Section 2, Chapter 2
Recommended Projects and Practices

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Introduction

Chapter 1 detailed the vision, goals, and targets set forth by the stakeholders of the watershed. This chapter details the projects and practices chosen by the stakeholders in order to meet these goals and targets and fulfill the vision. This chapter describes what is already in place in the watershed and what is recommended throughout the entire watershed and at specific locations for chosen projects. Chapters following provide guidance for implementing these projects including costs and benefits.

Stakeholders' Current Conservation Efforts

We address the goals of this watershed plan to improve water quality by suggesting ways to improve land use, implement best management practices, and educate residents and land managers about water quality issues. The watershed planning participants have learned more about the county's current land uses through this watershed planning process. It is impressive the genuine care and respect that both residents and agricultural producers within this watershed provide to their land. While outlining goals and targets for this watershed, we also commend efforts already in place. The stakeholders within the watershed already practice conservation in various ways, both within the Lake Carroll Association and in the rural community.

Homeowner Efforts

Through their Lake Carroll Association, homeowners have stabilized the entire lake shoreline and constructed sediment basins at its inlets, and they have found and protected a large, native prairie remnant that houses rare plant and animal species. They have engaged engineers to explore stabilization of the ravines surrounding the lake, and they are in the process of expanding one of their sediment basins. They have implemented ongoing programs including goose population control, landscaping restrictions, experimental septic systems, and lake water quality monitoring.

- The entire shoreline of Lake Carroll has been stabilized with rip rap, which is monitored and maintained on an annual basis.
- Sediment basins were constructed near the confluence of the two main tributaries to the lake.
- The lake and coves were dredged, removing 94,000 cubic yards of sediment. More dredging is currently taking place, with a focus on the coves that have the most sediment accumulation.
- Ravines contributing the most sediment to the lake have been identified.
- Three existing native prairies are being preserved and maintained: two plantings and one remnant. The remnant prairie of impressive size was discovered in recent years, and Prairie Club of Lake Carroll has adopted ongoing stewardship. Rare species found within the prairie are being monitored as discussed in Chapter 5.
- Goose population control has been an ongoing venture, including egg addling, round-ups, and hunting.
- Vendors, including landscapers, must be registered prior to performing work within the community.

- Private, improved lots greater than 1 total acre in size may install native plantings. These native planting areas may not exceed 1,000 square feet.
- Experimental septic systems within the community include modified sand filters and some chlorinated systems, all of which are monitored every four years for homeowners and pumped annually for Association-owned buildings.
- A Volunteer Lake Management Program (VLMP) had been active for many years and became active again after a break before the program was discontinued by the Illinois Environmental Protection Agency. The Association now hires an environmental consulting firm to monitor the lake's water quality annually, an effort that began in 2007 and overlapped with the VLMP for many years.

Agricultural Producer Efforts

According to the USDA, in the year 2018, Carroll County planted 134,000 acres of corn and produced 28,488,000 bushels of corn. Most farms in the watershed practice a combination of no-till farming and conservation tillage, contoured farming, grassed waterways, and nutrient management. About 20% of them use cover crops. In addition, some have ponds and basins in line with the stream to slow and detain the water during storm events, protecting the streambanks and streambeds below.

- No-till farming doesn't disturb the soil, and conservation tillage leaves good vegetative cover on the ground, preserving soil moisture and organic matter. Stakeholders reported that all crop fields in the watershed rotate no-till and conservation tillage practices, utilizing conventional till only when planting corn for two consecutive years.
- Farming on the contour at a ninety-degree angle from the flow of runoff and grassed waterways safeguards soil and preserves water quality of nearby waterways, which is important on this hilly landscape.
- Grassed waterways protect fields from erosion and deliver stormwater runoff in a controlled manner. As storms have been more frequent and intense in recent years, many area producers have noticed that the grassed waterways need to be widened to handle the larger flows. This concern was echoed by producers in nearby watersheds.
- Nutrient management controls the timing and amount of fertilizer applied to the fields, based on actual field conditions rather than schedules and amounts prescribed by common practice.

In addition to the practices found consistently throughout the watershed, Hunter Haven Farms contains many beautiful examples of how to implement best management practices within livestock operations. Manure management and containment of silage leachate are unique highlights.

- The manure management system turns cow manure into fertilizer, compost, bedding, and even electricity. All portions of the manure management system are disconnected from any waterway leading to the stream, including large manure basins which are pumped into a tank that produces methane gas used to run the motor for the generator that produces electricity. Waste liquid is used to fertilize crops while solids are used for bedding.

- Leachate, an organic liquid that forms when runoff contacts piles of silage, could deplete the oxygen in a receiving stream or pond so quickly that anything living, like fish, could immediately die (Curell and Lee, 2011). The leachate at Hunter Haven Farms is contained in a basin offline from any stream or waterway.

> "The majority of dairy farmers live where they work and they drink the water…. Many of them want that land or business to continue to their children or grandchildren if it's possible. Not only are they in favor of saving the environment… they are not about to harm the environment or the water system because that's where they live."
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> ~Doug Block, Dairy Farmer – Hunter Haven Farms.

To learn more about their conservation techniques, see Hunter Haven Farms: The People Behind the Product (https://www.youtube.com/watch?v=Zc757kqn5Pw).

What More Can be Accomplished

Local agricultural producers and Lake Carroll Association staff, board members, and homeowners chose which of the best management practices recommended by consultants would most likely be implemented in the watershed. The group was most interested in implementing best management practices within ravines and greenways, on streambanks, and on the land immediately next to streams (riparian area). After reviewing a menu of best management practices appropriate for the watershed, stakeholders prioritized the projects and practices that were most likely to be implemented, as discussed below. They also recognized the need to stay current with best management practice options and adapt the plan accordingly over time, as some opportunities might come into existence after this plan was written.

If East Fork Creek stakeholders choose to implement the recommended best management practices within this plan, then they will help reduce the amount of nutrients that Illinois contributes to waterways which correlates with the goals of the NLRS. Moreover, combing multiple conservation practices together allows for additional compounding benefits.

Stakeholders prioritized selected projects as high, moderate, or low priority, as listed below. Chosen projects are recommended throughout the watershed, with some locations specified. In order to apply some of these practices, the Lake Carroll Association would need to ensure that Association guidelines allowed for shoreline buffer plantings and other native vegetation associated with best management practices on private and association-owned properties. The guidelines would need to describe the allowed function and offer flexibility of the visual affect. Currently, the rules and regulations allow for prairie plantings on private lots up to 1,000 square feet and lots are allowed no more than 40% impervious surface like rooftops, driveways, and sidewalks (Lake Carroll Association, IL Code of Ordinances, 2019). We recognize that many of these applications will require cultural change for the appearance and maintenance of the community's landscape. We hope that once homeowners understand the importance of these best management practices, they will embrace these changes.

All recommended projects and practices, no matter their priority, would ease the sedimentation and nutrification of the lake and streams, and they would ease flashy hydrology during storm events. Further details needed to implement projects and practices are explained in Chapter 4 for watershed-wide recommendations and in Chapter 5 for site-specific projects.

High Priority Projects and Practices

Projects and practices receiving highest priority from stakeholders either applied to the entire watershed or differed between the residential and rural portions of the watershed. Those that applied to the entire watershed included the following:

- Stabilize highly erodible land by removing invasive shrubs or other non-native vegetation, allowing natural ground cover to re-establish.
- Line stream corridors with vegetated filter strips of permanent, native vegetation.
- Stabilize steep ravines, either with grade stabilization structures like check dams, block chutes, and drop boxes or by encouraging self-healing by forest stand improvement.
- Stabilize severely eroded streambanks.

In addition to the projects and practices above that applied to the entire watershed, other applicable residential practices within the Lake Carroll Association given high priority by stakeholders included:

- Plant riparian buffer strips above shoreline rip rap.
- Install vegetated swales planted with native vegetation along water courses that run through greenways.
- Plant rain gardens and bury downspouts and French drains to carry runoff from rooftops to rain gardens.
- Install floating treatment wetlands within coves of the lake with high levels of suspended solids accumulated from runoff.

Within the rural community, projects and practices considered high priority by agricultural producers in addition to those listed above were:

- Repair and widen existing grassed waterways to handle the larger, flashier, more frequent storms that have been occurring recently.
- Construct detention features, such as ponds, basins, dry detention, and scrapes.

Rationale for prioritizing each of these projects and practices as high is discussed below.

Highly Erodible Land Stabilization with Forest Stand Improvement

Many of the highly erodible acres within the watershed were not able to be utilized for production or residential lots. Left to naturalize, invasive shrubs have taken over these areas and shaded out stabilizing ground cover. Stewardship of these lands choked with invasive species would allow ground cover to fill in, therefore reducing erosion and protecting water quality.

There are varying purposes for forest stand improvement. Considerations for implementation and specifications depend on the selected purpose. One purpose of forest stand improvement that correlates to the NLRS is to "alter quantity, quality, and timing of water yield (NRCS eFOTG, 2018)." This calls for diversity in tree age classes and for canopy openings to foster a diverse array of understory vegetation. Trees and understory vegetation should vary in plant species and height. These considerations improve precipitation infiltration, reduce runoff and erosion, and reduce nutrient loading into the watershed.

Most implemented best management practices with the purpose of stabilizing Highly Erodible Land (HEL) will correlate to the goals of the NLRS because erosion and runoff within the East Fork Creek watershed contain nitrogen and phosphorous and stabilizing this land reduces or prevents erosion. The EPA estimates converting land uses to forest to reduce loading by 92% of nitrogen, 28% of phosphorus, and 87% of sediment (Region 5 Model for Estimating Load Reductions, 2018). We assume similar benefits from forest stand improvement in areas of invasive shrub domination on highly erodible land.

There are about 638.5 acres of forested, highly erodible land within the watershed: 370 acres within the Lake Carroll Association and 268 acres in rural areas of the watershed (see Figures 2.1 and 2.2). We plan to focus on 25% of this area (160 acres) located closest to ravines in order to maximize the practice's benefit to water quality. This would best be conducted in conjunction with ravine stabilization.

Ravine Stabilization with Grade Stabilization and Forest Stand Improvement in Riparian Area

Grade stabilization and forest stand improvement would benefit many ravines in the watershed. The steep topography of the area makes these BMPs applicable and desirable for this watershed. Dry dams and drop boxes used to stabilize the ravines were of great interest to the planning group, as was forest stand improvement within riparian areas and on highly erodible lands near ravines. Dry dams and drop boxes are grade stabilizations structures to be installed where a structure is needed to stabilize steep grading and to evenly distribute or drop the water down to elevation. Sloped areas within the watershed where gully erosion occurs could benefit from the installation of these grade stabilization structures. These structures would help to stabilize the sloped soils and reduce erosion and runoff, both of which contains nitrogen and phosphorous. Forest stand improvement within the riparian areas along ravines would control invasive shrub growth that is currently shading out understory vegetation that would otherwise stabilize the area. Sediment and nutrient removal from ravine stabilization vary depending on the severity of the gully erosion, which was calculated by averaging slopes of differing bank heights and lateral recession rates per ravine for site-specific projects and average of all severely eroded ravines for watershed-wide recommendations. Benefits will likely be higher due to the ripple effect of reduced erosion of ravine banks and downcutting of ravines that can be expected when forest stands along riparian areas and banks are improved.

A total of 112,149 feet of ravines were found throughout the watershed, with double this length of banks (224,297 feet). Fifty-one percent (51%) of these banks were severely eroded (114,391 feet).

We used the severely eroded bank length to calculate the opportunity for stabilization. Furthermore, we separated banks of ravines found within the Lake Carroll Association from those found throughout the remainder of the watershed to aid with implementation by the Association and landowners. Severely eroded bank length within the Association included 24,707 feet identified as site-specific projects plus 31,378 throughout the remainder of property owned by the Association and its homeowners. Outside of the Association in the rural portions of the watershed, there were an additional 58,306 feet of severely eroded ravine banks.

Access to install and maintain grade stabilization structures was an issue in some areas near Lake Carroll. Within these areas, forest stand improvement could act alone to allow ravine gullies to self-heal. Ravines with site-specific recommendations could benefit from forest stand improvement on a total of 184 acres of riparian area along 48,446 feet of bank, 24,707 feet of which was highly eroded, as mapped in Chapter 5. Ravines throughout the rural portions of the watershed outside of the Lake Carroll Association are likely accessible. We hope to stabilize the 24,707 feet of site-specific projects plus 25% of the remaining severely eroded banks: 7,845 feet within the Association and 14,576 feet outside of the Association for a total of 22,421 feet of severely eroded ravine banks addressed with watershed-wide projects.

-Ravine headcut, photo by Rebecca Olson

Streambank Stabilization

Streambank Stabilization (i.e. Streambank Protection) is the process of stabilizing and protecting shorelines to reduce the negative effects of sedimentation, both on-site and downstream, resulting from bank erosion. Sediment eroding into streams often contains high levels of nitrogen and phosphorous. Thus, if eroding streambanks within the East Fork watershed are stabilized, then less nitrogen and phosphorous containing sediment enter the streams and lakes. Streambank stabilization reduces sediment and nutrients by varying amounts depending on its severity.

The amount of severely eroding streambanks within the watershed was estimated as 51%, including 277,517 feet of streams that were not ravines. This high amount can be attributed to the steep topography of the watershed and intensive adjacent land uses combined with lack of vegetated filter strips and forest stewardship. Because of the high estimate, this plan focuses on stabilizing severely eroding banks only, not moderately eroding banks, in order to maximize the cost to benefit ratio of the efforts.

The plan aims to stabilize 80,627 feet of severely eroding streambank. This represents 14,998 feet of severely eroded streambank in site-specific locations within the Lake Carroll Association (mapped in Chapter 5) plus 25% of the severely eroded streambank in the rest of the watershed: 8,320 feet within the Association and 57,310 feet outside of the Association.

-Severely eroded streambank, photo by Rebecca Olson

Vegetated Filter Strips

Filter strips are vegetated sections of land that enable stormwater to pass through vegetation, slow runoff, and filter out sediment, organic matter, and other pollutants before emptying into swales or other bodies of water. Filter strips may provide some reduction in stormwater runoff volume, but their primary function is to filter out contaminants in stormwater runoff. Filter strips are usually located between impervious surfaces or agricultural fields and the waters to which they drain. The EPA has estimated load reductions of 40% in nitrogen, 45% in phosphorous, and 73% sediment in water sources when vegetated filter strips are in use (Region 5 Model for Estimating Load Reductions, 2018).

Vegetated filter strips can be located along streambanks and shorelines or at the edge of farm fields or home lots. Runoff sheets off adjacent lands and creeps through the filter strips in a perpendicular direction prior to entering the nearest waterway. Stakeholders indicated that they would be open to working next to the water's edge. Therefore, we focused our recommendations on buffering streams and waterbodies, although at the border of a crop field or residential lot would be just as highly prioritized and effective. We encourage the use of native, deep-rooted vegetation for any new plantings.

Vegetated Filter Strips along Streambanks

Next to streams, 63% of riparian areas throughout the watershed were in poor or fair condition, indicating room for improvement. Within 50 feet of the streambank, this area totaled 556 acres. Within this plan, we aim to stabilize 33% of the area, or 185 acres, with dimensions of 161,374 feet of bank and 50 feet wide.

In addition to the above watershed-wide target, stakeholders identified four sites for installation of riparian buffer strips along streambanks that would filter nutrients and sediment draining from 5,475 acres of residential lots and open spaces. In total, these filter strips would cover 5.3 acres of mapped riparian area.

Vegetated Filter Strips along Shorelines of Lake Carroll, Ponds, and Basins

Vegetated filter strips along shorelines of water bodies, also known as riparian buffer restoration is the process of installing, establishing, and then maintaining plant species that can

tolerate intermittent flooding as the dominant vegetation cover in the transitional zone between aquatic and upland habitats. When placed along the shorelines of waterbodies, vegetating these riparian zones provide multiple benefits for wildlife habitat, carbon storage, floodplain storage, and pollinators; moreover, they improve water quality and trap nutrient-ridden sediment and help control nuisance goose populations. At a minimum, riparian buffer strips of lakes, ponds, and basins need to be the larger of 20% of the drainage area length or 15 feet wide to achieve the load reductions stated above. Any width is encouraged, as some homeowners indicated that a strip 15 feet wide would not fit in every situation surrounding Lake Carroll. Stakeholders also felt that many homeowners would not be in favor of the plantings next to the lake. Consultants felt that their inclusion was vital to the success of this plan and used a 15-foot width to calculate acreage of prescribed filter strips.

A surveyed 87% of the riparian areas (67,604 ft of shoreline) adjacent to Lake Carroll were in mowed turf grass with the remainder as naturalized, vacant lots. Next to ponds within the watershed, 20% of riparian areas (3,896 ft of shoreline) were in mowed turf grass or otherwise poor condition within 50 feet of the edge of the water.

Within the Lake Carroll Association, stakeholders identified two locations for installing riparian buffer strips along basins covering a total of 1.6 acres as mapped in Chapter 5. We aim to plant riparian buffer strips within the 1.6 acres of identified locations plus up to 23 additional acres creating a buffer around the entirety of Lake Carroll and outlying ponds.

Vegetated Swales

Swales constructed to carry water away from its source and to the nearest waterbody can be improved by planting deep-rooted, native vegetation within the path of water and in some cases amending the soil to increase infiltration capacity. Vegetated swales reduce sediment by 65%, phosphorus by 25%, and nitrogen by 10% (Region 5 Model for Estimating Load Reductions, 2018).

Greenways conveying water are priority locations for installing best management practices within the Lake Carroll community. Stakeholders identified three locations to install vegetated swales for a total of 9.7 acres. Beyond these site-specific treatments, we recommend finding 35 other swales carrying stormwater that could be filtered by converting turf grass to deep-rooted, native sedges, grasses, and wildflowers. For planning purposes, we estimated each of the additional 35 vegetated swales to be 100 feet long and 30 feet wide, or 3,000 square feet. The 35 swales would cover a total area of 105,000 square feet (2.4 acres).

Wetland Restoration

In addition to the 78 acres of existing wetlands at the time of the inventory, there were only 23 acres of hydric soils with wetland restoration potential. Given the area's steep topography and lack of floodplain, the lack of hydric soils historically developed under wetland conditions was not surprising.

Even though the group recognized the importance of wetland restoration to water filtration, the group realized the lack of opportunity within this watershed and prioritized wetland restoration at four site-specific areas (mapped in Chapter 5) and not throughout the watershed. The four areas would cover a total of 18 acres slated for wetland restoration.

Rain Gardens

Installed next to rooftops, driveways, parking lots, or other impervious surfaces, rain gardens are one of the first conservation features to intercept stormwater runoff from the source. They are small detention features planted with water-tolerant vegetation that are suitable for use in private lawns that can be maintained as attractive gardens. Preferably, the vegetative is deep-rooted native vegetation, which is more capable of infiltrating runoff than cultivars. Detention features are described in more detail below. The EPA estimates that dry detention such as rain gardens can remove 30% nitrogen, 26% phosphorus, and 58% sediment from runoff (Region 5 Model for Estimating Load Reductions, 2018). They also minimize the amount of runoff leaving the property as much of the water will be allowed to infiltrate and evaporate, thus alleviating issues downstream. Keep in mind that these pollutant load reduction estimates can be achieved when rain gardens are properly sized to intercept the stormwater coming from the impervious surface and drainage area.

A successful educational movement could inspire homeowners to plant their own rain gardens. Within the life of this plan, we hope to see 100 rain gardens installed, ideally on 20% of the ¼-acre lots within the Lake Carroll community that are adjacent to and upstream from steep ravines. Although sizes may need to vary, we assumed 150 square feet per rain garden for planning purposes.

Grassed Waterways

Grassed waterways are broad and shallow channels that slow water velocity of runoff through crop fields and release water to a stable outlet. While the focus here is more on preventing erosion and enhancing water conveyance capacity, if the width of the grassed waterway is increased, then the filtering capacity and nutrient removal capabilities also would also be increased. Producers expressed a desire to widen existing grassed waterways to handle the larger, flashier, more frequent storms that have been occurring recently. Furthermore, producers recognized that some grassed waterways needed to be fully repaired each year. When fully functioning, the EPA estimates that grassed waterways remove 10% of nitrogen, 25% of phosphorus, and 65% of sediment from runoff exiting crop fields (Region 5 Model for Estimating Load Reductions, 2018).

In the watershed, grassed waterways in varying conditions would allow for opportunity to widen 67% of the existing grassed waterways and fully repair 14%. The remaining 19% were already wide enough to handle larger storm events. For planning purposes, we used 15 feet as the increased width needed for existing waterways and 30 feet as the desired total width for both widened and fully repaired waterways. We intend to accomplish all opportunities for widening and repairing grassed waterways within the life of this plan. This includes widening 153,318 feet of waterways be an additional 15 feet for a total of 53 acres and fully repairing 32,037 feet of waterways at a width of 30 feet for a total of 22 acres.

Detention Features: Ponds, Basins, Dry Detention, and Scrapes

A combination of detention features, including ponds, basins, dry detention, and scrapes could ease flashy hydrology and were highly prioritized by the planning group. Specific sites were not identified, but detention features could be considered to further enhance any streambank stabilization project. These could either be designed deep for stormwater storage or as shallow marsh features for wildlife habitat. Due to the lack of hydric soils, we did not list wetland detention or wetland scrapes. If the opportunity arises for wetlands to form as part of the detention feature, it would be an improvement over a dry system. In order to estimate pollutant load reduction efficacy, we averaged estimates made by the EPA for wet ponds, wetland detention, and dry detention systems, resulting in estimated removal of 28% nitrogen (N), 38% phosphorus (P), and 68% sediment.

We aim to construct 144 acres of detention features during the life of the plan, equal to 1% of the 14,436-acre drainage area.

Floating Treatment Wetlands

Floating treatment wetlands (FTWs) create an opportunity to filter pollutants in the waterbody. We recommend exhausting all possible preventative measures in addition to using FTWs. One main benefit of the FTWs is their ability to filter free-floating nutrients out of the water that would otherwise feed algae. Wetlands are nature's answer to the ever-increasing need for filtration of pollutants. Creating a floating wetland system introduces this benefit to the water body where only open water previously existed. Once pollutants and excess nutrients runoff into the water system it is difficult to filter them out, unless the ecosystem has a wetland system nearby. Installing these man-made wetlands in areas that have no wetland filtering capacity or have degraded wetlands can greatly increase the filtering capacity of the water body. One 300-square foot island that is 8 inches thick has the capacity to decrease nitrogen and phosphorous in these waters by 331 lb/yr and 106 lb/yr, respectively and 3 tons/yr of sediment (Mark Reinsel, Apex Engineering, personal communication based on measured performance of BioHaven floating islands by Floating Island International in similar conditions).

Stakeholders identified ten coves and ponds on which to install FTWs. Their size, shape, and configuration will be dictated by site constraints, as placement will need to allow for boat passage. Therefore, budget and pollutant load reduction goals remaining after upstream preventative measures have taken effect will dictate project size and desired outcome. During the life of this plan, we aim to install one 300-square foot (225-cubic foot) FTW per location for a total of 3,000 square feet (2,250 cubic feet) of FTWs.

Moderate Priority Projects and Practices

As the group discussed other best management practices that didn't rise to the top but were still recognized as worthy of time and effort, the following projects and practices were recognized for their importance by consultants and stakeholders. These differed between residential and rural settings within the watershed.

Within the Lake Carroll Association, homeowners, staff, and board members wished to accomplish the following:

- Install porous pavement or pavers at the marinas and new driveways, access roads, sidewalks, and other low traffic impervious surfaces.
- Test soils in association with lawn fertilization.
- Establish native plantings throughout the community. For example, change brome to prairie within the Lake Carroll Association on vacant lots and common spaces.

In addition, agricultural producers in the watershed wished to improve their current use of cover crops:

- Install cover crops on the estimated 80% farm fields that currently do not use them.

Rationale for prioritizing each of these projects and practices as moderate is discussed below.

Porous Pavement or Pavers

Porous pavement or pavers turn impervious surfaces into pervious areas that allow stormwater to soak into the ground at first contact with the ground, minimizing runoff from the source. EPA estimates that porous pavements have the potential to reduce nitrogen loading by 85%, phosphorous loading by 65%, and sediment loading by 90% (EPA Region 5 Model for Estimating Load Reductions 2018).

No sites or watershed-wide targets were set for porous pavement or pavers. The parking lot at the Lake Carroll Clubhouse was considered by the Architectural and Environmental Committee, but the lot is on a hillside and maintenance and the ability to plow snow were obstacles. Instead, stakeholders located vegetated filter strips and swales immediately below the parking lot to capture and treat stormwater as it ran off the parking lot. We encourage stakeholders to consider porous pavement or pavers when constructing or repairing driveways, sidewalks, parking lots, trails, and low traffic roads. Future opportunities may be defined as construction or repair plans are formed.

Soil Testing

In an effort to reduce fertilizer application on lawns and crop fields, stakeholders encourage testing soils for their nutrient content prior to applying additional nutrients. Agricultural producers are often aware of resources for such services, but homeowners would benefit from an organized community program and education.

Nutrient reduction potential varies, and no specific actions or targets for soil testing were proposed within the life of this plan, although education and outreach are encouraged.

Native Plantings

Deep-rooted, native vegetation prescribed for best management practices like vegetated filter strips and vegetated swales increases infiltration of runoff, making it a benefit over cultivars no matter where it is planted. Planting natives in the path of water flow is prioritized for water filtration; however, any native planting will improve the overall environmental health of the area and provide important wildlife habitat and is encouraged by stakeholders and this plan. As estimated by the EPA, native plantings can decrease loads of nitrogen by 92%, phosphorus by 67%, and sediment by 87% (EPA, 2018) within the footprint of the planted area when compared to residential land use.

Stakeholders identified one specific location within the Lake Carroll community for a new 0.6-acre native plantings. The Prairie Club already actively manages 21 acres of prairie preservation.

Cover Crops

Cover crops help to stabilize soil in bare crop fields after harvest while also proving to curb nitrogen loss. According to the NLRS 2016 report on effectiveness and cost savings from specific BMPs, utilizing cover crops on corn and soybean fields results in a 20.5% nitrogen loss reduction on tiled-drained acres and a 7.9% nitrogen loss reduction on non-tiled acres (Illinois Nutrient Loss Reduction Strategy 2016).

Cover crops were already planted on about 15% to 20% of the farmed acres within the watershed each year, mostly on wheat ground. Cover crops used included cereal rye and wheat. The producers within the group had an interest in using cover crops on corn and bean fields. They discussed obstacles of timing and application methods. By the time corn is normally harvested, it would be too late in the year to plant cover crops for successful germination. Alternative methods such as aerial application might work but is difficult and expensive. Further discussion is needed to determine the interest of increasing cover crop usage in the watershed.

No specific targets related to cover crop usage were considered by this plan. Stakeholders recognized a strong need for education including successful techniques for implementation.

Low Priority Projects and Practices

Just as important as determining which projects will provide the best water quality benefits to the watershed, the group also decided which projects were not worth pursuing. These included those practices already being implemented and some that did not have high potential or applicability for this watershed.

Projects and practices already in place that did not have great potential for growth included:

- Practice no-till and conservation tillage on active farm fields.
- Implement nutrient management plans on active farm fields and livestock operations.
- Farm with terraces.
- Farm on the contour.
- Implement livestock management plans.

In general, agricultural producers are either already regulated or already practicing these techniques to the best of their ability. As the collective knowledge about such practices improve, we anticipate that the producers of this watershed will improve their techniques accordingly.

Furthermore, restoring stream channels did not have great potential or applicability to this watershed due to the steep topography of the area.

Pollutant load reductions were not calculated for the low priority best management practices, nor were watershed-wide or site-specific targets selected. The rationale for each is discussed below.

No-till farming and Conservation Tillage

No till farming was already occurring throughout the entire watershed on every farm when crops were rotated from beans to corn, corn to beans, or beans to beans. When fields were planted to corn two consecutive years, fields experienced conservation or conventional tillage as necessary to produce profitable yields. The NLRS Science Assessment reported that when 1.8 million acres of conventional tilled land eroding at greater than the soil T value is converted to conservation tillage or no-till, phosphorous is reduced by 50%. This massive phosphorous reduction also results in savings of $17 per acre (Illinois Nutrient Loss Reduction Strategy 2016).

Watershed producers discussed the obstacles to continuous no-till farming, yet they were open to learning new techniques from producers who have successfully used it, as discussed in Chapter 3. Due to the stated challenges, we encourage producer-to-producer sharing of successful methods for continuous no-till practices but did not choose a specific number of acres to convert to continuous no-till.

Nutrient Management Plans

Nutrient management plans were required and followed on large livestock operations within the watershed. Therefore, the opportunity for further implementation would be for smaller farms, of which there were only four. Cost may prohibit formal planning for these smaller farms. In reality, the smaller farms were known by stakeholders to be already following the guidelines of such a plan without going

through the formalities. For example, they were already soil testing every three years, sampling within 2.5-acre grids, and timing fertilizer applications. Therefore, we did not recognize room for improvement.

Terraces

Terraces in place were made for different sized equipment than what is currently being used. Producers in the watershed had been removing them and replacing them with grassed waterways.

Contour Farming

Contour farming was already common throughout the watershed, but strip farming was not due to equipment size and style. The group thought that this practice would no longer be needed when the fields were planted via no-till.

Livestock Management Plans

Livestock management was already occurring, such as pasture rotation. Excluding cattle from the stream was not a reasonable expectation on the landscape due to flashy hydrology threatening fencing.

Stream Channel Restoration

Most channelized stream segments were found in headwaters on intermittent streams through agricultural land. This was expected due to the steep topography of the area. Opportunities to re-meander highly channelized stream segments would not be likely; therefore, this option was not considered. Instead, the 22% of stream segments that were highly channelized and 44% of stream segments that exhibited moderate channelization could be studied for their channel stabilization needs and suitability for rock riffles.

Each project and practice listed above, no matter the level of prioritization, should also consider enhancements to benefit wildlife, when applicable.

Enhancements for Wildlife

When implementing any conservation project or practice, we would like stakeholders to consider how it could be enhanced to better serve wildlife. Fish, birds, amphibians, reptiles, and invertebrates could all benefit from adding simple features in and near streams, ponds, and lakes (Hastings, 2009). We encourage special attention paid to habitat enhancements to support threatened and endangered species found in this watershed like rusty patch bumble bee and Indiana bat, other butterfly and bee pollinators, and species in greatest conservation need (SGCN) according to the Illinois Wildlife Action Plan (IDNR, 2019). Trout Unlimited produced the Habitat Guide: Complimentary Opportunities for Stream Restoration Projects, which provided a decision matrix and design specifications for each recommended habitat feature (Hastings, 2009). Suggestions include the following habitat features for each group of wildlife:

Fish

- Lunkers
- Brush bundles
- Deep pools created with cross channel logs and rock weirs
- Rock and log deflectors
- Minnesota skyhook
- Random boulder placement
- Side channels
- Vortex weirs

Birds

- Dead trees and bird perches to provide perches for hawks and other birds of prey
- Various riparian habitat for nesting such as native grasslands, trees, and brush

Amphibians

- Microhabitats including downed woody debris and healthy duff layers

Reptiles

- Open canopy providing varied habitat structure
- Basking logs and rocks
- Turtle and snake hibernaculum

Birds, Amphibians, and Reptiles

- Wetland scrapes near streams and in floodplains
- Vernal pools with shallow standing water that warms up faster than streams and larger ponds
- Mud flats and backwater refuge areas next to streams
- Oxbows
- Riparian prairie plantings

Invertebrates

- Flat and embedded rocks in terrestrial areas
- Various types and sizes of downed woody debris

For more information, consult the Habitat Guide: Complimentary Opportunities for stream Restoration Projects (Hastings, 2009). Note that any surface area within water would grow biofilm, a sticky collection of microorganisms including beneficial bacteria instrumental in digesting excess nutrients and cycling them into the food chain.

Successful implementation of any project or practice will require the support of the entire community. The Lake Carroll Association is poised to organize and manage programs to assist private homeowners,

such as educational events and materials, organization of group efforts such as soil testing, and guidance toward technical assistance. Further information needed to education landowners is provided in Chapter 3. Chapters 4 and 5 provide details regarding the costs and benefits of the recommended projects. Financial and technical assistance is also available to all stakeholders of the watershed as referenced in Chapter 6.