 1-2 feet
- Foliage develops considerable brown coloration in late summer
- Tough and reliable

Carex granularis (Meadow Sedge)

- Wet to moist soil
- Sun or filtered shade
- Low stature sedge under 1 foot with broad bluish-green leaves
- Not tolerant of long periods of inundation
- Good groundcover in moist soil

Carex grayii (Burr Sedge)

- Wet to moist soil
- Partial Sun to Shade
- 1 to 2 feet in height
- Interest mace-like seedhead
- Great for shady rain gardens
- Long season of interest

Carex muskingumensis (Palm Sedge)

- Wet to moist soil
- Shade to partial sun
- 1-2 foot height
- Attractive foliage throughout season
- Pointed Seedheads in summer
- Excellent groundcover for moist shade

Carex vulpinoidea (Fox Sedge)

- Wet to moist soil
- Adaptable sedge for sun or partial shade
- Around 2 feet in height
- Brown seedheads in summer
- Tolerates dry periods
- Attractive Foliage through the season

Tufted Hair Grass (Deschampsia caespitosa)

- Moist to wet soil
- Full sun to partial shade
- Around 2 feet height
- Ornamental seedheads in late spring or early summer
- Attractive for use as an ornamental grass

Switchgrass (Panicum virgatum)

- Wet to well-drained
- Full sun
- 5 feet in height
- Extremely tough and adaptable poor site conditions
- Ornamental
- May be too large and aggressive for small rain gardens

Little Bluestem (Schizachyrium scoparium)

- Moist to well-drained
- Full sun
- Around 3 feet in height
- Wet tolerance varies with origin
- Use in drier or sloping edges of rain gardens
- Attractive fall color
- Great winter interest

Reddish Bulrush(Scirpus pendulus)

- Moist to wet soils
- Full sun
- Reaches around 4 feet in height
- Attractive drooping seedheads in mid-summer
- Nice vertical accent

Prairie Dropseed (Sporobolus heterolepis)

- Moist to well-drained soils
- Full sun
- Around 2 ft in height
- Very ornamental fine-
- textured foliage
- Nice fall color
- Tolerates periods of saturation
- Excellent for providing a refined edge to a rain garden or bio-retention

FORBS

- Valuable for pollinators
- Include species that bloom in spring, summer and fall
- High maintenance in the absence of graminoids
- Provide seed for birds in the fall and winter
- Too much diversity can make maintenance difficult for untrained individuals

Marsh Milkweed (Asclepias incarnata)

- Wet to moist
- Excellent inundation tolerance
- Full sun
- 3 feet in height
- Excellent for attracting butterflies
- Larval food plant for Monarchs
- Fragrant flowers in summer

Heath Aster (Aster ericoides)

- Moist to well-drained
- Full sun
- Reaches around 18” in height
- Spreads slowly by rhizomes
- Completely covers itself in tiny white flowers in September
- Excellent low-stature plant for small rain gardens

New England Aster (Aster novae-angliae)

- Wet to well-drained
- Full sun
- Around 4 feet in height
- Beautiful purple flowers in September and early October
- Excellent for butterflies

Blue False Indigo (Baptisa australis)

- Moist to well-drained soil
- Forms an herbaceous “Shrub”
- 3-4 foot height and spread
- Blue Flowers in May
- Decorative seed pods later in the season

Wild Senna (Cassia hebecarpa)

- Moist to wet Soils
- Bold plant growing 4-5 feet
- Locust-like foliage
- Showy yellow flowers in mid-summer
- Very attractive to bumblebees
- Conspicuous brown seed pods in the fall

White Turtlehead (Chelone glabra)

- Moist to wet soils
- Prefers partial shade
- 3 to 5 feet in height
- Larval food plant of the Baltimore butterfly
- White flowers in August and September

Pink Turtlehead (Chelone obliqua)

- Moist to wet soil
- Best in partial shade
- 3 to 4 feet in height
- Attractive Pink Flowers in late summer and early fall
- Tolerates well drained conditions better than White Turtlehead
- Dark green attractive foliage throughout season

Purple Coneflower (Echinacea purpurea)

- Well drained soils only
- Sun to partial shade
- Around 3 feet in height
- Well known garden perennial
- Attractive to butterflies and goldfinches

Blue Mistflower (Eupatorium coelestinum)

- Moist Soil
- Best in partial shade
- Around 2 feet in height
- Excellent for attracting butterflies
- Spread vigorously by rhizomes
- May be too aggressive for small rain gardens

Spotted Joe-Pye Weed (Eupatorium maculatum)

- Moist soil
- Full sun
- Grows 4 to 6 feet
- Attracts hoards of Butterflies
- Whorled leaves like other Joe-Pye Weeds
- Full sun

Queen of the Prairie (Filipendula rubra)

- Moist to wet soil
- Full sun
- Grows 4 to 6 feet
- Extremely showy flowers in early Summer
- Prone to powdery mildew in droughty soils

Bottle Gentian (Gentiana andrewsii)

- Moist to wet soil
- Full sun to partial shade
- 1-2 feet tall
- Unique bud shaped flowers that never open
- Nice late season color lasting into October

Autumn Sneezeweed (Helenium autumnale)

- Moist to wet soil
- Full sun to partial shade
- 3 to 4 feet in height
- Does not cause hay fever
- Does have irritant if you handle the dry seed

Swamp Rose Mallow (Hibiscus palustris)

- Moist to wet soil
- Full sun
- 4-6 feet tall
- Tolerates long term significant inundation
- Large showy flowers in July and August
- Color varies – Rose/Pink/White

Blue Flag Iris (Iris virginica var shrevei)

- Moist to wet soil
- Good inundation tolerance
- Sun to shade
- 2 feet tall
- Beautiful blue flowers in late spring
- Attractive foliage throughout the season

Dense Blazing Star (Liatris spicata)

- Moist to wet soil
- Full sun
- 3 to 5 feet tall
- Showy purple flowers are popular with florists
- Excellent for attracting birds and butterflies

Cardinal Flower (Lobelia cardinalis)

- Moist to wet soil
- Sun to shade
- 3-4 feet
- Pollinated by hummingbirds
- Short lived – around 3 years
- Self-sows in muddy soil

Great Blue Lobelia (Lobelia siphlitica)

- Moist to wet soil
- Sun to shade
- 2-3 feet
- Pollinated by bees
- Slightly longer lived than Cardinal Flower
- Self sows in muddy soil

Monkeyflower (Mimulus ringens)

- Moist to wet soil
- Good inundation tolerance
- Full sun to partial shade
- 3-4 feet
- Attractive lavender flower resemble a snapdragon

Smooth Beardtongue (Penstemon calycosus)

- Well-drained to moist soil
- Sun to shade
- To 2 feet in height
- Attractive flowers washed with purple in late May and June
- Great for early season color to a rain garden

Foxglove Beardtongue (Penstemon digitalis)

- Well-drained to moist soil
- Sun to partial shade
- To 2 feet in height
- Attractive white flowers in late May and June
- Great for early season color in a rain garden

Obedient Plant (Phystostegia virginiana)

- Well-drained to wet
- Full sun to partial shade
- 3-4 feet in height
- Variety speciosa is an aggressive spreader
- Attracts hummingbirds
- Flowers August-Sept

Mountain Mint (Pycnanthemum virginianum)

- Well-drained to moist soil
- Full sun
- 2 feet in height
- Showy white flowers in midsummer attract numerous pollinators
- Spreads slowly but is not aggressive

Showy Black-Eyed Susan (Rudbeckia fulgida var speciosa)

- Moist soil
- Full sun
- Around 2 feet in height
- Showy golden flowers in a long-lasting late summer display
- Attracts butterflies and birds

Sweet Black-Eyed Susan (Rudbeckia subtomentosa)

- Wet to well-drained
- Full sun to partial shade
- 4 to 5 feet in height
- Long lasting display of showy yellow flowers in late summer
- Tough adaptable plant

Riddell's Goldenrod (Solidago riddellii)

- Wet to well-drained
- Full sun
- 2-3 feet in height
- Showy flat flower clusters in September attract butterflies
- Interesting sickle-shaped foliage
- Foliage has fall color

Wrinkled Goldenrod (Solidago rugosa)

- Wet to Moist
- Full sun to partial shade
- 2-3 feet in height
- Attracts butterflies
- Unique textured foliage
- Spreads slowly by rhizomes

Smooth Ironweed (Vernonia fasciculata)

- Wet to moist
- Good inundation tolerance
- Full sun
- 4-5 ft in height
- Vivid purple flowers in late summer
- Attracts butterflies
- Tall Ironweed (Vernonia altissima) is also appropriate for large areas

Culver’s Root (Veronicastrum virginicum)

- Wet to well drained
- Full sun
- 3-5 feet in height
- Elegant wildflower with attractive whorled foliage and showy white flower spikes

Golden Alexanders (Zizia aurea)

- Wet to moist
- Sun to shade
- 2 feet in height
- Showy golden flowers in May
- Adds early season color to rain gardens
- Attractive foliage all year

Emergent Plants for Lake Edges

- Bulrushes
- Burreed
- Arrowhead
- Pickerel Weed
- Soft Rush
- Creeping Spikerush

Softstem Bulrush (Scirpus validus)

- Excellent and adaptable shallow water emergent
- Spread by rhizomes
- Rapid establishment by rhizomes

Giant Burreed (Sparganium eurycarpum)

- Shallow Water emergent species
- Tolerates drying
- Rhizomatous
- Gives structure of cattails without the invasive tendencies

Common Arrowhead (Sagittaria latifolia)

- Shallow water emergent
- Spreads by rhizomes
- Forms edible tubers
- Attractive white flowers

Pickerel Weed (Pontederia cordata)

- Shallow Water Emergent Species
- Slowly forms large clumps
- Showy purple flowers

Soft Rush (Juncus effusus)

- Shallow water emergent
- Under 6 inch water depths
- Spiky foliage year round

Creeping Spike Rush (Eleocharis palustris)

- Shallow water emergent to sedge meadow
- Spreads rapidly by rhizomes
- Low Stature
- Tolerates flowing water and drying

Contact Information

Kevin Tungesvick
Senior Ecologist

Eco Logic
8685 West Vernal Pike
Bloomington, IN 47404

kevin@ecologicindiana.com