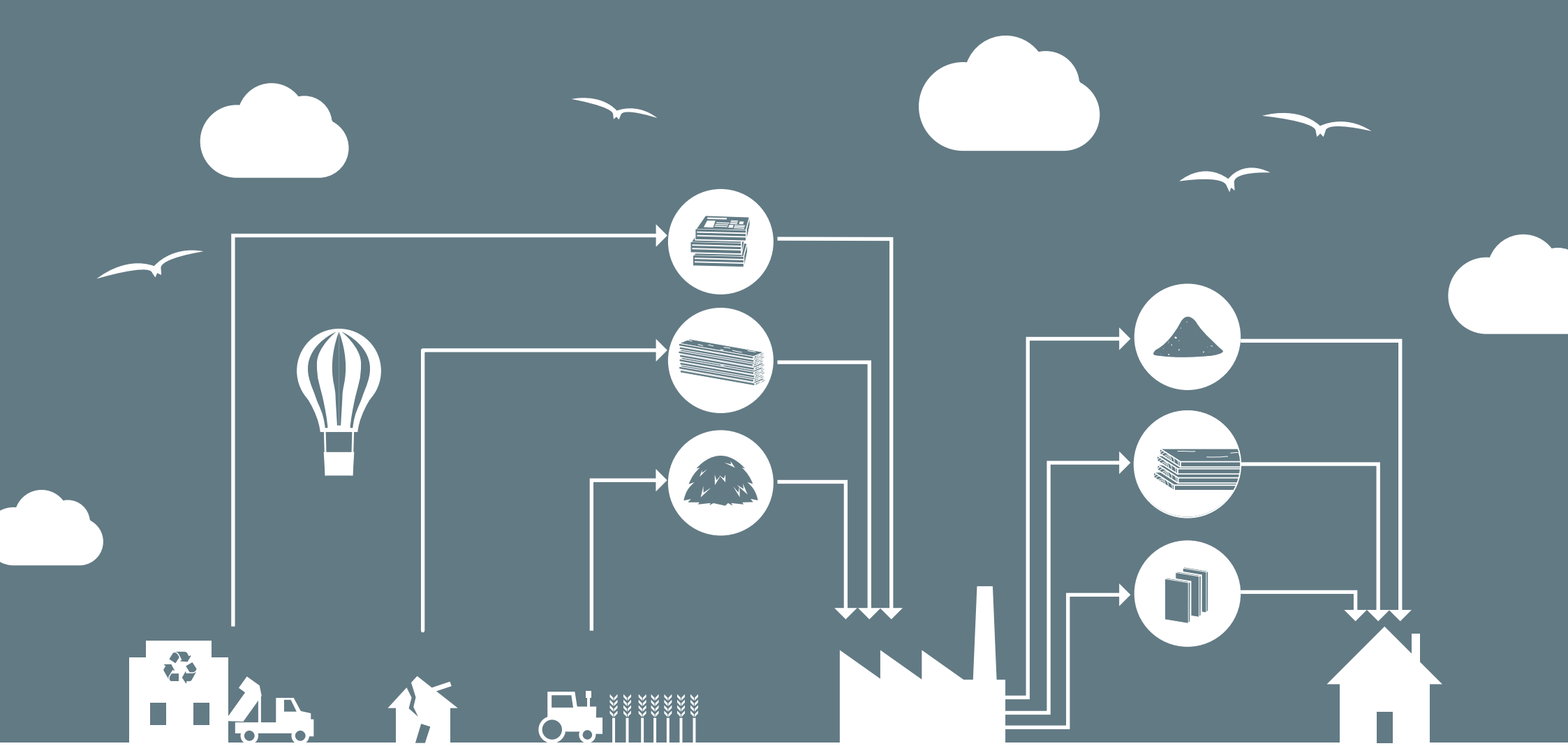

CAN HJO BUILD WITH LOCAL RESOURCES?

PLANNING AND DESIGN IN LOCAL CONTEXT

Master Progamme MPDSD - Chalmers University - Ida Röstlund

ABOUT THIS REPORT

This report is written for the studio 'Planning and Design for Sustainable Development in a Local Context', as part of the master program: Design for Sustainable Development at the department of Architecture,
Chalmers University of Technology
Autumn 2016

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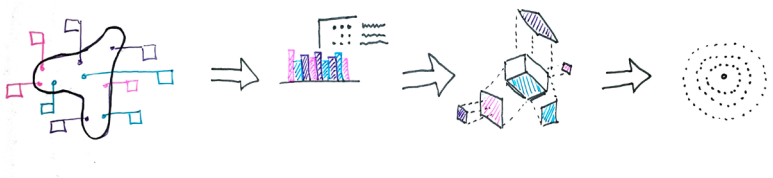
Thank you to everyone in Hjo who has been so kind and helpful in the development of this project!

SUMMERY

This report investigates the opportunities for the municipality of Hjo to design and build with the use of local resources and reflects on how this could effect the local society. The main outcome is a library of potential materials that could be created with main resources that are currently available within the municipality.

The report is divided into chapters following the process of linking local resources with a design proposal.

This theme has been explored in the response to the global trend of diminishing resources and an increasing ecological footprint. The goal of the process is to find ways of building with low embodied energy and increase resourcefulness. The hope is also that the ripple effect of the process can promote and support a more resilient community and economy.



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INTRODUCTION
Process & Method

BACKGROUND

In todays society we have developed many innovative solutions in which to promote a more sustainable lifestyle. Energy efficient houses are becoming a standard, preferably with the incorporation of cyclic service systems. The embodied energy that goes in to the construction of a building is however not widely considered. This could be due to a tradition within architecture where materials are secondary to form (Lloyds, 2007). This disconnection has been reinforced by the global post-industrial society when we no longer have to consider the inherent properties of natural materials, or are be restricted by local availability (Ingold, 2000).

AIM

The aim of this project is to raise awareness of the potential opportunity that lies in the use of local resources in the building industry.

In order to promote/support the use of local building materials the design process might have to be shifted so that the locally available materials set the parameters for the form. The project goes one scale beyond bespoke self-build projects but rather identify this as a market opportunity that is needed in order to support the process for construction industry.

This project is focused on the first step in this process - identifying potential materials that can be produced with resources available in Hjo municipality.

SUPPORTING GOALS

GOAL 1 - Encourage Resourcefulness

This goal is very linked to the main goal, it also emphasise that it should promote this in other areas in the community.

GOAL 2 - Lower Embodied Energy

This goal has been important to not forget the energy that might be needed to reconfigure a resource in to a material.

PROJECT PROCESS

1. Local Resources
The first step is the mapping of resources that can be found with in the municipality boarders. This has been done through interviews, site visits and online research.

2. Material Library
The second stage explores what material opportunities the local resources could be transformed into. This has been done by studying reference projects.

3. Design Proposal
A conceptual design proposal for a Material Center exemplifies where components can be used and the volumes required. The sense of spatial quality is also lightly tested.

4. Ripple Effect
The process of building with local resources has other effects on the local society on a social and economic level as well as environmental. This is explored through the idea of a ripple effect.

INTRODUCTION
Studio Strategies

These are the strategies and directions identified by the class that this projects relates to and builds upon.

OBJECTIVES

By the year 2025 usage and consumption of local resources is greater than the dependency of imported goods.

New Buildings and transformations in Hjo are primarily built with local resources and are carbon negative.

Hjo inhabitants have awareness of sustainable life styles and have the ecological footprint of one.

SWOT

STRENGTHS
- Local Resources

WEAKNESSES:
- Low-efficiency (Resilience)
- High ecological footprint

OPPORTUNITIES
- Growing interest in local resources
- Increased environmental awareness
- Increased sharing economies
- Slow City Trend

THREATS
- Unsustainable lifestyles
- Diminishing Global Resources

STRATEGIES

Optimise use of local resources

See waste as a resource

Use renewable materials

Reuse materials

Create sharing platform

Identify and strengthen circular system

Open source

INTRODUCTION
Context of Hjo

Hjo municiplaity is located on the west side ofVättern in the region ofVästra Götaland and sub-region Skaraborg. The main town in the this area is Hjo, which is one of the three wooden towns in Sweden. This cultural heritage and tradition of building with timber is still a strong part of the identity of the town.

The landscape of the municipality varies from deep spruce and pine forests to vast agricultural fields and waterways such as Vättern and Mullsjön.

Like for most settlement patterns there is a clear link to the character of the landscape. This was shaped by the ice 12 500 years ago and has created favorable conditions for agriculture and there is a strong farming tradition in the area. It has also created condition for other good quality natural resources such as clay, gravel and sand. (Hjo Municipality, 2015)

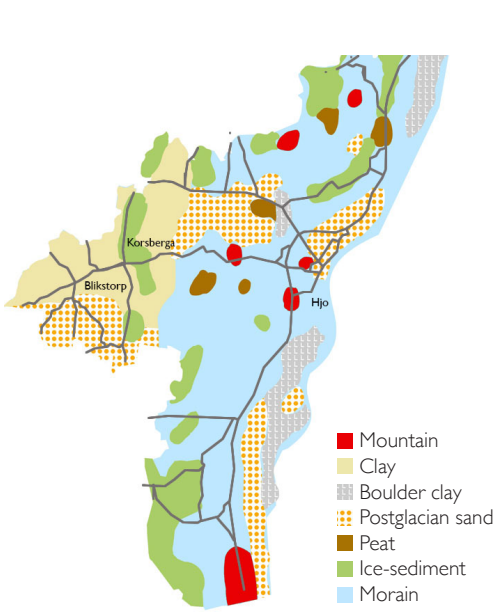
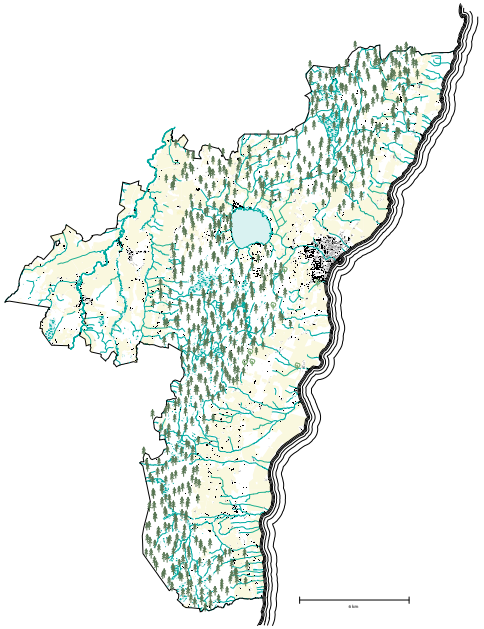
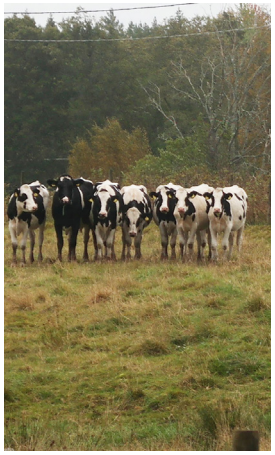


Fig 1. Geology map





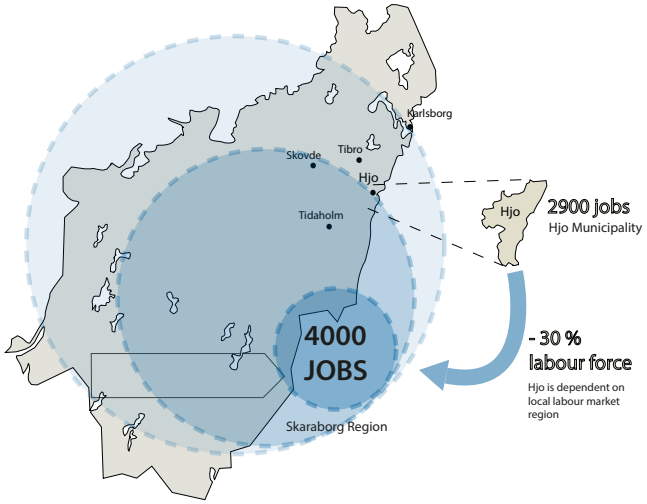
INTRODUCTION
Context of Hjo

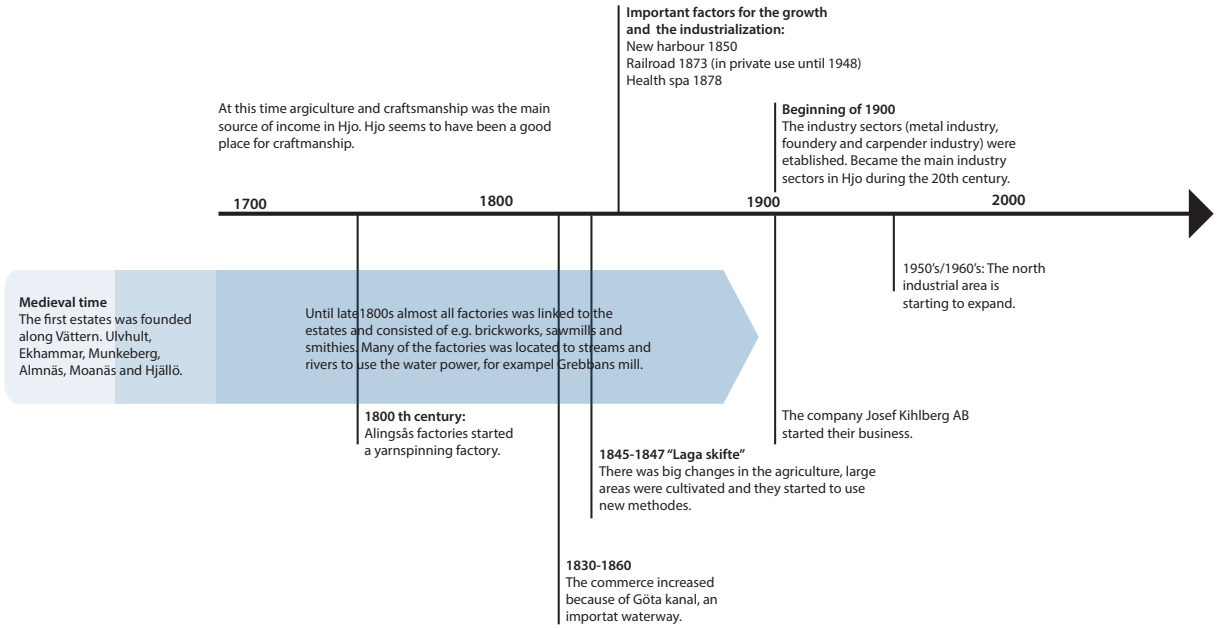
The natural resources have historically been just as important for the local professions as it was for the settlement patterns. There used to be brick factories, mills and farms scattered all over the municipality e.g. gravel from Korsberga was mined and used to maintain the railway.

Current Situation

Hjo town is today viewed as a commuter town and many travel to other municipalities such as Skövde to work. Entrepreneurship and small enterprises are however an essential part of the corporate sector with in Hjo today. These are within many different industries such as farming, forestry, tourism retail and metal industries.

These diagrams are taken from the studio work in the step 'The Local Context'.





THE CORPORATE SECTOR IN HJO TODAY

Hjo's corporate sector has always been charactarized by small-scale industries. This is typical for the situation today as well, were the entrepreneurship and small enterprises are central issues for Hjo. The corporate sector in Hjo is diverse and consists mainly of metal industry, larger agricultural farms, tourism and retail. Other sectors such as commercial fishing and forestry is also of importance.

Agriculture
Today the farms have become fewer and larger and the agriculture in Hjo is of national interest. Total agricultural land areal: 10 000 ha (44% is farm land). Mainly producing grain, forage, oilseeds and potatoes. Almost a third of the agricultural companies have other sources of income besides agriculture.

Metal and service industries
In the municipality there are 100 industry and manufacturing companies (2010). The manufacturing companies together with service companies is mainly located in the industrial area in the northern part of the city.

Retail
The retail in the municipality is mainly located in the city center and in the harbor with smaller, local shops. In Hjo there are around 60 shops. There are some also retail companies in the industry area. Many of them are connected in the association "Hjo Handel".

Tourism
Some of the central attractions in Hjo are connected to the profile of "Trästaden Hjo" (events and attractions in the city center, the city park and the harbor) Guldkroksbygden and the closeness to Vättern. But also natural tourism attractions (the trout safari) and culture tourism events (Konstrundan and Slöjdmässan).

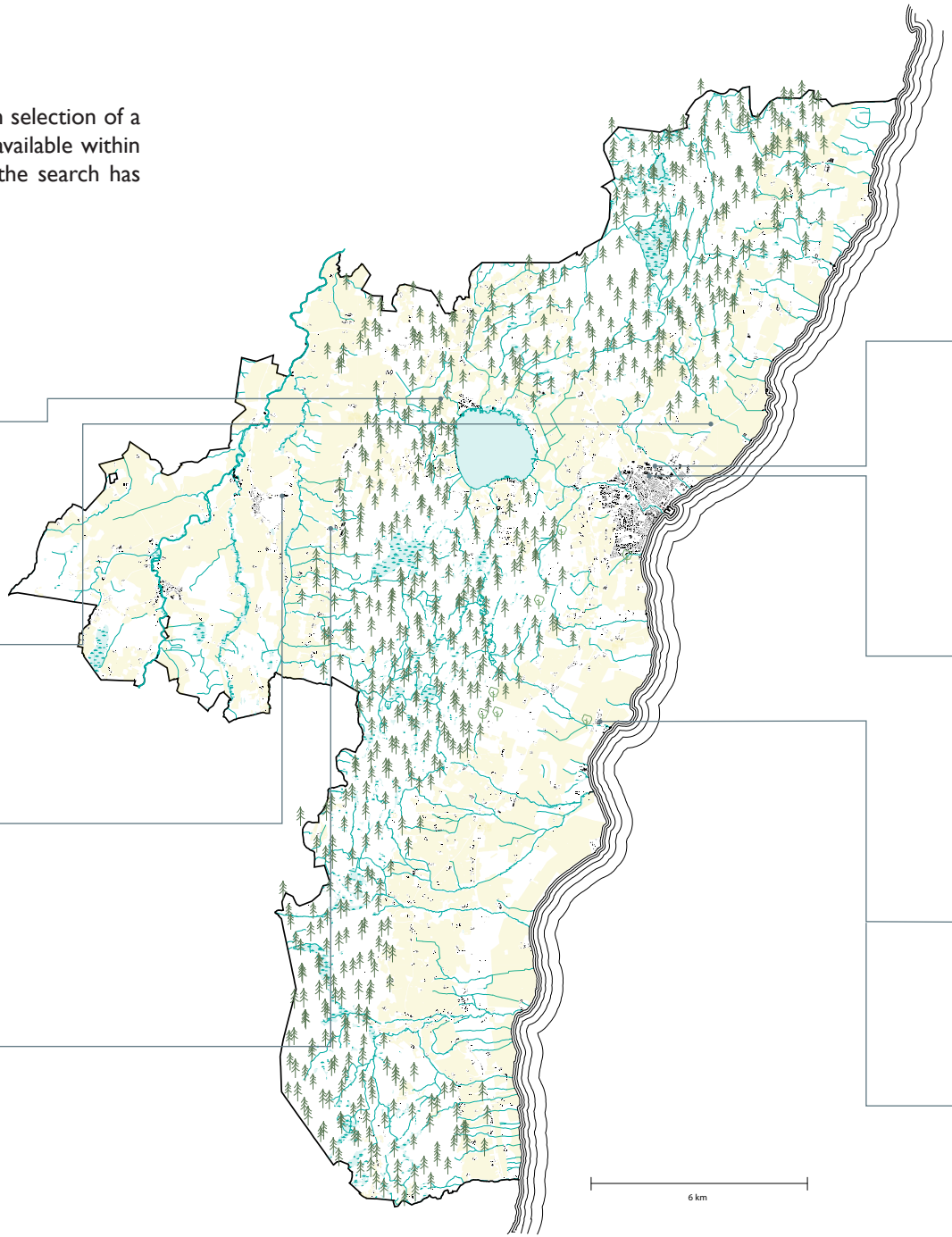
Commercial fishing
The number of commercial fishermen in Vättern has decreased from 100 (in 1940's) to 22 (in 2005), 4 of them were living in Hjo. The most important fish species for commercial fishing in Vättern is e.g. char, whitefish, trout, salmon and perch. A fish shop and a smoke house is located in the harbour, which generate employment.

Forestry
The forest areas in Hjo consists a variation of broad-leave, pine and spruce forests. It make 12 % of the total land area. There are 400 forests estates with an average area of 40 ha and 78 % is privately-owned. The income from the forestry is often not the only income source for forest owners.

LOCAL RESOURCES

RESOURCES
Local Resource Map

This mapping is based on a semi-random selection of a small sample of the resources that are available within the municipality. As shown in the map, the search has not been restricted to raw materials.



BENDERS
Really good quality gravel that is 'exported' out of the municipality

GRAVEL

FARM BUILDING
Could potentially be disassembled and material reused.

WOODEN BOARD
ROOF TILES
BEAMS

JAN LUNDBLAD
Company that deals with demolitions amongst other things.

WOOD CHIPS
RUBBLE

MUNKEBO FARM
Small scale farm with chickens, strawberries, fields and small forestry.

TIMBER
WOODEN CHIPS
STRAW
SAW DUST

RECYCLING CENTRAL
Large variety of waste products from individuals and some small companies.

TIMBER
CERAMIC
METAL
PLASTIC
PAPER
GLASS
TIRES
NEWSPAPER
ETC.

JACQUET
Abrasive sand imported from India used for cutting metals. (High value metal is sold to be recycled.)

GRANET SAND
SCRAP METAL

ALMENÄS FORESTRY
Mange forest, materials are sold to be refined (paper mas and construction material)

TIMBER
(Mainly Pine and Spruce)

ALMENÄS BRICK FACTORY
Is closed but there should still be clay available in the ground.

CLAY

RESOURCES
Volumes - Examples

JAN LUNDBLAD AB

TIMBER to chips	1800 m3/year
RUBBLE	200 m3/year

MUNKEBO FARM

STRAW -	300 ton/year
WOOD CHIPS	80 ton/year
TIMBER (Low grade)	200 ton /year

ALMENÄS FORESTRY

FOR TIMBER	5200 ton*/year
FOR PAPER	5200 ton*/year
SURPLUS**	2080 ton/year

*In M^3Fub, tree trunk without tops and roots
** Tops and Roots

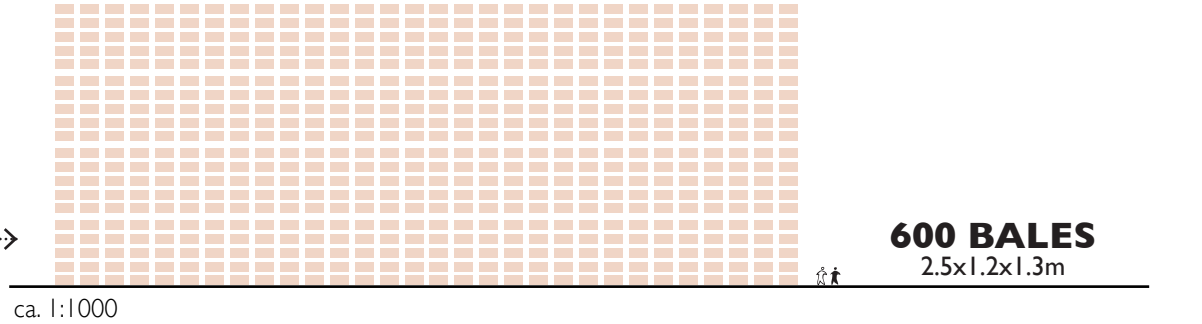
RECYCLING CENTER HJO

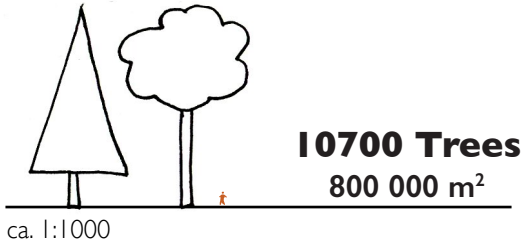
NEWSPAPER	194.2 ton/year
PAPER	57.5 ton/year
GLASS	144.4 ton/year
PLASTIC	19.4 ton/year
METAL	12.8 ton/year
TIRES	10 ton/year

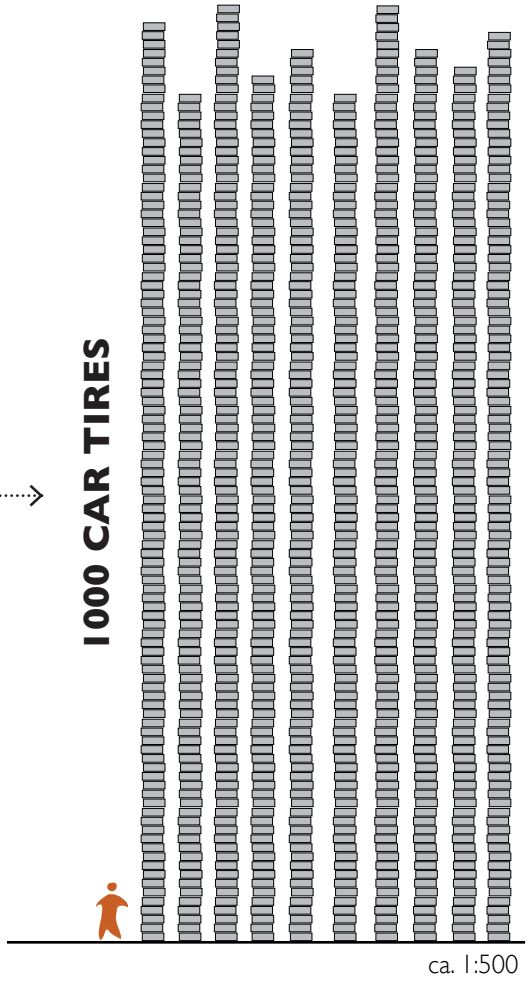
(www.ftiab.se, 2016)

JAQUECT

GRANET SAND	300 ton/year

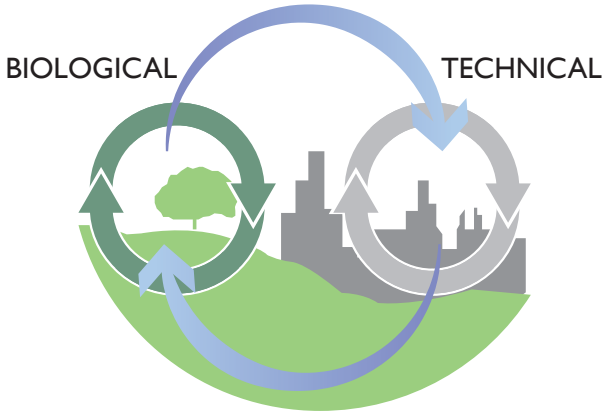






RESOURCES
Categories

Cradle to Crade and Potential Building Materials
The book Cradle to Cradle divides resources into technical and biological systems. In order to promote resourcefulness in the built environment the project makes a division between construction material and other bio-based/technological resources since the level of 'straightforward' is higher for these materials. (McDonough & Braungart, 2003) While materials from the other two groups need to be refined or reconfigured.



CIRCULAR SOCIETY

Biological Nutrients
Resources and products made from biological resources and that can be returned to the ecological cycle.

Technical Nutrients
Resources that has been modified (without gaining toxic properties) and that no longer can be decomposed by natural systems.

BIO-BASED MATERIALS
These local natural resources can through high- or low-tech modification become building materials.
Examples: Straw, clay and wood.

Consider: Strive to keep biodegradable properties so that material can be returned to the ecological system.


Fig. 2

CONSTRUCTION COMPONENTS
Construction material that through different levels modification can be reused as a new building components.
Examples: Windows, boards and plumbing.

Consider: Some of these materials are biodegradable while others will need a larger modification to be reused as a material (e.g. rubble)


Fig. 3

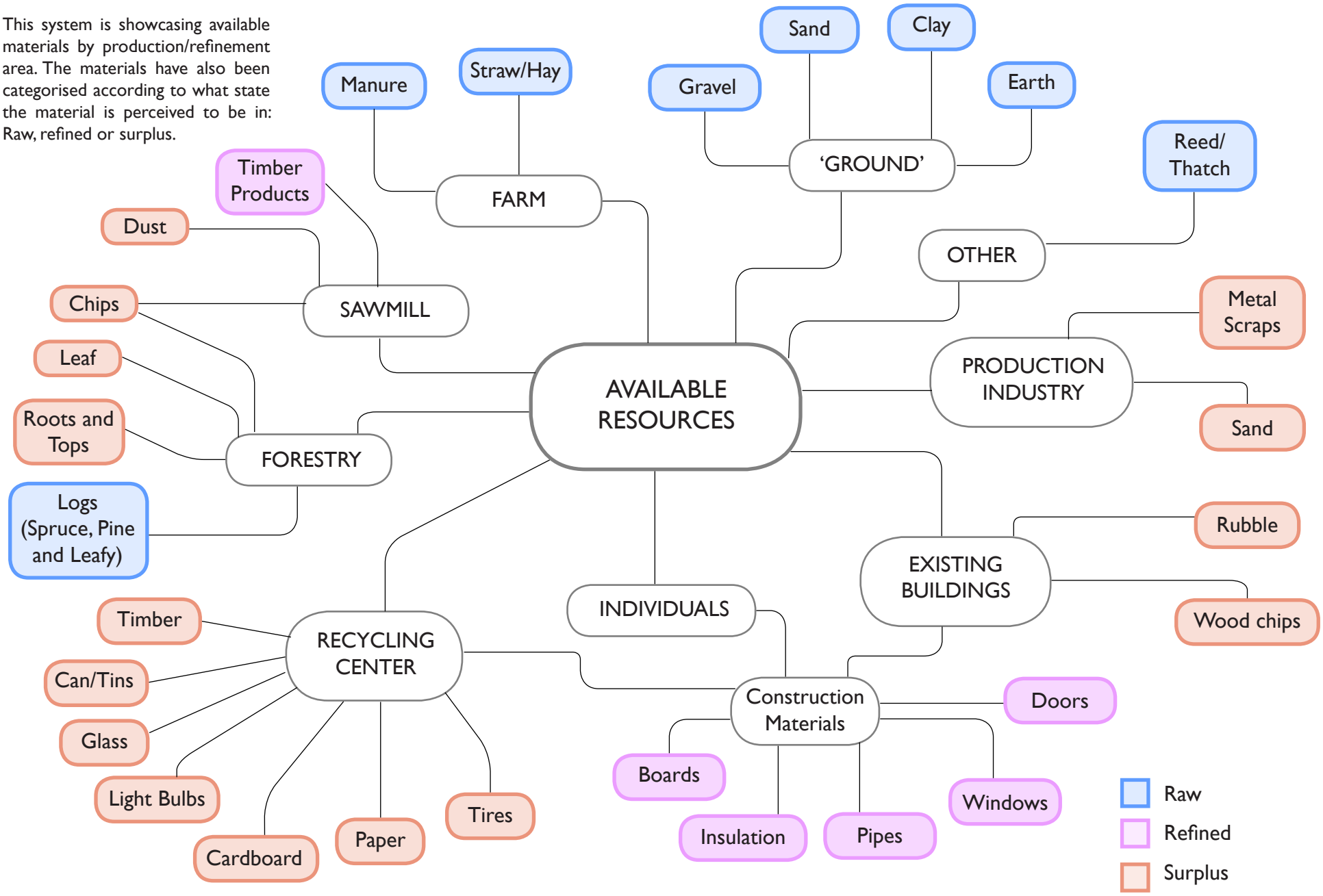
CONSUMPTION & PRODUCTION SURPLUS
These materials are available since they have fulfilled their first life and can now be reused as they are or through low- or high-tech modifications as building materials.
Examples: Cans, windscreens and paper.

Consider: Have to be careful of potential off-gas. There area usually system in place to recycle/down-cycle these materials.

RESOURCES

Available - Sector & State

This system is showcasing available materials by production/refinement area. The materials have also been categorised according to what state the material is perceived to be in: Raw, refined or surplus.



RESOURCES
Circular Use

A large part of a resourceful society is the circular use of resources. On this page two important notions regarding circular societies are explored through the circular ladder and circular economy diagrams below.

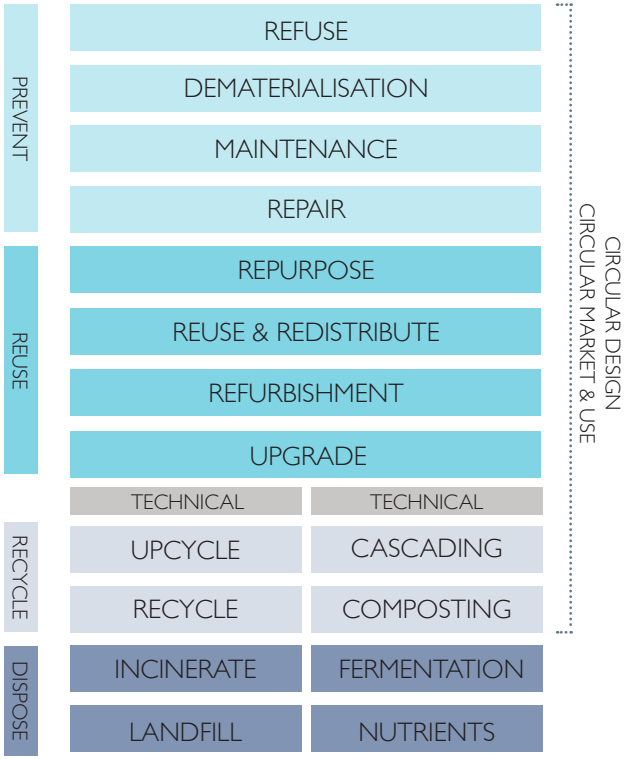


Fig. 4 This Circular Ladder shows that an important change is to minimise the use from the start by maintaining existing objects. The next step is to encourage reuse. (Based on De Groene Zaak, 2016)

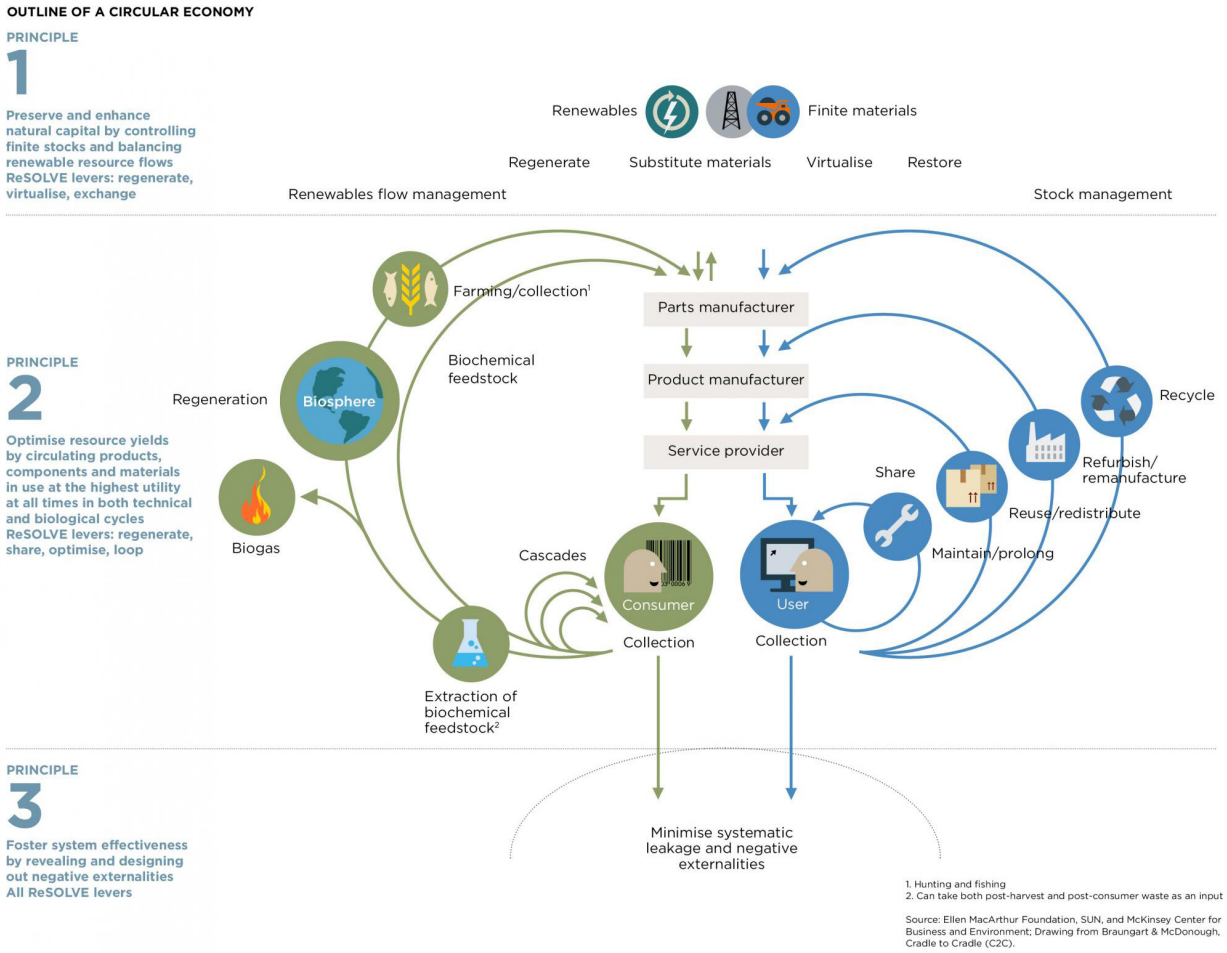


Fig. 5 This diagram of circular economy explains that the natural resources should be preserved and kept in balance. It also shows different loops for circling resources. Resources should be kept in the cyclic system for as long as possible. (ellenmacarthurfoundation.org, 2016)

RESOURCES
Hierarchy

As identified in the last spread, the resources can be categorised by the Cradle to Cradle groups technical or biobased and they can also be divided according to what state that they are in.

Looking at circular ladder and diagram for a circular economy there is a clear order in which resources should be used/disposed of in a circular society.

Step 1-4 deals with resources that already have been extracted from nature and modified. These have been prioritised to reuse/modified before extracting further resources. This encourages a circular society that does not generate waste and put less strain on nature.

In step 5-7 resources are extracted from nature in different ways. This should firstly be renewable materials and preferably use surplus from other sectors (e.g. food production). The last resource should be to use none or slow renewable resources.

This hierarchy is rather a guideline than a set of rules. There are many exceptions that need to be considers. For example clay that has not been burnt can be returned to the biosphere whereas a modified material from group 3 might need a very high energy input in the modification process which would make it less favorable. The Life Cycle Analysis could be used to get a deeper understanding of the hierarchy between specific materials.

1 REUSE STRUCTURES

2 REUSE CONSTRUCTION COMPONENTS
E.g. Window, door, timber

3 MODIFY CONSTRUCTION COMPONENTS
E.g. Rubble

4 REUSE/MODIFY CONSUMPTION & PRODUCTION SURPLUS
E.g. Newspaper, plastic, metal,

5 REFINE RENEWABLE BIOBASED SURPLUS
E.g. Straw, Wood Fibers

6 REFINE RENEWABLE RESOURCES
E.g. Thatch, Timber

7 REFINE NONE/SLOW RENEWABLE
E.g. Stone, Sand

RESOURCES
Overview - Examples

These are some examples of available resources according to the hierarchy groups.

1. Reusable Structures

Farm building fig. 6

Villa fig. 7

Mill

2. Reusable Building Components

Timber

Bricks fig. 8

Insulation

Windows

3. Modifiable Building Components

Fibers - Damaged Timber

Ceramics & Rubble

Window Glass

4. Reuse/Modify Consumption & Production Surplus

Newspaper

Glass fig. 9

Metal

Tires

5. Refine Raw Renewable Biobased Surplus

Straw fig. 10

Forest Clearance

Barking

6. Refine Raw Renewable Biobased

Thatch fig. 11

High & Low Grade Timber fig. 12

7. Refine Raw Non/Slow Renewable Biobased

Clay fig. 13

Gravel fig. 14

Sand fig. 15

RESOURCES
Reference Projects - Finding Resources

VÅGEN
Disassembly Project, Hjo

This was a disassembly project that took place in Hjo in the mid 90's. An old wheat warehouse was due to be demolished in the harbor, however it was decided that the building would be deconstructed instead. This created job opportunities in a time of a stagnated construction industry.

The materials collected were of good quality and much of it was sent to Forsvik Bruk outside of Karlsborg for potential reuse.

Photo from Hjo Municipality

Photo from Hjo Municipality

ALELYCKAN
Reuse Center, Göteborg

This recycling park is encouraging a circular use of materials and products

Återbruket
This is a shop for reclaimed construction components and materials such as doors, windows, terraces, timber as well as service systems such as toilets.

Returhuset
This part of the Recycling Center is also focused on enabling reuse, there is a workshop here where furniture is upcycled, and materials are reclaimed. They also have an inviting public side with a shop selling upcycled products, cafe with locally produced organic food and a small 'junk yard' garden. (Göteborg.se, 2016)

Fig. 16 Återbruket Shop

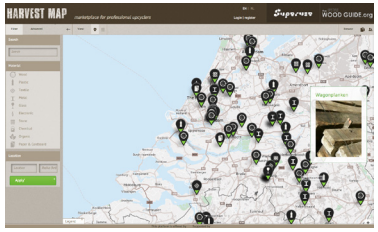
Fig. 17 Eko-cafe at Returhuset

HARVEST MAP & SUPERUSE
Online Platforms, Netherlands

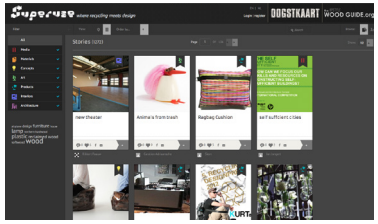
Both these platforms are open sourced and were created by the practice Superuse Studio. Their office has done a lot of both within design work and organisation regarding reuse of materials.

Harvets Map
This is an online platform where people and companies can post if there are reusable materials available. It is called "a marketplace for upcyclers".

Superuse
This in an online community where designers, architects and others can showcase their reuse and upcycling projects.
(Superusestudios.com, 2016)



Website - harvestmap.org



Website - superuse.org

RESOURCES
Reflection

- The resources presented are only a fraction of what is available in the municipality based on findings from the early stages in the studio and a quick overview of the area.
- The volumes that have been presented are rough estimations by the producers that have been interviewed during this project.
- The question of what is local needs to be addressed further, for this project it was set by the municipality border but this is quite an abstract boundary when looking at resource flow. Maybe the scale of what is local changes depending on the resource?
- This project has gone beyond raw material as a resource and puts a strong emphasis on the use of resources that have already been extracted and refined. This means that they have been brought in externally within another industry. If these industries adopt the same category 4 in the hierarchy will become considerably smaller.
- The hierarchy is more of a guidelines than a rule, the relationship between them is a lot more complex and it would be beneficial to use Life Cycle Analysis to evaluate different resources to get a more realistic view of a more true hierarchy.
- The availability of the materials has to be considered. In this project it has looked at the mass potentially available in a year but some like straw is more seasonal. It is also very important not to overuse especially the biobased resources e.g. Thatch.
- Most of the resources presented are already part of a system. These should perhaps be challenged in order to “release” them for other use.

MATERIAL LIBRARY

STONECYCLE TILES

This material is up-cycling rubble such as glass, concrete, bricks and ceramics from demolition sites, which would normally be used as road foundation filling. The resources are sorted into different groups, the pulverized and mixed in different compositions. These mixes are then baked then results in new stone-like products.

Other materials required: No artificial binders or no-waste additives

Designer/Manufacturer: Tom van Soest, Netherlands
Reference: Hebel, D., & Ebrary. (2014). *Building from waste:* - p.98

Load-bearing	Insulating	High-tech	Low-tech
Water resistant	Finish	Reusable	Energy Input:
Fire resistant		Recyclable	high/low

180 m^3 RUBBLE

could generate

62500 STONECYCLE TILES

which would cover

25.5 Guldkroksvallen Football Fields

(6784m^2)

NEWSPAPER WOOD

The newspaper is soaked in glue and wrapped in to a roll much similar to a tree trunk. When cut into pieces the material resembles wood cut from a log. The material can be cut, drilled, nailed and sanded. If the material is sealed it can also become waterproof. If glue is solvent and plasticize free the material can be returned to the normal flow of newspaper recycling.

Other materials required: Glue and potentially sealer.

Manufacturer: Mieke Meijer with Vij5, Eindhoven - Netherlands
Reference: Hebel, D., & Ebrary. (2014). *Building from waste*: - p.46

Load-bearing	Insulating	High-tech	**Low-tech**
Water resistant	**Finish**	Reusable	Energy Input:
Fire resistant		**Recyclable**	high/**low**

194.2 TON NEWSPAPER could make

325 940 PIECES NEWSPAPER WOOD

With these one could cover

THE SQUARE IN HJO 4.5 TIMES

(Square approx. 3900m2)

BIOGLASS

These panels are made from 100% recycled glass and do not requirer any additives. The colour varies depending on the glass used in the production and they can be used as counter tops and wall panels both internal and externally. The panels can be cut on site using water-cooled diamond tools.

Other materials required: None

Manufacturer: Coverings Etc,US
Reference: Hebel, D., & Ebrary. (2014). *Building from waste*: - p.184

Load-bearing	Insulating	**High-tech**	Low-tech
Water resistant	**Finish**	**Reusable**	Energy Input:
Fire resistant		**Recyclable**	high/**low**

144.4 TON GLASS could make

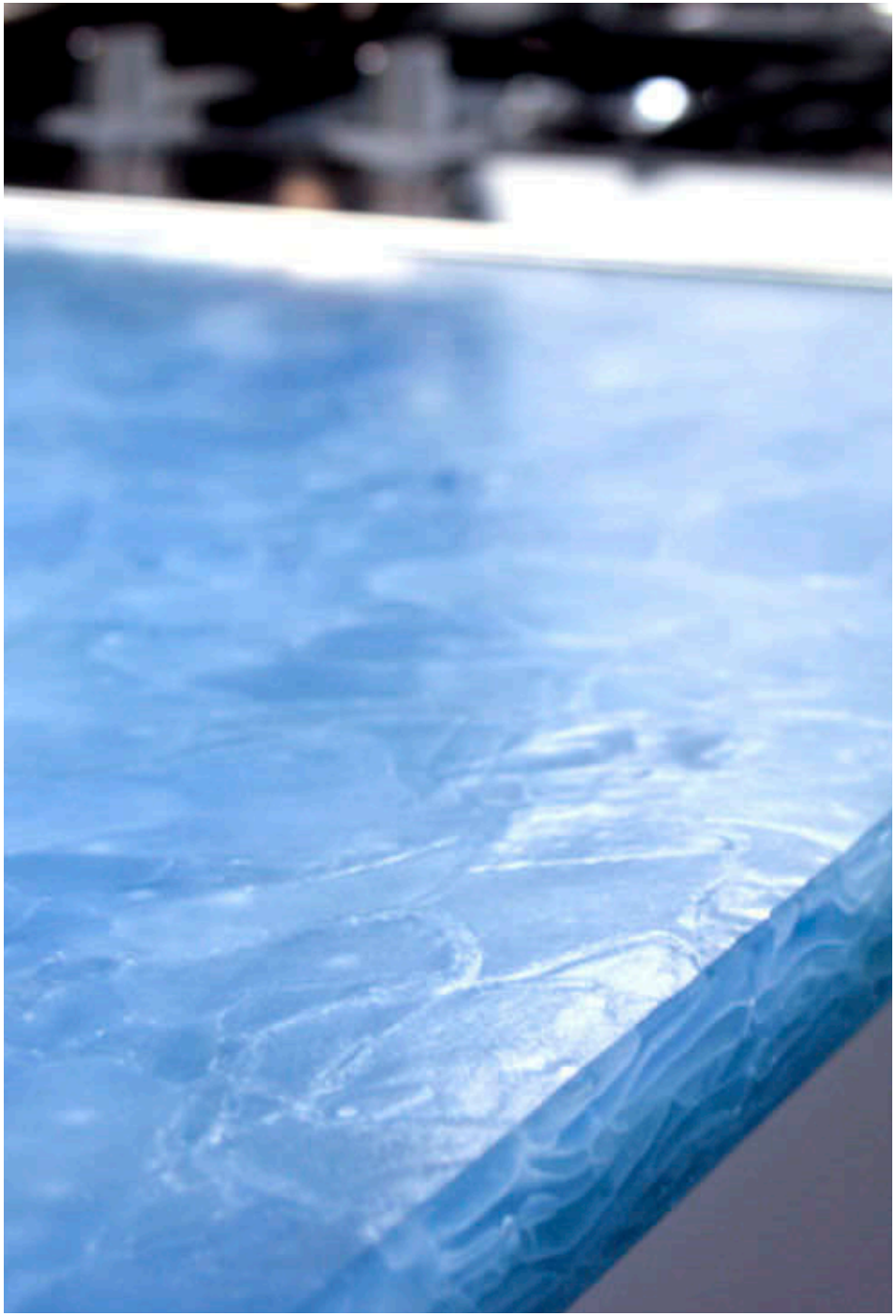
857 BIOGLASS PANELS

With these one could build a 2.8 m high wall between

HJO BUS STATION AND GULDKROKS

SKOLAN

(1.1 km)



TIRES VENEER

When recycling tires, rubber is firstly removed from it by grinding, the dust created in this process can then be modified. This dust is mixed with a binder and put in to molds. By applying heat and pressure a block is formed, this block can then be sliced into thin tiles or sheets. Coloured rubber can be added to the mixture before it is exposed to heat in order to create a more versatile finish.

Other materials required: Polyurethane binder

Manufacturer: Yemm & Hart Ldt, US
Reference: Hebel, D., & Ebrary. (2014). *Building from waste*: - p.122

Load-bearing	Insulating	High-tech	Low-tech
Water resistant	Finish	Reusable	Energy Input:
Fire resistant		Recyclable	high/low

3.26 TON RUBBER could make
12917 CAR VENEER TILES
these could be used as floor in

11 DOWNSTAIRS EXHIBITION ROOMS
IN KULTURKVARTERET
(70m2)

STRAWTEC PANEL

These panels are used in Ethiopia to build large scale housing projects. The panels are held together by the starch within the straw, this natural glue is activated by exposing the straw to heat. This means that no additional additives or glues have to added to the process, making the product 100% biodegradable. The process also only requires 10% energy compared to normal drywall systems. The panels can be load-bearing but are mainly used as non-load-bearing elements. There is also limit in the span when used as floor.

Other materials required: Cardboard

Manufacturer: Strawtec Building Solutions, Germany
Reference: Hebel, D., & Ebrary. (2014). *Building from waste*: - p.57

Load-bearing	Insulating	High-tech	Low-tech
Water resistant	Finish	Reusable	Energy Input:
Fire resistant		Recyclable	high/low

300 TON STRAW could make

3545 STRAWTEC PANELS

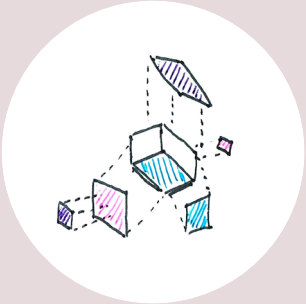
With this one could build the outer load-bearing walls for

40 140m2 SINGLE FLOOR VILLAS.

MATERIAL LIBRARY
Reflection

- The volumes of materials that can be produced is based on rough estimation and calculations on the density of the materials and is more to showcase potential than exact numbers.
- The Life Cycle Analysis will be an important tool to compare the different modified materials in order to be able to pick the material with the best qualities and embodied energy.
- In some cases ‘external’ resources are needed to produce the materials.
- All of the materials are being produced by existing companies. This means that they have been tested. This means that there should be less resistance for larger construction companies to use them.
- New industries and skills will be needed to produce the modified materials, it would also be beneficial with to have an industry that refines building components.
- There will also be a need for a developed skill set for the contractors working with these innovative materials since they might have other requirements than mainstream materials used today.
- The transformation of local resources and use of these materials could be a strong tool in supporting a localised economy.

DESIGN PROPOSAL



DESIGN PROPOSAL
Intro

This chapter tests the use of the proposed materials in a design proposal. This is to get a clearer idea of opportunities and possible obstacles. It is also to make an estimation of how much resources are needed in the construction of a building and also if there are materials to fulfill the different component requirements.

To the right are three case studies of project that have been built with local resources and material.

MANSON BEND

It is a simple open building out of rammed earth, a steel structure, timber panels and a large rain screen of layered glass made from car windscreen.

Designer: Rural Studio, US
Reference: Andrea Oppenheimer Dean, Timothy Hursley, *Rural Studio*, p. 50

VILLA WELPELOO

The facade of this building is made from cable reel slats and the structure was created by machine steel profiles.

Designer: Superuse Studios, Neatherlands
Reference: superuse-studios.com

TÅKERN NATURUM

This nature visitor center at the lake Tåkern and the facade were made from thatch from the river edge.

Designer: Wingårdhs Arkitekter
Reference: http://www.wingardhs.se/projects/s/takern/

SEAWEED HOUSE

In this project an old vernacular technique was used in the production of the facade. Where local seaweed is rolled into 'pillows' and used to clad the building.

Designer: Vandkunsten Architects
Reference: www.dezeen.com

DESIGN PROPOSAL
Location

This chapter test the use of the proposed materials in a design proposal. This is to get a clearer idea of opportunities and possible obstacles. It is also to make an estimation of how much resources that are needed in the construction of a building, also if there are materials to fulfill the different component requirements.

PROGRAM
The will be connected to circular use of resources and promote this in the municipality.

SITE
When looking for a site there were a few criteria that the location should fulfill:
- Public Access
- Distribution Connection
- Bridge the urban and rural

In discussion with the city architect Aila Hirvonen the site of Knäpplans farm buildings was considered. This farm might be demolished in a few years time to make way for a new housing development. There are also plans for a new recycling center within this development.

This site fulfilled all the criteria and is also located close to the Knäpplan school which could be an opportunity for an educational awareness-building collaboration.

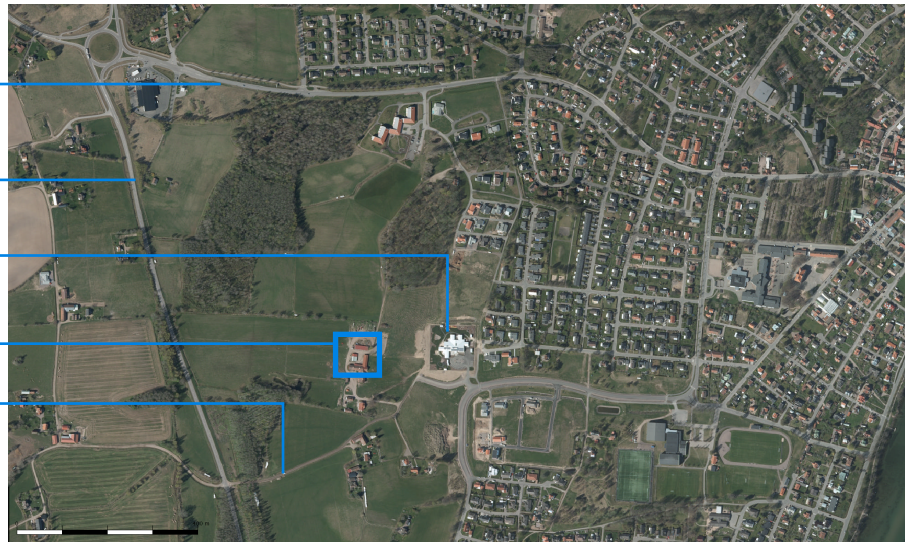


Fig 18 Ortographic Photo of the south-west part of Hjo Town


Fig 19 Ortographic Photo
of Knäpplan Farm


Fig 20 View of the farm from the east

DESIGN PROPOSAL
Program Usual Models

Deciding the main focus of the program is important for determining not only what spaces are needed but how the building will relate to the context of Hjo. On this page four traditional options are explored.

Production/Supply
The distribution of building materials through refinement/up-cycling/reconfiguration.

Skills &Training
Teaching people the skills to produce the new materials through hands on experience.

Awareness
Make general public on different scales aware of local resources and systems.

Academic Education
Teaching on a academic level regarding local systems and resources.

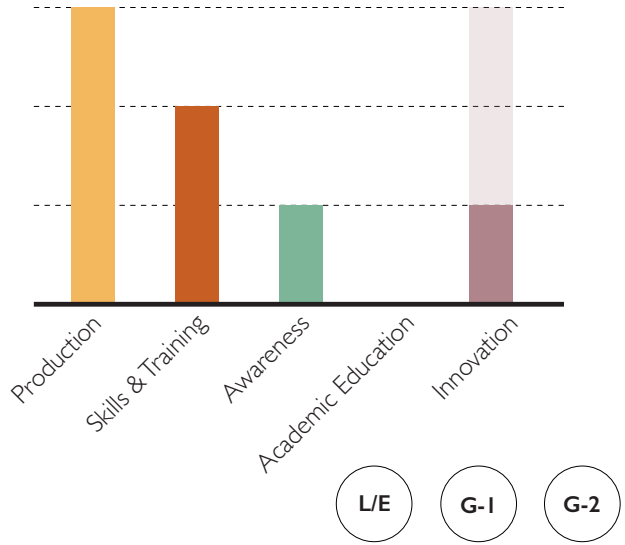
Innovation
Creation of new form of local materials.

L/E
Local/External
Indicates where if the main focus is on local (L) or regional/national scale (E).

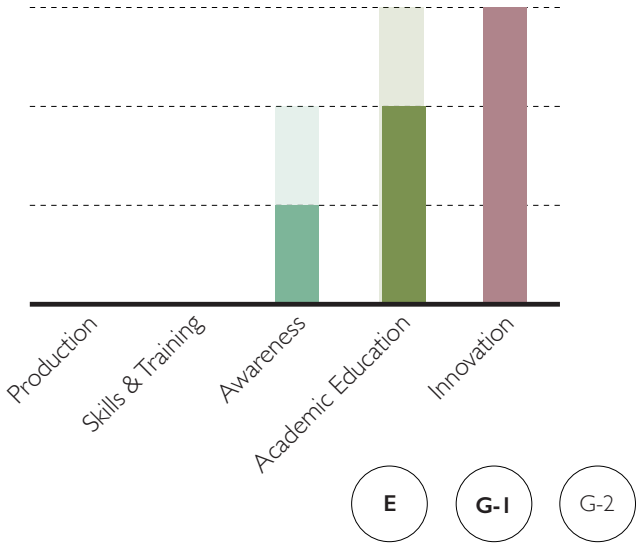
G-1
Goal 1 - Lower Embodied Energy
Is the project promoting goal 1.

G-2
Goal 2 - Encourage Resourcefulness
Is the project promoting goal 2.

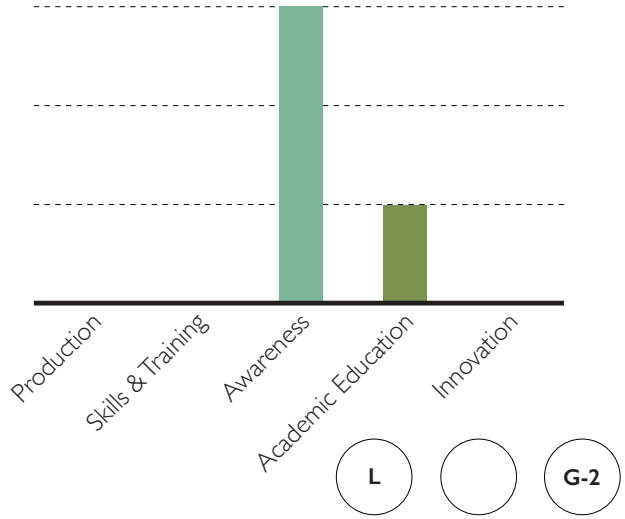
Production - Company
Producing new materials as a main focus while teaching the 'how to' skills.
Will generate good volume of materials.



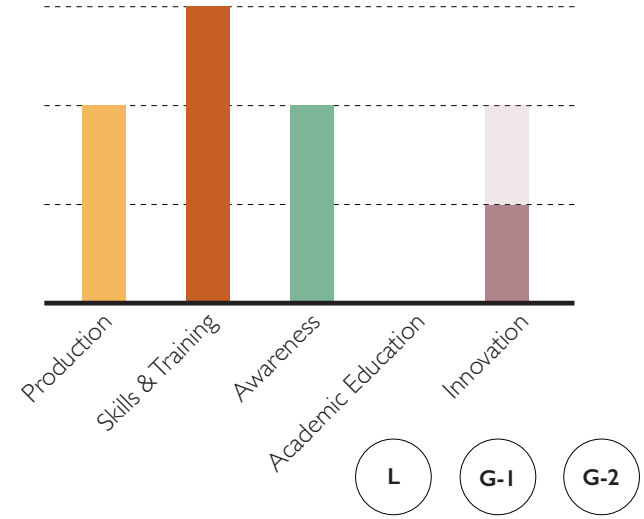
Resource Lab - University
Research focused on developing new materials from local resources.
Will generate only new materials.



'Naturum' - Municipality
Main focus is to showcase local resources and bring awareness through light participation.
Will not generate materials.



'Rural Studio' - KY/Folkhögskola
Practical education teaching people to work with local resources.
Will generate some materials.

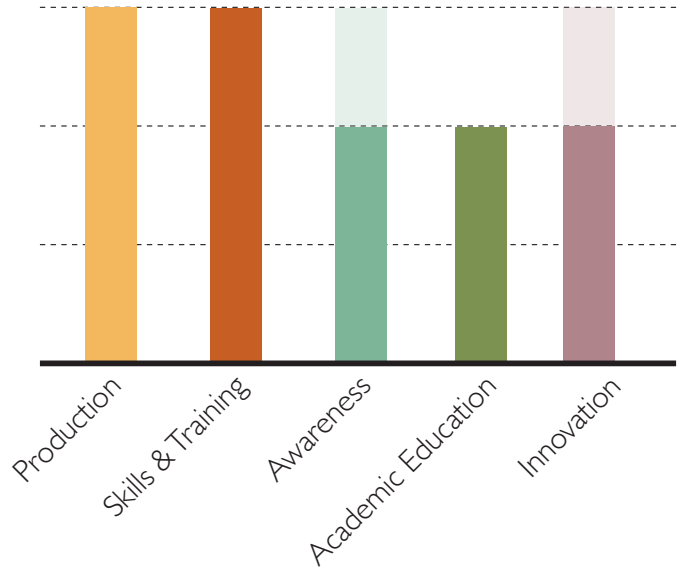


DESIGN PROPOSAL
Material Center

Rather than following one of the usual models this program will merge them into the proposal of a Material Center. A place that can enable the transformation of local resources into materials through production, training and awareness building.

This program can fulfill the two goals as well as having a focus on the local scale of Hjo by local resources and local people. Though the main focus is local scale, there are still opportunities to have connections to external collaboration partners e.g. universities.

The area with a the Material and Recycle Centers can become a node in the new development around Knäpplan.



L/E **G-1** **G-2**

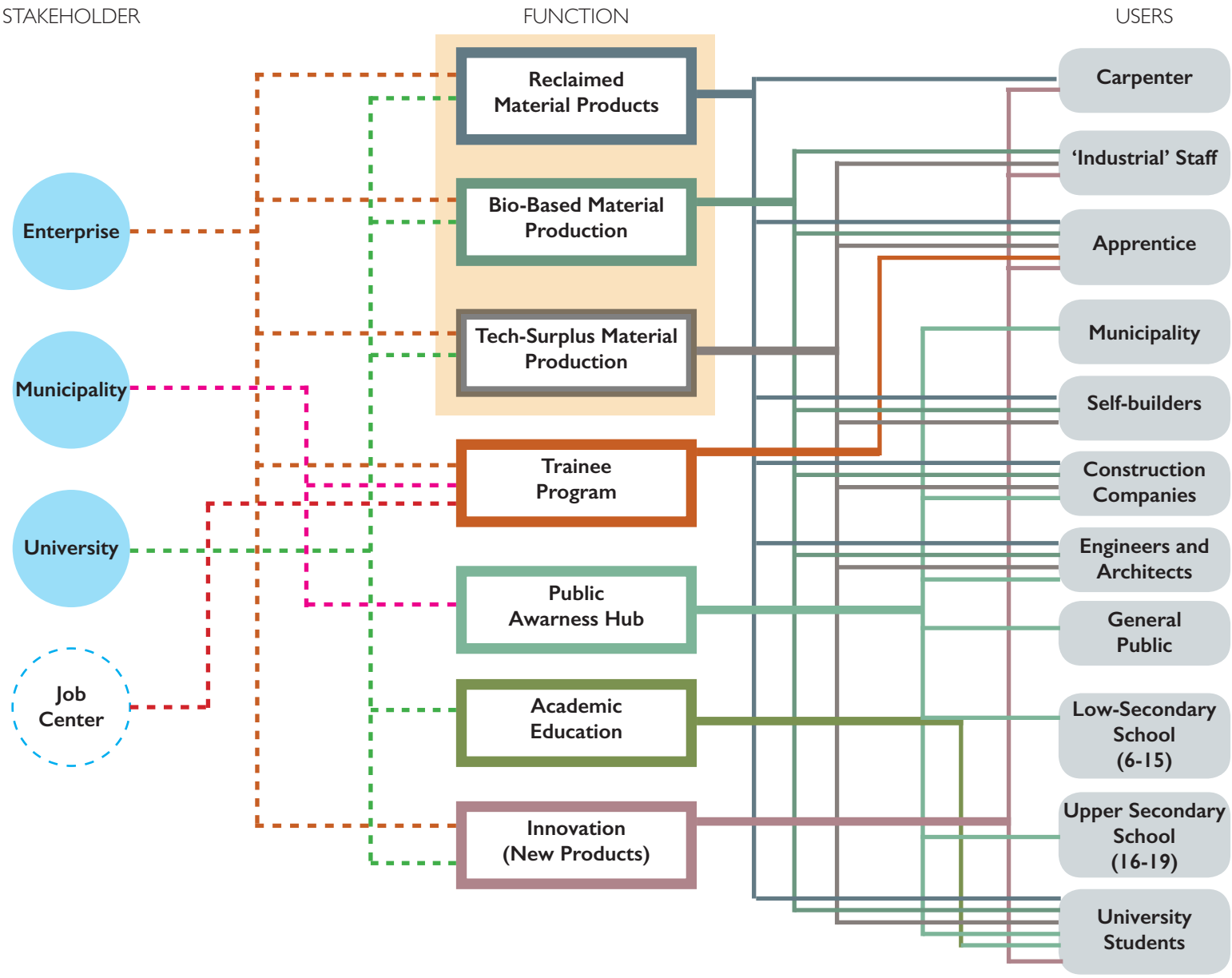
PRODUCTION

	Staff	Students	Visitors
Reclaimed Construction Material Restore, prepare and sort reusable materials from construction. Advice and assistance in disassembly and reuse.	4		
Production with local Bio-based resources Production and distribution of building components made from e.g. straw or thatch.	4		
Production with local technical surplus Production and distribution of building components made from e.g. straw or thatch.	3		
Skills and training Teaching people the skills to produce the new materials through hands on experience.		6-10	
Awareness Make general public on different scales aware of local resources and systems.	2		<30
Academic Education Projects together with university students can take place, focused on local resources. (Collaboration with the 'Skill' students.)	1*	6-10	
Innovation Creation of new of construction materials based on locally available resources.			

All users are given space and encouragement to experiment.

*Academic Staff from the university

DESIGN PROPOSAL
Stakeholder and Function



DESIGN PROPOSAL
Implementation

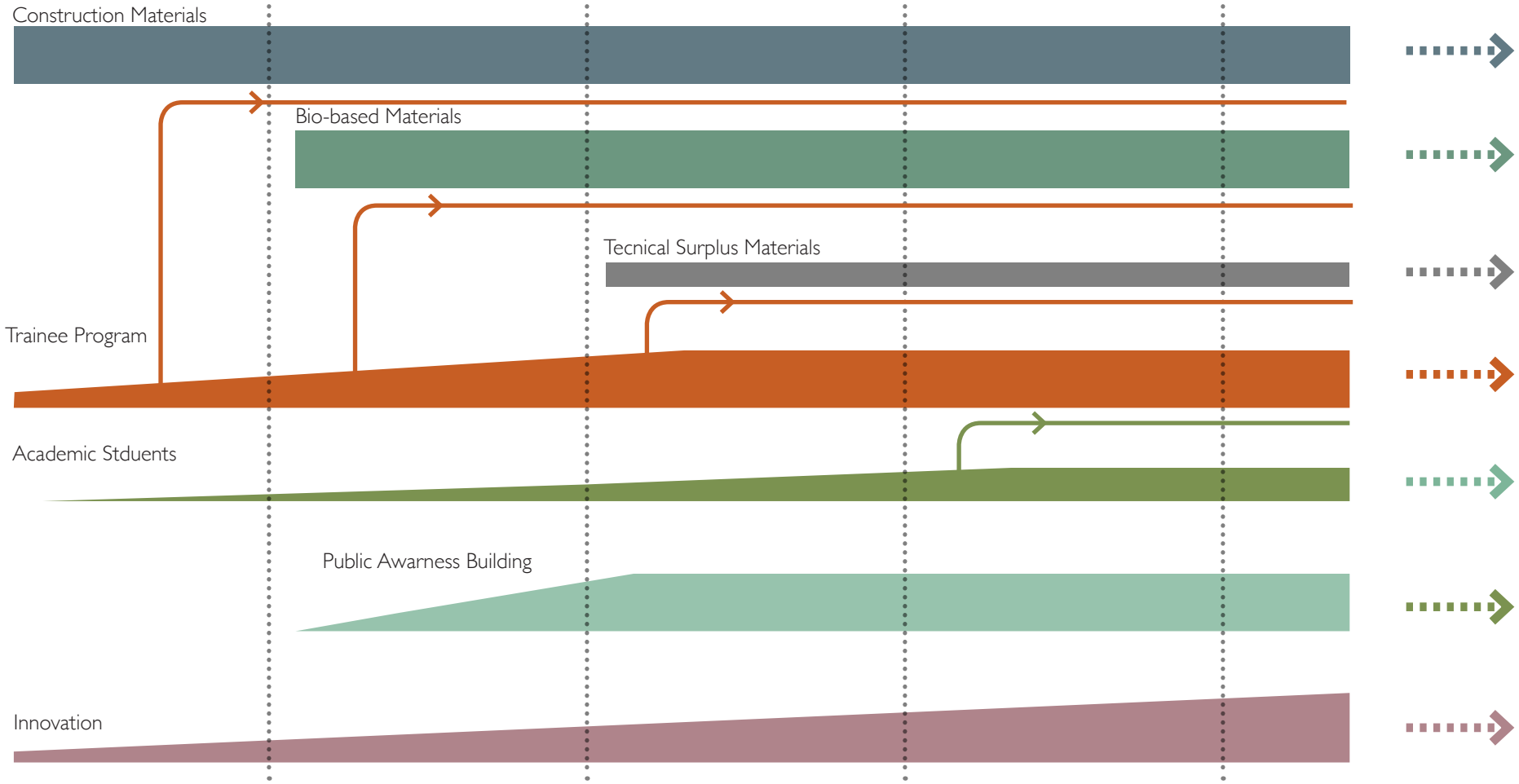
Stage 1
The first step is to start up with reclaimed building materials, a training program will be a part of if from the beginning.

Stage 2
Secondly the production from renewable biobased materials is started. The training program is extended to encompass this as well. Visits from local schools are encouraged as well as visits from universities.

Stage 3
Stage three is the implementation of material production with technical surplus and a public part for awareness building.

Stage 4
The fourth step is a stronger collaborative connection is made with a university. Part of it is a small yearly project where trainee and academic students work together (Rural Studio style).

Stage 5,6,7,8...
The program and structure should be adaptable to handle several unforeseen stages to come.



DESIGN PROPOSAL
Site

The proposal is very schematic and is only looking at which of the functions that could potentially go inside the existing structures and what would have to be added in additional volumes.

The site has been divided into three zones. This is to understand the space requirements of program related to the site. The sizes of areas for the Material Center have been estimated according to directions by Neufert and Neufert in Architects' Data, 2000.

Recycling Center
The program proposed to be in the area has been placed in some of the existing buildings on the north side of the site.

Material Center
The proposed program is suggested to be located in the main farm building and that this space is fully utilised.

Housing
The housing currently existing and will hopefully be part of the new housing development.

RECYCLING CENTER ZONE

MATERIAL CENTER ZONE

Within Existing Structure

Production with Biobased Surplus 260m²

Showroom and Shop 240m²

Workshop for reclaimed materials 312m²

Distribution and Circulation 130m²

Additional Structures

Production with tech surplus 150m²

Lecture Space and Test Room 2x60m²

Distribution and Storage 120m²

Open Test 100m²

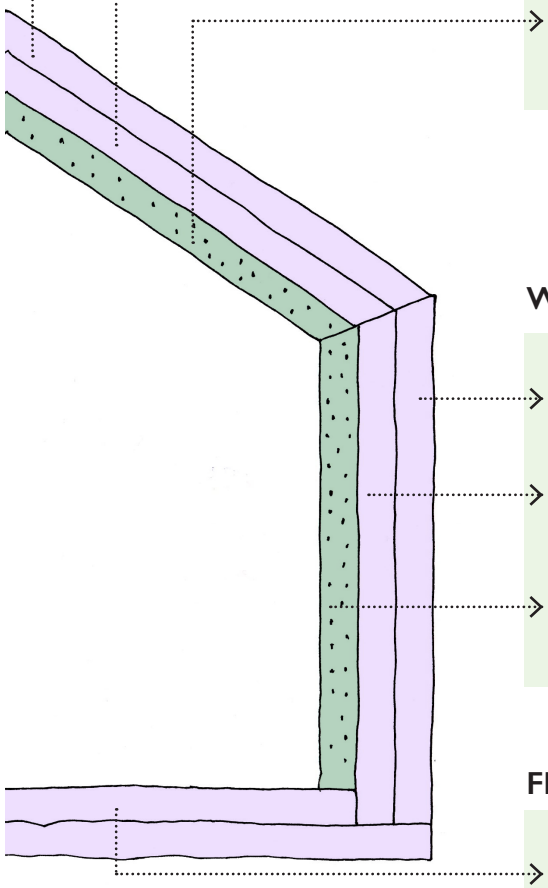
HOUSING ZONE

Fig 21 - 1:1000

DESIGN PROPOSAL

Lecture & Testspace

240m² (12mx20m)



ROOF

CLADDING
Existing

STRUCTURE
Existing

INSULATION
Stawtec Panels
Volume: 7.5 m³ - 2.9 ton straw

WALLS

CLADDING
Existing

STRUCTURE
Existing

INSULATION & FINISH
Strawtec Panels
Volume: 8.9 m³ - 3.4 ton straw

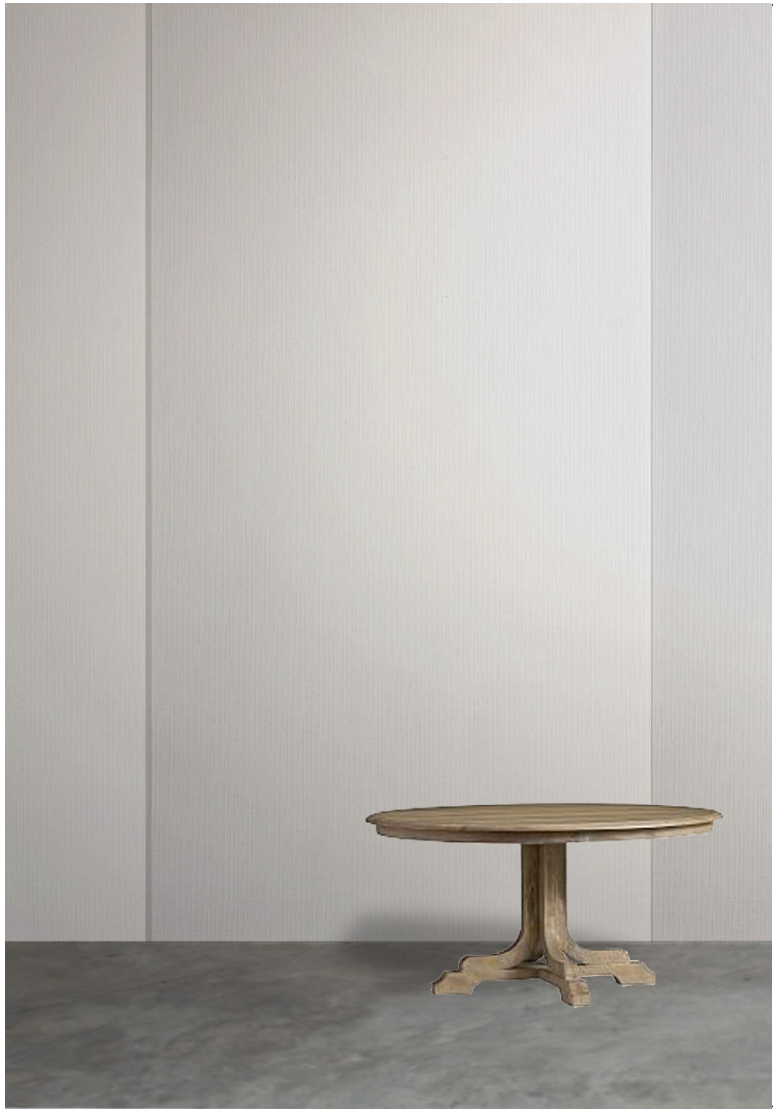
FLOOR

FINISH
Existing

Existing

Biobased Renewable Surplus

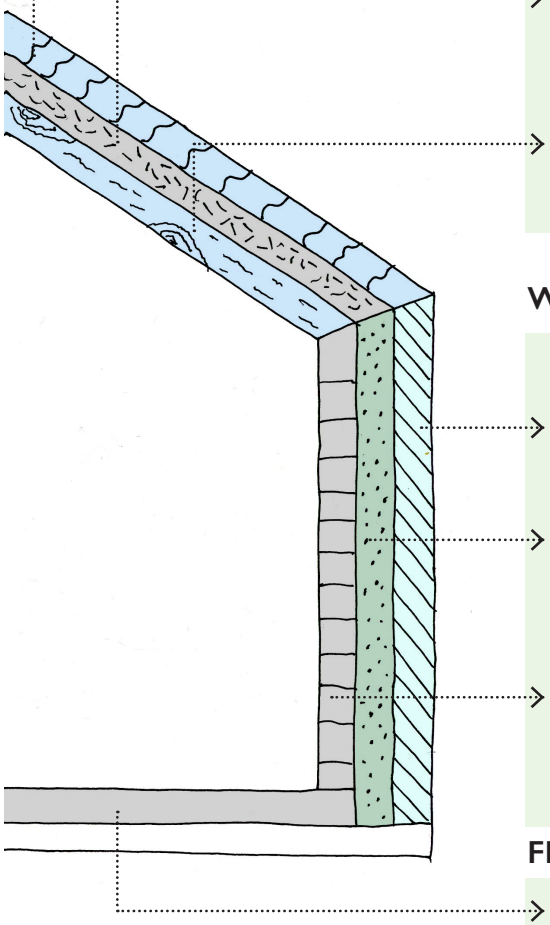
STRAWTEC



DESIGN PROPOSAL

Lecture & Testspace

120m² (12mx10m)



ROOF

CLADDING
Reclaimed tiles from barn
Volume:

STRUCTURE
Reclaimed Trusses
Volume: 20 trusses - 6m
Reclaimed boards
Volume: ca. 159 m²

INSULATION
Cellulose
Volume: 80m³ - 2.8 ton newspaper

WALLS

CLADDING
StoneCycling Tiles
Volumes: 1.2 m³ - 2.5 ton rubble

STRUCTURE & INSULATION
Stawtec Panels
Volumes: 16 m³ - 6 ton straw

FINISH
Newspaper Wood
Volumes: 1.28 m³ - 717 kg newspaper
BioGlass
Volumes: 1.5 m3 - 3600 kg Glass

FLOOR

FINISH
Tire Veneer Tiles
Volumes: 0.96 m³ - 1 ton rubber

Reused Construction Components

Consumption & Production Surplus

Modified Construction Components

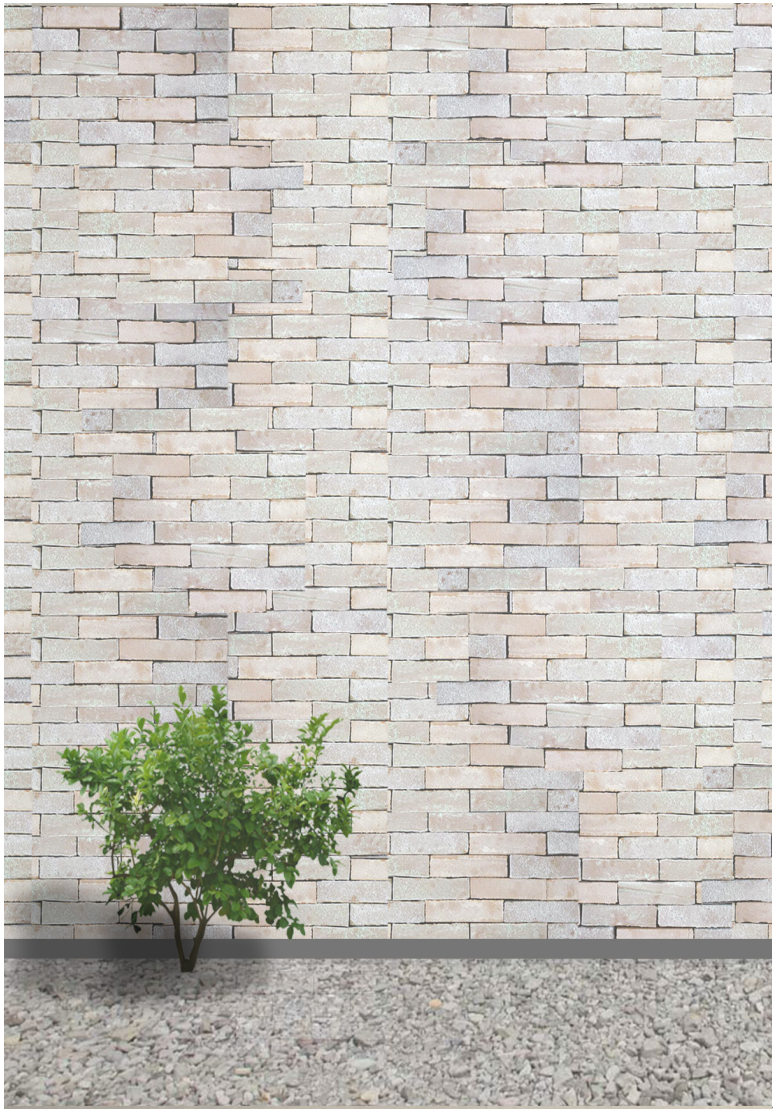
Biobased Renewable Surplus

NEWSPAPER WOOD

DESIGN PROPOSAL
Material Elevations

BIOGLASS

STONECYCLING



DESIGN PROPOSAL
Reflection

- When designing for a program that is planned to be built with a specified selection of materials, these have to be considered a lot earlier in the process since it their properties that set the parameters for the design.
- It was a struggle to find an alternative foundation technique that would not require cement.
- Though the main mass of the materials used stems from local resources there are some elements that are harder to source within the municipality e.g. tools and some service systems.
- Though the proposed materials are similar to mainstream materials the contractors might require special skills in order to work with these new ones.
- The volumes estimated to be needed are based on rough calculations. A more detailed study would be needed in order to get a more precise number.
- The balance between the different hierarchy groups will most likely vary depending on the program requirements and the context the building is in.
- Consideration has to be taken to the placement of certain materials e.g. a plastic composite might work well as external cladding but be less suited for an indoor environment due to the risk of off-gassing.

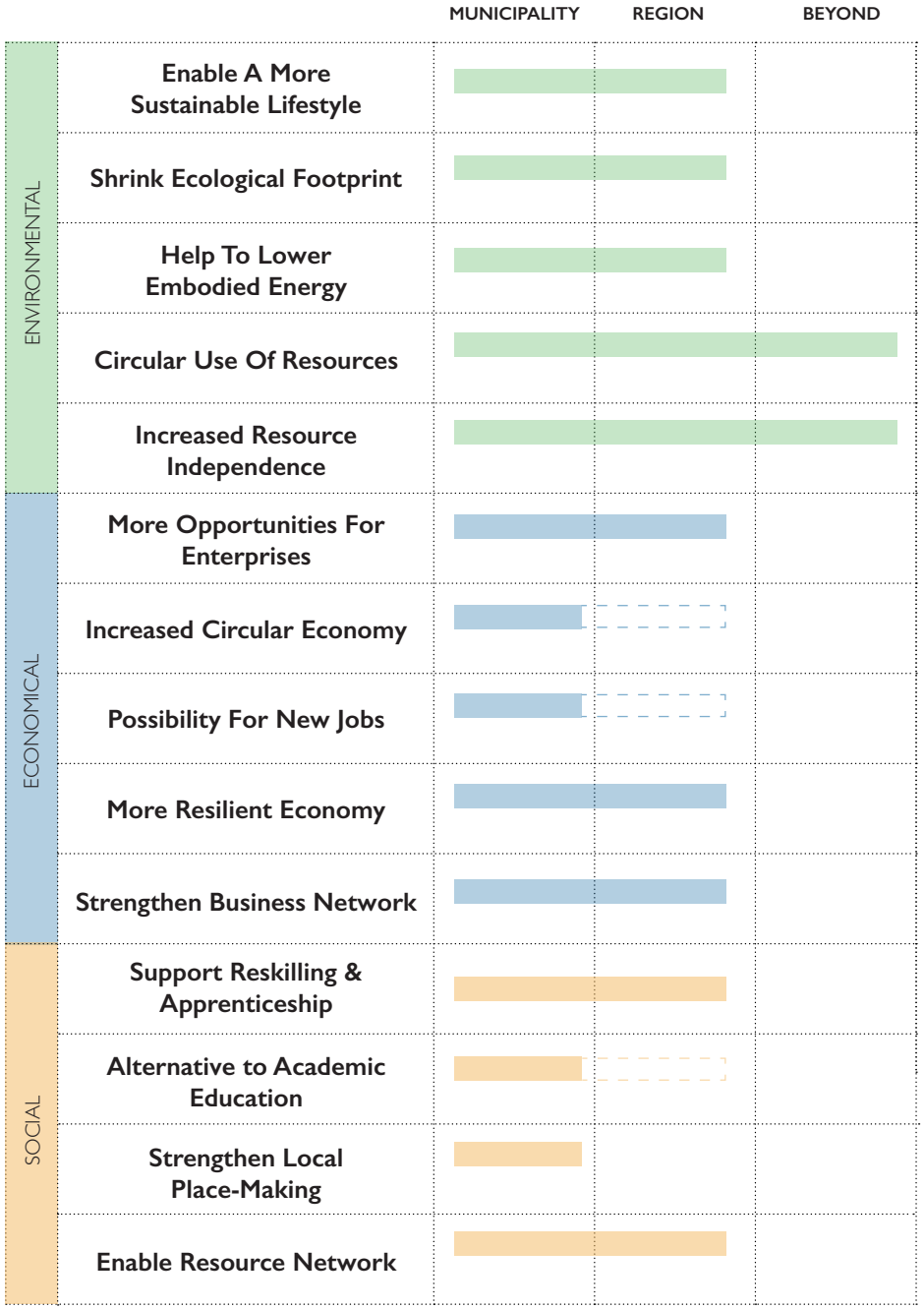
RIPPLE EFFECTS

EFFECTS
The Ripple Effect

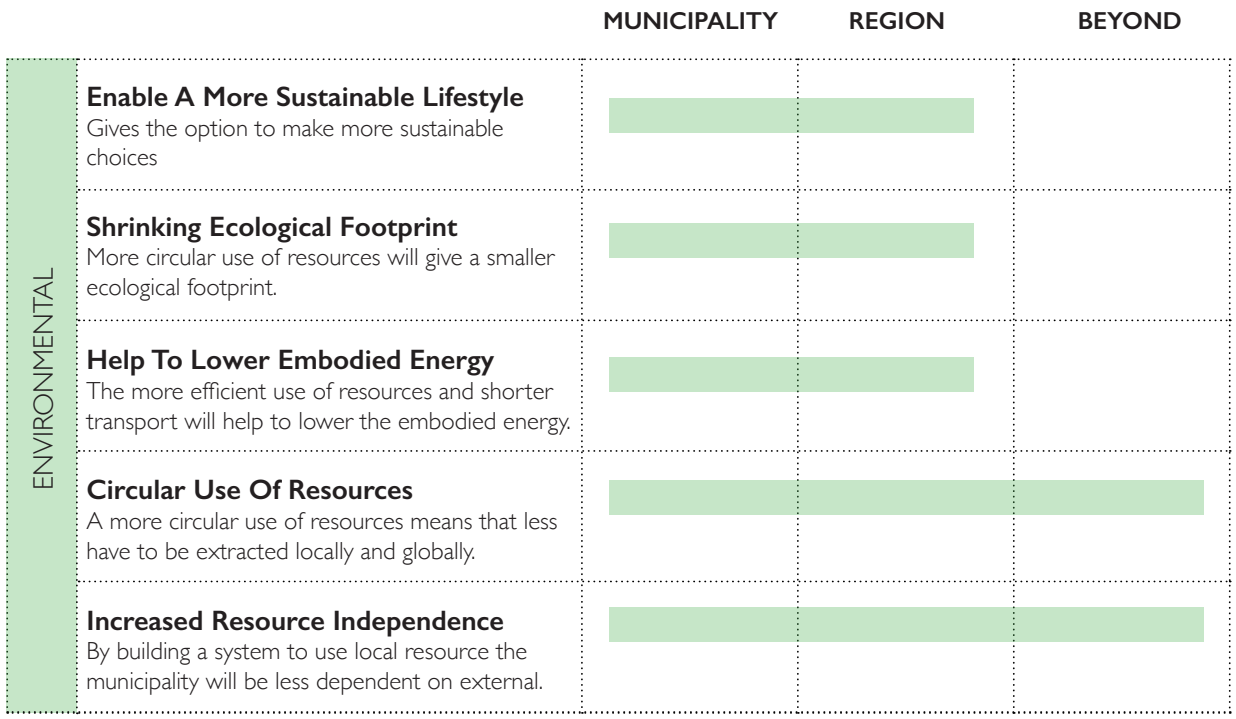
The main goals for this project was to encourage resourcefulness and lower embodied energy by the introducing local resources as potential building materials. All of these goals are very linked to environmental sustainability, to take care of the resources that exists in a local and global context. While developing the project it has been clear that in order to utilise local resource an economical and social infrastructure is needed.

This diagram explores what positive effects the process of collecting, refining and building with local resources could potentially have for Hjo municipality in a social, economical and environmental way. It also reflect on how far out the 'ripple effect' reaches: within the municipality, region or beyond (national and global). The strong tradition of entrepreneurship within the municipality is a great strength that can be linked to the process.

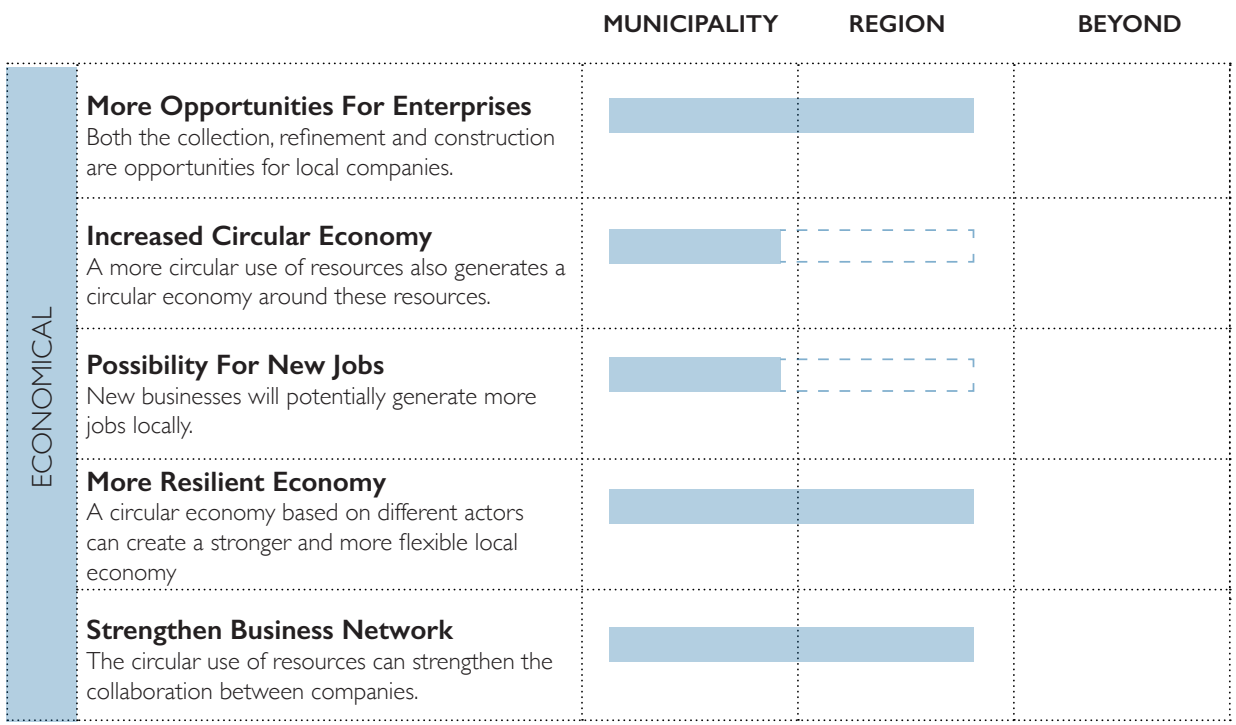
Many of the reflections below have been made with support from the text "Peak Oil and Transition Town" by Rob Hopkins, 2012.



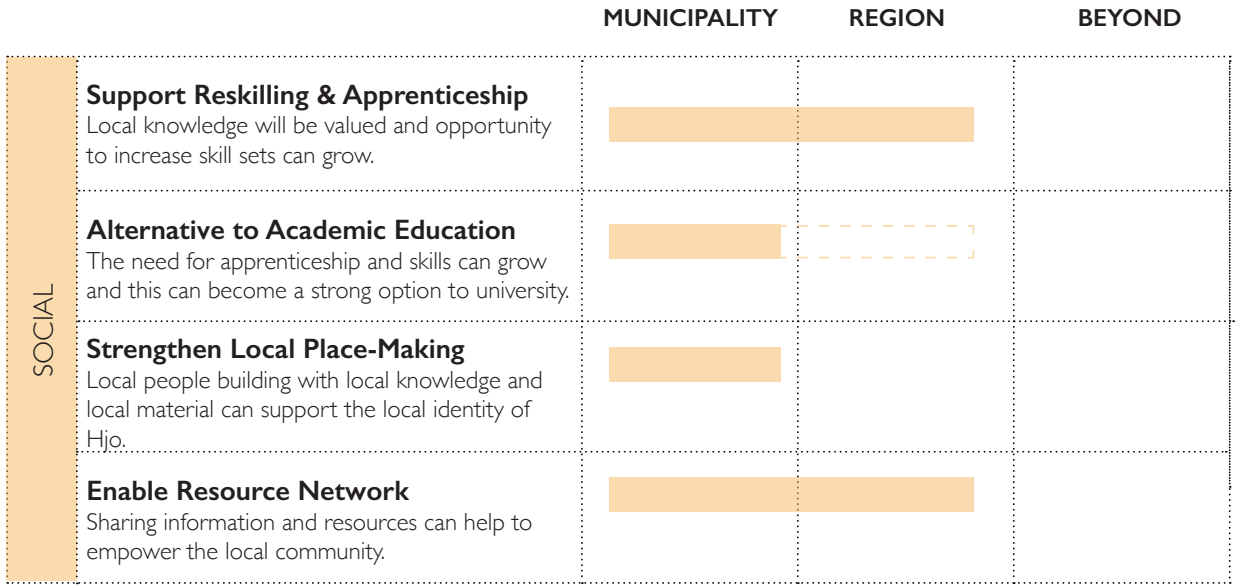
EFFECTS
Environmental



EFFECTS
Economical



EFFECTS
Social



EFFECTS
Transition Towns

The Transition Movement was created as a response to the increasing dependency of peak oil and that only cheap energy could be the driver to economical growth. Rob Hopkins, who is a professor and author regarding environmental issues is one of the co-founders to this movement that argue that localised bottom-up initiatives can generate economical development. This also creates a more resilient system where the local community is empowered it also becomes a way to deal with complex global problems on a local level.
(Hopkins, 2012)

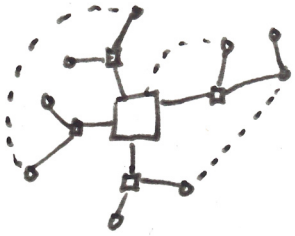
MATERIALS
Vernacular architecture has derived from local resources and climate e.g. cob and clay or timber. (Hopkins, 2012) So has also the building techniques both of these are an important part of the identity of the place.

One of the concepts in the Transition movement is the one of 'the Great Reskilling', since "new" materials might need different skills than what mainstream materials do). By using local people and local resources it can potentially keep money circulating within a community as many times as possible. (Hopkins, 2012)

SWEDEN
There are four initiatives and one Hub registered in Sweden at Transition Network. The hub that is register is 'Hela Sverige ska leva!' that is an national organisation that works with issues regarding small communities and the countryside. The branch that is focused on sustainable societies is called Omställningen and consist mainly of small scale community initiatives (helasvergie.se,2016)

GLOBAL LOCAL

LOCAL **KNOWLEDGE**
LOCAL **PEOPLE**
LOCAL **RESOURCES**



NATIONAL NETWORK

EFFECTS
Hjo in Transition?

As mentioned above there are many initiatives in the spirit of the Transition Town movement but only a few directly linked directly to the Transition Network, could Hjo be the first municipality in Sweden that does this?

This project has hopefully built a case for the potential in use of local resources in a circular way, which is a strong part of the Transition Town agenda. Looking at the extended list of the *Strengths* and *Opportunities* that was identified by the studio during the initial part it shows that Hjo have other potentially strong connections to the Transition Town movement.

To join the Transition movement will of course not be the answer to all weakness and threats that Hjo might be facing but it can be a good step in the right direction. To set a course, get support and guidance from a network of places that are facing the same challenges in a local way - work locally in a global world.

STRENGTHS

Cultural heritage
Natural heritage, built heritage, agricultural heritage

Proximity (physical)

Human scale and picturesque

Community
Social capital, social trust, social spaces

Local resources

Closeness to nature (physical and mental)

OPPORTUNITIES

Growing interest in local resources
Renewable resources, agriculture innovation, organic foods and goods

Growing interest in eco-tourism

Increased environmental awareness
Individual and political level

Immigration and multiculturalism

Increase in sharing economies
resources, knowledge, services

Slow city trend / Ruralisation

New technologies / digitalization connects Hjo and it's labour market to the world

RIPPLE EFFECT
Reflection

- How far the "ripples" reaches depends in some cases on the scale which is it implemented. E.g. some resources should perhaps stay very locally while others are shared in the region.
- This process will not create and independence from the outer world but rather strengthen the local market.
- It is important to understand what effects investments generates and support the ones that gives the ones with the most positive outcome - to think in long term investments.
- The change will most likely have to strongest positive effect for the whole community if the effect in all of the areas (environmental, economy and social) are considered. E.g. by selling the resources to be refined/modified in another location will not have as strong effect on the local economy and hardy any on the social.
- Diversity and small scale is important to create a resilient system.
- There are probably alternatives to the Transition Town movement that can be used to build a resilient and circular society by dealing with global issues on a local level.

FINAL THOUGHTS

This project has been exploring a local way of dealing with global sustainabilty problems. It does not advocate complete local independence but rather to fulfill the potential of the resources which are available, by using them in a more efficient way. In order to do so small and large scale changes are needed but it is a feasible and positive process, especially when looking at it with more holistic view rather than the one of short term economical profit.

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Fig 4 Circular Ladder
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Fig 5. Circular Economy
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Fig 7. Villa
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Fig 11. Thatch
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Fig 12. Timber
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Fig. 13 Clay
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Fig 14. Gravel
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Fig 15. Sand
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Fig 16. Återbruket
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Fig 17. Eko cafe
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Fig 18, 19 and 21. Ortographic Photos of Knäpplan Gården
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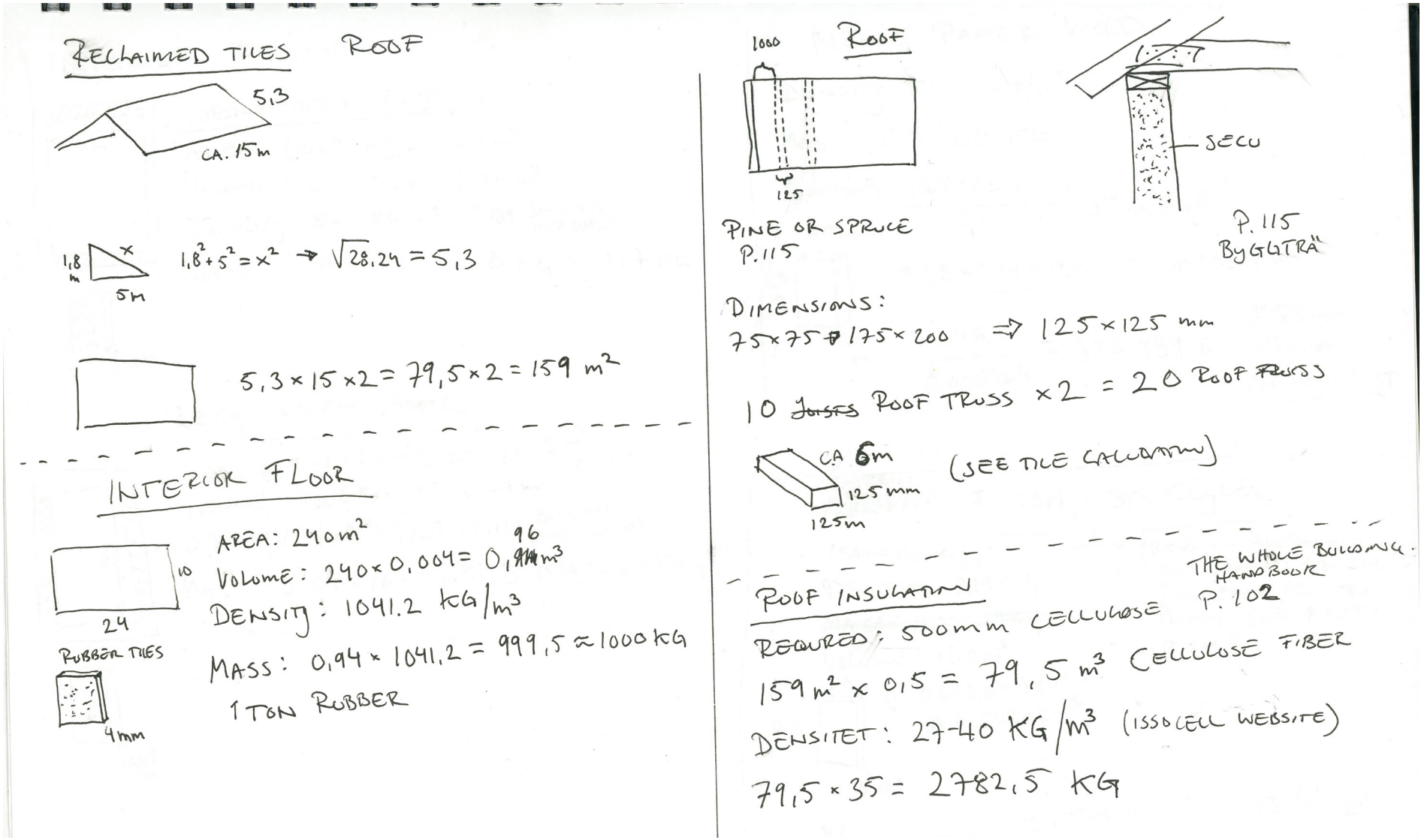
Fig 20. View of Knäpplans Gården
Google Street View (2011) Retrieved 2016-11-10 from
https://www.google.se/maps/place/Hjo/@58.2971197,14.2668247,3a,75y,276.87h,85.29t/data=!3m7!1e1!3m5!1sUPe4LjlgwmGjwCtvC0gAng!2e0!6s%2F%2Fgeo0.ggpht.com%2Fcbk%3Fpanoid%3DUPe4LjlgwmGjwCtvC0gAng%26output%3Dthumbnail%26cb_client%3Dmaps_sv.tactile.gps%26thumb%3D2%26w%3D203%26h%3D100%26yaw%3D192.87122%26pitch%3D0%26thumbfov%3D100!7i13312!8i6656!4m5!3m4!1s0x465a4d4d368321ad:0xa52401d0ec1dcdf3-!8m2!3d58.3070702!4d14.2874663

REFERENCES

Appendix

These are the calculations that were made to estimate volumes and mass relationships between resources and materials. These a rough calculation that are meant to showcase the relationship between the different aspects rather than being precise volumes.

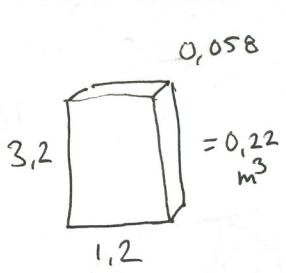


~~BYGNINGSMATERIALE~~ STRAWTEC

DENSITY: 380 KG/m³

MASS: 300 000 KG

VOLUME: $\frac{300000}{380} = 789,5\ m^3$



AMOUNT: $\frac{789.5}{0,22} = 3589$ ST ⇒ 17 (NOT LOADED / LOADED)

DISTANCE: 3589 × 1.2 = 4307 m = 4.3 km

---

* TIRE VENEER

AMOUNT OF TIRES: APPROX 1000 ST/YEAR

1 TIRE ≈ 10 KG

* RUBBER IN TREAD = 32,6 %

RUBBER PER TIRE = 10 × 0,326 = 3,26 KG

3,26 KG × 1000 = 3260 KG RUBBER/YEAR

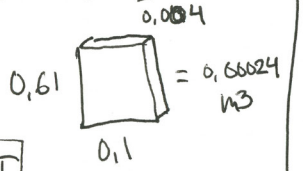
DENSITY: 1041 KG/m³

MASS: 3260 KG

VOLUME: $\frac{3260}{1041} = 3,13\ m^3$

AMOUNT: $\frac{3,1}{0,00024} =$

12 916,7 ST



AREA = 788 m²

* US RUBBER ASSOCIATION → WRAP.ORG.UK

BIO GLASS

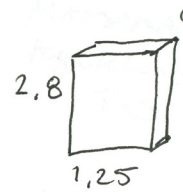
DESITY 2400 KG/m³

MASS: 144 400 KG

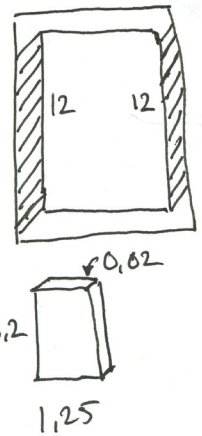
VOLUME: $\frac{144400}{2400} = 60\ m^3$

NR: $\frac{60}{0,07} = 857,1$ ST

"DISTANCE": 857,1 × 1,25 = 1071 m



INTERIOR FINISH - BIO GLASS



AREA: (3,2 × 12) × 2 = 38,4 × 2 = 76,8

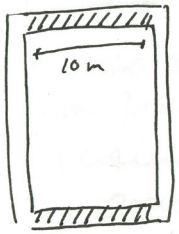
VOLUME: 76,8 × 0,02 = 1,5 m³

DENSITY: 2400 KG/m³

MASS: 1,5 × 2400 = 3600 KG

(THE GLASS WASTE OF 225 PEOPLE)

INTERIOR FINISH



NEWSPAPER WOOD

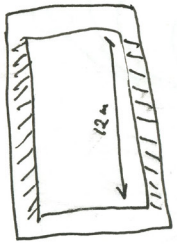
AREA: (10×2)×3,2 = 64 m²

VOLUME: 64 × 0,02 = 1,28 m³

DENSTY: 560 KG/m³ P. 189 BUILDING WITH WASTE

MASS: 1.28 × 560 = 716.8 KG ≈ 717 KG

RECY SCREENS/~~Block~~



AREA: ~~12×2 = 24 → ×3,2~~ = 76,8 m²

VOLUME: 76.8 × 0,05 = 3,84 m³

DENSTY: 167 KG/m³ (P. 121 BUILDING WITH WASTE)

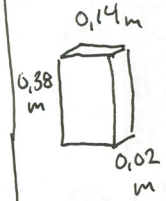
MASS: 3.84 × 167 = 641,3 KG ≈ 641 KG

NEWS PAPER WOOD

DENSITY: 560 KG/m³

MASS: 194200 KG

VOLUME $\frac{194200}{560} = 346,8\ m^3$



0,38 × 0,14 × 0,02 = 0,001064 m³

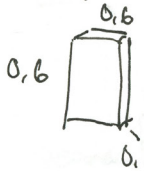
$\frac{346,8}{0,001064} = 325\,939,8 \approx$ ~~[illegible]~~ 325940 ST

~~EXTERIOR~~ FINISH - STONECYLE

(SAME DENSITY) → DENSITY: 2197,4 KG/m³ (BASE ON AVERAGE FOR CERAMIC & STONEW, DATA FROM ARCHITECT POCKET BOOK P. 229 = P. 219)

~~MASS: 180 × 2197,4~~

VOLUME: 180 m³

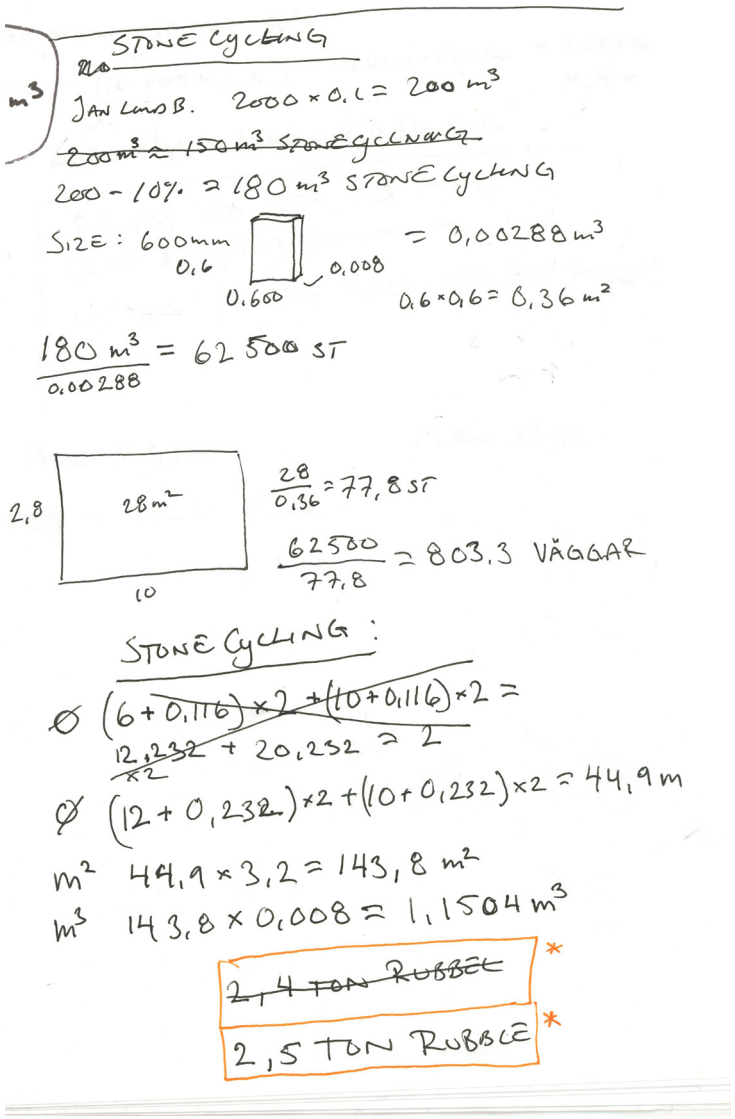


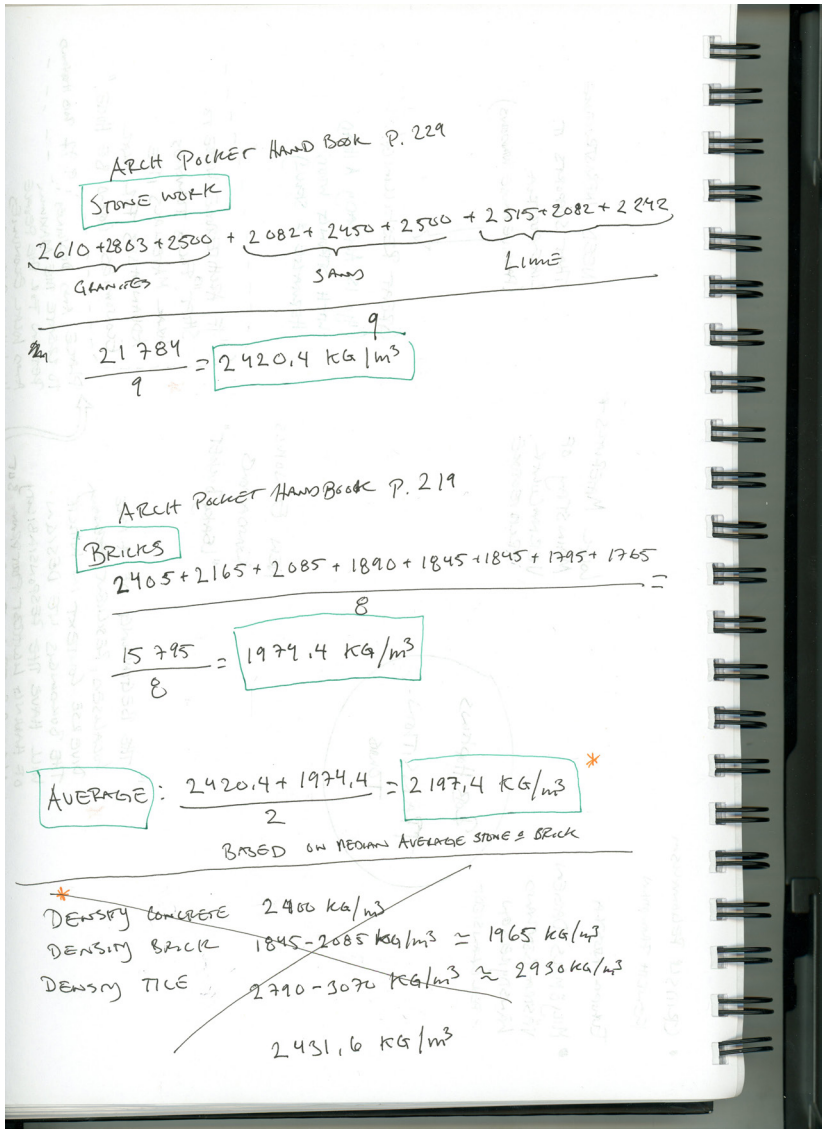
V: 0,6 × 0,6 × 0,008 = 0,00288 m³

$\frac{180}{0,00288} = 62500$ ST

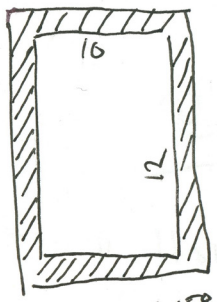
62500 × 0,36 = 173 611 m²

StoneCycling Mass





STRAW TEC PANELS IN EXISTING



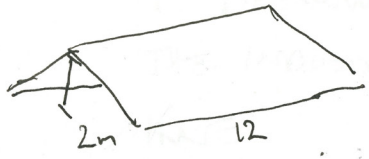
ESTIMATED HEIGHT:
3,5 m

$(10+10+12+12) \times 3,5 =$
$44 \times 3,5 = 154\ m^2$

VOLUME OF STRAWTEC:
$154 \times 0.058 = 8.9\ m^3$

DENSITY: 380 KG/m^3

MASS: $380 \times 8,9 = 3382$ KG



ESTIMATED ROOF SIZE

$2^2+5^2=x^2$
$4+25=29 \Rightarrow \sqrt{29} =$
$\simeq 5,4m$

$5,4 \times 12 = 64,8\ m^2 \times 2 = 129,6 m^2$
$\simeq 130\ m^2$

VOLUME OF STRAWTEC:
$130 \times 0,058 = 7,54\ m^3$

MASS: $7,54 \times 380 = 2865 \simeq$

2,9 TON

MUNKEBO

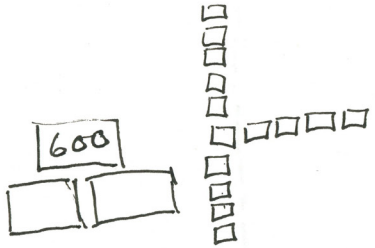
300 TON STRAW

(BAL 80 KG/m^3

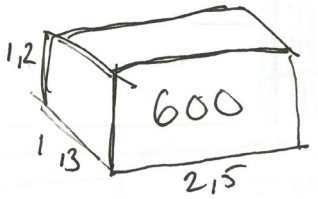
35×50 cm

$2,5 \times 1,3 \times 1,2 = 3,9\ m^3$

$\frac{500}{3,9} = 128$ KG/m^3



$\frac{300\,000}{128} = 2343,75\ m^3$



$\frac{2343,75}{3,9} = 600$ BALAR

HJO CAN!