Stormwater Management for HOAs

Presented by HWC and the Partnership

Presenter: Taylor Eash, Project Engineer

HWC ENGINEERING

HWC WATER & LAND RESOURCES, LLC

Wednesday, September 24, 2025
Hendricks County Fairgrounds, Danville, IN

What is your role in the community?

What is the purpose of a residential pond?
Who is responsible for the upkeep of the pond?

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Hendricks County Partnership for Water Quality

Objectives – *What's in it for me?*

[SOLitude's 6-Step Guide for Proper Stormwater Pond Management | SOLitude Lake Management]

1. Gain a better understanding of what your role is in inspecting and maintaining stormwater systems
2. Understand what stormwater BMPs do
3. Able to identify some key features of stormwater systems

Agenda – *What are you talking about?*

1. Introductions
2. Water Quantity vs Water Quality
3. Why Stormwater Matters
4. HOA Responsibility
5. **Break**
6. Benefits of Good Stormwater Management
7. What HOAs Need to Do
8. Simple Steps for HOAs
9. Key Takeaways
10. Call to Action
11. Additional Questions

Introductions – *Who are you people?*

Hendricks County Partnership for Water Quality

- Christy Chalfant, Permit Administrator
- Sarah Wolf, Hendricks County Partnership
- Betsy Porter, Avon
- Kathy Dillon, Brownsburg
- Barry Lofton, Danville
- Chris York, Pittsboro
- Shannon Swan, Plainfield

HWC Engineering

- Taylor Eash, Project Engineer
- Bryan Grotz, Stormwater Team Lead

HWC Water & Land Resources, LLC

- Luke Versprille, Director
- Tyler Boyd, Manager

Water Quantity vs Water Quality

Water Quantity

Small amount, controllable flow

Large amount, too fast

Water Quality

Fresh out of the tap from the water treatment plant

Fresh out of the pond

Water Quantity vs Water Quality

Water Quantity

Contact County Surveyor

Shallow ponding

Flooding

[What are the odds Indiana will see a '100-year flood?' What to know before the next storm hits | IndyStar]

Water Quality

Focus of This Presentation

Clear, swimmable

Would not swim

[Clear Choices Clean Water]

Why Stormwater Matters

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Why Stormwater Matters – *Where does it go?*

[Infiltration and the Water Cycle | USGS]

Why Stormwater Matters - *Where does it go?*

[Stormwater Runoff | USGS]

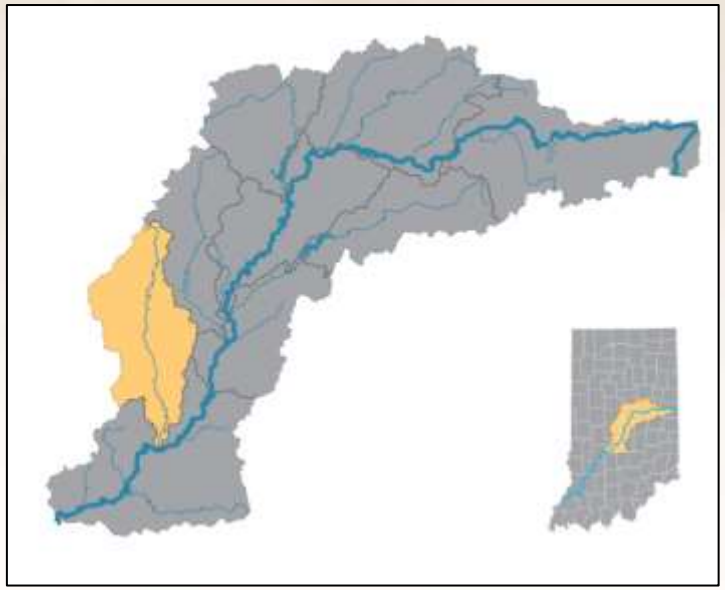
[Water Trails | DNR]

Why Stormwater Matters - *What is stormwater?*

Why Stormwater Matters – *How bad is it here?*

White River Alliance Report Card:

White Lick Creek Watershed



[White Lick Creek Watershed | White River Alliance]

Why Stormwater Matters - *What pollution?*

Impacts of pollution

- Stormwater picks up and transports various pollutants
- Effects flow capacity and human health

[Polluted runoff: a top Puget Sound pollution source | RE Sources]

[Stormwater Pollution | Regional Stormwater Partnership of the Carolinas]

Top 5 HOA Pollutants of Concern

- Trash/Yard Waste
- Animal Waste/Fertilizer
- Sediment
- Vehicle Fluids/Heavy Metals
- Elevated Temperature

Why Stormwater Matters

Impacts of pollution common to HOA:

Leaf litter can block storm drains. Here's how to help | Karl Schneider, IndyStar

Stormwater is no friend to the White River | Robert Scheer, IndyStar

Trash/Yard Waste

Impact:

- Clog drains and cause flooding
- Release harmful substances like heavy metals, chemicals, nutrients, bacteria, and viruses
- Harmful to wildlife
- Consume oxygen
- Microplastics bioaccumulate

Resolve:

- Properly dispose of waste
- Pick up waste

Why Stormwater Matters

Impacts of pollution common to HOA:

Waterfowl & Water | Clear Choices Clean Water Indiana

Animal Waste/Fertilizer

Impact:

- High nutrient load to water = increased algae and bacteria
- Harmful to human health

Resolve:

- Pick up and properly dispose of waste
- Buffer strips along ponds
- Test the soil to determine nutrient needs
- Apply fertilizer in accordance with Indiana Law, during dry weather, and only what is needed
- Don't water freshly fertilized lawn (you will wash away the fertilizer)

Why Stormwater Matters

Impacts of pollution common to HOA:

[Screenshot of Eagle Creek Confluence with White River Spring 2024 Indianapolis | MapIndy]

Sediment

Impact:

Increased turbidity

- Reduce photosynthesis of aquatic plants
- Reduce oxygen
- Difficult for visual hunters like bass and trout to forage
- Increased cost to treat for drinking water purposes

Sedimentation

- Fills voids between rocks, reducing sensitive species' habitats
- Build up reduces channel and river capacities to carry stormwater
- Other pollutants (like heavy metals) stick to sediment

Resolve:

- Correct erosion features as soon as possible
- Provide erosion protection measures like deep rooted vegetation
- Provide measures to capture sediment

Why Stormwater Matters

Impacts of pollution common to HOA:

[Yes, you can reduce ocean oil contamination! | Friends of the Mississippi River]

Vehicle Fluids and Heavy Metals

Impact:

- 1 gallon of spilled oil can contaminate 1 million gallons of water
- Heavy metals can bioaccumulate and cause neurological issues and increase the risk of cancer (e.g., mercury poisoning)

Resolve:

- Prevent spills from reaching the storm system
- Contact IDEM and local FD to assist with clean up efforts of large spills
- Capture sediment = also captures heavy metals

Why Stormwater Matters

Impacts of pollution common to HOA:

[Runoff from a parking lot in summer can cause heated runoff | USGS]

Elevated Temperature

Impact:

- Stress and kill aquatic organisms
- Reduce dissolved oxygen levels
- Promote harmful algal blooms
- Increase in invasive species
- Increased disease spread

Resolve:

- Trees provide shade, keeping the ground cooler
- Promote infiltration practices
- Maintain deep pools in ponds (dredge if needed)
- Minimize shallow ponding areas

HOA Responsibility

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HOA Responsibility – *What is our responsibility?*

Maintain the stormwater system so it reduces flooding and pollution.

Common measures owned by HOAs:

- Ponds
- Swales
- Culverts
  - Storm drains
  - Rain gardens

HOA Responsibility – *What is our responsibility?*

[Stormwater Control Measures (SCMs) | High Point, NC]

Wet Ponds

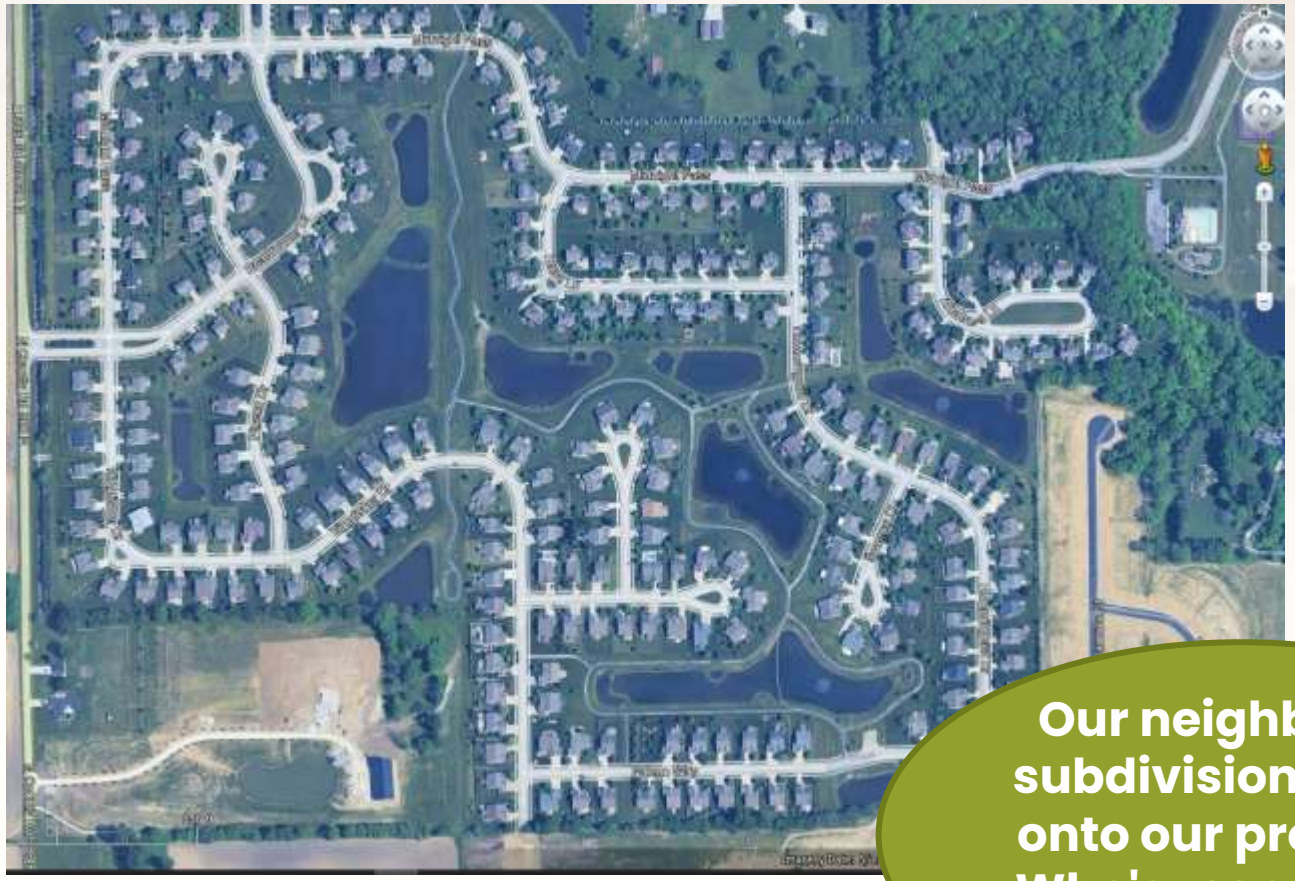
Basins with permanent pools of water

Pollutant removal mechanisms

- Sediment settling
- Pollutant uptake through biological activity

Outlet structures can provide water quality control

HOA Responsibility – *What is our responsibility?*



Multiple ponds can work together to provide a cumulative benefit. Be sure to keep track of each.

Our neighboring subdivision drains onto our property. Who's responsible for the runoff?

The neighbor is responsible for the water quality and quantity to your property. You are responsible for it through your property.

HOA Responsibility – *What is our responsibility?*

[What is a detention basin? | EcodesignSD]

Dry Ponds

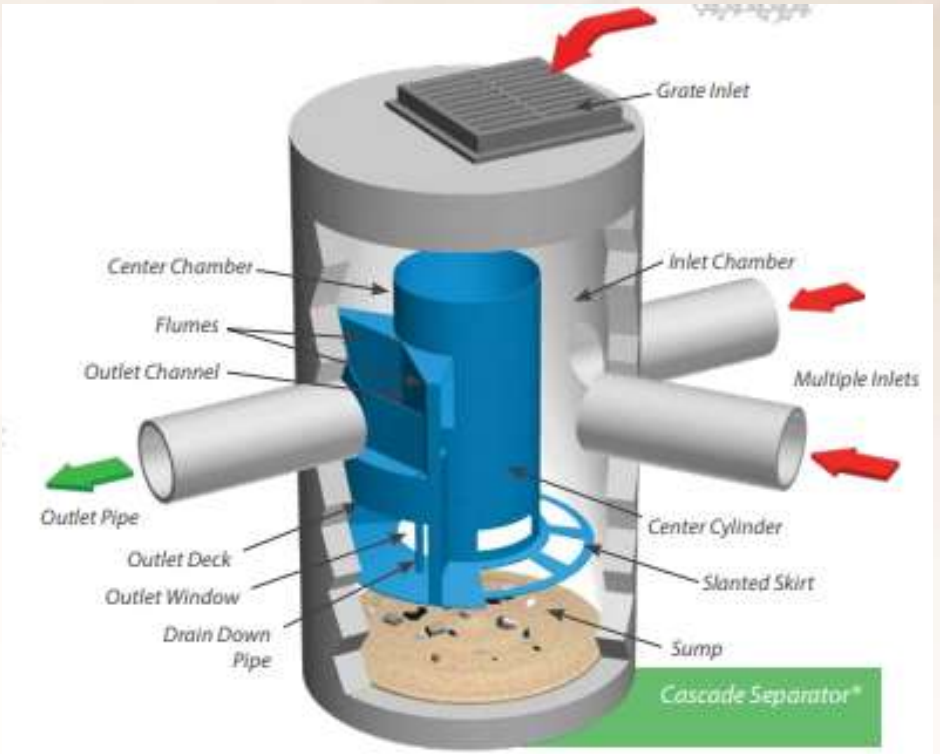
- Temporary storage of stormwater (should be mostly drained within 48hrs)
- Shallow ponding (can be deeper)
- Often require additional filtration to help with pollutant removal
- Sometimes equipped with underdrains (should have cleanouts)

HOA Responsibility – *What is our responsibility?*

Swales

- Primary function is to convey (keep them clear of debris and obstructions)
- Allow for infiltration

HOA Responsibility – *What is our responsibility?*



[Hydrodynamic Separation | Contech]

Hydrodynamic Separator (HDS)

- Separates and traps sediment and debris

HOA Responsibility – *How does it work?*

Design to reduce pollution and flooding

Stormwater design features

- Capture
- Convey
- Store
- Treat

[Notre Dame now has the Biggest Green Roof in Indiana | Greenroofs.com]

HOA Responsibility – *How does it work?*

[Drainage Grates, Frames And Curb Inlets | EJ Prescott]

Inlets are designed to allow the largest storms to create some ponding. Within a couple of days, the ponding should subside.

Design to reduce pollution and flooding

Stormwater design feature: Capture

- Street inlets
- Yard inlets
- Curb turnouts

HOA Responsibility – *How does it work?*

Design to reduce pollution and flooding

Stormwater design feature: Convey

- Pipes
- Swales/channels
- Curb and gutter
- Emergency spillway

HOA Responsibility – *How does it work?*

Conveyance measures need to be inspected to confirm they still have capacity to convey runoff. The pipe does not have capacity to convey the runoff. If it was just sediment/mud, it could be cleaned; however, the collapsed pipe requires it to be replaced.

HOA Responsibility – *How does it work?*

Swales and curblines are designed to direct runoff to inlets.

[Roadside Guide to Clean Water: Vegetated Swales | Penn State]

Primary spillway controls release rate for most storms

The riprap spillway conveys flow for larger storm events

Design to reduce pollution and flooding

Stormwater design feature: Convey

- Pipes
- Swales/channels
- Curb and gutter
- Emergency spillway

HOA Responsibility – *How does it work?*

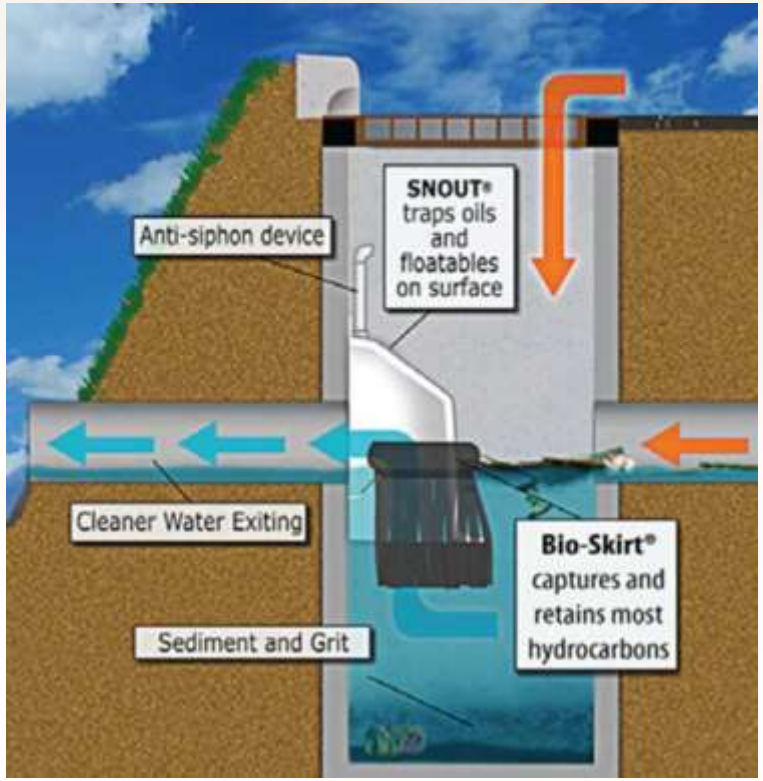
[ChamberMaxx® Stormwater Infiltration Chamber System | Contech]

Design to reduce pollution and flooding

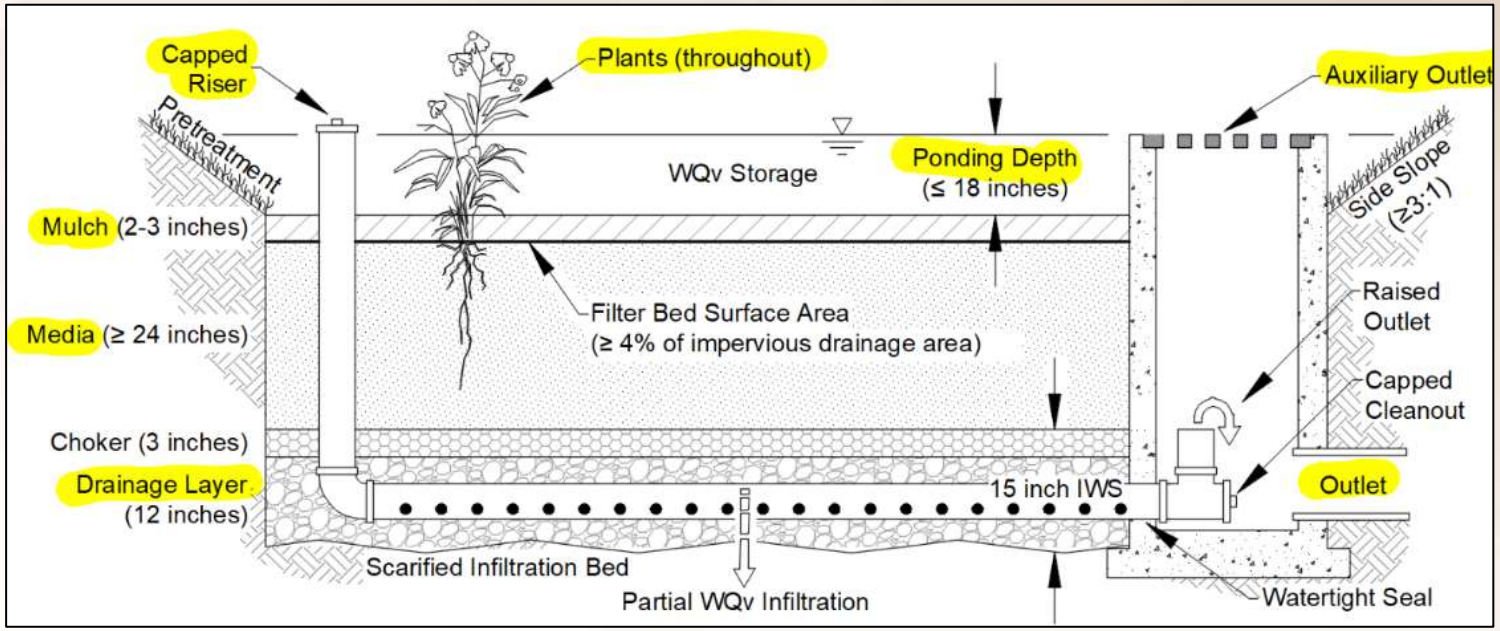
Stormwater design feature: Store

- Ponding
- In soil/gravel (void spaces)
- In pipe/underground
- Outlet control structures (small openings, raised inlets)

HOA Responsibility – *How does it work?*



Overview methods of pretreatment | Minnesota Stormwater Manual



Bioretention Design Guidance | Ohio EPA

Stormwater design feature: Treat

- Filter (pass through stone, soil, or media)
- Skim (trash racks, submerged outlet)
- Settle (slow/long retention times)
- Chemical (spraying/applying chemicals)

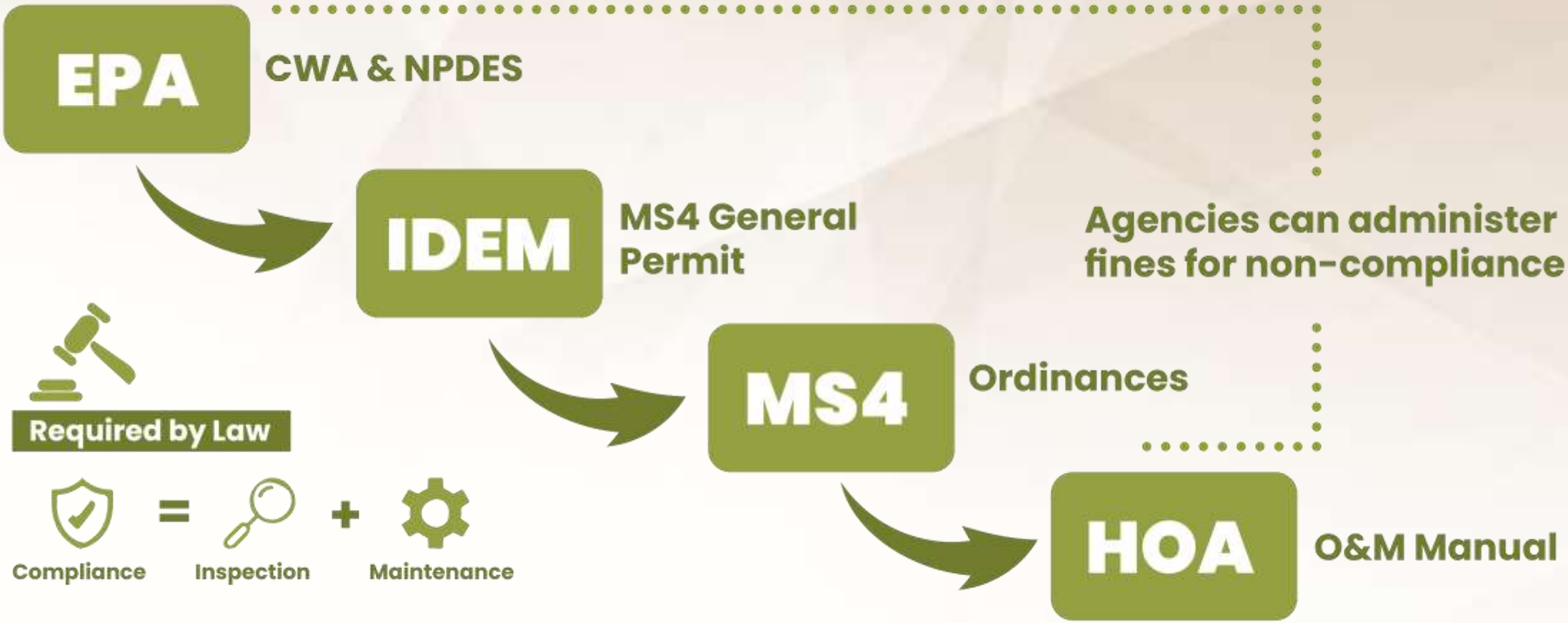
HOA Responsibility – *How does it work?*

Stormwater measures are constructed in easements

[Homeowner Consultation | Tippecanoe County]

Flow paths blocked by fences. Cannot inspect or maintain the flow path or inlets. Remove fences to improve drainage and allow access.

HOA Responsibility – *Who enforces this?*



HOA Responsibility – *Why do we have to do this?*

Failure to comply can mean:

- **Fines or legal action**
- **Costly emergency repairs**
- **Decreased property values**
- **Destroyed water quality**
- **Increased illness**

Who owns the common area land, still the HOA? The property owner has ultimate responsibility.

Our HOA was disbanded. Who takes care of it now?

HOA Responsibility – *What do we have to do?*

Is it illegal to blow your grass clippings into the street in Indiana? | WIBC

You're not just mowing… you're managing water

- Maintain the stormwater system so it reduces flooding and pollution
- Follow the guidance provided in the operation and maintenance manual
- HOA is responsible for all costs associated with inspection and maintenance
- Submit reports to the MS4

Benefits of Good Stormwater Management

Protects property values by preventing flooding, erosion, and pollution

Reduces repair costs (fixing early vs. crisis response)

Enhances neighborhood appearance (well-kept ponds and green spaces)

Supports community pride and environmental stewardship

Shows compliance → avoids liability

Break Time

HOA Management Practices (BMPs)

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HOA Best Management Practices (BMPs)

HOA Budgets

- Create a long-term maintenance plan
- Gather quotes from contractors
- Budget for routine and future expenses
- Have a reserve account
- Avoid special assessments, when possible

Fix the little things before they become big problems

Our HOA does not collect dues for stormwater

That doesn't remove the responsibility from the HOA

We pay a stormwater fee to the Town. Does that go to our pond?

No, the stormwater fees cover the Town's MS4 program and the Town's stormwater infrastructure

HOA Best Management Practices (BMPs)

Preventative Measure	Cost	Reactive Measure	Cost
Erosion repair	$3,000/year	Regrade and stabilize eroding shorelines	$21,000 every 3 years
Remove cattails and willows	$3,000/year	Fine + repair of property damage caused from flooding	>$100 and litigation
Fountain (aesthetically pleasing)	$12,000/one time $300/year operating and maintenance	Algae treatment + fine	$6,000/year + Fine + Smells + Upset homeowners
Diffusers (reduces dredging frequency to >25+ years)	$8,000/one time $300/year operating and maintenance	Algae treatment + fine	$6,000/year + Fine + Smells + Upset homeowners
Turf repair of bare areas	$35,000/once stabilized properly should not need further maintenance	Dredge pond	$60,000 every 10-15 years

HOA Best Management Practices (BMPs)

Inspect Regularly + Maintain as needed

Operation and Maintenance (O&M) Manual

- **Inspection and Maintenance Frequency**
- **Guidance for Inspection and Maintenance**
- **Site Map**
- **Checklists**

Educate residents and your management company

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Inspection


Check your nearby storm drains before and after storms
I won't do any good in a storm.
Ah, much better!
Before
After
Hendricks County Partnership for Water Quality

Inspection & Compliance

Paper/Digital Trail

- Keep track of the maintenance completed
- Take photos

Routinely

- After storms 1”-2” or more (highly encouraged)
- Monthly (preferred)
- Once every quarter (minimum)
- Follow the guidance in the O&M Manual (required)
- More inspections = more likely to notice potential failures sooner

Inspection & Compliance - HOA

Keep maintenance records (checklists, receipts, work completed, etc.)

Frequency

Routine

- Tending to the lawn
- Pick up trash

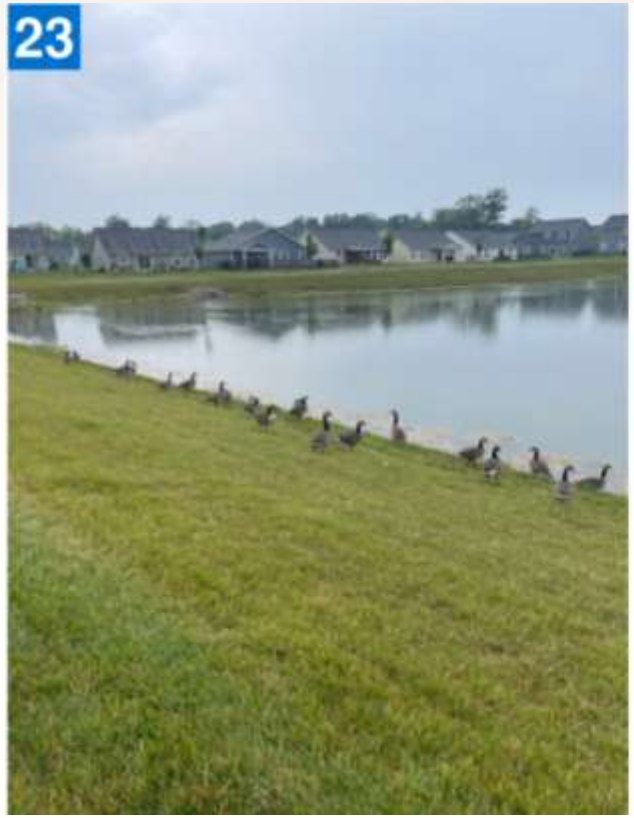
Periodic

- Trimming back vegetation overgrowth
- Repair eroded areas
- Install erosion protection measures (e.g. native vegetation, riprap, etc.)

Infrequent

- Dewatering the pond (less frequent if routine and periodic maintenance is completed properly)

Inspection & Compliance - Contractors

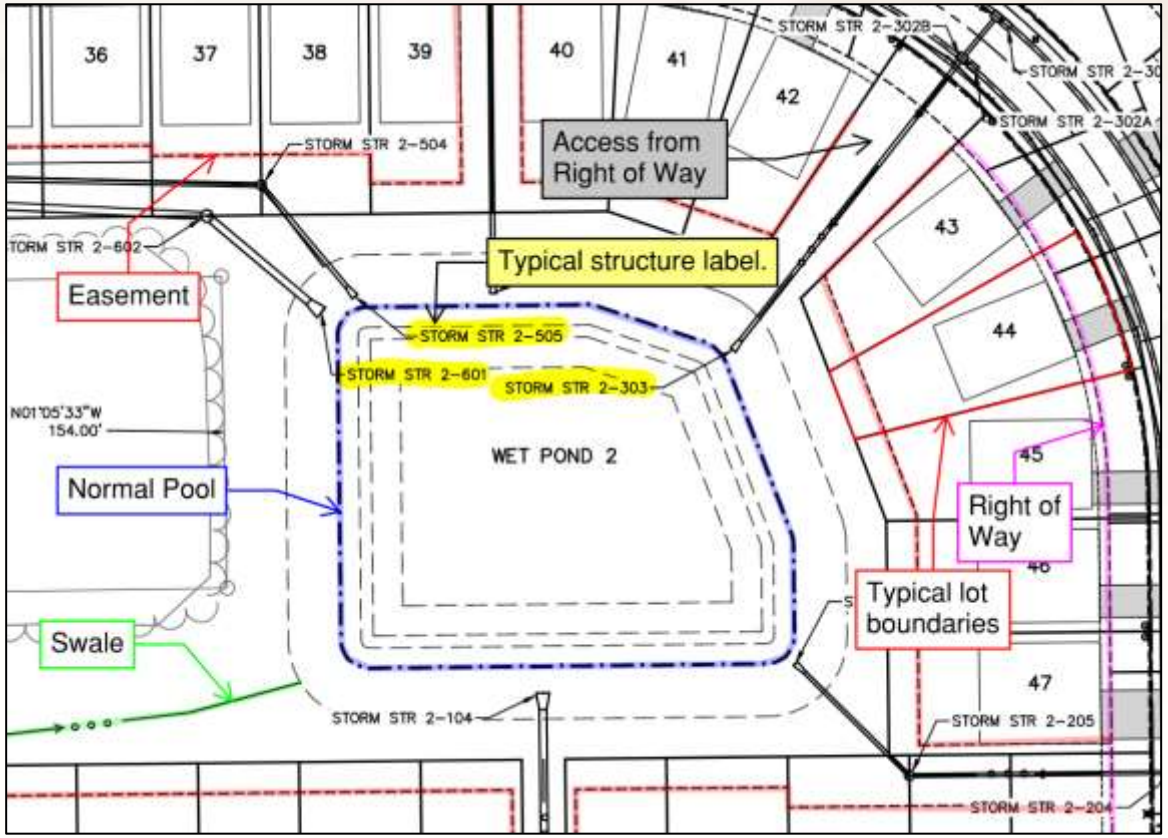


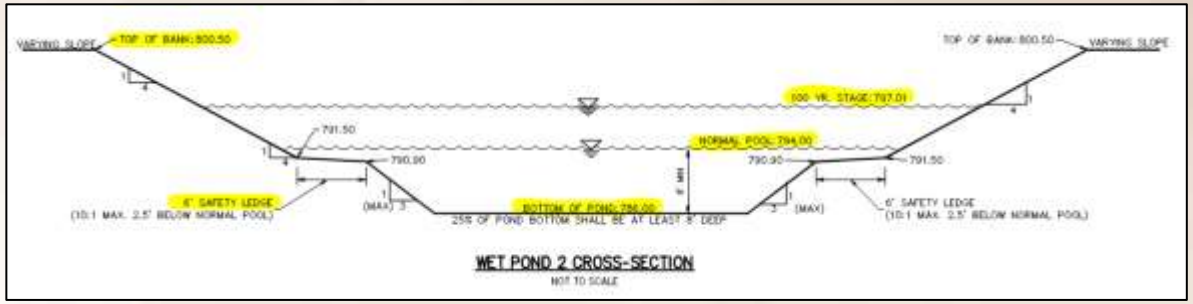
- Provide a Quality Site Assessment Report
- Notify HOA of issues or potential issues of their system
- Provide budgetary quotes to perform the work
- Set up recurring contracts

23 Install Swans in the pond to reduce geese population.

24 Revisit pond bank erosion solutions. Working on quote to create a naturally planted shoreline to eliminate erosion.

Inspection & Compliance



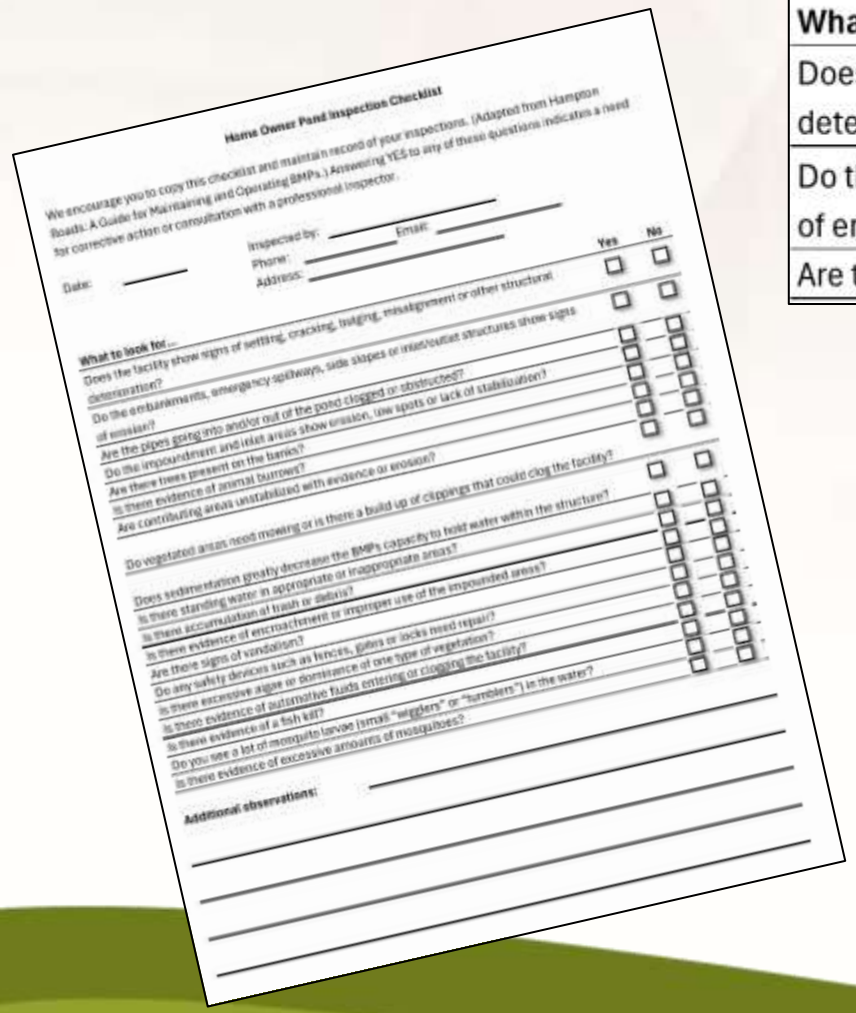


Typical Site Maps include:

- Easements
- Structure locations
- Structure details

The MS4, Engineers, or Contractors can help you interpret the information

Inspection & Compliance - HOA



Home Owner Pond Inspection Checklist

We encourage you to copy this checklist and maintain record of your inspections. (Adapted from Hampton Roads- A Guide for Maintaining and Operating BMPs.) Answering YES to any of these questions indicates a need for corrective action or consultation with a professional inspector.

Date: _____ Inspected by: _____ Email: _____ Phone: _____ Address: _____

What to look for...	Yes	No
Does the facility show signs of settling, cracking, bulging, misalignment or other structural deterioration?	☐	☐
Do the embankments, emergency spillways, side slopes or inlet/outlet structures show signs of erosion?	☐	☐
Are the pipes going into and/or out of the pond clogged or obstructed?	☐	☐
Do the impoundment and inlet areas show erosion, low spots or lack of stabilization?	☐	☐
Are there trees present on the banks?	☐	☐
Is there evidence of animal burrows?	☐	☐
Are contributing areas unstabilized with evidence of erosion?	☐	☐
Do vegetated areas need mowing or is there a build up of clippings that could clog the facility?	☐	☐
Does sedimentation greatly decrease the BMPs capacity to hold water within the structure?	☐	☐
Is there standing water in appropriate or inappropriate areas?	☐	☐
Is there accumulation of trash or debris?	☐	☐
Is there evidence of encroachment or improper use of the impounded areas?	☐	☐
Are there signs of vandalism?	☐	☐
Are safety devices such as fences, gates or locks need repair?	☐	☐
Do any safety devices such as fences, gates or locks need repair?	☐	☐
Is there excessive algae or dominance of one type of vegetation?	☐	☐
Is there evidence of automotive fluids entering or clogging the facility?	☐	☐
Is there evidence of a fish kill?	☐	☐
Do you see a lot of mosquito larvae (small "wigglers" or "tumblers") in the water?	☐	☐
Is there evidence of excessive amounts of mosquitoes?	☐	☐

Additional observations: _____

Example Checklist:

- Is there erosion?
- Are the pipes going in or out of the pond obstructed?
- Is there an accumulation of trash or debris?

Answering "YES" indicates a need for corrective action or consultation with a professional inspector

Record an estimate for the amount of pollutants/invasives removed (e.g., 3x large trash bags, 400 sqft of cattails, etc.)

Inspection & Compliance - Contractor

Scoring Breakdown:		
N/A = Not Applicable	1 = Monitor (potential for future problem exists)	*Use open space in each section to further explain scoring as needed.
N/I = Not Investigated	2 = Routine Maintenance Required	
0 = Not a Problem	3 = Immediate Repair Necessary	

1. Outfall Channel(s) from Pond						
Woody growth within 5' of outfall barrel	N/A	N/I	0	1	2	3
Outfall channel functioning	N/A	N/I	0	1	2	3
Manholes, Frames and Covers	N/A	N/I	0	1	2	3
Released water undercutting outlet	N/A	N/I	0	1	2	3
Erosion	N/A	N/I	0	1	2	3
Displaced rip rap	N/A	N/I	0	1	2	3
Excessive sediment deposits	N/A	N/I	0	1	2	3
Other:	N/A	N/I	0	1	2	3

Example Checklist:

- More elaborate than residents'
- Provide trackable information
- Provide insight into what the root cause may be
- Record quantity of pollutants/invasive vegetation removed

Did a single, large storm cause it or has it progressively gotten worse with smaller storms?

HOA Best Management Practices (BMP)

Phragmites: common reed, 10’-12’ tall

Cattails: 5’-7’ tall

Harvesting the vegetation is crucial to prevent clogging and nutrients from being released back into the water

Aquatic Plant Management | Purdue University

Cattails - The Wetland Supermarket | DNR

Invasive Phragmites Australis: Learning the basics | MSU Extension

Inspection & Compliance

Sinkhole identified. Repair void in pipe and backfill hole. Inspecting the pipe could have found the problem before a sinkhole formed.

Inspection & Compliance

Geese present. A lot of algae ("pond scum"). Possibly high water temperature and too much nutrients. Treat pond chemically or treat mechanically with skimmer or draining.

Some algae is expected. Some leaf and tree litter is expected with the amount of trees along the shoreline. Trees provide shade for most of the pond, keeping temperatures relatively cool. Shoreline vegetation is left longer than turf.

Inspection & Compliance

A lot of pond weed (possibly muskgrass) growing in shallower portions of the pond. Can provide oxygen and hiding places for pond life, but can get out of control and smells. Filamentous algae (“pond scum”) near the shore. Provides little value to the health of the pond.

Inspection & Compliance

Changing water levels and waves, as well as runoff, is causing erosion. Install shoreline protection (vegetation or riprap) to reduce future erosion.

Inspection & Compliance

This erosion in the swale will continue to expand if it is not addressed

A lot of runoff drains to this area, causing erosion

Inspection & Compliance

The willow trees will continue to grow and become more expensive to remove. The vegetation is blocking the pond outlets.

Inspection & Compliance

The normal pool dropped during a dry period (continue to monitor). Riprap does not extend below outlet, erosion/undercutting may occur. Add riprap to prevent.

Inspection & Compliance

Orifice and inlet are not clogged. Riprap over pipe serves no purpose here. Weeds on pipe could be trimmed for aesthetics.

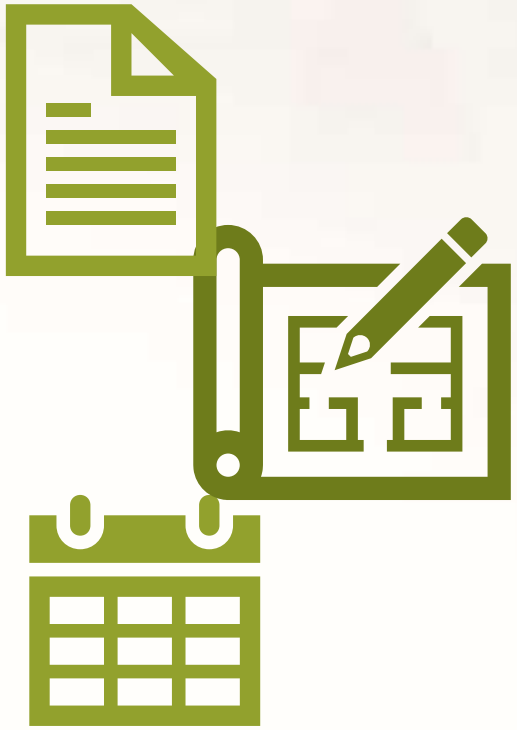
Inspection & Compliance

Dry periods lead to increased water temperatures and reduced oxygen. Fish died. Trash along the shore. Dispose of fish and trash. Install aerators or fountains to add oxygen to the pond.

Inspection & Compliance

Pond fountain operating. Shoreline protected.

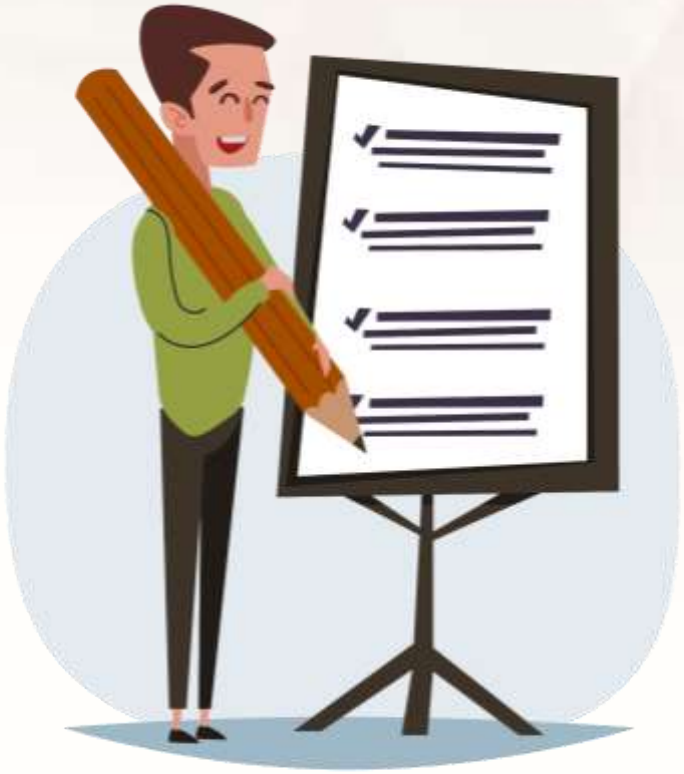
Inspection & Compliance



Annual MS4 Correspondence

- Provide a single report to the MS4 contact that the inspection and maintenance has been completed
- It is OK if something needs to be repaired or is not satisfactory on the report
- Important that a corrective action plan is in place and moving forward
- The MS4 can require a different corrective action and/or timeline

Inspection & Compliance



Take Aways:

- Keep records of inspection
- Take photos
- Correct problems early to avoid expensive repairs (and/or fines)
- If it does not look, smell, or sound right… it probably needs to be corrected
  - Short-term fixes are OK while you investigate long-term solutions

Simple Steps for HOAS

HWC Engineering and
HWC Water & Land Resources, LLC

Hendricks County Partnership for Water Quality

Inspection & Compliance

Hire professionals for inspections & maintenance

Keep maintenance logs (proof of compliance)

Incorporate stormwater in HOA governing documents & contracts

Communicate responsibilities to homeowners and your management company

Apply for grants or partnerships. Reach out to the community foundation

Lawn and Yard Care Considerations

[Leaving Grass Clippings in the Street is Illegal - Please help our lakes! - Whitewater Banner]

[Man dies after being trapped under lawnmower in pond | WBPF News]

[How to Get Pet Waste Stations Installed in Your Neighborhood | Dog Poo Pros]

Homeowner recommendations:

Pick up pet waste & limit fertilization

- Reduces the chance of it getting into stormwater runoff

Do not blow grass in the street

- Clippings can clog drains
- Depletes oxygen in water
- Releases nitrogen & phosphorus into the water

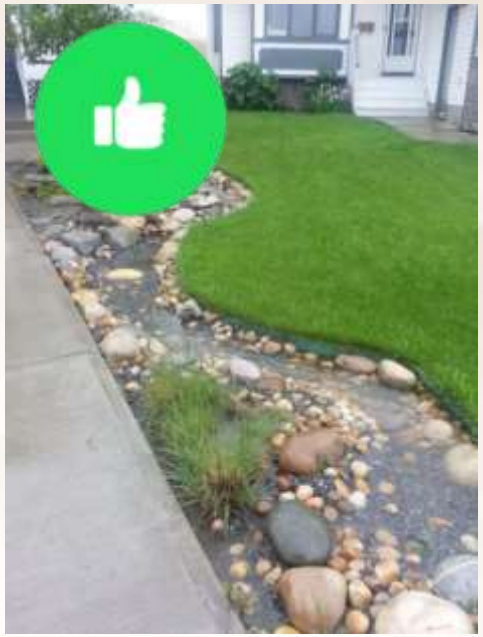
Do not mow down to the edge of the pond

- The vegetation filter/capture pollutants
- Deeper-rooted vegetation stabilizes the shoreline
- Equipment can destabilize the shore – creating a hazardous work condition

Lawn and Yard Care Considerations

[Benefits of Native Buffers for Detention Basins | Lower Dupage River Watershed Coalition]

[Rain Barrels | City of Lafayette]



[Gardening For Rainwater: Creating a Rain Garden | Save Tarrant Water]

Homeowner recommendations:

Native plants

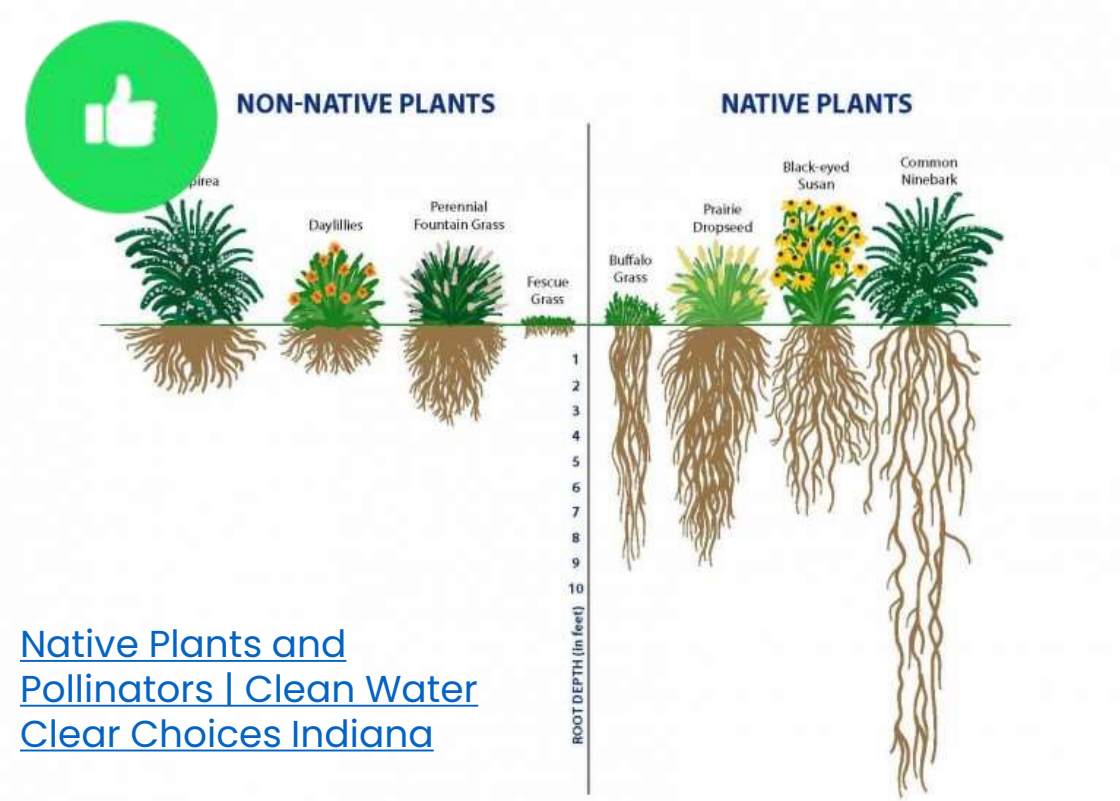
- Absorb and retain water and nutrients
- Allow for biodiversity
- Pollinator friendly
- Resistant to floods and droughts
- Attract dragonflies (can eat hundreds of mosquitoes a day)

Rain barrels and rain/rock gardens

- Store/slow down runoff
- Reduce erosion

Lawn and Yard Care Considerations

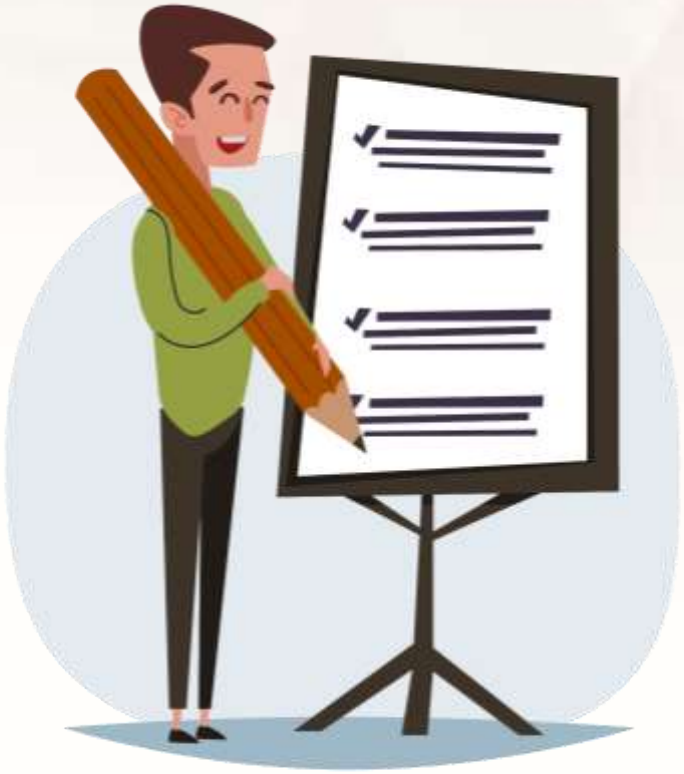
Lawn and Yard Care Considerations



[Native Plants and Pollinators | Clean Water Clear Choices Indiana]

The deep roots of native plants help stabilize the ground (prevent erosion), help infiltrate water into the soil (reduce runoff), help the plants survive droughts, require less watering, and provide resources for the food web

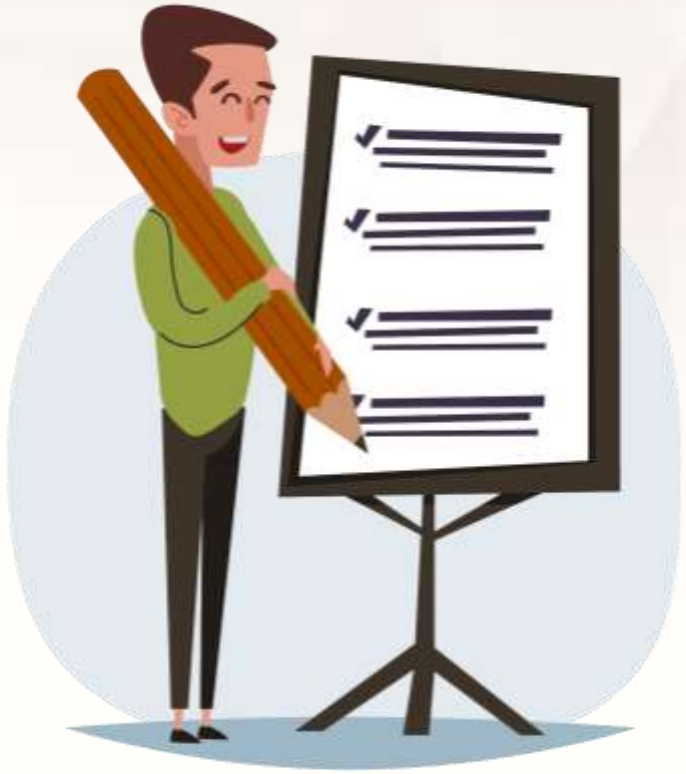
Lawn and Yard Care Considerations



Take Aways:

- Pick up the mess
- Native plants are good
- Storm inlets are not garbage disposals

Key Takeaways



- Stormwater is your responsibility as an HOA
- Good management = protection, savings, and compliance
- Residents benefit from cleaner, safer, more attractive neighborhoods
- Action today prevents costly problems tomorrow

Call to Action

- **HOAs: Take Charge of Your Water**
- **Inspect → Maintain → Educate → Plan**
- **Protect your investments and community**

What is your role in the community?

Safeguard people and investments against flooding and contaminated water.

What is the purpose of this residential pond?
Reduce flooding and capture pollutants

Who is ultimately responsible for the upkeep of the pond?
The HOA

HWC Engineering and
HWC Water & Land Resources, LLC

Hendricks County Partnership for Water Quality

Upcoming Events

Landscaping with Native Plants Workshop

- Hendricks County Partnership
- Date: TBD
- Check Clean Water Website and/or Facebook for future events

Appendices

- Contacts/introductions
- References and additional resources
- More examples

Introductions – *Who are you people?*

Hendricks County Partnership of Water Quality

Hendricks County
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Introductions – *Who are you people?*

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Introductions – *Who are you people?*

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HWC
WATER & LAND RESOURCES, LLC

Appendix – References and Additional Resources

Taylor's Top 4 Recommended Resources

- Stormwater Wet Pond and Wetland Management Guidebook | EPA
- Clear Choices Clean Water
- Free Stormwater Maintenance Virtual Training | White River Alliance
- Recommended Indiana-native Plants for Attracting Pollinators | Purdue Extension

Appendix – References and Additional Resources

Local Resources

- Hendricks County Partnership for Water Quality | Facebook
- Hendricks County Department of Clean Water | Hendricks County
- Avon Stormwater Utility | Town of Avon
- Brownsburg Stormwater | Town of Brownsburg
- Danville Stormwater Department | Town of Danville
- Pittsboro Waste Water Department | Town of Pittsboro
- Plainfield Department of Public Works | Town of Plainfield
- Landscape, Aquatics, and Weed Management | HWC Water and Land
- Drainage Engineers | HWC Engineering
- Watershed Monitoring Protection | White River Alliance

Appendix – References and Additional Resources

Pond Maintenance

- Stormwater Wet Pond and Wetland Management Guidebook | EPA
- SOLitude's 6-Step Guide for Proper Stormwater Pond Management | SOLitude Lake Management
- Aerated Pond vs Non-Aerated Pond | Candianpond.ca Products Ltd.
- Cattails - The Wetland Supermarket | DNR
- Invasive Phragmites Australis: Learning the basics | MSU Extension
- Aquatic Plant Management | Purdue University

Appendix – References and Additional Resources

Green Infrastructure

- Notre Dame now has the Biggest Green Roof in Indiana | Greenroofs
- Roadside Guide to Clean Water: Vegetated Swales | Penn State
- Overview methods of pretreatment | Minnesota Stormwater Manual
- Bioretention Design Guidance | Ohio EPA
- Stormwater Control Measures (SCMs) | High Point, NC
- What is a detention basin? | EcodesignSD
- Benefits of Native Buffers for Detention Basins | Lower Dupage River Watershed Coalition
- Gardening For Rainwater: Creating a Rain Garden | Save Tarrant Water
- Rain Barrels | City of Lafayette
- Native Plants and Pollinators | Clean Water Clear Choices Indiana
- Recommended Indiana-native Plants for Attracting Pollinators | Purdue Extension

Appendix – References and Additional Resources

Gray Infrastructure

- Drainage grates, frames and curb inlets | EJ Prescott
- ChamberMaxx® Stormwater Infiltration Chamber System | Contech
- Hydrodynamic Separation | Contech
- AquaSwirl | AquaShield

Flooding and Prevention

- The importance of purchasing flood insurance in Indiana | in.gov
- Homeowner Consultation | Tippecanoe County

Appendix – References and Additional Resources

Pollutants

- Polluted runoff: a top Puget Sound pollution source | RE Sources
- Stormwater Pollution | Regional Stormwater Partnership of the Carolinas
- Waterfowl & Water | Clear Choices Clean Water Indiana
- Yes, you can reduce ocean oil contamination! | Friends of the Mississippi River
- Runoff from a parking lot in summer can cause heated runoff | USGS
- Leaving Grass Clippings in the Street is Illegal - Please help our lakes! | Whitewater Banner
- How to Get Pet Waste Stations Installed in Your Neighborhood | Dog Poo Pros

Appendix – References and Additional Resources

Newsworthy

- What are the odds Indiana will see a '100-year flood?' What to know before the next storm hits | IndyStar
- Flooding in Indianapolis shown through photos | Indy Star
- Stormwater is no friend to the White River | IndyStar
- Leaf litter can block storm drains. Here's how to help | IndyStar
- 113,000 more properties may be at risk of flooding in Indiana | IndyStar
- Baltimore City testing screens on storm drains to keep waterways clean | WBAL
- 300-Mile Swim Through The Great Pacific Garbage Patch Will Collect Data On Plastic Pollution | Forbes
- Man dies after being trapped under lawnmower in pond | WBPF News

Appendix – References and Additional Resources

Studies/Reports

- Clean Water Act at 50 | EIP
- White Lick Creek Watershed | White River Alliance

Maps

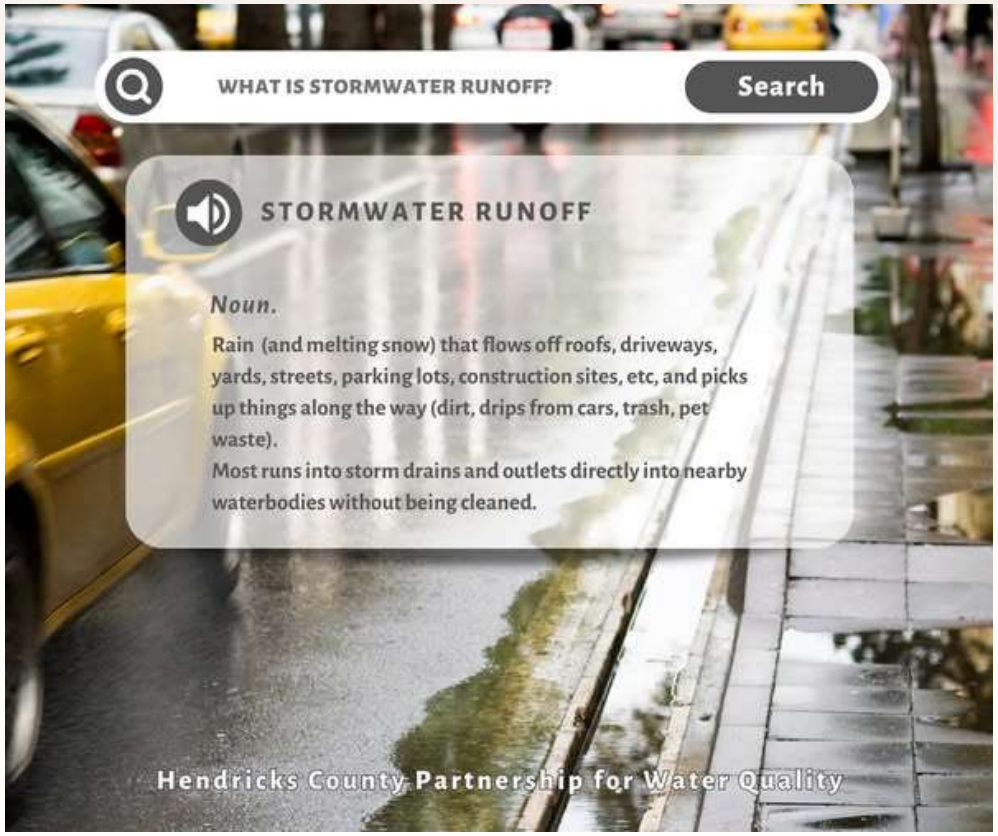
- Hendricks County Beacon
- Google Earth

History

- Endorsed Projects | Hendricks County Historical Museum
- The Cuyahoga River Caught Fire at Least a Dozen Times, but No One Cared Until 1969 | Smithsonian Magazine
- Flooding in Plainfield, Ind. 1979 | Hendricks County Historical Museum
- Survivorship Bias | Wikipedia

Appendix – More Examples

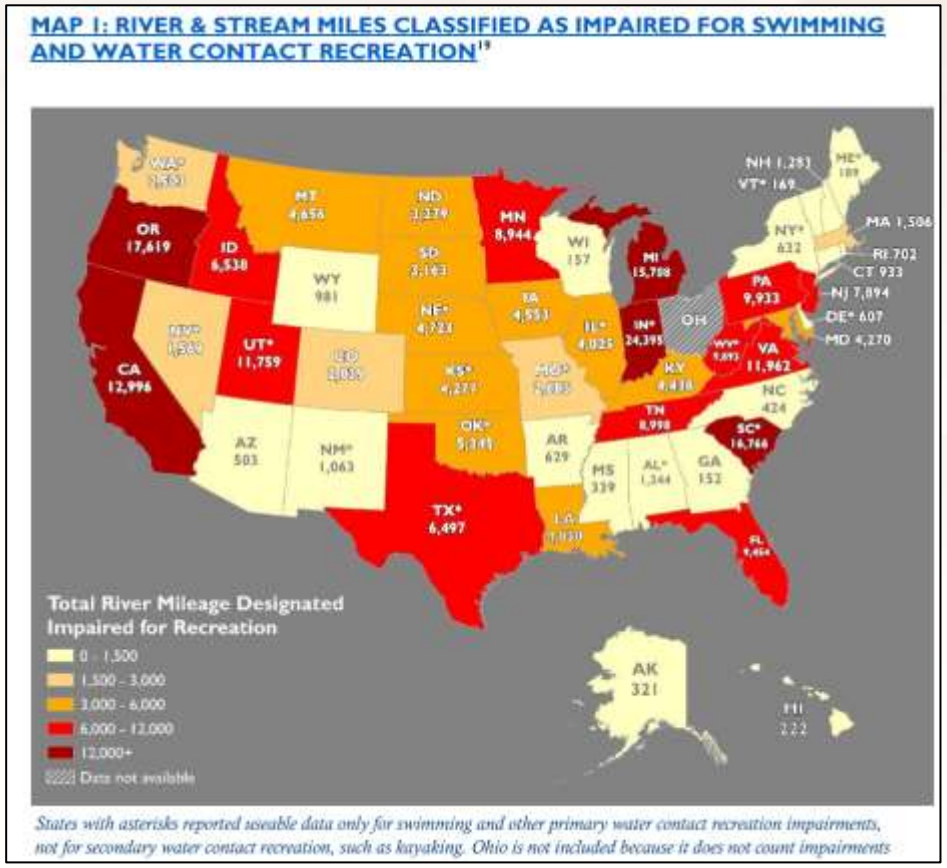
Stormwater Management & Impacts



What is stormwater?

- Rain or snow
- Picks up pollutants
- Stormwater = A wastewater

Why Stormwater Matters – *How bad is the water?*



The Clean Water Act at 50 report by Environmental Integrity Project (March 17, 2022) identified Indiana with the most river miles classified as impaired for water contact

Clean Water Act at 50 | EIP

Impaired = Too much $#!T

HOA Best Management Practices (BMP)

HOA Budgets

PV = FV / (1 + r)^n where;

- PV = Present value ($)
- FV = Future value ($)
- r = rate (decimal)
- n = number of years

Can also be rewritten to determine FV; FV = PV * (1+r)^n

Example

- PV = $15,000
- r = 7% (typ. Inflation assumed)
- n = 3 years (expected sediment removal frequency)
- FV = $15,000 * (1+0.07)^3 = $18,375.65 expected cost in 3 years
- Need to save $6,125.22 per year to have enough funds
- Assuming 200 units in the HOA, each unit would pay $30.63/year in dues OR Special Assessment $91.88/unit at time of project

Stormwater Infrastructure Basics

Examples of Green Infrastructure:

Stormwater Ponds

- Reduce stormwater discharge
- Long residence times allow for settling of pollutants

Bioretention

- Small-scale depressions
- Plants and soil absorb and filter stormwater
- Allow infiltration

Grassed Swales

- Open channels that convey stormwater
- Slow and filter stormwater flow
- Allow infiltration

Stormwater Management & Impacts

The 20-0-8 indicates the percent of N, P, and K in the bag. In this bag there is 2.67# of N (20% N x 13.35# bag), 0# of P, and 1.07# of K.

[Scotts Turf Builder SummerGuard Lawn Food 13.35-lb 5000-sq ft 20-0-8 All Purpose Lawn Fertilizer with Insect Control | Lowes]

[Scotts Turf Builder Starter Food 15-lb 5000-sq ft 24-25-4 All Purpose Lawn Starter Fertilizer | Lowes]

One bag of Starter can create 1 ton of algae.

1# of P can create 500# of algae 25% P of 15# = 3.75# of P => 1,875# ≈ 1 ton of algae use low/zero P fertilizer instead, like Summerguard

This bag has 3.6# of N, 3.75# of P (25% P x 15# bag), and 0.6# of K.

Stormwater Management & Impacts

[Flooding in Indianapolis shown through photos | Indy Star]

Flooding

- Moves a lot of pollution
- Damages property
- Not safe

Stormwater Management & Impacts

[Flooding in Plainfield, Ind. 1979 | Hendricks County Historical Museum]

[The importance of purchasing flood insurance in Indiana | in.gov]

Flooding

In 2021

- 103 flash floods, floods, or heavy rain events in Indiana.
- 123 flood insurance claims
- $3.5 million paid to property owners

Floods cause property damage

Stormwater Management & Impacts

[113,000 more properties may be at risk of flooding in Indiana | IndyStar]

Take Away:

- Stormwater carries pollutants
- Stormwater can cause flooding
- There are steps to take to minimize pollutants and flooding

HOA Best Management Practices (BMP)

Crucial to harvest/remove dead plant materials

Prevent nutrient release:
The primary function of stormwater plants is to absorb excess nutrients like nitrogen and phosphorus from runoff. If this plant material decomposes in the pond, it releases those captured nutrients back into the water, undermining the plants' purpose and potentially fueling algal blooms, drainage.

Avoid sediment accumulation:
As plant matter decays and sinks, it contributes to the build-up of organic sediment on the pond's bottom. This can decrease the pond's depth and capacity over time, reducing its effectiveness for flood control and water quality treatment.

Prevent oxygen depletion:
The decomposition of large amounts of organic material consumes dissolved oxygen in the water. Low oxygen levels can harm fish and other aquatic life.

Remove invasive species:
Harvesting allows for the targeted removal of invasive or undesirable plant species, such as phragmites or cattails, that can clog water flow and crowd out beneficial vegetation.

Control overgrowth:
Regular harvesting prevents plants from becoming so overgrown that they impede water flow through inlets and outlets, which is crucial for proper drainage.

HOA Best Management Practices (BMP)

Crucial to harvest/remove dead plant materials

Timing:
The best time to harvest or cut back emergent wetland plants is typically in late winter or early spring before new growth starts. This prevents the dead foliage from adding nutrients to the water and allows the plant roots to use stored energy for spring growth.

Technique:
For herbaceous plants and grasses, a light raking or trimming to a height of 6–18 inches is often sufficient to remove dead material while preserving the root structure. Clipping should be done carefully to ensure fragments do not fall back into the pond.

Disposal:
Removed plant material should be composted or disposed of far away from the pond to prevent nutrients from leaching back into the water.

Professional harvesting:
For large-scale problems or heavily infested areas, mechanical harvesting may be necessary. This process is most effective when paired with other management strategies to prevent new growth.

Stormwater Management & Impacts

Screenshot of Hendricks County 2025 Aerial Photography | Beacon

Impacts of pollution common to HOA: Sediment

Stormwater ponds allow sediment to settle out

Screenshot of Hendricks County 2016 Aerial Photography | Beacon

Inspection & Compliance

Bank slope too steep and flow causing erosion. Regrade or install geotextile and riprap to reduce erosion.
Undercutting occurring at headwall.

Inspection & Compliance

Shoreline protection. Spillway protection.

Inspection & Compliance

Large amount of algae.
Drain pond.
Dam is the responsibility of the owner.

Inspection & Compliance

Dam removed. Continue to monitor channel for sediment build up and erosion. Monitor outlet for erosion.

HOA Responsibility – *How does it work?*

Riprap around outlet. Trash rack secured.

Inspection & Compliance

Don’t let it get this bad (expensive to fix)

Inspection & Compliance

Pond contractor does not have stabilized maintenance access. Consider installing an aggregate or reinforced maintenance ramp for long-term inspection and maintenance activities. Regrade ruts to prevent future erosion.

Stormwater Infrastructure Basics

Primary spillway controls release rate for most storms. The riprap spillway conveys flows for larger storm events.

Stormwater Management & Impacts

[Blue-green algae alert at Lake Monroe beaches | The Herald-Times]

[Red Tide is Devastating Florida Sea Life | National Geographic]

Animal waste and fertilizer contribute excess nutrients to water increasing algae

Stormwater Management & Impacts

Impacts of pollution common to HOA: Animal Waste/Fertilizer

Waterfowl & Water | Clear Choices Clean Water Indiana

A Canadian Goose can generate 3# of waste a day.
Canadian Goose waste has a lot of P and N that leads to algal blooms.

Canadian Goose Facts and Management | NH DES

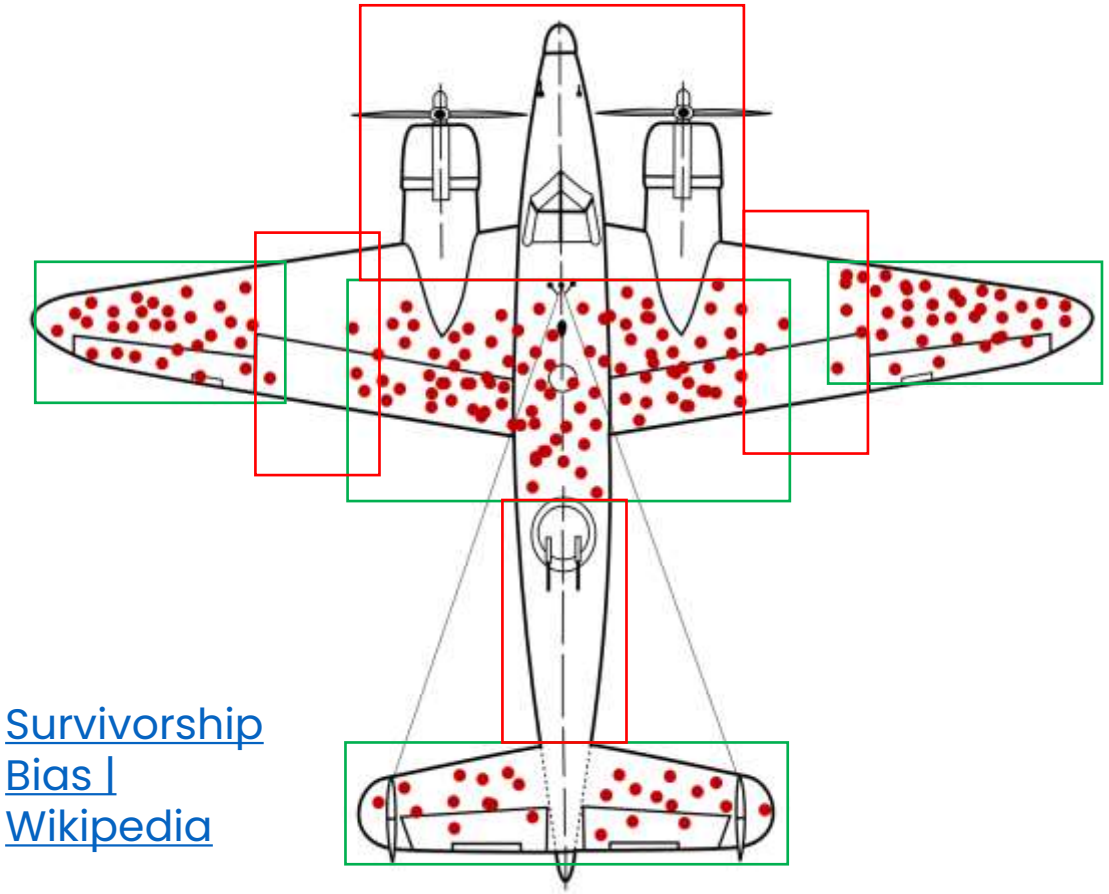
A dog generates 0.75# of waste per day.
Dog waste contains almost twice as much fecal coliform bacteria than human waste.
Domestic dog waste can take over a year to fully decompose.

Dog Waste and Waterways | City of Eugene Oregon Public Works

Buffer strips should be 30’ wide 3’ tall to be effective

Canadian Geese Buffer Strip | DNR

Inspection & Compliance



[Survivorship Bias | Wikipedia]

WWII plane returns to base with the strikes shown (red dots). What areas need reinforcing?

Areas where bullet holes are, have enough reinforcement to prevent critical failure

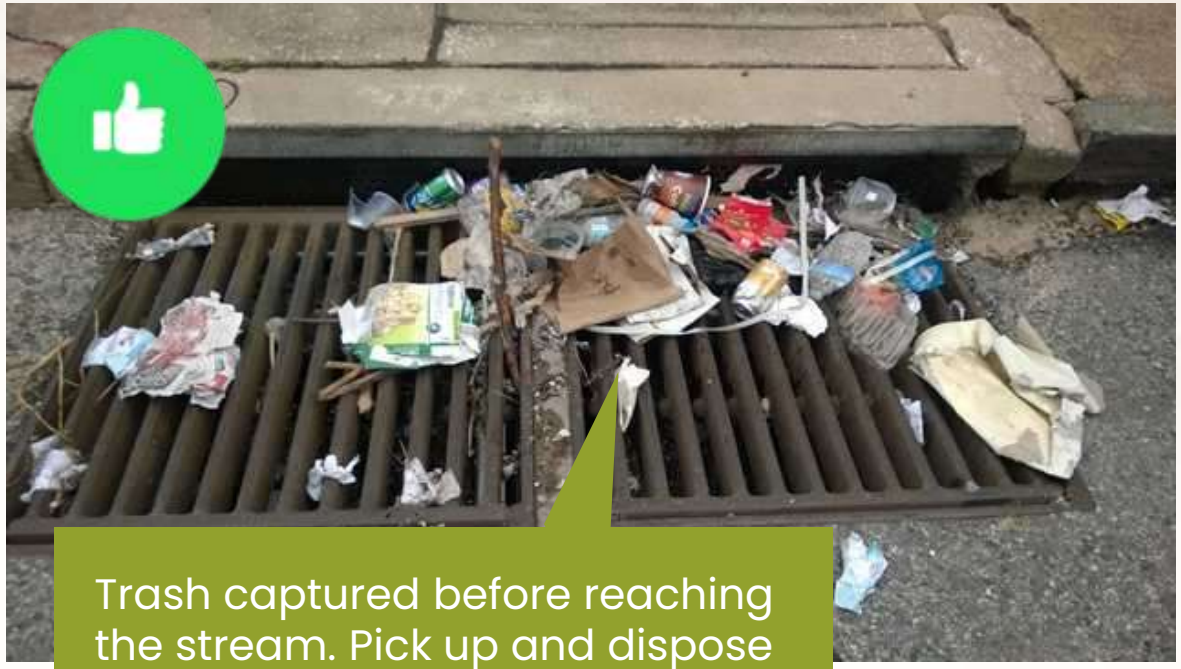
Reinforce the areas where the bullet holes are not

There's a lot of artillery in the air. Did the planes not get hit in the green boxed areas? Not likely. The planes that were struck in the green boxed areas likely experienced critical failure and did not return to base.

The planes were able to return to base with the red dot strikes and did not experience critical failure.

Therefore, reinforce the areas where the bullet holes are not.

Inspection & Compliance



Trash captured before reaching the stream. Pick up and dispose of properly. Maybe add additional trash receptacles to reduce trash load.

Trash reached the ocean. Much more expensive to clean up.

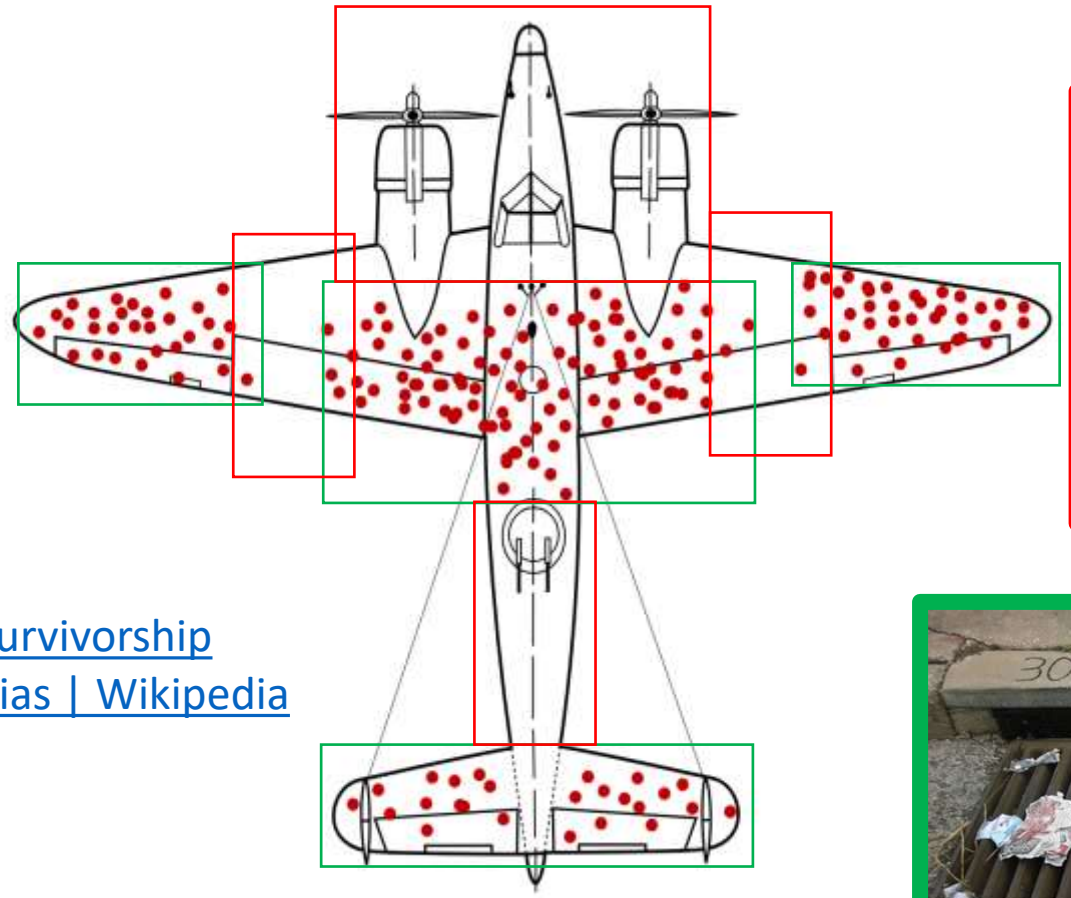
Trash is expected to be captured by inlets and in the vegetation. This is good because if it isn't captured, it enters the stream.

[Baltimore City testing screens on storm drains to keep waterways clean | WBAL]

[300-Mile Swim Through The Great Pacific Garbage Patch Will Collect Data On Plastic Pollution | Forbes]

Inspection & Compliance

Assuming the stormwater system is like a plane, we expect the different areas to be hit with pollution.



[Survivorship Bias | Wikipedia]

Inspect the areas that have not captured pollution to see if the pollution is bypassing the system

Continue to perform maintenance on the areas that capture pollutants

Inspection & Compliance

This flock of 40 can contribute 840# of waste per week (12# of P). This could produce 5,880# (~3 tons) of algae.

This flock of 13 can contribute 182# of waste per week (3# of P). This could produce 1,274# (~0.6 tons) of algae.

Geese like short grass and easy access to water. A single goose can contribute 4# of waste per day.

Stormwater Management & Impacts

Screenshot of Quarry 1998 | Google Earth

Screenshot of Quarry 2005 | Google Earth

Stormwater Management & Impacts

Screenshot of Quarry 2012 | Google Earth

Screenshot of Quarry 2013 | Google Earth

Stormwater Management & Impacts

Impacts of pollution common to HOA: Sediment

Screenshot of Quarry
2014 | Google Earth

Screenshot of Quarry
2016 | Google Earth

Screenshot of Quarry
2017 | Google Earth

Stormwater Management & Impacts

Impacts of pollution common to HOA: Sediment

Screenshot of Quarry 2018 | Google Earth

Screenshot of Quarry 2020 | Google Earth

Screenshot of Quarry 2021 | Google Earth

Stormwater Management & Impacts

Screenshot of Quarry 2005 | Google Earth

Screenshot of Quarry 2024 | Google Earth

Screenshot of Quarry 2024 | Google Earth

Stormwater Management & Impacts

Screenshot of Quarry 2005 | Google Earth

Screenshot of Quarry 2024 | Google Earth