Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2016 Work Plan

Date of Report: December 1, 2015

Date of Next Status Update Report: Feburary 1, 2017

Date of Work Plan Approval:

Project Completion Date: June 30, 2019

Does this submission include an amendment request? No

PROJECT TITLE: Establishment of Permanent Habitat Strips Within Row Crops

Project Manager: Shawn Schottler

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Location: Demonstration fields at Willow Lake Farm, Windom MN. Cottonwood and Jackson counties

Total ENRTF Project Budget:	**ENRTF Appropriation:**	**$179,000**
	Amount Spent:	**$0**
	Balance:	**$179,000**

Legal Citation: M.L. 2016, Chp. xx, Sec. xx, Subd. xx

Appropriation Language:

I. PROJECT TITLE: Establishment of Permanent Habitat Strips Within Row Crops

II. PROJECT STATEMENT:

Grassland species such as native bees, monarch butterflies, meadowlarks, and pheasants continue to decline, and water-quality trends are not improving in many lakes and rivers. The common denominator linking these negative trends is the need for more perennial vegetation/cover crops on the landscape. Annual cover crops such as rye offer promising water-quality benefits but do not provide extended habitat value and require the farmer to incorporate several management steps and costs every year. Perennial cover crops would eliminate the additional management steps and provide full season habitat value. The challenge is to find ways to introduce perennial habitats into the agricultural landscape that do not take land out of production, are economically viable, and result in measurable benefits to water quality and grassland species.

This project will test and demonstrate a new approach to creating perennial habitat for pollinators, monarchs, songbirds and gamebirds within an agricultural landscape without removing land from production. This method will take advantage of precision farming techniques, where equipment drives in the same field rows year after year, and establish strips of permanent vegetation in the bare ground between selected corn/soy rows (Figure 1).

The end product will be a suite of 16, ~30-inch wide strips of perennial prairie species or alfalfa established in the bare space between every 24th row of a 60 acre corn/soy field on the Willow Lake Farm, near Windom Minnesota. This configuration means that **no land is taken out of production**, yet ~4% of the field is in perennial cover. We will evaluate which individual plant species or combination of species creates the most habitat value, the least crop yield loss, and are the most cost effective to implement. We will develop the techniques necessary for management of these species on a farm scale and provide a cost-benefit summary of the results. The technology tested in this project could ultimately result in thousands of acres of perennial filter strips within a watershed, offering not only an expanded habitat component to the landscape, but also a significant potential water-quality benefit.

This project will be the first phase of what is intended to be a long-term and evolving demonstration of the techniques and advantages of introducing perennial vegetation into row-crops. Because it takes several years to get native prairie species established, this project will focus on the methods and costs associated with implementing the technique and will offer preliminary analysis of the habitat benefits of the perennial strips.

Primary objectives during the 3-year project:

a) Develop methods for seeding and establishing perennial species in the inter-row strips, including techniques to protect the strips from herbicide application to the row-crops.
b) Evaluate which species and combination of species can survive in the inter-row environment.
c) Quantify the cost of implementing this conservation technique, including the corn/soy yield reduction due to the perennial strips.

Secondary objectives:

a) Evaluate habitat value of the strips to songbirds, gamebirds, bumble bees and monarchs.
b) Compare habitat value in fields planted with conventional corn/soy seed to fields planted with non-insecticide treated seed.

These latter objectives are listed as secondary because the perennial strips will only have completed two growing seasons by the third year of the project and will still be maturing. Thus, habitat evaluations at this point offer only the initial glimpse into the faunal value of the strips. Non-treated seed in the above objective refers to corn/soy seed that has not been treated with neonictinoid insecticides and is a non-GMO variety—

hereforth simply called “non-treated” seed. This element was added to the project to allow comparison of faunal response in habitats within treated and non-treated row-crop fields.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of: February 1, 2017

Project Status as of: August 1, 2017

Project Status as of February 1, 2018

Project Status as of: August 1, 2018

Project Status as of: February 1, 2019

Overall Project Outcomes and Results: Final Report August 1, 2019

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Test the establishment and management of ~20 different prairie species and alfalfa as permanent cover strips within row crops

Description:

Site/Field Design

On many farms, corn and soybeans are planted on a 30-inch wide row spacing. The area between the rows (the inter-row, Figure 1) is typically treated with herbicide to keep the soil weed free. Willow Lake farm uses a 24-row planter; meaning 24 rows (60 feet) are planted per pass. Within a 60-acre field, we will establish perennial strips in 1 of every 24 inter-row areas (Figure 2) − in other words, we will plant one inter-row area per pass of the corn planter. Because we are planting the strips in the inter-row area, no corn/soy rows are removed from production.

Willow Lake farm manages its cropland with a technique known as ridge till or strip till. This is a form of no-till, precision farming that is increasing in popularity. In this method, the tractor and equipment drive on the exact same paths each year and the corn (or soy) are planted in the exact same rows each year. This means that only a very narrow band where the corn/soy seed is planted needs to be tilled or disturbed each spring. The remaining ground is left untilled and is covered with corn/soy residue from the previous year. Because of this precision planting method, perennial strips can be established and maintained with no annual disturbance.

Sixteen strips, each about ½ mile long, will be planted in four fields, totaling 60 acres (Figure 2). Depending on Willow Lake Farm’s crop rotation at the time of planting, these four fields may be within one 80 acre field as shown in Figure 2, or within two separate, but nearby, 40 acre fields. In either case, half of the strips will be planted into a cornfield and the other half into a soy field (Table 1). This will allow us to compare how well perennial strips establish within corn versus soy. Since most farms rotate between corn and soy, we will have fields rotate similarly in this project. It is currently planned that fields will rotate between corn and soy annually (Table 2).

Currently, nearly all conventional corn and soy seed is treated with neonictinoid insecticides. It is suggested that fields treated with neonictinoids pose a threat to non-target fauna such as songbirds and bumblebees. To help assess this risk, we will plant two five-acre fields with non-treated corn/soy seed adjacent to the conventional corn and soy fields (Figure 2, Fields A and D.). Ultimately we will compare the success of fauna using the perennial strips in the treated versus non-treated fields.

Species Selection

Introducing long-lived native prairie species into row-crops is challenging for two main reasons:

1) We have to find perennial species that can survive the nutrient and water competition within the corn/soy environment, and have the ability to handle the changing light regime (shading) created by the maturing crops.
2) However, the perennial species/strips themselves cannot be overly competitive with the corn/soy and should induce only minimal yield loss to the adjacent corn/soy rows.

Some prairie species may be highly compatible with the lifecycle of corn/soy. Long-lived, short stature species, such as Golden Alexander that have low water and nutrient demands, may thrive in the area between rows with minimal competition to the corn/soy. Perennial nitrogen-fixing legumes, including alfalfa, could offer the additional benefits of reducing fertilizer needs. Glyphosate-tolerant varieties of alfalfa offer particular promise due to the ease of adapting to existing herbicide treatments.

Each of the 16 inter-row strips will be planted with either individual prairie species, a mix of prairie species or alfalfa (Table 2). Many of the strips will be divided into a north and south half, allowing us to test more species or have duplicate treatments. A list of probable species and planting design are shown in Table 2. Historically, row-crop fields with escape milkweeds were shown to be good habitat for Monarch reproduction. We will evaluate milkweed species specifically in certain strips (Table 2) and we will include at least three milkweed species in all strips that use a mix on native forbs. Because of the low light regime (high shade) created by maturing corn and soy, we will focus on using savanna species that are naturally adapted to increased shading throughout the growing season. In addition to the individual species listed in Table 2, candidates for the multiple species strips (e.g. Inter-row 1 in Table 2) will include (but not limited to):

Forbs: Figwort, Butterfly Milkweed, Cream Gentian, Anise Hyssop, Mountain Mint, Beardtongue
Legumes: Cream Indigo, Bush Clover, Purple Prairie Clover, Showy Trefoil,
Grasses: Bottlebrush Grass, Woodland Brome, Fringed Brome, Bicknell Sedge, Oval Sedge

Seeding Method

Seeding these strips into an active no-till, row-crop field has several difficulties. We must restrict the planting to the 30" inter-row area without disturbing the nearby corn/soy rows, and the seeding method needs to create good seed to soil contact through the heavy corn/soy residue present in a no-till field. We will work with a local manufacturing firm to design and fabricate a custom seed drill (using parts from existing equipment) that could be piggybacked onto the 24-row corn planter or pulled separately by an ATV. The intention is to have the seed drill built by the fall of 2016. We will then plant some rows in fall of 2016 by pulling the drill with an ATV and plant other rows in the spring of 2017 by attaching the seed drill to the 24-row corn planter. With either method, 2017 will be the first growing season for all strips. Strips will be planted with a known amount of seeds to facilitate evaluating the "success" of each species. Based on past experience, we will use a total seeding rate of about 80 seeds/ft^2 to promote a high density of seedlings and minimize weed competition.

Herbicide shielding

The corn and soy fields are sprayed at least once each year with a broad-spectrum herbicide to control weeds. A key component of this project is to demonstrate a technique that will protect the perennial strips from this herbicide application, yet still provide weed control in the adjacent corn/soy rows. Herbicide shielding is a well developed technology and it should be relatively straightforward to adapt an existing shield to the conventional sprayers used today. The shield will likely be a 1.5 x 0.75 meter piece of sheet metal formed into a 90-degree angle along the long-axis. (imagine a long, narrow tin roof). This shield will be attached to the herbicide sprayer boom at a position and spacing equivalent to the perennial strips and will deflect the application of the herbicide away from the plants in the inter-row area.

Evaluating Establishment

A major objective of this project is to evaluate which species or combination of species can be successfully established within a row-crop field. The entire length of all strips will be walked twice each growing season for the duration of the project to provide a qualitative assessment of how well each planting is doing. A list of species present, overall height, density of plants, and presence/absence of flowers will be recorded for each strip.

A quantitative assessment will be conducted on four, 5-meter long representative sections of each strip—two in the north half and two in the south half. We will count and record the number of individuals of each species in the 5-meter section, and calculate both the total plant and individual species density for that strip. Because we will know the number of seeds of each species planted, we can compare the established plant density to the seeded density. This will allow us to estimate the establishment success for both individual species and the overall planting. For an overall seeding rate of 80 seeds/ft^2, an establishment success of 15% (12 plants/ft^2) or greater will be considered very good. (Of course in the mixed plantings with 20 species, any one species will only be planted at 4 seeds/ft^2. At 15% success we will still have a total of 12 plants/ft^2 but the density of any one species will be proportionally less.) Average height, presence/absence of flowering and seed set for each species will also be measured in each 5m section to give an estimate how "robust" the planting is.

Since 2017 will be the first growing season and plants will be in the seedling stage, we will only conduct the two qualitative assessments in this year and won't begin the quantitative assessments until 2018. Quantitative assessments of the 5m sections, along with the additional full strip qualitative assessments, will be conducted in late May and September 2018, and late May of 2019. Funding for this project ends in June of 2019, but we intend to find additional funding and continue these establishment surveys through at least 2020.

Summary Budget Information for Activity 1:

ENRTF Budget: $ 65,000
Amount Spent: $ 0
Balance: $ 65,000

Outcome	Completion Date
1. *Plant and maintain strips of permanent cover in the bare space between every 24th corn/soy row*	July 2018
2. *Evaluate suitability of species as perennial cover strips, compatible with row crops*	June 2019

Activity Status as of: February 2017
Activity Status as of: August 2017
Activity Status as of: February 2018

Activity Status as of: August 2018
Activity Status as of: February 2019

Final Report Summary: August 2019

ACTIVITY 2: Evaluate benefits of inter-row perennial cover strips to pollinators, monarchs, songbirds and gamebirds.

Description:

Strips will be searched multiple times during the growing season to inventory songbird/gamebird nesting, monarch production, and density of native bees (pollinators**)** as metrics of the strip's habitat value. Because it takes three years or more for native plantings to become established and fully flowering, the habitat evaluations conducted within the time frame of this project will offer only initial results −but will demonstrate the habitat potential for this conservation technique and provide the foundation for on-going evaluations.

Songbird and Gamebird Recruitment

May and early June are the peak nesting season for many songbirds and gamebirds. The entire length of all strips will slowly and systematically walked at two-week intervals in May and early June of 2018 and 2019 to detect nesting birds. With this technique, adult birds flush from their nests at close proximity to the searchers, allowing the nesting sites and eggs to be visually located. Each nest will be marked by placing a pink-pin flag two meters north of the nest. (Flags are placed away from the nest to avoid habituating predators to nest locations). Nesting species, number of eggs, surrounding vegetation and coordinates will be recorded for each nest found. Return visits will be conducted for all nests do determine the fate of the nest and estimate the number of individuals recruited. Number of bird species and nesting densities will be determined for each strip. A comparison between nesting preference and success will be done for strips within the neonictinoid treated versus non-treated fields.

Monarch Butterfly Reproduction

All strips containing milkweeds will be searched once a month for Monarch larva in June, July and August of 2018 and early June of 2019. (We intend on completing additional Monarch larva surveys pending additional funding). In mixed plantings where the density of Milkweeds will be lower (e.g. Inter-row 1 of Table 2), we will search the entire length of the strip for larva. In strips that are planted with only Milkweeds (e.g. Inter-row 7 of Table 2), we will search four representative 10-meter long sections. Individual milkweed plants will be visually inspected for Monarch larva. Given the frass (fecal pellets) and leaf chewing associated with larva, locating them on milkweeds is fairly easy. Plants with feeding larva will be marked with flagging tape and coordinates will be logged with a handheld GPS. Instar stage, length and health of each larva will be recorded. It would be useful to survey and record chrysalides as well; however, even though Monarch larva feed exclusively on milkweeds, they often leave these plants and form their chrysalis on nearby, non-milkweed plants thus, making it difficult to locate them. We will return to the milkweeds that had been marked with larval presence and examine the surrounding area for chrysalides, but since we cannot guarantee finding the chrysalis associated with the larva, we will rely on larval densities as the metric to evaluate the strip. Total number (abundance) of monarch larva will be summarizing for each strip. Using the plant data collected in Activity 1, we will also estimate a density of larva per milkweed plant for each strip. A comparison in the number of larva found and their average length within the neonictinoid treated versus non-treated fields will also be assessed.

Pollinators: Bumblebee Density

Because bumblebees are large and relatively easy to distinguish from other bees, they will be used as the indicator insect to evaluate the habitat value of the strips to pollinators. A timed, transect method will be used to assess bumble density in each of the strips. Two, 20-meter sections of each strip will be marked off with pin flags. These sections will be visually surveyed over a 15-minute time period and the total number of bumblebees (all species) will be counted. To create comparability between strips, all surveys must be conducted between 9:00am and 3:00pm, with winds less than 10mph, under dry conditions. All strips will be surveyed within a weeklong period of June and September of 2018. Abundance and density of bumblebees will be estimated for all strips. Additionally, while conducting surveys, a qualitative description of bumblebee vigor will be recorded, and the bare ground near the perennial strip will be visually inspected to check for dead or debilitated bees. This information will be contrasted between the neonictinoid treated and non-treated fields.

Summary Budget Information for Activity 2:

ENRTF Budget: $ 74,000
Amount Spent: $ 0
Balance: $ 74,000

Outcome	Completion Date
1. *Quantify gamebirds and songbird nesting recruitment from inter-row cover strips*	June 2019
2. *Estimate number of bumble bees per area utilizing cover strips*	June 2019
3. *Estimate number of Monarchs butterflies produces per cover strip*	June 2019

Activity Status as of: February 2017
Activity Status as of: August 2017
Activity Status as of: February 2018
Activity Status as of: August 2018
Activity Status as of: February 2019

Final Report Summary: August 2019

ACTIVITY 3: Technology transfer: cost analysis, implementation recipes and field tours.

Description:

This project seeks to demonstrate a new conservation practice that will provide both habitat and water quality benefits within the agricultural landscape. Future adoption and implementation of this practice will be facilitated by providing a simple synthesis of the implementation method, expected outcomes and cost estimates. We will summarize and disseminate this information through a short fact sheet, an agro-ecology conference and on-farm tours.

Cost Analysis.

There are two principle costs associated with the conservation practice demonstrated in this project. One is the cost associated with getting the perennial strips established. The second is the cost to the farmer of the yield reduction in the corn/soy rows adjacent to the perennial strips. Both implementation and yield-reduction costs will be summarized in the fact sheet, and together provide the foundation for estimating the cost-share necessary to get this practice implemented on a large number of acres.

We will document the cost of seed, fuel and labor associated with establishing the strips. Since some strips will perform better than others, we will provide an implementation cost estimate for each of the strips. In addition to the basic costs of seed, labor, and fuel there is the cost of the custom planter and herbicide shields. We will document and describe these equipment costs, but will keep them separate from the general implementation costs as they are one-time capital costs and may be skewed higher due to the development phase of the technique.

The larger, and on-going cost of this conservation practice is the yield reduction in the corn/soy rows adjacent to the perennial strips. Vegetation in the perennial strips will compete with the corn/soy for water and nutrients and will almost certainly induce a yield reduction in the adjacent rows. We expect that yields in the two rows adjacent to the strips could be reduced by 10-25%. We will quantify grain yields in rows adjacent to the strips and compare those to whole field averages. Yields will be estimated using the *Corn Yield Calculator* (also know as the "slide rule" method) developed by the University of Illinois. The basic procedure for this method is:

Slide rule method for estimating corn yield

1. For 30" row spacing, mark off a 17.5-foot section of a row (this is equivalent to 1/1000th of an acre)
2. Count the number of harvestable ears in this section
3. On every 5th ear count the number of kernel rows per ear and determine the average
4. For these ears, determine the average number of kernels per row
5. Yield (bushel/acre) = Number Ears x Avg. Rows per Ear x Avg. Kernels Row

A similar method, using number of pods and beans per pod in 21 inches of a soybean row will used to estimate yields in the soybean fields. Using these methods, we will estimate yields in the rows adjacent to the strips and the row furthest from the strip—the difference between these is the yield reduction due to the perennial strip. The suite of perennial species tested in the strips will likely impact the corn/soy differently. Thus, we will estimate the yield reduction associated with each of the strips and calculate strip-specific "yield-loss cost" based on a range of market values ($/bushel) of the corn/soy. We will combine this yield-loss cost with the implementation costs to offer an estimate of the total cost to the farmer to adopt the conservation practice.

The Optimal Implementation Recipe

We will compile and summarize the establishment success, habitat results and costs (implementation plus yield reduction) associated with each of the strips. Some strips/species may establish well, but induce high yield loss. Conversely, other strips/species may not induce a significant yield loss but may also not provide meaningful habitat value or have poor establishment. We will review all factors together and select the strips that optimize the balance between establishment, habitat value and cost. For these optimum perennial strips, we will generate a short implementation recipe that will include planting method, species list, and a summary of expected costs and habitat value.

Fact Sheet

We will create a two-page, graphic rich, easy to follow fact sheet highlighting the conservation practice demonstrated in this project. The fact sheet will summarize the rationale, findings, costs and optimum method determined at the Willow Lake Farm. Information will be targeted at farmers and natural resource managers likely to adopt or promote the use of perennial strips. For users looking for more detailed information, we will direct them to the final report that will be submitted to LCCMR.

Field Tours

In person, farmer-to-farmer connection if often the best way to promote new conservation practices. Tony Thompson, owner/operator of Willow Lake Farm hosts an "agro-ecology" summit every two years at his farm. The theme of this conference always centers on new technologies, research and practices that promote healthy natural resources within an economically viable agricultural landscape. The Willow Lake Agro-Ecology conference has an attendance of ~200 people, with good representation from the University of Minnesota, MN Department of Ag and MN-DNR, along with farmers from the Minnesota River watershed. The next conference will be in August of 2017. The theme of this conference will be perennial vegetative cover crops and inter-seeding methods in row-crop agriculture. The concept and early results of this LCCMR project will be presented at the conference and will be highlighted with an afternoon tour of the demonstration fields. At this conference and tour, attendees will see the strips in the seedling stage, get a feel for the project objectives and be introduced to the concept of creating perennial strips within row crops. Willow Lake farm will host a second field tour in either the summer of 2018 or spring of 2019 to show the progress of the strips and faunal use. We will coordinate this field tour with other on-farm natural resource agency tours looking at cover crops in southern Minnesota. Both of the field tours will be attended by farmers and will offer an excellent opportunity to engage them in conversations about the need for perennial vegetation in the agricultural landscape −and techniques to accomplish this.

Summary Budget Information for Activity 3:

ENRTF Budget: $ 40,000
Amount Spent: $ 0
Balance: $ 40,000

Outcome	Completion Date
1. Cost Analysis: Determine cost of establishment, management, and yield loss associated with each perennial strip type	*March 2019*
2. Implementation Recipes: Summarize species and management techniques that optimize habitat value and minimize yield loss.	*May 2019*
3. Dissemination: Host two field tours, and on-farm agro-ecology summit sharing results with farmers and resource managers.	*May 2019*

Activity Status as of: February 2017
Activity Status as of: August 2017
Activity Status as of: February 2018
Activity Status as of: August 2018
Activity Status as of: February 2019

Final Report Summary: August 2019

V. DISSEMINATION:

Description:
This project will demonstrate a new conservation practice that will provide both habitat and water quality benefits within the agricultural landscape. Future adoption and implementation of this practice will be facilitated by providing a simple synthesis of the implementation method, expected outcomes and cost estimates. We will summarize and disseminate this information through a short fact sheet, an agro-ecology conference and two on-farm tours. The fact sheet, tours and conference will be targeted at farmers and natural resource managers likely to adopt or promote the use of perennial strips. See Activity 3 above for details.

Status as of: February 2017

Status as of: August 2017
Status as of: February 2018
Status as of: August 2018
Status as of: February 2019

Final Report Summary: August 2019

VI. PROJECT BUDGET SUMMARY:
A. ENRTF Budget Overview:

Budget Category	$ Amount	Overview Explanation
Personnel:	$ 120,000	1 project manager at 40% FTE for 3 years ($120,000) Salary = 70% Benefits = 30%
Professional/Technical/Service Contracts:	$ 20,000	Task Based Contract with Willow Lake Farm Staff, ~500 hours over 3 years, ($20,000)
Equipment/Tools/Supplies:	$ 5,000	Prairie Seed (~$2,500); fuel (~$500); field supplies (~2,000)
Capital Expenditures over $5,000:	$ 25,000	Design and fabrication of custom seed drill and herbicide shields.
Fee Title Acquisition:	$	
Easement Acquisition:	$	
Professional Services for Acquisition:	$	
Printing:	$	
Travel Expenses in MN:	$ 9,000	Mileage ($3,000); Lodging for summer intern over 3 years ($6000)
Other:	$	
TOTAL ENRTF BUDGET:	**$ 179,000**	

Explanation of Use of Classified Staff: Not Applicable

Explanation of Capital Expenditures Greater Than $5,000:

The seed drill designed and built to the plant the strips in this project will serve to demonstrate the technology specific to this new conservation practice. Going forward, as other landowners wish to adopt the inter-row conservation practice, the drill will be made available to them at no cost. The seed drill and herbicide shields will also serve as the prototype for the manufacture of additional inter-row seed drills in the future.

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:
1.2 FTE Equivalent (One FTE at 40% over 3 years)

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:
0.24 FTE (Contract with Willow Lake Farm, 167 hours/year over 3 years)

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds

Non-state			
Tony Thompson, owner and operator Willow Lake Farm was awarded the *Siehl Prize for Excellence in Agriculture* in 2011. Mr. Thompson is dedicating $22,500 from this prize as a cash match to the project.	$ 22,500	$	Funds will be used to help support a field season intern: (Field Season Intern. $15/hr x 500 hr/yr x 3 years = $22,500
State			
	$	$	
TOTAL OTHER FUNDS:	**$**	**$**	

VII. PROJECT STRATEGY:

A. Project Partners:

Tony Thompson, owner and operator of Willow Lake Farm near Windom Minnesota, is the co-investigator on this project and has offered his farm as the location for the demonstration fields. Mr. Thompson and Willow Lake Farm staff will assist with field design, planting of the cover strips, habitat evaluation and yield monitoring**.** Willow Lake Farm will assist with hiring and supervising summer interns who will work on this project.

B. Project Impact and Long-term Strategy:

This project will demonstrate a new conservation technique that is applicable on farms using precision tillage methods (e.g. strip till and ridge till), and is thus applicable to tens-of-thousands of acres of Minnesota's cropland. Our intention is to show that perennial vegetation can be cost-effectively introduced into row-crops on these types of farms, providing both habitat and water quality benefits without removing land from production. Successfully demonstrating that perennial vegetation can be incorporated into crops with minimal impact to grain yields will accelerate this concept and allow natural resource mangers to add this type of management technique to their suite of agricultural best management practices. Ultimately, we hope that this project provides a significant step forward in developing new methods to add cover crops and perennial vegetation to the agricultural landscape. Because of the time required for perennial plantings to establish and mature, this project can only provide initial assessments of the habitat value of the inter-row strips. We will actively seek funding from other sources to extend the floristic and faunal evaluations of the strips for several years beyond the timeframe of this project.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	$ Amount
Not Applicable		$
		$
		$

VIII. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS:

Not Applicable

IX. VISUAL COMPONENT or MAP(S):

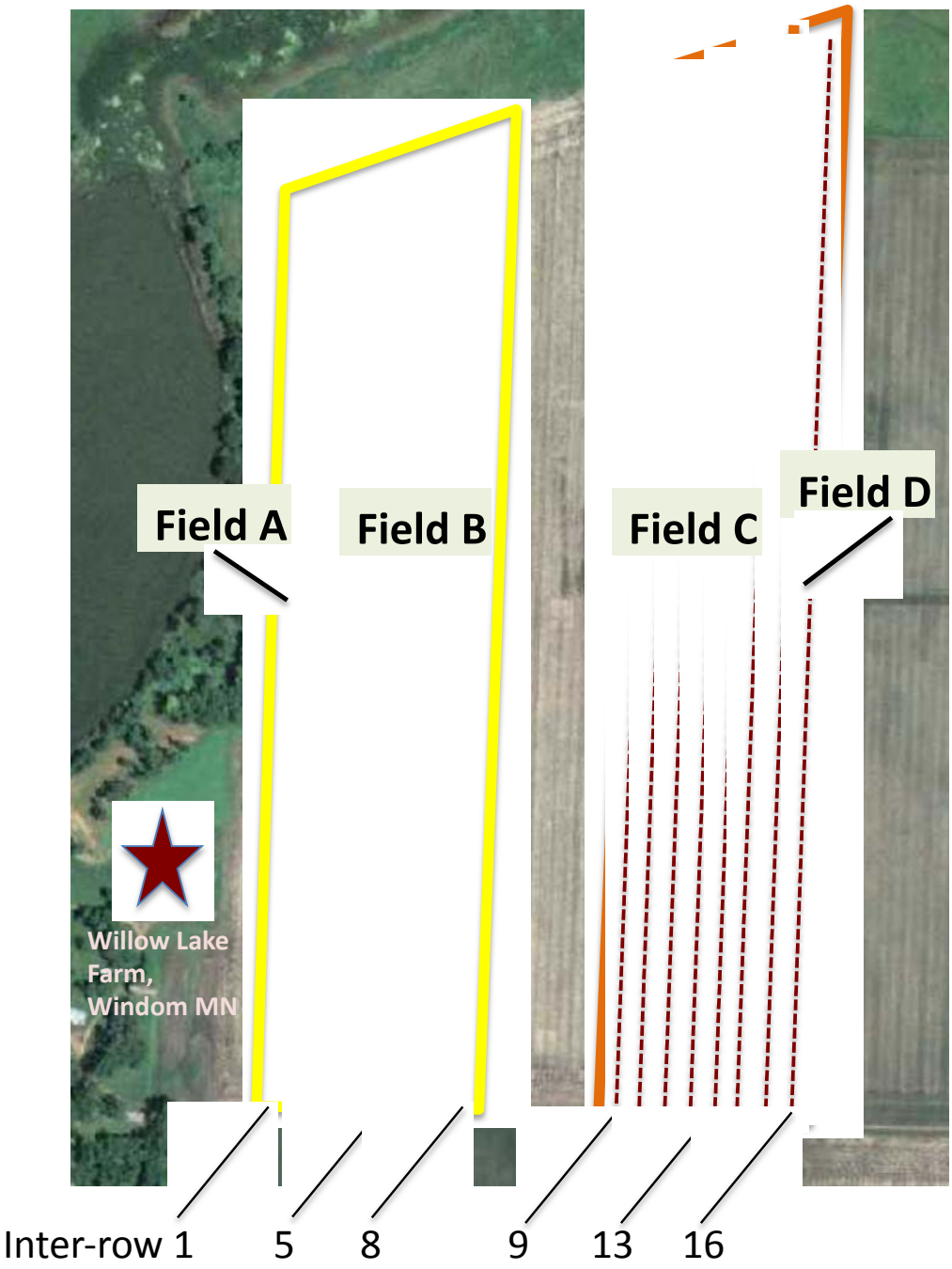

Figure 2. Location and layout of perennial vegetation inter-row plantings at Willow Lake Farm. Sixteen strips of perennial vegetation (dashed lines) will be planted within four corn/soy fields. Fields A and B will be corn in 2017 and fields C and D will be soybeans. Fields rotate between corn and soy annually. Fields A and D will be planted with non-neonictinoid, non-GMO corn/soy seed. Fields B and C will be planted with conventional corn/soy seed. See Table 1 for field size and crop rotation details. See Table 2 for species composition of the 16 inter-row strips

Table 1. Field sizes, crop rotation and variety of grain-seed used in demonstration fields. Non-treated means the corn/soy seed is not treated with neonictinoid and is a non-GMO variety.

Field	Acres	Crop Rotation 2017	2018	2019	Variety
A	5	Corn	Soy	Corn	Non-treated
B	25	Corn	Soy	Corn	Conventional
C	25	Soy	Corn	Soy	Conventional
B	5	Soy	Corn	Soy	Non-treated

Table 2. Floristic species to be planted in the 16 inter-rows (strips) of the four demonstration fields shown in Figure 2. Inter-row strips are divided into a north and south half to allow testing of more species. Inter-row strips that are planted with a mix of forbs (e.g. Inter-row 1, north- half) will include all native species tested in the other rows plus at least 10 additional species.

Inter-row	**Field**	**Species Planted North-half of Strip**	**Species Planted South-half of Strip**
1	A	Mix of 20 prairie/savanna forbs	Mix of native legumes
2	A	Mix of 9 native grasses/sedges	Mix of 20 prairie/savanna forbs
3	B	Prairie Blazing Star	Cupplant
4	B	Mix of 20 prairie/savanna forbs	Mix of native legumes
5	B	Mix of 9 native grasses/sedges	Mix of 20 prairie species
6	B	Golden Alexander	Stiff + Showy Goldenrod
7	B	Common Milkweed	Swamp Milkweed
8	B	Alfalfa	Alfalfa
9	C	Alfalfa	Alfalfa
10	C	Common Milkweed	Swamp Milkweed
11	C	Golden Alexander	Stiff + Showy Goldenrod
12	C	Mix of 20 prairie/savanna forbs	Mix of native legumes
13	C	Mix of 9 native grasses/sedges	Mix of 20 prairie/savanna forbs
14	C	Prairie Blazing Star	Cupplant
15	D	Mix of 20 prairie/savanna forbs	Mix of native legumes
16	D	Mix of 9 native grasses/sedges	Mix of 20 prairie/savanna forbs

X. RESEARCH ADDENDUM:
Not Applicable

XI. REPORTING REQUIREMENTS:
Periodic work plan status update reports will be submitted no later than February 1 and August 1 of 2017, 2018, and February 1, 2019. A final report and associated products will be submitted between June 30 and August 15, 2019

Environment and Natural Resources Trust Fund
M.L. 2016 Project Budget

Project Title: Establishment of Permanent Habitat Strips Within Row-crops
Legal Citation:
Project Manager: Shawn Schottler
Organization: Science Museum of Minnesota: St. Croix Watershed Research Station
M.L. 2016 ENRTF Appropriation: $ 179,000
Project Length and Completion Date: Three Years June 30, 2019
Date of Report: 12/4/2015

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	***Establish and Manage Perennial Inter-row***			***Evaluate Habitat Benefits of Inter-row Strips***			***Technology Transfer and Cost Analysis***				
Personnel (Wages and Benefits)	$32,000		$32,000	$60,000		$60,000	$28,000		$28,000	$120,000	$120,000
Shawn Schottler, Project Manager $ 120,000 (70% Salary, 30% Benefits) 40% FTE for 3 years											
Professional/Technical/Service Contracts	$2,500		$2,500	$7,000		$7,000	$10,500		$10,500	$20,000	$20,000
Task Based Contract with Willow Lake Farm Staff for Assistance with Planting, Habitat Surveys, Equipment Design, Field Tours, Yield Loss											
Equipment/Tools/Supplies	$4,000		$4,000	$500		$500	$500		$500	$5,000	$5,000
Prairie Seed (~$2500), fuel (~500), field supplies (~2000)											
Capital Expenditures Over $5,000	$25,000		$25,000			$0	$0		$0	$25,000	$25,000
Design and fabrication of custom seed drill and herbicide sheilds											
Travel expenses in Minnesota	$1,500		$1,500	$6,500		$6,500	$1,000		$1,000	$9,000	$9,000
Travel to and from Willom Lake Farm-Mileage ($3000); Three summers of Lodging for Intern in Windom Area ($6000)											
Other	-		-	-		-	-		-	-	-
COLUMN TOTAL	**$65,000**		**$65,000**	**$74,000**		**$74,000**	**$40,000**		**$40,000**	**$179,000**	**$179,000**