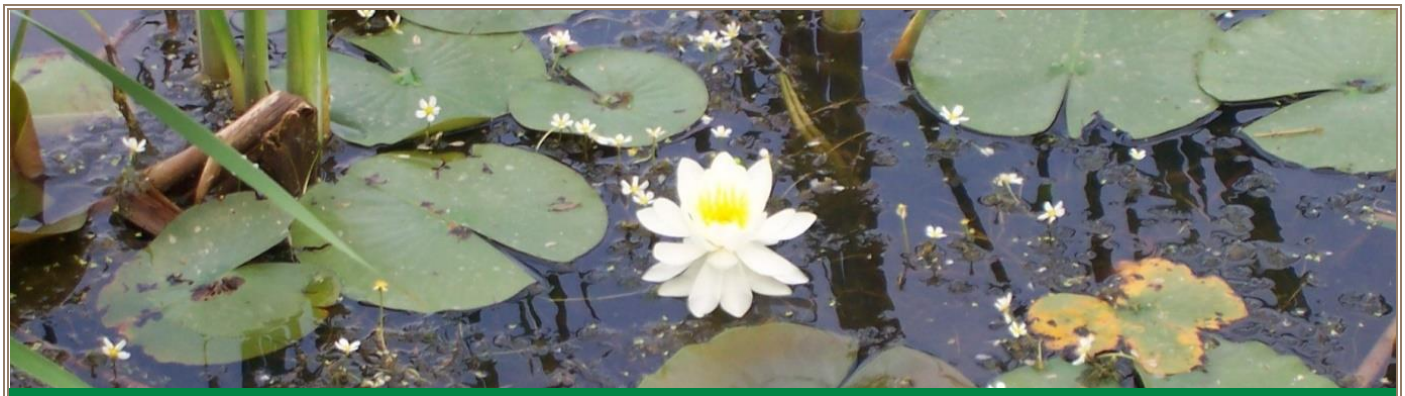

Pond System Management Plan

Winslow Farm Community Association
Perry Township, Monroe County, Indiana

September 2018

Prepared for:
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Introduction

Winslow Farm Community Association

Winslow Farm Community Association (WFCA), Inc. is a collection of residential communities comprised of 417 homes located in south Bloomington, Indiana. Residential communities in the area include Moss Creek Village, Moss Creek, Olde Mill, Bent Tree, New Bent Tree, Laurelwood, Sweetbriar, and Bayberry. The residential community is comprised of condominiums and single-family homes. Conversion of the area from farmland to residential houses took place between 1994-2002. Ownership of the common area has since transferred from the builder to the community association.

A system of seven ponds was created in the southern portion of the community during construction. The pond system is comprised of seven ponds located within Moss Creek, Moss Creek Village, and the Winslow Farm Community Association common area located in the southern portion of the Winslow Farm Community. The layout of the ponds is shown in Figure 1 on page 2.

Ponds 1-6 were included in initial construction to increase property values and improve aesthetics throughout Moss Creek and Moss Creek Village. Pond 7 was constructed as a required detention pond per local ordinance construction requirements for developments.

Davey Resource Group was retained by WFCA to create a comprehensive management plan. This plan will serve as a guide for future management decisions by the community and includes options and recommendations for each individual pond and for the system.

Management Plan Goals

The WFCA and member-homeowners have expressed their desire to establish a long-term management plan to maintain the pond system in their common property. This management plan is designed to help the WFCA control costs, maintain property values, maintain aesthetics, guide ecologically and environmentally smart choices, and decrease the amount of work required by volunteer board members to maintain the system. WFCA is interested in addressing the following within the pond system:

- Aquatic plant selection
- Erosion control to maintain bank integrity and minimize soil moving into the ponds
- Increasing water quality including biological and chemical control
- Pond liner maintenance and repair
- Water level maintenance including leakage repair and prevention
- Maintaining related equipment including aerators, fountains, and pumps
- Removal of excess sediment
- Deterring Canada Geese

The WFCA Board and member-owners have expressed their desire to address short-term needs of the system as well as establish a long-term, multi-year management strategy. This plan serves to fit both desired goals.

Figure 1. Winslow Farms Pond Layout

Existing Pond System Components

Pond 1

Summary

Pond 1 is the upper-most waterbody in the system. The pond is located southwest of the East Winslow Farm Drive and South Highland Avenue intersection. The pond is approximately 0.11 acre with an average depth of 2 feet. Three aerators are installed in the pond to create adequate mixing for improved dissolved oxygen levels.

Water inputs into Pond 1 include runoff from South Highland Avenue, stormwater pipes from surrounding residences, and through a water pump in Pond 7 creating a continuous loop in the pond system. A silt trap was installed at the inflow from South Highland Road in September 2017 to filter soil and rock particles from water moving into the system. Other recent work in the pond includes dredging in 2015 and a new pond liner and shoreline repair with Flexamat installation in the fall of 2016. Approximately four feet of muck was taken out of the pond at the time of dredging according to local membership and management staff.

Pond 2

Summary

Pond 2 is located immediately west of Pond 1. The pond is approximately 0.10 acre with an average depth of 2 feet. No fountains or aerators may be found in Pond 2.

Pond 2 receives incoming water from Pond 1 through a weir. The weir was resealed on June 2017 to prevent loss of water in the pond system. Other recent work in the pond includes new pond liner and shoreline repair with Flexamat installation in the fall of 2016. Up to three feet of muck was taken out of the pond at the time of dredging according to local membership and management staff.

Pond 1

Pond 2

Pond 3

Pond 4

Pond 3

Summary

Pond 3 is located west of Pond 2, south of East Winslow Farm Drive, and north of East Moss Creek Circle. Pond 3 is the largest pond in the portion of the system within Moss Creek. The pond is 0.32 acres with an approximate average depth of 2 feet. The northern half of this pond is much shallower than the southern portion.

The pond receives water from several sources including a weir from Pond 2, a stream flowing into the pond from Winslow Woods north of the pond, a street outlet pipe, and several residential stormwater outlets. The weir between ponds 2 and 3 was resealed on June 2017 to keep water from escaping the pond system and creating erosion underneath the weir itself.

Pond 4

Summary

Pond 4 is located east of the intersection of East Winslow Farm Drive and East Moss Creek Circle. The pond is approximately 0.27 acres with an average depth of 2 feet.The pond receives water from a weir connected to the southwest corner of Pond 3. Water also enters the pond through a system of underground pipes designed to collect surrounding stormwater. Two underground stormwater outlets exist in Pond 4. Surface drainage from street runoff adjacent to the pond also occurs at the southwest corner of the pond.

Pond 5

Summary

Pond 5 is located southwest of Pond 4. The two water bodies are connected by a culvert passing under East Moss Creek Drive. The pond is approximately 0.12 acres with an average depth of 1 foot.

Pond 5 also receives direct street runoff through two concrete drainage channels located along the northern shoreline. A groundwater pump exists along the southern shoreline underneath a large tree. The pump outlets into Pond 5 to provide additional water during periods of drought.

Pond 6

Summary

Pond 6 is located west of Pond 5. The ponds are connected by a culvert underneath East Winslow Farm Drive. Water is conveyed into Pond 6 once water levels reach the elevation of the culvert. Pond 6 is approximately 0.32 acres with an average depth of 2-3 feet.

Pond 6 also receives street runoff along the northeast corner of the pond through a poorly designed stormwater collection system involving numerous culverts and pipes to move water underneath East Moss Creek Drive and into Pond 6. Street drainage also enters Pond 6 long the west bank. Drainage water west of the pond along East Moss Creek Drive makes way into the system at this location. Runoff from surrounding residential roofs is also piped into the pond in a few locations.

Pond 7

Summary

Pond 7 is located south of Pond 6. The two ponds are connected by a concrete weir. Pond 7 is located west of East Winslow Farm Drive and north of East Winslow Road. Pond 7 is

approximately 0.41 acres with an average depth of 3 feet. Pond 7 is the only required pond in the system at the time of construction—it is classified as a stormwater detention pond. Ponds 1-6 are in-line detention ponds not required for stormwater detention.

Water is conveyed into the pond through a weir connecting Pond 6 and 7. Street and residential stormwater runoff is conveyed into the pond through pipes. A pump circulates water from Pond 7 into Pond 1 recycling water through the pond system. An outlet drop structure is located along the western shoreline of Pond 7. Once the pond is full water can fall through the control structure and outlet into a rip-rap drainage swale. Water leaves the property west towards the Clear Creek residential development along the north side of East Winslow Drive.

Existing Vegetation

Native and non-native vegetation is currently found along the banks of the pond system. Many non-naitve plants are considered invasive and should be treated or removed on a regular basis. Below is a comprehensive list of plant species found surrounding the pond system.

Table 1. Existing Vegetation Surrounding the Pond System

Beneficial and Neutral Species		
American Germander	American Pondweed	Asters
Black Eyed Susan	Curly Dock	Daisy Fleabane
Flowering Tick Seed	Foxtail Grass	Goldenrod
Heath Aster	Ironweed	Late Flowering Thoroughwort
Mist Flower	Queen Anne's Lace	Rice Cut Grass
Sedges (Various)	Three-Sided Mercury	Tridens Flavus
Invasive or Detrimental Species		
Annual Ragweed	Cattail	Marestail
Water Primrose	Reed Canary Grass	Thistles
Woody Species		
Ash	Callery Pear (Invasive)	Maple
Mulberry	Sumac	Sycamore

Davey Resource Group identified the species listed above along the shoreline of the pond system during the August 2018 site visit. A thin buffer of unnowed vegetation around most ponds allowed for development of the species. Many of the species are categorized as beneficial or neutral requiring no management activities.

The invasive and detrimental species should be managed to maintain the integrity of the pond system. Annual ragweed can be eradicated by mowing (with grass trimmer) before pollination in mid-to-late summer. Thistle should be chemically treated early in the growing season (early April) by using either glyphosate, triclopyr, or 2, 4-D. Chemicals must be applied by a certified applicator using water safe products. Allowing thistle to grow taller than 12 inches will increase the risk of overspray on surrounding vegetation. Thistle may be cut and chemically treated a few weeks after once regrowth has started. Using a broadleaf specific chemical such as triclopyr or 2,4-D will decrease the risk of off-target damage.

Marestail should be monitored but not treated at this time. Marestail may require treatment if native seed is spread along the shorelines as part of any stabilization project. Only a few individuals of reed canary grass were found around the pond system. This species will need to be treated following rain garden wetland installation or shoreline stabilization due to its aggressive nature in shallow water and along shorelines.

Cattail and water primrose are the species of most concern at this time. These species should be treated on a monthly basis throughout the growing season to prevent their spread. Cattail and primrose pose a threat to any future rain garden or shoreline stabilization project. Both species are considered invasive and will spread aggressively through the system if left unattended. A water safe glyphosate is recommended to treat these species.

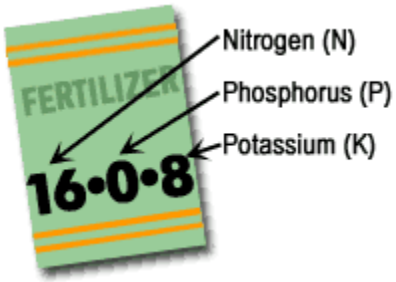
Stopping the practice of mowing is very beneficial for the shoreline; however, it allows woody species to establish. Davey Resource Group recommends physical and chemical removal of any woody species. Removal can occur once every 1-2 years on an as-needed basis.

Urgent Issues and Recommendations (Short Term)

Lawn Fertilizers

Landscaping contractors and private homeowners often use fertilizers to provide heathy growth benefits to residential lawns. The use of fertilizers should be managed closely near any freshwater resource.

Nitrogen, Phosphorus, and Potassium are the nutrient components of lawn fertilizers. The amount of nutrients in fertilizer is depicted on the packageing as Nitrogen-Phosphorus-Potassium (##-##-##).



Nutrient Composition in Fertilizers

Phosphorus is known as a “limiting” nutrient in freshwater systems. An adequate amount of each of the three nutrients must be found within freshwater before aquatic plants and algae may thrive. An excess of nitrogen and potassium is already within the pond system. These nutrients make their way into the water naturally and through runoff from the surrounding landscape. Phosphorus is naturally low in freshwater systems. Runoff from fertilized lawns allows for an excess supply of phosphorus to trigger aquatic plant and algal growth.

Applying phosphorus free fertilizers in the surrounding area is an effective method of curbing aquatic plant and algal growth. Phosphorus free fertilizers will show a middle number of zero on the packaging (##-0-##).

Flexamat

Flexamat within and surrounding Ponds 1 and 2 appears to be installed incorrectly. Vegetation is not growing through the Flexamat as planned. Davey Resource Group coordinated with D2 Land and Water as well as the Flexamat manufacture to receive further details.

The Flexamat manufacturer indicated a pond liner was installed just below the Flexamat. The pond liner was placed in this location to help promote sufficient water levels in Ponds 1 and 2. The manufacturer indicated the overall goal of the installation did not include growing vegetation through the Flexamat.

Pond Liner Below Flexamat

Pond Liner Below Flexamat

Davey Resource Group is aware a seed mix was purchased to grow through the mat. Property management personnel has indicated the original goal of the area was to be vegetated through the Flexamat. Management personnel also indicated a sufficient amount of soil was placed over any liner to ensure the liner was not punctured while staking down the Flexamat. A miscommunication between the manufacturer and WFCA representatives likely occurred leading to unexpected results and incorrect installation.

Davey Resource Group did see some evidence of seed mix germination around Ponds 1 and 2. The areas with the most success establishing vegetation are along the base of the shoreline immediately next to the water. Davey Resource Group believes this is because the soil in this location has adequate moisture immediately adjacent to the water. The thin layer of soil in the middle and top of bank will not allow for a diverse native vegetative community to establish.

Vegetation Concetrated Near Water

Vegetation Concetrated Near Water

The manufacturer did not recommend removing the Flexamat because damage to the pond liner is likely to occur. Placing sufficient amounts of soil over the Flexamat to grow vegetation renders the Flexamat less effective for its purpose to decreasing erosion into the pond system.

Most of the soil will wash away from the Flexamat into the pond system prior to vegetation establishment. Native grasses will not have enough soil to successfully grow even if more soil is placed on top of the Flexamat. A full replacement of the liner and disposal of the Flexamat may be required to vegetate the banks of Ponds 1 and 2 if the pond liner was installed just below the Flexamat. D2 Land and Water should be consulted before replacing the Flexamat in Ponds 1 and 2. Jake Roberts at D2 Land and Water is a good resource and is familiar with the Winslow Farm project. His initial recommendation is to not bury the Flexamat. Davey Resource Group agrees with this recommendation.

Davey Resource Group recommends addressing other areas of the pond system before addressing the Flexamat in Ponds 1 and 2 from a functionality standpoint. The area is stable and no longer a source of erosion. However, aesthetics in the area are a concern for the residents living there.

Whenever the Flexamat is addressed, Davey Resource Group recommends installing the pond liner several inches below the Flexamat. Native grasses require deep root systems in order to grow effectively. Place the liner approximately 6 inches below the Flexamat near the bottom of the bank. The liner should be installed approximately 18 or more inches blow the Flexamat near the top of bank.

Pond 3

Rain Garden Installation

Davey Resource Group has reviewed the rain garden installation plan prepared in August 2013. The rain garden plan was developed by Eco Logic, LLC and Bledsoe Riggert Guerrettaz Civil Engineers. Plans shared with Davey Resource Group included a set of maps and construction plans outlining existing and proposed topography, planting locations, and species lists. A report document was not generated during the creation of the plan.

Davey Resource Group does not see any technical problems with the rain garden plan. Installing a rain garden will help slow the flow of water entering the pond system from the stream located north of Pond 3. Slowing the flow of water will allow sediment to drop out of the water column before entering the rest of the pond system. Keeping sediment out of the pond system will increase the longevity of each pond before dredging is required.

Davey Resource Group would expect to find a report document to accompany a rain garden installation plan such as this. The plan would outline the benefits of rain garden installation as well as permitting requirements. Artificial ponds do not typically fall under federal or state Clean Water Act Section 404/401 permit requirements; however, the pond system was constructed within an existing stream network. An unnamed tributary of Clear Creek flows into the northern section of Pond 3. Water from the stream flows through the pond system and outlets at Pond 7 into a roadside ditch north of East Winslow Road.

Water travels west from Pond 7 through the ditch approximately 0.6 miles until it reaches Clear Creek. This type of pond system is referred to as "in-line-detention" and is likely to fall within the jurisdiction of USACE and IDEM Clean Water Act Permitting requirements.

Davey Resource Group performed a brief investigation with WFCA members and the management company overseeing much of the work at Winslow Farms. Past coordination with the United States Army Corps of Engineers (USACE) and the Indiana Department of Environmental Management (IDEM) is inconclusive as to whether it took place and the exact outcome. These agencies oversee Clean Water Act permitting from a federal and state level, respectively.

Davey Resource Group recommends contacting the USACE's Indianapolis Field Office. Explain the basic premise of the project and ask for a jurisdictional determination. The conclusion of the jurisdictional determination will decide whether Clean Water Act permitting is required. An environmental consulting agency could be used to perform this task.

A jurisdictional determination should be performed prior to implementing the rain garden installation or any other work within the ponds involving placement or dredging of soil, stone, or other fill materials. Failure to perform agency coordination could lead to a violation notice mandating construction activity stop immediately and require remediation. Violations are very costly and burdensome to the landowner. The contact information for both USACE and IDEM are as follows:

United States Army Corps of Engineers
Indianapolis Field Office
Attention: Laban Lindley
8902 Otis Ave., Ste S106B
Indianapolis, IN 46216
(317) 543-9424
Laban.C.Lindley@usace.army.mil

Indiana Department of Environmental Management
Office of Water Quality, Wetlands and Storm Water Section
Attention: Aileen Driscoll-Farid
100 North Senate Avenue
Indianapolis, IN 46204-225
(317) 233-0467 (Direct Phone Number)
adriscol@idem.IN.gov

Monroe County regulates the quality of stormwater through their MS-4 Coordination Staff. Coordination with the Monroe County MS-4 Office should occur throughout the agency coordination process. The contact information for Monroe County MS-4 is as follows:

MS-4 Coordinator: Terry Quillman
349-2499
tquillman@co.monroe.in.us

MS-4 Assistant: Dana Wilkinson
349-2960
dwilkinson@co.monroe.in.us

A second option for Pond 3 includes dredging and installation of a new pond liner. More information specific to pond liners and dredging may be found in Low Water Level and Exposed Liner Section of this report. Both dredging (taking soil out of) and rain garden installation (placement of fill material) could involve the need for USACE and IDEM Clean Water Act

permitting based on the outcome of a jurisdictional determination. Dredging the southern half of Pond 3 will be more difficult once the rain garden is installed.

A third option would involve not moving material in or out of Pond 3. Wetland emergent seed could be spread along the bank in the northern half of the pond. Emergent vegetation would also serve to slow the water down and provide improved aesthetics in the area. This is an option with low cost; however, the chance of quick establishment of plant is low. Seed would have the ability to float around and travel out of the pond system. Emergent seed mixes normally cost between $1,000-$1,500 per acre from Spence Restoration Nursery. An example emergent seed mix maybe found within the Primrose Section of this report. If the seed is dispersed during a time with no water leaving the pond the chances of success increase.

Permitting is not required for vegetation installation or seeding—USACE and IDEM coordination would not be required but encouraged to maintain contact with the agencies and keep them up-to-date. The agencies could provide information regarding what future work would be permittable within the pond system.

Another related option involves installation of live vegetative "plugs" throughout the northern extent of the existing pond. Plugs are small pots of soil with newly emerged plants.

Plug installation would be costlier but have a better chance of success and would lead to faster vegetation establishment. Wetland (rain garden) vegetation would establish itself over time throughout the northern extent of Pond 3 as it fills in with sediment over time from the upstream unnamed tributary. Planting plugs in a few inches of water or within completely saturated soils is ideal. Wetland plugs may be installed during spring and early summer. Plugs planted after mid-June run the risk of drying out following planting. Plugs may also be purchased through Spence Restoration Nursery. The existing pond liner can be left in place—the plugs will not affect it. A species list and cost estimate for plugs may be found in the Primrose Section of this report. Pond 3 is significantly larger than Pond 5 and would cost more to plug. Davey Resource Group recommends installing plugs around the banks to keep costs down. The area would take longer than Pond 5 to fully establish if only the banks are plugged. Davey Resource Group recommends this option if permitting is required and too burdensome as it relates to the Rain Garden installation plan previously created.

Pond 3 will likely fill in slowly with sediment as time passes. Wetland vegetation will slowly migrate south through the pond as it fills with sediment. WFCA will need to stay on top of invasive species control during this transition. Native wetlands provide both aesthetic and habitat value; however, they are easily overrun with invasive species such as cattails, reed canary grass, phragmities, and purple loosestrife. Invasive species control is an important element of any wetland management plan.

Low Water Level, Exposed Liners, and Shoreline Erosion

Overview of System

Shoreline erosion is widespread in the pond system, resulting in exposed pond in many areas. The largest contributing factor to shoreline erosion at Winslow Farm is lawn mowing. Placement of mowing equipment along the edge of a pond can place too much weight on a thin layer of soil covering the edge of the pond liner. In response the soil "sloughs" off into the pond exposing the liner. Other types of erosive pressure often found in ponds or lakes include wind driven waves, boat activity, and ice heave. Davey Resource Group wouldn't expect to find any of these other erosive forces with any significance at Winslow Farms.

A water pump conveys water from Pond 7 into Pond 1 whenever required. The pump has been turned off since fall 2017 to prevent the spread of water primrose from the lower sections of

the pond system into Ponds 1 and 2. This practice should remain until successful control of watr primrose is established. Davey Resource Group performed a site visit in August 2018. The only pond experiencing dense primrose growth was Pond 3. Assess the primrose following initial treatments in 2019. The pump may be utilized once the species is under control. Continued control and monitoring should occur during monthly visits by the treatment provider. The pump may run with small primrose populations present—the risk of primrose making it into Ponds 1 and 2 will never be completely eliminated. Please reference the primrose section of this report for more information.

Pumping water from Pond 7 to 1 should take place whenever water levels are approximately 3 inches below the weir outlet elevation. Water should be added to the system using the groundwater pump in Pond 5 whenever pumping water out of Pond 7 causes the water level in this pond to drop to an unsatisfactory level.

Ponds 1 and 2 were recently modified with Flexamat placed over the top of the liner. During Davey Resource Group's site visit in February 2018, the pond level was roughly 3-4 inches below the elevation of each outlet weir. Davey Resource Group would expect to see this level in the ponds during February. No additional work is recommended in Ponds 1 and 2 regarding the water level. The Flexamat will act as a barrier preventing the need to mow to the water's edge.

Pond 3 was also roughly 3-4 inches below the elevation of the weir during the February site visit. Davey Resource Group would expect to find this water level in February. Approximately 8 inches of bare soil or pond liner can be seen along the bank of the pond. Bare soil and exposed liner will be visible during max pool. The excess soil erosion and bare soils are caused by mowing to the water's edge.

Pond 4 was roughly 6 inches below the culvert elevation. Much of the liner was exposed during the February site visit. Cracks were visible near the top of the liner exposing soil underneath. Exposed liners are likely a result of damage to the liner as well as shoreline erosion from mowing to the water's edge. Stormwater infrastructure (inlet pipes and concrete conveyances) mark the old shoreline location (photographs below).

Pond 4 Southwest Bank

Pond 4 Northwest Bank

Pond 5 was approximately 4 inches below the culvert elevation during the February site visit. The pond liner was exposed, but not as much as other ponds in the system. The largest amount of exposure was found along the western bank of the pond. The soil erosion surrounding the pond is attributed to mowing to the waters edge. Increased erosion may be found underneath each of the street stormwater conveyances located along the northern shoreline of the pond. The edge of these conveyances marks the original shoreline location prior to erosion.

Pond 6 was approximately 3 inches below the weir elevation during the February site visit. In many places as much as 12 inches of the pond liner were exposed. Erosive pressure from mowing has caused most of the shoreline to erode into the pond along the immediate shoreline.

Pond 7 was approximately 10 inches below the outlet elevation during the February visit. A water level below the outlet elevation would be expected in February. Rip-rap stone has been installed along the western half of the pond. The eastern half of the pond had a large amount of exposed soil and pond liner and no rip-rap stone installed. Much of the eastern shoreline contains 8 inches of bare soil with some areas experiencing up to 12 inches of erosion.

Recommendations

A buffer should be established between each pond and the mowed lawn surrounding it. Davey Resource Group recommends approximately 2-5 feet of buffer between the water and mowed turf grass to allow for an adequate root system to hold soil in place and prevent excess weight from mowing equipment immediately adjacent to the ponds themselves. The banks of each pond should be re-shaped by adding top soil. Stone could be used along base of the shoreline for added protection. Erosion control materials, such as straw blankets or coconut fiber mats should be installed over bare soils. The following seed mix could be used to help create an extensive root system along the shoreline to prevent future erosion. The cost of the seed mix from Spence Restoration Nursery is approximately $1,750 per acre (Table 1). Over 21,000 feet of shoreline could be seeded assuming an average width of 2 feet for this amount. Seeded areas should be either bare dirt or dead turf grass. Do not apply seed to areas with living turf grasses.

Table 2. Low Stature Mesic Prairie Seed Mix

Species Name	Common Name	Oz/Acre
	Grasses	
Bouteloua curtipendula	side oats grama	32
Carex bicknellii	prairie oval sedge	2
Carex muhlenbergii	sand-bracted sedge	2
Elymus canadensis	Canada wild rye	32
Elymus virginicus	Virginia wild rye	4
Schizachyrium scoparium	little blue stem	48
Sporobolus heterolepis	prairie dropseed	8
	Forbs	
Allium cernuum	nodding wild onion	1
Asclepias sullivantii	Sullivant's milkweed	1
Asclepias tuberosa	butterfly weed	1
Aster azureus	sky blue aster	1
Aster ericoides	Heath aster	0.5
Aster laevis	smooth aster	2
Baptisia leucantha	wild false indigo	2
Coreopsis lanceolata	lance-leaf coreopsis	3
Coreopsis palmata	plains coreopsis	2
Echinacea pallida	pale purple coneflower	3
Echinacea purpurea	purple coneflower	4
Eryngium yuccifolium	rattlesnake master	3
Helianthus mollis	downy sunflower	1
Helianthus occidentalis	western sunflower	1
Lespedeza capitate	round-headed bush clover	2
Liatris aspera	rough blazing star	1
Liatris scariosa var nieuwlandii	savanna blazing star	1
Liatris spicata	dense blazing star	1
Monarda fistulosa	bergamot	0.5
Parthenium integrifolium	wild quinine	2
Penstemon digitalis	foxglove beardtongue	1
Penstemon hirsutus	hairy beardtongue	1
Petalostemum purpureum	purple prairie clover	2
Potentilla arguta	prairie cinquefoil	1
Pycnanthemum virginianum	mountain mint	0.5
Ratibida pinnata	yellow coneflower	2
Rubbeckia hirta	black-eyed Susan	4
Solidago nemoralis	gray goldenrod	1
Solidago riddellii	Riddell's goldenrod	1
Solidago speciose	showy goldenrod	1
Veronicastrum virginicum	Culver's root	0.5

The natural buffer should be mowed using either a string trimmer or brushcutter. Brushcutters may be fit with either a string trimmer or grass blade. Mowing the buffer to a height of 4-6 inches is recommended 0-2 times per year depending on the overall aesthetics WFCA would like to see surrounding the ponds. An early and mid-season mowing is recommended the first few years to prevent the spread of annual weeds. Mowing will prevent flowers from forming in most species decreasing the aesthetic appeal through the first few growing seasons. The area may be mowed less often as it matures and the density of native vegetation increases. Mowing the area also prevents woody species from establishing within the natural buffer.

Stormwater conveyance infrastructure maintenance is recommended in the next few years. Davey Resource Group recommends placement of stone in Ponds 4 and 5 at the base of each

conveyance. Placing stone at the base of each conveyance will dissipate energy reducing the potential for erosion to occur underneath the base of each conveyance. Stormwater conveyances with cracks should be replaced or repaired. A cracked water conveyance will allow running water to slowly erode beneath each concrete structure eventually causing gully erosion and potential failure. The same contractor used to repair weirs may investigate each conveyance and decide whether repair or complete replacement is appropriate at each location. Replaced conveyances should be designed to move water as straight as possible without sharp 90-degree bends.

All future pond liners installed should be made of reinforced polyethylene (RPE) materials. RPE pond liners is superior to other materials such as ethylene propylene diene monomer (EPDM) and polyvinyl chloride (PVC) in terms of puncture resistance, flexibility, ease of installation, and lack of ultraviolet sunlight reactiveness. RPE liners can be melted together at seams to create a water-tight seal. Davey Resource Group recommends a PPL-24 liner for use in the future.

Davey Resource Group recommends restoring the shoreline by placing top soil on top of exposed liners along the water's edge. Stone can be placed at the base of the shoreline to provide extra protection. Soil has fallen from the shoreline into the pond system overtime due to repeated exposure to the weight of mowing equipment. Soil for restoring the shoreline may come locally from dredged soils. Davey Resource Group recommends restoring the banks and replacing damaged liners at the same time any dredging occurs. Agency coordination should occur prior to placing any soil on the shorelines. Restoring the shoreline without replacing pond liners is recommended in Ponds 6-7. The same stone installation previously performed by Evergreen Home Improvement, LLC in Pond 7 could be used for the rest of Pond 7 and the entirety of Pond 6. Permitting agencies should be consulted before performing this activity. Davey Resource Group contacted Evergreen Home Improvements for a cost estimate to perform this work in other areas of the pond system, but the company was not forthcoming with pricing information. WFCA should contact Evergreen Home Improvement for a cost estimate to install top soil and stone along the shoreline of Ponds 6 and 7.

Dredging is an expensive process. Different methods can be used such as hydraulic and mechanical dredging. Different physical requirements are needed for each method. Hydraulic dredging is generally cheaper but relies on a large open pit nearby. USACE and IDEM permitting is typically required for hydraulic dredging.

Mechanical dredging uses either land or barge mounted excavation buckets to scoop soil out of a water body and directly into a truck to haul away. This method is often described as 1-step dredging. The permitting requirements for mechanical 1-step dredging are much lower—often a permit is not required. The overall cost to perform dredging with this process is relatively higher than hydraulic dredging. This method can be used in areas without nearby open space.

Other types of dredging can exist including hydraulic dredging into trucks. Hydrovac trucks are available to rent from companies such as Badger Daylighting in Indianapolis. The cost to perform this type of dredging is likely more expensive than mechanical dredging and the need for a permit is very likely.

A detailed dredging plan is recommended prior to any dredging work. A dredging plan will include information such as field measured dredged material volumes, decision on dredging method for each pond, soil material disposal logistics, shoreline restoration installation, and agency coordination regarding potential permit requirements.

Permitting agencies (USACE and IDEM) should be contacted before performing dredging of any kind. A jurisdictional determination provided by USACE will dictate if a permit is required.

A dredging plan would provide an exact breakdown of costs. Davey Resource Group cannot provide an exact dredge cost estimate without detailed information such as measured spoil volume, dredging methods allowed by permitting agencies, and spoil disposal logistical information. The cost to move dredged materials can vary widely based on method of dredging and transportation distance.

Hoosier Aquatic Management, Inc, has provided a cost estimate to complete a dredge plan and an overall cost range to dredge and restore the shorelines of Ponds 3-5. Hoosier Aquatic Management estimates a detailed dredging plan could be provided for approximately $15,000.

This estimate does not include information provided by this report such as seed mix recommendation and recommendations to coordinate with permitting agencies. Davey Resource Group recommends contacting Hoosier Aquatic Management for an updated cost estimate to perform a dredging plan following this report. Some tasks such as agency coordination could be handled by WFCA or property management staff to reduce costs. If a determination is made that indicates USACE/IDEM have jurisdiction over the ponds a consultant would be recommended to perform permitting. Davey Resource Group can provide permitting services.

Hoosier Aquatic Management also provided an estimated cost range to dredge, re-line, and perform shoreline restoration within Ponds 3-5 for approximately $200,000-$350,000. The cost to perform these services will depend heavily on the outcome of the dredging plan.

The Pond 3 Rain Garden Installation section outlines other low-cost planting options if a jurisdictional determination yields unfavorable results for permitting either the rain garden or dredging in Pond 3. Davey Resource Group recommends dredging all of Pond 3 if dredging is to occur in this location.

Overall dredging costs will decrease if Pond 5 is turned into a wetland rather than dredged. Information on this low-cost option may be found in the Primrose Section of this report.

Expansion Joint Repair

Several of the ponds contain weirs to convey water from one pond to the next. The weirs between ponds 3-4 and ponds 6-7 require minor maintenance work.

The bottom of each weir is connected to the side walls with an expansion point. The joint contains a physical gap to provide room for concrete to expand during hot days with direct sunlight. The gap contains sealant which stretches, or contracts based on the movement of the concrete at different temperatures. Sealants used in the repair process should be rated to use with concrete.

Expansion joints should be inspected on a routine basis to discover failing sealant before it becomes a problem. Water flowing through the sealant can lead to gully erosion below the weir and possible weir collapse if not addressed. Water flowing into the expansion gaps may not stay within the pond system. Water running underneath the weirs could lead to soil erosion and the possibility of weir failure/collapse if not left unaddressed.

Primrose

Water primrose is an invasive emergent plant known for creating large monocultural communities. Plants are submerged at the beginning of the growing season; however, dense mats form above the surface as the growing season progresses. Chemical treatment occurs to the leaves after they emerge out of the water. Chemicals used to treat the species include 2,4-D, imazamox, imazapyr, triclopyr, and water-safe glyphosate. Consistent, repetitive treatments are recommended to get good control of the species.

Davey Resource Group witnessed successful control of primrose throughout the pond system during an August 2018 site visit. Pond 3 was the only pond to show signs of growth. Both cattails and primrose were growing extensively in this area. These species must be addressed during each site visit. All of Pond 3 will be covered with cattails and primrose within a few years if left unchecked.

Water primrose nearly covered all of Pond 5 in 2017. The pond is very shallow and stagnant—a perfect environment for emergent, invasive plants to establish. Consistent chemical treatment should be conducted to control the species. Davey Resource Group recommends seeding native, emergent species in Pond 5 to replace water primrose if dredging is not performed. Seeding other emergent species in the area will create competition with invasive primrose and provide a similar rain garden proposed in Pond 3. Seeding may take place in a few years following control primrose.

Vegetative plugs may be used if seed does not grow affectively in the pond. Plugs allow for faster establishment of vegetation, but installation and materials cost more compared to seed. Davey Resource Group does not recommend spending the extra resources required to install vegetative plugs while heavy primrose treatments are on-going due to the risk of over-spray damage to beneficial vegetation.

Below are a list of species Davey Resource Group suggests seeding within Pond 5 as a low-cost option to combat the presence of primrose:

Table 3. Emergent Seed Mix

Grasses and Sedges		
Species Name	Common Name	Oz/Acre
Carex comosa	bristly sedge	2
Carex hystericina	porcupine sedge	2
Carex lurida	lurid sedge	4
Carex vulpinoidea	fox sedge	4
Eleocharis erythropoda	creeping spike rush	1
Leersia oryzoides	rice cut grass	2
Schoenoplectus pungens	three-square bulrush	2
Forbs		
Acorus americanus	sweet flag	2
Alisma subcordatum	water plantain	2
Asclepias incarnata	marsh milkweed	3
Iris virginica shervei	blue flag	2
Lobelia cardinalis	cardinal flower	0.5
Lobelia siphilitica	great blue lobelia	0.5
Lycopus americanus	water horehound	2
Mimulus ringens	monkeyflower	1
Peltandra virginica	arrow arum	10
Penthorum sedoides	ditch stonecrop	0.5
Pontedaria cordata	pickerel weed	6
Sagittaria latifolia	common arrowhead	2

Table 4. Vegetative Plug Planting List for Pond 5

Species Name	Common Name	Quantity Required for Full Establishment (1 foot-on-center spacing)
Carex vulpinoidea	fox sedge	1,029
Eleocharis erythropoda	creeping spike rush	637
Leersia oryzoides	rice cut grass	637
Iris virginica shervei	blue flag	735
Acorus americanus	sweet flag	735
Pontedaria cordata	pickerel weed	735
Sagittaria latifolia	common arrowhead	735

WFCA may decide to go with either seed, plugs, or a combination of both to vegetate Pond 5. The seed mix in Table 1 may be purchased through Spence Restoration Nursery. The nursery's minimum for a seed mix purchase is 0.25 acres and for the mix suggested that is approximately $450. Davey Resource Group recommends seeding Pond 5 twice during low water periods (Fall and Spring). Do not seed Pond 5 while water is moving through the culvert into Pond 6. Vegetative plugs may be installed in Spring to Mid-June. The soil should be saturated with water to prevent the plugs from drying out. The pond existing pond liner should be left in place if either seeding or vegetative plugs are installed.

Approximately 5,200 plugs placed 1-foot-on-center from one another will completely vegetate the pond. The plant cost estimate is approximately $8,200 and will require more involved planting labor compared to seeding. The labor cost to install 5,200 plugs with a natural resource contractor would be approximately $10,000 in addition to the of the plugs themselves. A cost-saving measure could be to plant only area adjacent to the shoreline and allow planted materials to spread throughout the pond over-time Davey Resource Group estimates approximately 2-3 years to fully establish if partial planting is implemented. The cost of plant material and installation would decrease proportionally.

Fish Kills

Fish kills have been an ongoing issue for the pond system in Ponds 3-7. Several factors can contribute to cause a fish kill. Shallow water does not provide adequate living space for large amounts of fish. Fish respire (use oxygen) to maintain and perform basic cellular functions. Oxygen dissolves within water for use by organisms. Too many fish in a small water body can lead to a decrease in the amount of available oxygen.

Warm water is less dense than colder water meaning there is less room of oxygen to be dissolved within a warm-water body compared to a cold-water body. Fish kills often happen during summer months when water is the warmest.

Water is pumped into the pond system through a well during periods of drought. Ground water does not have contact with the atmosphere. Dissolved oxygen levels are extremely low or non-existent in ground water. Filling a pond quickly with ground water will cause dissolved oxygen levels to drop quickly.

Chemical vegetation and algae treatments can lead indirectly to fish kills. Vegetation and algae growing in water should only be treated with aquatic approved herbicide by a state licensed applicator. Chemicals not approved for aquatic use can have toxic properties to fish and amphibians. Fish kills caused by chemical application are usually not due to improper chemical application. Most chemically related fish kills occur when vegetation and algae under water

decays. Bacteria use decaying plant and algae as an energy source. Bacteria also take in dissolved oxygen. Excessive amounts of vegetation and algae decay at one time can lead to an acute dip in available dissolved oxygen in a water body.

The fish kills occurring in the pond system are likely a result of these pressures working together. Fish kills will be a common occurrence in the Pond system until these items are addressed. Pond 5 is at the largest risk of a fish kill. Pond 5 is the shallowest pond in the system, contains nearly complete coverage of primrose, and has a well attached to it to provide groundwater to the system during times of drought. Fish kills may be common in this pond until a dense native emergent vegetative community is established. A physical barrier to prevent fish from moving into Pond 5 may be required such as a perforated stormwater grate in the culverts connecting Pond 5 to Ponds 4 and 6. Pond 5 could be dredged to provide more water and dissolved oxygen availability for fish.

Rain garden installation will remove fish habitat in the shallowest portion of Pond 3. Fish will congregate in the southern portion of the Pond with more water and oxygen availability. However, dredging may be required to provide adequate habitat and oxygen to fish in the remaining portion of Pond 3 and all of Pond 4.

Wildlife Control

Geese and duck deterrents can be installed surrounding the pond system if residence decide they wish to keep waterfowl out of the pond system. A few options include a flashing light to disturb Canada geese sleep patterns, predator decoys, and a chemical to spray on turf grass.

The simplest way to deter geese is to not mow an area up to the water edge. Instead leave a buffer of tall, native grasses along the waters edge. Geese will not go into these areas for fear of predators.

Canada geese and other waterfowl are protected by the Migratory Bird Act and should not be directly trapped or harmed.

Muskrats and other small mammals can become a problem for pond systems. Muskrats burrow into pond banks and can cause issues with pond liners and water management if left unchecked.

Specific remedial information for wildlife control may be found in the On-Going Maintenance Section of the report.

Five-Year Plan to Restore to Optimum Condition

The following plan includes steps for WFCA members to follow to address issues within the pond system. The plan includes initial steps to take (Year 1), less pressing or expensive issues to address (Years 2-3), and items that could wait years before addressing (Years 4-5). Action items listed below are in addition to on-going maintenance activities.

Year 1

- WFCA should take necessary steps to ensure the ponds are not mowed directly to the water's edge. This simple change can help protect the remaining shorelines within the pond system.
- Invasive primrose should be added to the list of species chemically treated by Aquatic Control.
- Expansion joints in the weirs between ponds 3-4 and 6-7 should be repaired.

- Investigate the need for dredged soil removal or fill material placement permitting within the pond system from USACE and IDEM.

Years 2-3

- Ponds 1 and 2
  - Test soil below Flexamat for the potential to grow vegetation.
- Ponds 3 and 5
  - Conduct detailed dredging plan
  - Decide appropriate course of action (dredging or rain garden/wetland installation) for Ponds 3 and 5 to meet WFCA's goals, budget, and permitting requirements.
    - Too many questions currently exist for Davey Resource Group to provide a specific recommendation for Ponds 3 and 5. Completely dredging each pond is possible but could be prohibited by cost and permitting requirements. Emergent vegetation installation is a low-cost option but will eliminate open water within the system. A dredging plan will address these concerns and decide the appropriate course of action.
  - Continue invasive species treatment on primrose
    - Seed or vegetative plugs may be installed on Year 3 if control of the species is achieved and dredging will not be performed.
  - Address any damaged stormwater conveyance concrete structures.
- Pond 4
  - Conduct a detailed dredging plan
  - Dredging in this pond is not an immediate concern; however, it will be required in the next 5-10 years. Davey Resource Group recommends shoreline restoration occur simultaneously with dredging. A detailed dredging plan will address this further. Davey Resource Group recommends performing these activities by Year 3 to achieve desired aesthetics and functionality in Pond 4.
- Ponds 6-7
  - Placement of top soil (fill material) along exposed liner on shoreline, seed with native shoreline seed mix, and installation of stone edge. Dredging is not currently a concern with Ponds 6-7 and the lining appears to be in good shape. Shoreline restoration will provide protection to exposed liners and should occur soon. Check for permitting requirements from USACE and IDEM prior to performing this activity.
- A buffer should be maintained without constant mowing along the shoreline. The buffer may be 2-5 feet in width.

Year 4-5

- Ponds 1 and 2
  - Address unvegetated Flexamat. Reinstallation could be required.

On-going Maintenance Recommendations

Invasive Vegetation and Algae Treatments

Vegetation and algae treatments will be an on-going for the life of the pond to maintain aesthetic character of the pond system. Submergent and emergent invasive vegetation is currently treated by Aquatic Control at a fair price. Other companies serving the Bloomington area include:

- Jones Fish and Lake Management (Indianapolis, Indiana)
- Aquatic Services of Indiana (Greenwood, Indiana)
- Puddle Jumpers (Westfield and Farmersburg, Indiana)
- ASAP Aquatics (Indianapolis, Indiana)
- Hoosier Aquatic Care (Indianapolis, Indiana)

Primrose was added to the list species treated within the system during 2018. Control of the species may require a few years of treatment before adequately accomplished. Primrose should be well controlled before spending amounts towards vegetation establishment because of the risk of over-spray while treatments are performed. Seeding could be performed in areas requiring extensive primrose treatments to offer competition.

The aquatic treatment contractor should maintain the rain garden area for invasive vegetation following installation. Invasive vegetation to remove will include

- Cattail
- Reed canary grass
- Phragmities
- Purple loosestrife

Cattail already grow around the edges of the ponds. A shallower rain garden is a perfect area for cattail to over-populate and out-compete planted materials. Treatment of these species will be in addition to on-going primrose eradication.

Contractors should be instructed to treat any additional invasive species within the pond system and rain garden/wetland areas.

Water Level

Water levels should be monitored to ensure an adequate supply of water is found within the pond system. Ground water may be pumped into Pond 5 during periods of drought. Water levels should be compared to the elevation of the outlet structure—do not compare the water level to the top of bank along the shoreline. Excessive erosion has occurred in much of the pond system making the water levels appear low when much of the area is preforming as designed.

Aerators, Fountains, and Water Pumps

The current maintenance strategy for maintaining aerators, fountains and pumps is working well for WFCA. Companies such as Aquatic Control can be used to maintain this equipment. These companies will pull fountains out of the water during winter months for maintenance. They can be used as an on-call service provider for pumps and aeration services.

Wildlife Control

Waterfowl (ducks and geese) can be deterred on an as needed basis. Decoys and other devises may be purchased through websites such as:

https://jonesfish.com/collections/wildlife-control

The simplest way to deter geese is to not mow up to the edge of the water. Tall grasses can trick geese into thinking predators could be hiding along the water's edge. The geese will find another place to nest with clear access.

Canada geese and other waterfowl are protected by the Migratory Bird Act and should not be directly trapped or harmed.

The Indiana Department of Natural Resources (IDNR) keeps a list of licensed wildlife removal professionals that can trap and remove nuisance wildlife. The list of contractors may be found at the following web address:

https://www.in.gov/dnr/fishwild/files/fw-Licensed_Nuisance_Wild_Animal_Control_Op.pdf

A few professionals are in Monroe County and can come on an as needed basis. Others are not located in but still provide serves in Monroe County.

Figure 2. Winslow Farms Common Areas

Pond System Common Area Enhancements

Winslow Farm Property Owners Association and Moss Creek owns the area containing the pond system. Much of the area surrounding the ponds is also owned and maintained by WFCA. Davey Resource Group has mapped the approximate location of common area property owned by WFCA surrounding the pond system in the above map in Figure 2.

Enhancements within the common areas could include public seating and native plantings. Potential landscape element opportunities may be in areas with pedestrian access through nearby sidewalks. Allowing places for residence that do not live directly on a pond will increase the overall community's ties with the success of the pond system. Residents could look out on the improved aesthetic appeal the pond system has once much of this plan is implemented.

References and Professional Staff

Please see Appendix A for a list of Davey Resource Group professionals involved in the preparation of this document.

Appendix A
Davey Resource Group Personnel Profiles

Caleb Asbury, M.S.E.S. is a project manager and biologist with Davey Resource Group. Mr. Asbury assists with a variety of ecological projects, including restoration plans and implementation, invasive species management, water quality monitoring, wetland mitigation monitoring, freshwater mussel surveys and relocations, macroinvertebrate collections, aquatic vegetation and sediment sampling, and bat tree habitat identification. He also serves as a team leader for Indiana DNR Lake and River Enhancement projects involving lake and watershed diagnostic, engineering, aquatic vegetation, and sediment removal studies. Mr. Asbury regularly treats invasive vegetation species in deep water, wetland, and upland habitats, and he is experienced with multiple ecological and biological assessment tools. He is responsible for preparing and delivering public educational materials and outreach presentations by communicating scientific data into readily understood materials. In addition, Mr. Asbury contributes to a variety of watershed and water quality improvement studies. Mr. Asbury is a Qualified Mussel Surveyor of Groups 1 and 3 Systems through the Ohio Department of Natural Resources (ODNR), Division of Wildlife. He also has an Ohio Scientific Collectors Permit certification through ODNR. Mr. Asbury is a Certified Lake Professional through the North American Lake Management Society, and he is a licensed applicator through the Office of Indiana State Chemist (F250567). Prior to joining Davey Resource Group, Mr. Asbury performed fish, macroinvertebrate, E. coli bacteria, and other water chemistry sampling for the Indiana Department of Environmental Management (IDEM). He is also experienced with numerous deep water invasive vegetation and algae treatments. Mr. Asbury has performed field research on the feeding behaviors and year class strength of smallmouth bass in various environmental conditions, including the effects of large spring rain amounts and increased total suspended solids. Mr. Asbury has a master's degree in environmental science with a concentration in applied ecology from Indiana University. He also has a bachelor's degree in biology and environmental studies from Manchester University.

Heather Bobich, M.L.A is the coordinator of ecological services for Davey Resource Group. Ms. Bobich is responsible for overseeing all ecological surveys and environmental planning studies, as well as the specialized management of ecological and wetlands permitting projects, mitigation and monitoring projects, and natural resource restoration design projects. She has over 15 years of experience in the natural resources and environmental planning fields and is knowledgeable of state and federal stream and wetlands regulations, all aspects of Section 401 and 404 permitting, isolated wetlands regulations, the federal mitigation rule for compensatory mitigation, floodplain regulations, and federal and state endangered species protocols. Ms. Bobich has managed multiple Section 401 and 404 permitting projects along with numerous natural resource inventories and planning projects. In addition, Ms. Bobich has provided assistance with grant writing and managing grant-funded projects through EPA's Section 319 program. Ms. Bobich has coordinated and facilitated public meetings and hearings and has assisted in the development of various planning documents including watershed planning and site development plans. With a background in landscape architecture, she is well versed in working with planning commissions, steering committees, and local stakeholder groups. Ms. Bobich is certified in Ecological Surveys through the Indiana Department of Transportation (INDOT). She is INDOT prequalified for environmental document preparation – EA/EIS and CE. Ms. Bobich also holds INDOT prequalifications in Waterway Permits and Wetland Mitigation. She is a certified Professional Wetland Scientist (#2404) with a focus on native landscape and restoration design. Ms. Bobich has a master's degree in landscape architecture from Ball State's College of

Architecture and Planning. She is also a graduate of Indiana University with a bachelor's degree in public policy and environmental affairs and a minor in geological sciences.