

Sustainable Land Management Plan for Springbrook Farm

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Objectives:

To create a 5-year land management plan to convert current conventional farmland into a multifunctional homestead. This plan will:

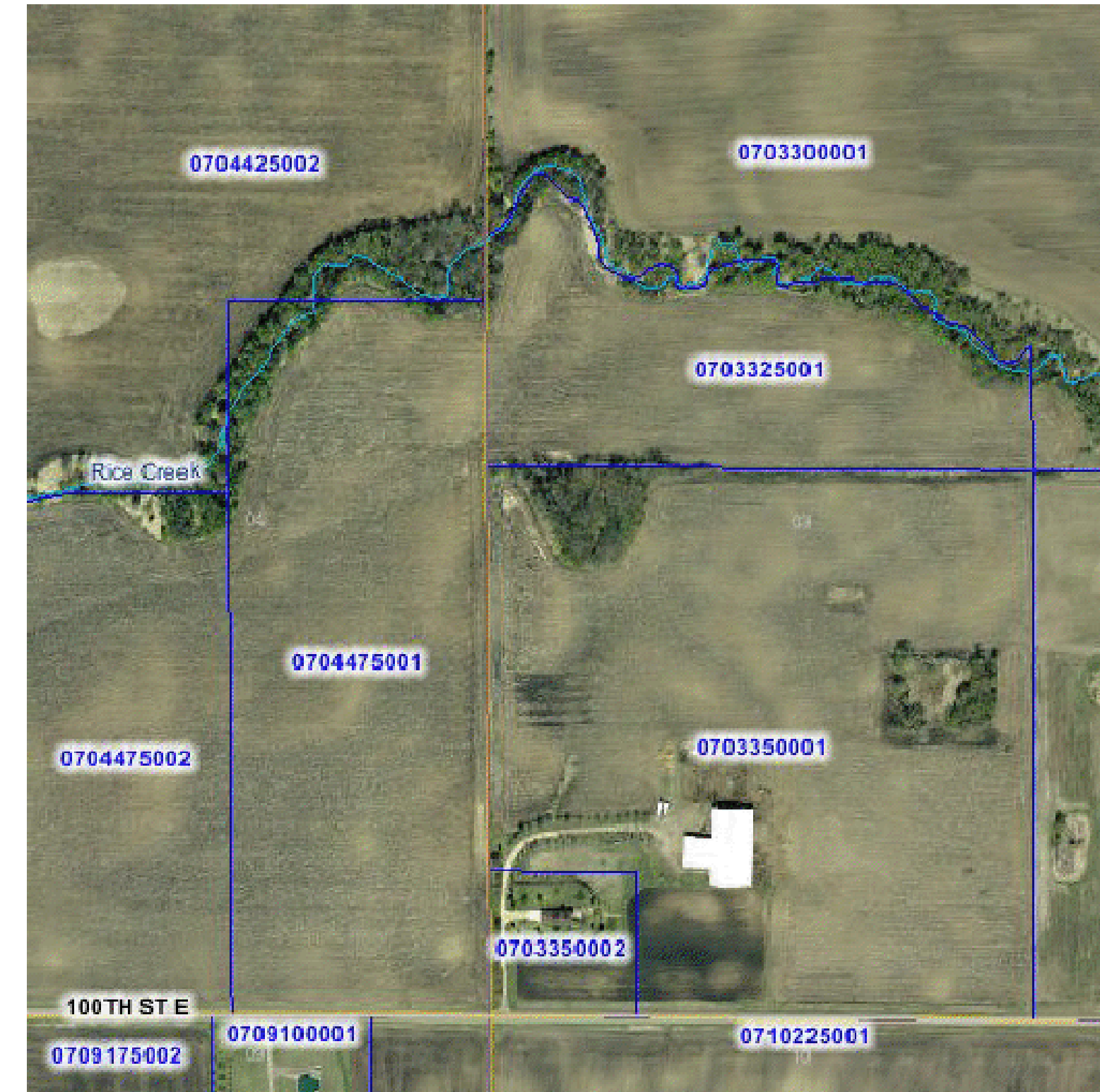
- Help manage invasive species effectively.
- Properly maintain native prairie without the use of fire.
- Design a riparian zone that will improve native trout habitat in stream.
- Create a distinctly Scandinavian aesthetic while using native species.
- Provide an enjoyable recreation space for the Nichols.

Homestead:

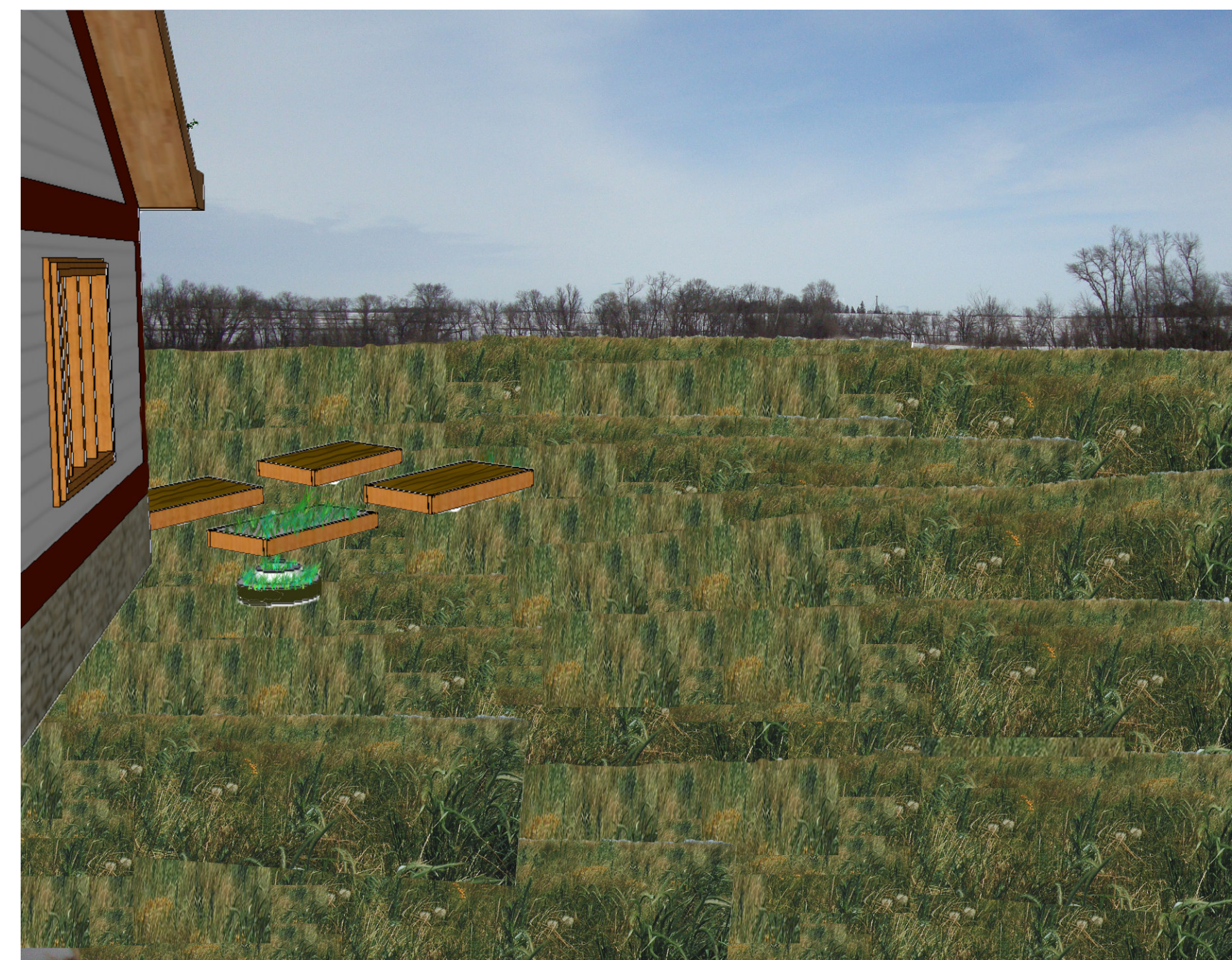
Integrating living space with garden space:

- Herb garden- herb spiral designed for aesthetics and physical ease.
- Kitchen garden with path and sitting spaces- raised bed keyhole garden for space efficiency and ease (Zone 5).
- Raised beds for salad greens.
- Gray water management garden- native plants and wildflowers to prevent runoff into stream.
- Perennial edibles along perimeter- black cap Raspberries, gooseberries, raspberries.
- Wildflowers incorporated along house and garden pathway for aesthetics, pollinator attraction, and pest control.

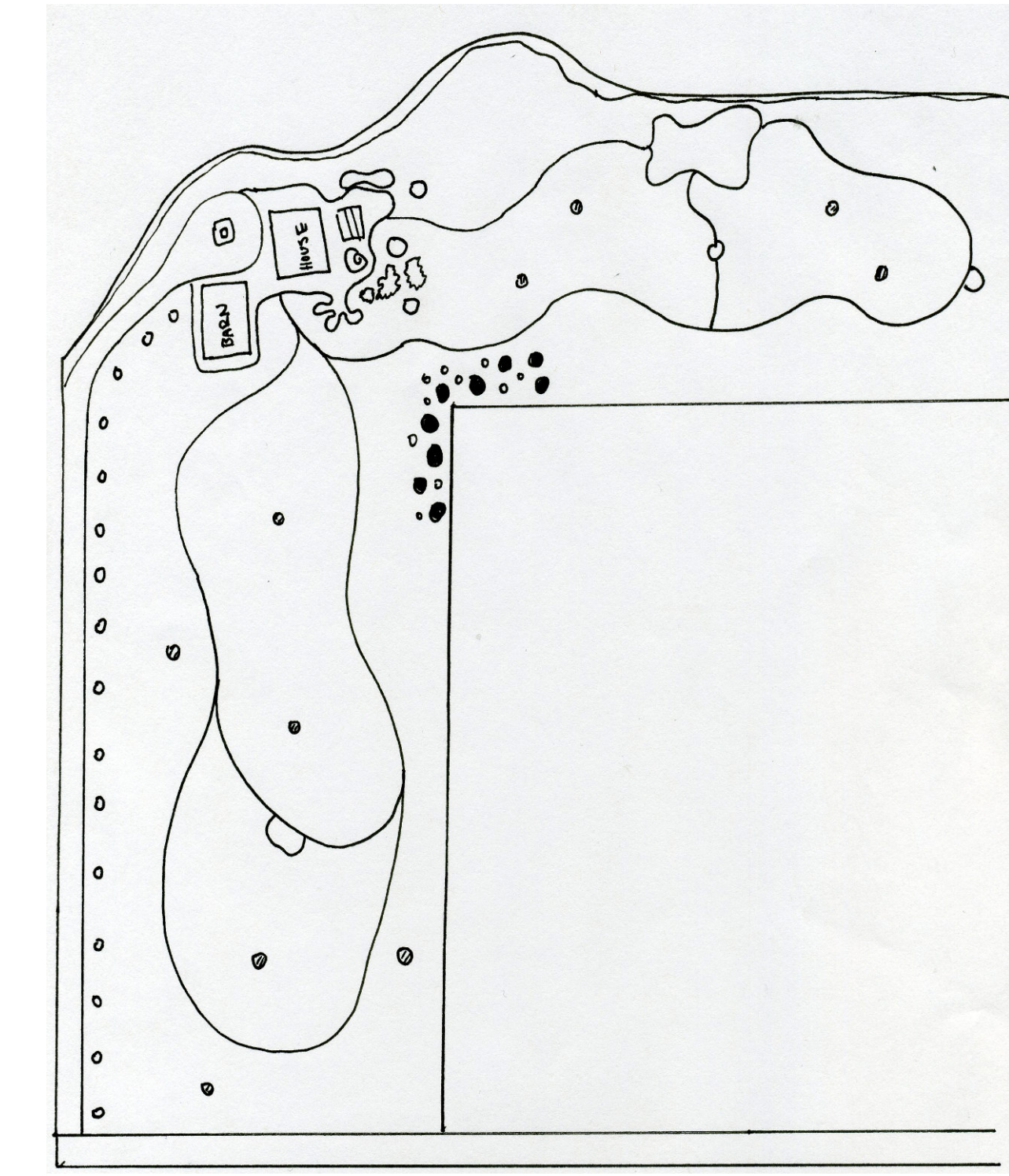
Aerial Photo of Springbrook Farm



Possible Homestead



Base Map of Springbrook Farm



View of Springbrook Farm (north)



Minnesota Native Prairie Plants



Big Bluestem
(*Andropogon gerardii*)
Source:
<http://plants.usda.gov/java/profile?symbol=ANG E>



Purple Coneflower
(*Echinacea purpurea*)
Source: <http://aggie-horticulture.tamu.edu/wildseed/33/33.1.html>



Dotted Blazingstar
(*Liatris punctata*)
Source:
http://www.wildflower.org/plants/result.php?id_plant=LIPU



Switchgrass
(*Panicum virgatum*)
Source:
http://en.wikipedia.org/wiki/File:Panicum_virgatum.jpg

Shade Cover at Spring Brook Creek



Source:
http://www.stolaf.edu/courses/2003sem2/Environmental_Studies/399/Projects/Jasperson_Project/IMG_1741.jpg

Forest:

- Clover as easy to maintain groundcover, does not require mowing, attracts beneficial native insects and pollinators, inexpensive, nitrogen fixing.
- A mixture of deciduous and coniferous trees for year-long sight block of farm field view (Zone 7, 10).
- Trees in plan will include Pin Oak, River Birch, White Pine, Red Pine, Swamp Maples, and Poplar.
- These trees are well-adapted to the soil and water conditions of the farm. They are native and disease, blight, and drought resistant.

Prairie:

Restoration of native prairie in SW section:

- Native grass mixtures will improve soil quality, nutrient availability, and microbial community.
- Will reduce erosion potential of land.
- Native prairie will provide a rich habitat for a diversity of insects, pollinators, and fauna.

Riparian Zone:

Stream Bank restoration and Maintenance.

- Reduce erosion along the stream by planting native, shade tolerant species.
- Maintain tree cover to help regulate stream temperature for a healthy trout habitat.
- Manage deadwood as potential habitat for animals and birds.
- Rebuild stone forde across stream as recreational location without impacting the hydrology of the stream.

A “Sustainable” Land Management Plan *for* Springbrook Farm

Scott Barvir - Laura Carpenter - Aika Mengi - Daniel Novak

Project Objectives

Our goal was to create a five-year management plan to convert a conventional farm into an ecologically sensitive and multifunctional homestead. We have sought ways to manage susceptibility to invasive species and select hardy species of plants. We required a prairie that could be managed without fires and a healthy riparian zone which maintained the trout habitat in Spring Brook itself. In addition we sought a way to make a landscape that was suitable for human recreational use and projected a sense of Scandinavian aesthetics. The challenge we faced was the realization that we knew very little about land management and creating an effective plan.

Homestead

The area immediately surrounding the home is open for a variety of designs and fun little projects. Many of the ideas that we have come up with are borrowed from permaculture, however, there is flexibility to stray away from the concepts and principles of permaculture.

One of the ideas that we believe will be helpful in creating a successful home garden and living area around the house is to think of the space as a series of concentric zones with the home in the center. The zones then go from high intensity use to low intensity use depending on what you desire to incorporate into the homestead. For example, in Zone 1 (the closest to the house) you would plant a small herb garden or large pots with herbs. Farther out would be the kitchen garden, and then areas for edible bushes and trees.

Other ideas that would be incorporated into the zone system are keyhole gardens, raised beds, aquifer recharging section, rain barrels and an herb spiral.

The Riparian Zone

Spring Brook (Rice Creek) stream is an important ecological stream that because of its rare qualities as a trout stream. The farmland on either side of the stream had historically been farmed close to stream shore. The trout in the stream are dependent of clean “clear water, an adequate food supply, areas to rest, places where trout may be protected from predators, places where they can spawn.”¹ The number of streams that can support trout are dwindling due to poor land use practice around streams and their watersheds.² Therefore it is important to maintain the streams that can still maintain a natural healthy population of trout.

The two challenges facing this stretch of the stream is how to maintain the shade cover to keep the stream cool. While simultaneously reducing the amount of sediment entering the stream due to erosion from the stream banks.

Streams have a remarkable ability to heal over time once the cause of their degradation is removed.³ But the steps that need to be taken in stream habitat rehabilitation must begin with an assessment of watershed conditions, that fit with the adjacent land activity. An important part of stream restoration and rehabilitation is that there is an adequate long term monitoring. Ways of measuring the success of the rehabilitation, parameters like water quality, channel morphology, stability after flood events, and the progress in establishing native plant communities.⁴ This can be done by using the “Judge your shore” checklist from the DNR.⁵ This could be done every 2 years to monitor the health of the stream.

Riparian planting projects require knowledge of soil type and condition; light and moisture availability; the extent, frequency, duration, and depth of flooding; land management; and wildlife use of the area, among other variables. Site assessments are capable of identifying, quantifying, and evaluating the condition of species and the abundance and quality of habitat at that particular site.⁶ A truly sustainable habitat restoration requires that the full array of stream processes be maintained within, or resorted to, a range of variability similar to what occurs naturally.⁷

Site Assessment: Spring Brook

The area that Spring Brook is located in is an oak savanna. Trees have been the dominant vegetation in some riparian corridors in southeast Minnesota.⁸ Spring Brook is a spring fed stream with the ideal conditions for trout. It is cool, has bank cover and pools for the trout to rest or hide from predators. It also has a relatively shallow gradient which implies that the stream velocity is not too fast that it requires impediments to support the trout. In addition it is not too slow that it creates a silty warm stream that can not support trout.⁹

The stream bed of Spring Brook is a combination of gravel and sand which provides suitable spawning grounds. It is important that sediment does not reach the stream in large amounts that could potentially cover the gravel stream bed, which would reduce spawning area and smother newly hatched trout fry.¹⁰

The shores of the stream are mostly sandy soils. As a result of the sandy soils that is common in the watershed and occasional high flows, the banks of Spring Brook have a tendency to erode.¹¹ After the spring melt, it was evident that some sections of the stream require additional vegetation with a root network that will increase the cohesion in the soil to decrease the amount of sediment entering the stream.

The relationship between the soil and stream is crucial. Soil is important, because water drains through the soil into the water. Water stored in the soil is a source of streamflow between storms or periods of snow melt.¹² In addition the loss of soil due to erosion can affect turbidity and make the stream less hospitable to the trout.

Erosion is a natural process, with rates varying due to a multitude of factors. Erosion rates tend to be episodic and linked to disturbance and weather. Surface erosion occurs the removal of vegetation. Vegetation provides the strength and roughness across the surface of the watershed, thereby slowing the movement of water and increasing resistance to erosion.¹³

Trees:

The interaction of large wood and the stream is also important. Trees serve as a function in the health of a stream and “removal of large woods has been one of the most destructive practices for aquatic habitat.”¹⁴ Fallen trees capture and retain sediment, ensuring that the streams do not quickly erode. Fallen trees also create habitats for local flora and fauna, therefore proper maintenance of the trees is crucial to creating a sustainable healthy ecosystem.

Trees play an additional role in the health of Spring brook stream, the trees provide cover and shade. The shade helps keep the temperature of water cool creating an ideal temperature for the trout. The trees also create cover which creates favorable environment for the trout.

Trees and Shrubs List:

Plant Guide: Native Plant Encyclopedia: Search by Criteria Menu A-Z Search

County	Life form	Habitat	Exposure	Maximum Height
Rice	<input type="checkbox"/> F Ferns and Wildflowers <input type="checkbox"/> G Grasses, Sedges and Rushes <input checked="" type="checkbox"/> T Trees and Shrubs <input type="checkbox"/> V Vines	<input type="checkbox"/> A Aquatic <input checked="" type="checkbox"/> W Transitional <input type="checkbox"/> UM Upland-Moist <input type="checkbox"/> UD Upland-Dry	<input checked="" type="checkbox"/> Full Sun <input checked="" type="checkbox"/> Partial Sun <input checked="" type="checkbox"/> Full Shade	20 Feet
Search				

To perform a search, choose a county and at least one check box in each of the categories above, then press **Search!** To view detailed information about a particular plant, click on the plant name.

	<u>Scientific Name</u>	<u>Common Name</u>	<u>Life Form</u>	<u>Habitat</u>	<u>Exposure</u>	<u>Height (ft)</u>	<u>Spacing (ft)</u>	<u>Flower Color</u>	<u>Bloom Time</u>
<input type="checkbox"/>	Amorpha fruticosa	False indigo	T	W,UM	☉☉☉	6-12	2-5	Blue-purple	May-June
<input type="checkbox"/>	Betula pumila	Bog birch	T	W	☉☉	4-8	6	---	---
<input type="checkbox"/>	Cornus amomum	Silky dogwood	T	W,UM	☉☉	5-12	8-15	White	May-July
<input type="checkbox"/>	Cornus sericea (stolonifera)	Red-osier dogwood	T	W,UM,UD	☉☉☉	5-12	8-15	White	May-July
<input type="checkbox"/>	Ilex verticillata	Winterberry	T	W,UM	☉☉	5-12	8	---	---
<input type="checkbox"/>	Salix bebbiana	Bebb's willow	T	W,UM	☉	5-15	5-10	---	---
<input type="checkbox"/>	Salix discolor	Pussy willow	T	W	☉	5-15	5-10	---	---
<input type="checkbox"/>	Salix eriocephala	Heart-leaved willow	T	W	☉	5-15	5-10	---	---
<input type="checkbox"/>	Salix exigua	Sandbar willow	T	W	☉	5-15	5-10	---	---
<input type="checkbox"/>	Salix humilis	Prairie willow	T	W,UM,UD	☉☉	3-9	3-6	---	---
<input type="checkbox"/>	Salix serissima	Autumn willow	T	W	☉	5-15	5-10	---	---
<input type="checkbox"/>	Sambucus canadensis	Common elderberry	T	W,UM	☉☉☉	3-12	8	White	July-August
<input type="checkbox"/>	Spiraea alba	Meadowsweet	T	W	☉☉	3-5	3-6	White	June-August
<input type="checkbox"/>	Viburnum trilobum	High-bush cranberry	T	W,UM	☉☉	5-15	5-10	White	June

Plants:

The plants that we want around the banks must be shade tolerant, due to the shade created by the trees. Ideally they will all be native. Because the riparian vegetation is important in determining the structure and function of stream ecosystems. A healthy riparian environment will lead to and increase in aquatic organisms that are directly and indirectly depended on inputs of terrestrial detritus to the stream for their food.¹⁷

Planting Plan:

Because Planting below the ordinary highwater line requires a license from the DNR, unless the owners might consider not planting below the ordinary high-water line.¹⁸ Once the appropriate plants are chosen, the method of planting needs to be determined. Do the owner prefer to seed plant, or plant seedlings. The planting of seedlings is more expensive but the results happen faster. Once the method of planting is determined then the number of plants needed must be calculated. Then the spacing and planting patterns determined.¹⁹

A general rule regarding shore line plants is to estimate a spacing of about 1.5 to 2 feet between plants. The distance they should be planted is dependent on how Plants can be spaced 6 inches to 4 feet apart, depending on how quickly they spread and how large or densely they grow. This can be found by observing the plants in there native communities.

Planting patterns - A natural pattern is to group species in clusters of 3-5, rather than planting single species all in one row or in regular intervals along rows. Observing the spatial arrangement of the plants of interest in the native communities can provide a model for planting patterns on your shoreline.²⁰

The Ford

The ford, is easy to maintain, but in order to minimize the impact of the structure on the fish, a culvert should be considered. The culvert would not inhibit the fish movement, while creating a spot for the family to enjoy the outdoors. More information of how to build a culvert can be found at "Design of Road Culverts for Fish Passage"²¹.

Plant List:

Plant Guide: Native Plant Encyclopedia: Search by Criteria

Menu A-Z Search

County Rice	Life form <input checked="" type="checkbox"/> F Ferns and Wildflowers <input checked="" type="checkbox"/> G Grasses, Sedges and Rushes <input type="checkbox"/> T Trees and Shrubs <input type="checkbox"/> V Vines	Habitat <input type="checkbox"/> A Aquatic <input checked="" type="checkbox"/> W Transitional <input type="checkbox"/> UM Upland-Moist <input type="checkbox"/> UD Upland-Dry	Exposure <input type="checkbox"/> Full Sun <input checked="" type="checkbox"/> Partial Sun <input checked="" type="checkbox"/> Full Shade	Maximum Height 3 Feet	Search
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To perform a search, choose a county and at least one check box in each of the categories above, then press Search! To view detailed information about a particular plant, click on the plant name.

	Scientific Name	Common Name	Life Form	Habitat	Exposure	Height (ft)	Spacing (ft)	Flower Color	Bloom Time
<input type="checkbox"/>	Anemone canadensis	Canada anemone	F	W,UM	☉☉	1-2	2	White	May-July
<input type="checkbox"/>	Caltha palustris	Marsh marigold	F	W	☉☉☉	0.5-2	1.5	Yellow-orange	April-June
<input type="checkbox"/>	Epilobium glandulosum	Willow-herb	F	W	☉☉	0.5-2	0.5	Pale pink	July-Sept
<input type="checkbox"/>	Gentiana andrewsii	Bottle gentian	F	W,UM	☉☉	1-2	1	Blue	August-Oct
<input type="checkbox"/>	Gentianella quinquefolia	Stiff gentian	F	W,UM	☉☉	1-2	1	Blue	August-Sept
<input type="checkbox"/>	Juncus tenuis	Path rush	G	W,UM	☉☉	0.5-2	1-2	---	---
<input type="checkbox"/>	Lilium philadelphicum	Wood lily	F	W,UM	☉☉	1-2.5	1	Orange-red	June-July
<input type="checkbox"/>	Lysimachia thyrsiflora	Tufted loosestrife	F	W	☉☉	1-2.5	1	Yellow	June
<input type="checkbox"/>	Menyanthes trifoliata var. minor	Buck-bean	F	W	☉☉	1-1.5	2	White	May-June
<input type="checkbox"/>	Onoclea sensibilis	Sensitive fern	F	W,UM	☉☉	1-2	2	---	---
<input type="checkbox"/>	Sagittaria cuneata	Northern arrowhead	F	A,W	☉☉	1.5-2.5	3	White	July-August
<input type="checkbox"/>	Sagittaria rigida	Sessile-fruited arrowhead	F	A,W	☉☉	1.5-2.5	2-3	White	July-August
<input type="checkbox"/>	Scutellaria galericulata	Marsh skullcap	F	W	☉☉	1-2.5	2	Blue	June-August
<input type="checkbox"/>	Scutellaria lateriflora	Mad-dog skullcap	F	W	☉☉	1-2.5	2	Blue	July-August
<input type="checkbox"/>	Thelypteris palustris	Marsh fern	F	W	☉☉	1-2	1.5	---	---
<input type="checkbox"/>	Triadenum fraseri	Marsh St. John's-wort	F	W	☉☉	0.5-1.5	0.5-1	Pinkish	July-August
<input type="checkbox"/>	Viola sororia	Woolly blue violet	F	W,UM	☉☉☉	0.5-1	1	Blue-violet	May-June

Prairie

The Prairie is going to be the biggest challenge to do it cheaply and well. Firstly, its going to be important that the land that will be converted to prairie is clear of as many weeds as possible. There are a couple of ways to accomplish this. The land can either be tilled over, or herbicide can be sprayed to insure a good kill.

The second issues is figuring out seed. Native prairie grasses are extremely expensive to buy in bulk, but it is quick and gives you many options for a variety of prairie styles.

One option that is less expensive, however more labor intensive, would be to go to an already established prairie and collect seed. This would require going during different seasons, because different plants are present at various times of the year. It would also be important that you know which plants are weeds and which ones are the native grasses that you want. So there is some plant identification that would be necessary. Professor Angell or Professor Shea would both be good sources to help with identification and the process of collecting seed.

Management of the prairie also has a few options. The least desirable option, fire, will be most effective in maintaining weeds during the first five years or so, but of course always runs the risk of getting out of control. One way to help insure that the controlled burn will not get out of control is to establish large buffers of short wet lawn grass or just gravel path. It would be also wise to hire a group of professionals. The other option is to mow the grass. Professor Angell said that mowing is a fairly good option, but it will not be as effective at reducing unwanted weeds as fire.

Both of these options are dependent on the type of prairie that is planted. If you decide that you would like more tall grass prairie, then we suggest that you use the mowing option as much as possible. If you decide on doing mostly short grass, the fire option may not be a bad idea because the fire can not get too high. It's important to remember that the first five years will be the most labor intensive period for the prairie.

Arboriculture

Tree species were selected for several factors and for practical and aesthetic reasons. The first priority was selection of trees native to southern Minnesota, which self selected for many traits including hardiness, suitability to the farm's acidic soil types and tolerance for fluctuations in moisture levels which ensure the health of the tree will be acceptable. Native trees also provide food for migrating animals and can support a healthy ecosystem when used properly. Finally, tree species were selected for their compatibility with the human species, and usefulness to a homestead.

Red Oak

A fast-growing oak species, red oaks can provide great shade with full, large crowns.

Black Walnut (*Juglans nigra*)

Thriving in rich, damp soil of southern Minnesota and producing nuts edible to humans and animals, walnuts are beautiful trees. They grow slowly, but the monetary value of their wood makes them a long-term investment.

Northern Pin Oak (*Quercus ellipsoidlis*)

Growing well in acidic soil, pin oaks can tolerate exposure and a range of conditions.

River Birch (*Betula Nigra*)

River Birch are tolerant of acidic soils and a wide range of conditions. They grow quickly, maturing at a height of 50 to 75 feet and produce vibrant yellows in the fall. Birch would be well suited to lining the driveway and creating a sight-block in the low-lying area southeast of the house. Scandinavian arts have a long tradition of working with the pliable bark of birch trees.

Wild Raspberry (Rubus sp.)

Raspberries are a delight to people and provide food for animals, they grow well on the margins of forested areas. Raspberries may require occasional pruning, which keeps their growth in check and improves their yields.

Forest:

White Pine (Pinus Strobus) and Red Pine (Pinus Resinosa)

These conifers are fast growing and thrive in acidic soil. White Pines prefer more fertile and moist soils, so they may be placed closer to the riparian zone. They are compatible with each other and are essential to the image of Scandinavia and the North country.

Red Cedar (Juniperus virginiana)

Red Cedar are tolerant of high exposure and can form a margin for the pines and forest. They grow well on former farmland and tolerate a wide range of soils. Cedar provide food for birds and maintain good color in winter.

Red Twig Dogwood AKA Red-osier Dogwood (Cornus sericea/stolonifera)

A native shrub of Minnesota, dogwood grows well in a wide range of conditions and can be used for landscaping around the house as well as an understory plant with pines.

Additional Work:

Further work should be to investigate what grants can be applied for to assist in the restoration process. ²² There appears to be several grants available that will assist in shore restoration. The plants and the method of planting need to be chosen. Any license that maybe acquired should be looked into. For example working with the ford, or if any aquatic planting is required.

The hope is to create an integrated plan that smoothly incorporates the different plans into a seamless landscape that is ecologically sensitive and aesthetically appealing to the Nichols family. While keeping it affordable, and easy to maintain in order to stimulate other landowners in around Northfield of the benefits of being ecologically sensitive.

Cited Works

- 1 Christopher J Hunter, Stream Restoration and management ,xx.
- 2 Ibid, 3.
- 3 Stream Habitat Restoration and Channel Design Guidelines, page 27
- 4 Ibid, 28
- 5 http://www.dnr.state.mn.us/restore-your-shore/html_pg/plantlistcriteriasearch.jsp?
- 6 Stream Habitat Restoration and Channel Design Guidelines, page 71
- 7 Ibid
- 8 William C. Thorn and Charles S. Anderson, comparison of two methods of habitat rehabilitation for brown trout in a southeast Minnesota stream. Minnesota Department of Natural Resources. Page 2
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http://www.stolaf.edu/courses/2003sem2/Environmental_Studies/399/Projects/Jasperson_Project/trouthabitat.html
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http://www.stolaf.edu/courses/2003sem2/Environmental_Studies/399/Projects/Jasperson_Project/community.html
- 12 Stream Habitat Restoration and Channel Design Guidelines, Page 31
- 13 Ibid
- 14 Ibid 49
- 15 http://www.dnr.state.mn.us/restore-your-shore/html_pg/plantlistcriteriasearch.jsp?
- 16 http://www.dnr.state.mn.us/restore-your-shore/html_pg/plantlistcriteriasearch.jsp?
- 17 Hunter, Christopher and Palmer, Tom. "Better trout habitat: a guide to stream restoration and management." Introduction.
- 18 <http://www.dnr.state.mn.us/restoreyourshore/st/considerations.html>
- 19 <http://www.dnr.state.mn.us/restoreyourshore/st/plantingplan.html>
- 20 <http://www.dnr.state.mn.us/restoreyourshore/st/plantingplan.html>
- 21 Design of Road Culverts for Fish Passage, 2003
- 22 <http://www.dnr.state.mn.us/grants/habitat/shoreland.html>