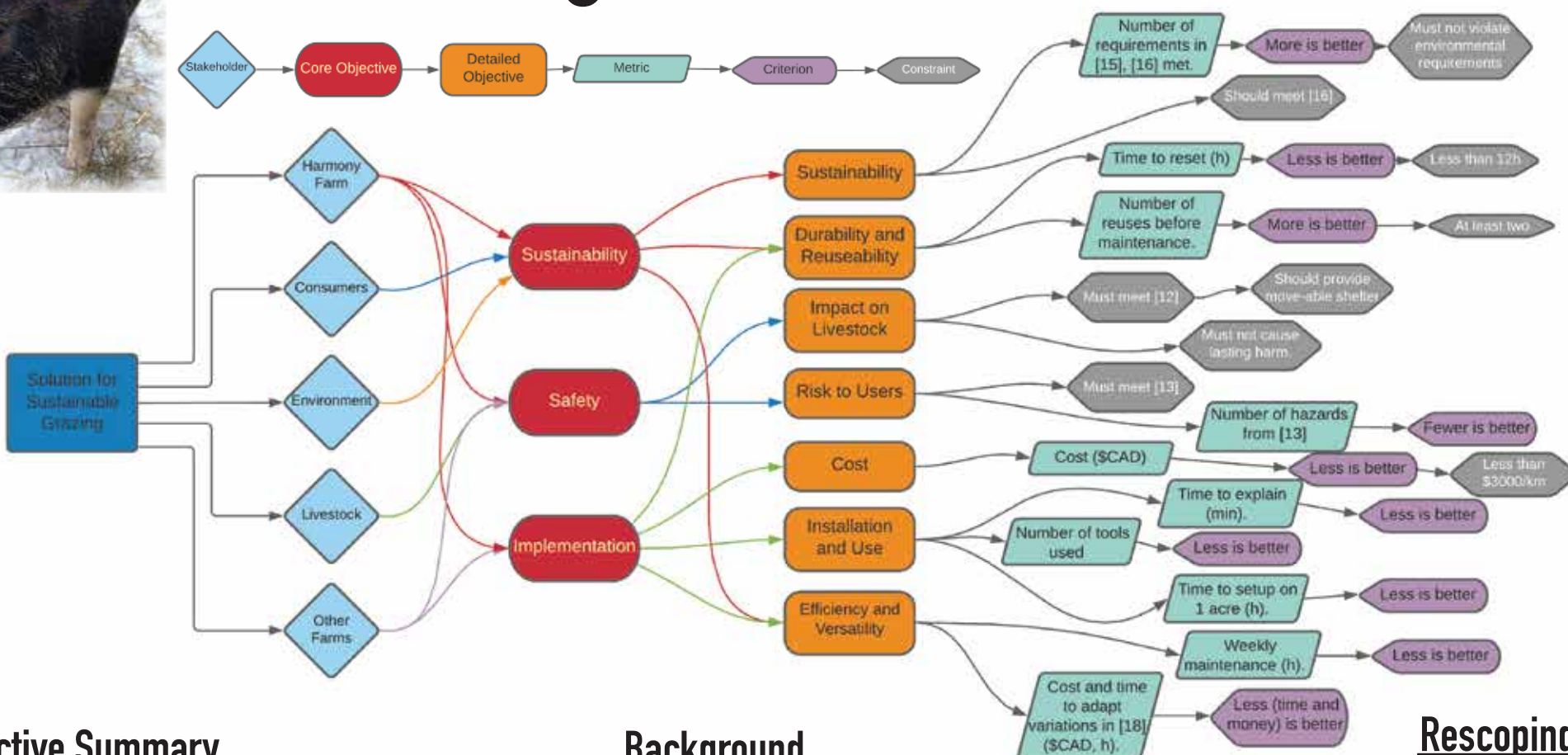




Grazing Containment



Core Objective Summary

Sustainability: solutions should adhere to principles of sustainability

Safety: solution should be safe for farmers and livestock

Implementation: solution should be easy and quick to assemble, install, and use

Background

Harmony Farm: small-scale sustainable farm in Brockville, ON

Sustainable Farming: farming using minimal equipment and resources

Rotational Grazing: containing livestock to small sub-pastures so their grazing replenishes soil

The Opportunity: develop an improved containment method for rotational grazing using pigs

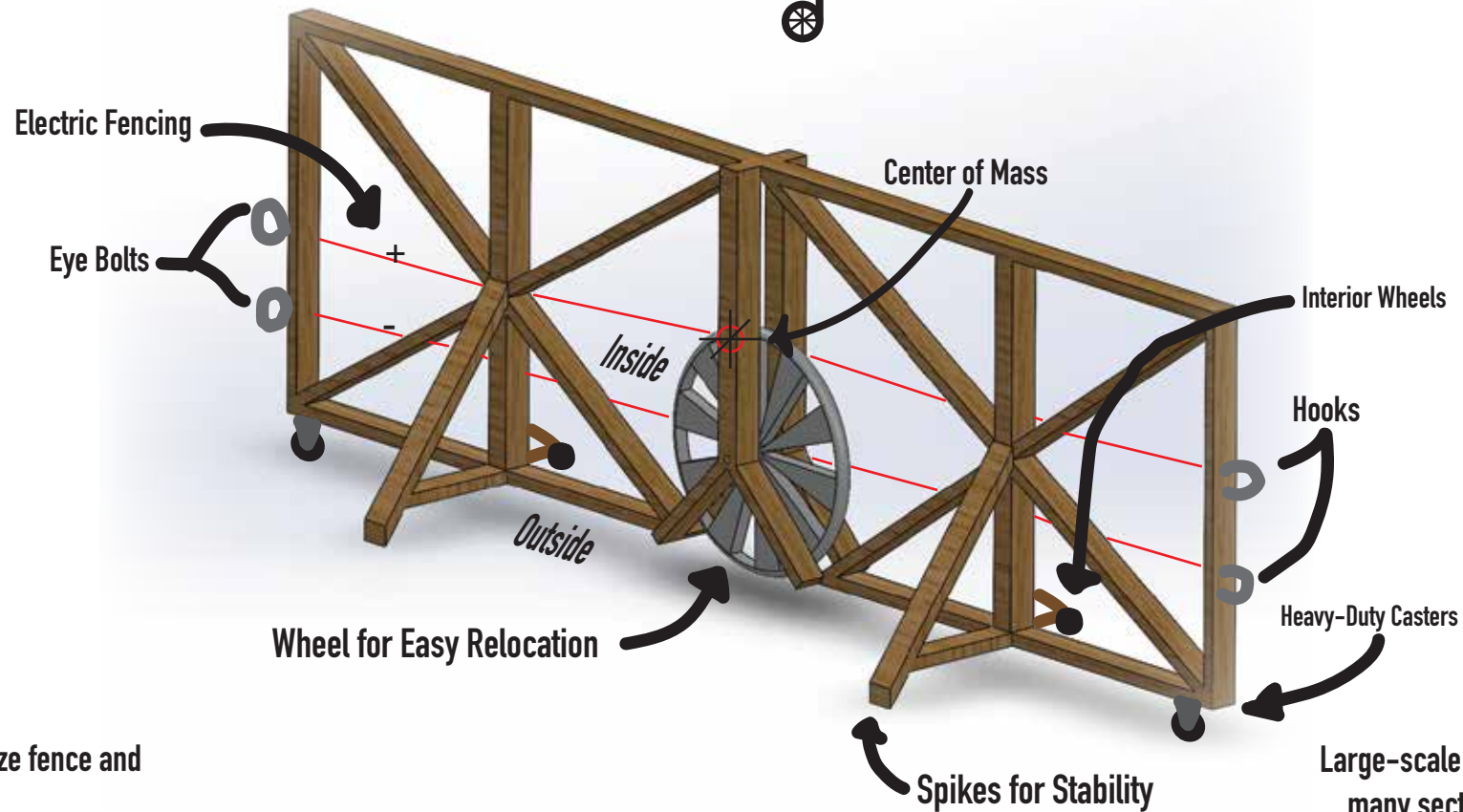
Rescoping

Shifted focus to containment

Prioritized implementation and feasibility metrics

Shifted weight away from metrics that are difficult to evaluate (reuseability, time to adapt)

The Rolling Fence



Key Features

Outer supports stabilize fence and prevent rolling

Truss Design for rigidity

Center wheel allows the fence to be rolled to contain different pastures

Made from lightweight, cheap and sustainable materials to minimize cost and weight

Features integrated electric fencing

Hooks and eye bolts connect sections and carry electric current, even around corners

Limitations

Large-scale grazing would require many sections (relocation could be time consuming)

Construction time is long and many sections must be built

Existing problems with electric fencing are not completely solved

Verification and Validation

Solidworks simulation: verifies strength and determines weight (~40kg) – helps to choose type of wood (cedar)

1:50 scale 3D-Printed Model: confirms rolling capability and simple stability – helps to confirm relative dimensions

Full Size Prototype: verifies feasibility of construction – helps to choose wheel size/type (27.5" Mountain Bike), reveals flaws – difficult to roll on a single wheel (solved by casters)

Stakeholder Validation: "I really like the rolling Idea"



Request for Proposals: Management Solution for Sustainable Rotational Grazing

September 29, 2021



Figure 1: Harmony Farm, just outside of Brockville, ON. From [1].

1 Abstract

This Request for Proposals seeks to frame the opportunity for a solution to several current problems surrounding the implementation rotational grazing, a sustainable farming practice, at Harmony Farm, a small-scale farm in Brockville, Ontario.

Rotational grazing is the practice of constraining livestock (pigs in the case of Harmony Farm) to a sub-section of a larger field. This allows for the livestock to intensively graze one portion of the pasture before they are transferred to the next subdivision. Rotational grazing is contrasted by the conventional grazing technique, where the livestock is allowed to free range the entire pasture. Rotational grazing has multiple intended consequences: first, it reduces or eliminates the need for commercial feeds for the livestock; second, it uses the grazing livestock to till the field, thereby avoiding the use of tillers; and third, it uses the livestock's manure as fertilizers, improving soil quality and eliminating the need for artificial fertilizers. Greg Huntington, the owner and operator of Harmony Farm, anticipates many challenges as he plans on implementing rotational grazing for the first time this season. These challenges arise from the need to frequently relocate the interior fences, livestock, and their shelter.

An effective solution to this problem will benefit several parties: Greg, who can use the design to make his farm more sustainable, attractive to consumers, and save costs; consumers seeking to buy organic and cheap products would benefit from the successful implementation of Greg's farming technique; livestock, with whom this solution closely interacts; and other small-scale farmers who also plan on implementing rotational grazing and face similar problems.

In accordance with stakeholder values, this opportunity's core objectives are sustainability, safety, and feasibility of implementation. A solution must address at least one of the outlined issues and, where applicable, needs to be effective in containing, caring for, and moving the livestock between pasture subdivisions, easy and affordable to implement and use, minimize environmental impact, and be safe for the operator and the livestock.

Current solutions, which do not integrate the aforementioned components, fail to adequately meet the requirements laid out in this RFP. Greg currently uses ordinary speedwire electric fencing which tangles easily (therefore not easy to move) and is sensitive to grounding by plants or snow. He plans on building a plywood shelter on wooden skis, which could be dragged by a tractor. However, this is a time-consuming project with questionable feasibility, as it risks damaging the field and causing quick wear to the shelter. Furthermore, Greg does not currently have a solution to move the pigs. Other existing solutions to Greg's problems, such as chicken wire, pre-built shelters, and livestock trailers are too costly, difficult to use, or do not meet requirements for safety and implementation.

As a result of these factors, there is an opportunity to design either one or a set of solutions, depending on the scale of the design and the schedule of Praxis II, to make rotational grazing at Harmony Farm more sustainable, safe, and cost effective.

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