Macdonald & Lawrence Timber Framing Ltd. wood residuals

Thesis Van Hall Larenstein University of Applied Sciences: forest- and nature management, International Timber Trade

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Thesis: MacDonald & Lawrence Timber Framing Ltd.

Research regarding MacDonald & Lawrence Timber Framing Ltd. wood residuals
Thesis forest- and nature management, International Timber Trade

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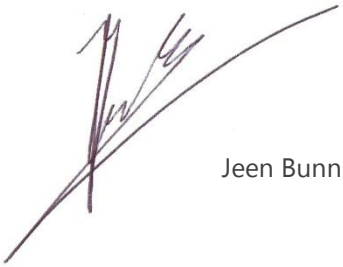
Acknowledgement

This report is written to complete my study International Timber Trade at the University of Applied Sciences Van Hall Larenstein. During my time at Van Hall Larenstein I learned, and hopefully mastered, the aspects of International Timber Trade. This thesis study and report show the competency in this area of business at 'bachelor' level.

After my traineeship in Sweden and studies in France I sincerely thank Gordon MacDonald & Steve Lawrence, as well as the whole crew and their families, for giving me the opportunity- and experience of a lifetime in Canada! The combination of true skill- and craftsmanship together with the warmth, enthusiasm and hospitality I encountered where simply amazing.

In addition I would like to express my gratitude to everybody that I have met during my studies, if I have to name every individual that helped me throughout International Timber Trade I need more pages and certainly forget some important names! I would like to thank all! By showing and opening up their culture, ways of living, advice and motivations truly enriched me professionally as personally.

Yours Sincerely,



Jeen Bunnik

Abstract

MacDonald & Lawrence timber framing Ltd. is a carpentry company specialised in timber framing residences, public & commercial timber frames and restoration & conservation projects. MacDonald & Lawrence 'tailor makes' every beam designed by its planners- designers for a perfect fit in all distinctive, bespoke projects.

Due to extensive sawing and re-cutting the issue arises: *What to do with the timber being cut off?* Macdonald & Lawrence feels that these fall-outs contain value, possible generating extra revenues for its business. Macdonald & Lawrence is a non-traditional business and likewise it's wood residue but the question remains, what to do with the wood residue and the organisation of it. Possible answers at the beginning of the supply chain could imply procuring larger dimension of timber, and cutting of tradable sizes, or buying larger lower grades and accepting more fall outs. At the end to the value chain it could result in clients paying a premium for having 'no waste' or 'waste' products incorporated in their projects

"What could be suitable end-uses for Macdonald & Lawrence Timber Framing Ltd. wood residuals, organised leading to customer- or added value?"

Through observations, employee interviews and following raw material flows, tracking the wood residuals Macdonald & Lawrence wood residuals capabilities could be examined. With the knowledge of species, qualities and quantities suitable- or valuable possibilities could be identified. With the help of a mind-map, personal assessments and scoreboard end-uses where gradually filtered. Last step was the organisation of the suitable end-uses according to Macdonald & Lawrence capabilities.

Macdonald & Lawrence Timber Framing Ltd. performs a diverse range of projects serving, quite different, markets. 'Labour', 'raw material' and 'resources' are allocated to every project. Wood residue likewise comes in all size and shapes. Within this context Macdonald & Lawrence' carpenters do not have the time- nor the pay check for handling, processing or stocking these unique wood residuals. The end-uses should be simple, 'low' grade and easy to handle:

- Community: A product which posses abstract values rather than its tangible product. It is the combination of all MacDonald & Lawrence's wood residuals for 'community' or 'privates'.
- Logs: or large dimension beams- or blocks ready to use.
- Maintenance & Packaging: jigs, sawhorses, stackers and covers for internal use.
- Disposables: small pieces and- or timber should be grinded to chips and be sold per container (incl. sawdust- and shavings)
- Craftsmanship: One of the carpenters could be appointed- or volunteer for a project, exhibiting his- or her skill. Creating a one of a kind, beautiful wooden product.

Macdonald & Lawrence tackles every 'problem' individually resulting in irregular raw material flows (read: wood residuals), no automatic dust/shaving disposal- or 'waste' protocol as a whole, the firm and its relations could all benefit by implementing:

- Wood residuals as an individual project: within the business model standard production lines do not fit in, not in the workshop [as in space and set-up] and in the mind-set of its employees. Wood residuals should be organised as an individual project.
- Wood residuals waste management system: Setting up a waste management system for wood residuals results in cost reduction, efficiency and work place safety benefits for MacDonald & Lawrence and 'green' marketing, image and goodwill opportunities for its relationships

Table of content

1 Introduction

Macdonald & Lawrence Timber Framing Ltd. probes to find uses for their wood residuals in order to increase lumber yield and thus savour financial benefits and corporate branding. Companies have to deal with the current volatile housing market conditions. Intensive competition and slacking demand push firms to critically review own operations. Increasing efficiency on one hand and reducing costs on the other should, in theory, lead to better financial positions.

§1.1 Macdonald & Lawrence Timber Framing Ltd.

MacDonald & Lawrence timber framing Ltd. is a carpentry company specialised in timber framing residences, public & commercial timber frames and restoration & conservation projects.

Located on Vancouver Island, British Colombia Canada, MacDonald & Lawrence consist of approximately 30 full-time staff of various nationalities, operating a full-equipped 12,000 square feet workshop, offering a range of services to design, assist and build timber structures- or components for private and professional clients. MacDonald & Lawrence is proud to be the first- and only FSC-certified timber framing company in Canada.

Figure 1: Timber frame conservation

Founded in 2004 by Gordon Macdonald, a journeyman carpenter with over 20 years experience of working with historic timber buildings, he specializes in traditional timber frame carpentry. Macdonald led carpentry teams through a range of interesting and award-winning projects: from the restoration of medieval houses to the re-creation of a 30-ton Roman war machine for the BBC Television. He has worked at locations as diverse as the equatorial jungles of Suriname, the uninhabited islands of the Outer Hebrides and the Ross Sea area of Antarctica.

Figure 2: Timber frame house

Steve Lawrence met Gordon Macdonald during their shared time at UK based Carpenter Oak & Woodland Co. Ltd. in the nineties. Steve Lawrence joined Macdonald in 2007, moving from the UK to Vancouver Island, Canada. Initially started his career in forestry as an arborist, Steve Lawrence has been involved with timber framing for over 18 years. He has worked on and supervised a diverse range of projects from traditional timber frames to large and complex modern timber structures: Steve's work at Windsor Castle and Stirling Castle earned him a personal letter of thanks from HM Queen Elizabeth and HM Prince Phillip.

§1.2 Problem analysis & definition

Within the wood industry the flow of raw material, and the material in itself, withholds a critical position. Availability, sustainability, environment- and social aspects are just a few timber supply issues influencing planners and policy makers to consider the efficiency and utilization of the timber resource. Improvement would favourably impact direct profits and corporate branding.

Macdonald & Lawrence Timber Framing Ltd. performs a diverse range of projects serving, quite different, markets. Therefore every assignment, both on management – and execution level, is set-up as a 'project' and likewise 'labour', 'raw materials' and 'tools' are allocated to the specific projects. Making Macdonald & Lawrence Timber Framing Ltd. not a typically secondary wood industry manufacturer. The core business is craftsmanship and the value is created by the carpenters which carve, and place, every! piece of timber by hand. Thus making 'time', as spend by the carpenters, and 'material', in custom shaping timber, critical to stay competitive and profitable.

Macdonald & Lawrence Timber Framing Ltd.'s carpenters allocate their time to 'frame' and material which does not have this purpose ends up as regular waste or is stocked, if considered valuable, for 'later use'. In volatile market conditions and ditto business operations, wood residuals are accumulated and left to waste, there is no later use. Because the wood is allocated and paid for (per specific project) management feels that these wood residuals still contain value and might generate extra revenues.

The main research question is:

'What could be suitable end-uses for MacDonald & Lawrence Timber Framing Ltd. wood residuals, organised leading to customer- or added value[1]?"

In order to answer the main research question the following sub-questions are derived:

- What are Macdonald & Lawrence Timber Framing Ltd. current lumber input, timber processing and wood residuals output capabilities?
- What could be possibilities for customer- or added value from Macdonald & Lawrence Timber Framing Ltd. wood residuals?
- How could Macdonald & Lawrence Timber Framing Ltd. organise wood residuals, if customer- or value added products are found?

§1.3 Goals & Objective

This thesis has the following goals. The first goal is to examine the current situation of wood residuals in regards of quantity, quality and handling. Secondly identifying possibilities for customer- or added value feasible for Macdonald & Lawrence Timber Framing Ltd.. And last but not least to determine a strategy- or platform in order to harness value found from Macdonald & Lawrence Timber Framing Ltd. wood residuals. All goals are set as part of the overall objective: which end-uses could be derived from Macdonald & Lawrence Timber Framing Ltd. wood residuals and how to organise the value it might contain.

§1.4 Target groups

The report is written on behalf of the University of Applied Sciences Van Hall Larenstein, Velp and Macdonald & Lawrence Timber Framing Ltd. Vancouver Island, Canada.

[1] Note the distinction between *customer* value: value perceived through the eyes of the customer, for instance a table top from trees out of the customers own garden, consequently having more cost and time constrains and *added* value: selling price minus the costs, for instance selling floorboards to the DIY sector like a regularly secondary wood processing manufacturer.

2. Methodology

The following chapter will explain the methodology of this thesis research. In order to find suitable uses out of wood residuals, specific to Macdonald & Lawrence Timber Framing Ltd., certain sources and techniques are addressed and wielded.

§2.1 Methodology per sub-question

What are Macdonald & Lawrence Timber Framing Ltd. current lumber input, timber processing and wood residuals output capabilities?

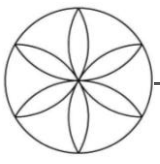
By following raw material flows from the first entry point, processing in to the shapes and the timbers that leave the workshop used in construction hard data needed to be collected. By observation and employee interviews it establishes what comes in: species, dimensions, characteristics/features, quantities. It will look at the workshop: machinery, saws, state/maintenance, cutting methods, employee decisions and furthermore the output side: dimensions, amount of waste, waste quality and waste processing. Observations- and interviews where written down on site and later processed and showed in tables- or figures or statements throughout the report.

What could be possibilities for customer- or added value from Macdonald & Lawrence Timber Framing Ltd. wood residuals?

The above mentioned identifies possibilities, for found values in the first sub-question. As methodology a mind map is made to answer this sub-question. By literature survey common uses per specie are established. Furthermore employee and management suggestions and assessments of wood residuals are valuable regarding the local market conditions. In addition a reference is made by visiting neighbouring wood processing companies. That information will 'fill in' the mind map and with the mind map as base employees are interviewed on the spot. However management is interviewed in office and involved with assessing wood residual quantities, qualities and customer- or added value with the help of a scoreboard. This scoreboard is made in order to judge the 'suitableness' and filters the end-uses generated by the mind map.

How could Macdonald & Lawrence Timber Framing Ltd. organise wood residuals, if customer- or value added products are found?

The sub-question confronts outcomes of the first two sub-question and doing so exploring fit end-uses which match (and fit-in) the current business model resulting in added value for MacDonald & Lawrence. In order to do so capabilities are directly confronted with the possibilities for customer- or added value. This assessment will identify which products could be made according to the capabilities. When determined personal assessments will generate an organizational structure which aims to enforces Macdonald & Lawrence capabilities and at the same time overcomes issues identified in the previous steps.



§2.2 Theory

§2.2.1 Desk-research

The search of secondary sources will be carried out to refine the objectives and provide guidelines for the next stages. Specifically, desk research will gather information on yield, lumber recovery and efficiency for general secondary wood processing companies. This information should give useful directions and insights in wood residuals. But beside general information, information on machines, end-uses and requirements are based on several, reliable second-hand sources. Generally one could say the desk research has a strong support and back-up function. Note: sources are public- or private libraries and the World Wide Web, acquiring access to reports, articles and informational websites.

The desk research will attempt to establish information about the following:

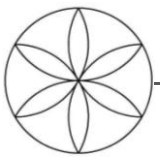
- Specie end-uses
- Lumber grades
- Cutting methods
- Waste data, lumber purchase
- Flowcharts, structure and organisations

§2.2.2 *Field-research*

Given the exploratory nature of some aspects of the objectives, providing detailed qualitative information is needed. Focused research will be used to explore and understand efficiency and supply requirements. Through personal- and telephone interviewing relevant respondents are contacted, an online approach is not desirable. The personal- and telephone approach gives the opportunity to select accurately and swiftly, this gives an assurance of achieving the desired type of respondents (read: employees & management). Besides the 'external' primary sources data is collected by personal observation and wood handling. Neighbouring companies are approached for their wood residuals utilization, within the company the workshop manager + personnel are enquired about current 'waste management'. Note: For all contacts *face-to-face* enquiries are most desirable, the telephone is used as alternative.

The field research will probe the following:

- Species, dimensions and saw use
- Cutting methods
- Wood (and residuals) handling
- Decision making of employees regarding wood residuals
- Products produced, asked
- Opinions/attitudes towards wood residuals
- Wood residuals quantity, quality



3. M&L's lumber input, timber processing and wood residuals output

In order to identify MacDonald & Lawrence's wood residual capabilities, the three stages where residuals originate are observed. De jure: 1 the input of raw materials, 2 the processing of these materials and 3 the output of the end-product. De facto this means 1 input: logs- or beams, 2 processing: saws (band, cross and hand), hand tools (mortisers, chisels, sanding etc) handling and 3 output: timber frames, packaging and storage. Along this path wood residuals are tracked and judged.

§3.1 Lumber input

Figure 3: Douglas fir

First stop, the input of raw material. This paragraph shows the different species being used, the dimensions in which the lumber is delivered along with lumber grade and price (to determine quality and costs in later stadia).

§3.1.1 Species

80% of the timber used is the Coastal Douglas- fir [Pseudotsuga menziesii Franco]. Douglas fir is a large tree which reaches heights of 85 meters on the coast and 42 meters in the interior of Canada. Coastal Douglas-fir is a much bigger tree than Interior Douglas-fir. The timber from the Coastal trees is generally lighter in colour, and more uniform in texture than that of Interior trees. Both have the same wood properties, however, one main difference is that Interior Douglas-fir is less permeable to preservative treatments. Douglas- Fir is available in abundance and used green.

Figure 4: Western Red Cedar

Western Red Cedar [Thuja plicata Donn ex. D. Don] makes up the remaining 20% of MacDonald & Lawrence's lumber input. It is a large tree up to 60 meters tall when mature.
Western Red Cedar lumber is often sold green due to its unique properties and longer drying times. When dried, lumber is dried according to end-use and customer specifications. Kiln drying inhibits natural staining of the wood, improves its strength and stiffness, and enhances its appearance as well as its resistance to decay and insect attack.

§3.1.2 Lumber dimension

Lumber is delivered in three types:

- Sawn lumber: 65% of the lumber input is lumber sawn to the desired dimension. Within the following could be distinguished. *Beams*: standard square sizes and length used to frame the 'outline' depending on the customers' demands this beams could be solid or laminated. *Dimensioned lumber*: lumber outside the standard sawmill specifications and lengths or specials curved timbers used to connect the 'outline frame' to each other. *Square edged timber*: standard ready to use building material like 2x4", decking or floors. Either used as temporary 'building'- or permanent floors. The lumber used for construction complies with the NLGA No.1 & Btr grade[2]. The average purchase price per 1000 board feet ranges from $900- to $1200 at the sawmill.
- Utility poles: 30% of the lumber input is utility poles usually used for electric cabling. These poles have a 17'' diameter, come in 35', 45' of 70' standard lengths and have an ANSI[3] H1 grade. When these utility poles are being cut the timber comply with the NLGA grade requirements. The average price of these utility poles range from $165. - 625. - piece, the longer the length the more expensive.
- Round logs: 5% of the lumber is wood in the rough (logs). Low due to the customers' needs. The 'standard' specifications and sizes are most of the time sufficient. However it occurs that customers have special requirements like 'free of heart' sawn wood, quarter sawn wood or 'old growth' wishes.

[2] For an overview Appendix I: NLGA Construction timber No.1 & Btr.
[3] American National Standards Institute. Wooden utility poles grades rank from H5, being the highest, to H1. Poles receive their grade primarily on their ability to carry a load.

§3.2 Timber processing

In order to process the inbound lumber several machinery are used. This paragraph will identify, describe and asses each machine on its state, saw blade and wood residual.

General tools

Consist of all portable, operated by hand or electricity, such as: blade saws, mortisers, routers, planers, drills, chisel etc. Are all *as new*, have thin saw kerfs and have a non significant, as in quantity per tool, wood residuals as in sawdust (due to small saw kerf), solid wood (small blocks being cut off) or shavings (as a result of chiselling mortise and tenon joist).

*Cook saw mill**

A horizontal band saw accompanied by a 65' long lumber carriage. Able to handle up to 32" diameter lumber. Mill is as new, being previously used for a specific multiple million dollar home, and at the time run to produce octagon shaped spars for an entertainment park. Cutting logs and beams thus, responsible for larger sized solid wood *off-cuts*. In comparison with a regular sawmill its blade kerf is 1/3 thinner and so resulting in less sawdust.

Figure 5: Cook saw mill

Delta power tools

Within the workshop two types of planners are used: X5 Type I 50-785 and the DJ-20. Both are in new state because these tools are only being used for the occasional 'fine' carpentry work. Produce fine sawdust.

Steel city- and Makita Canada tools

Both table- arm saws are used for cross-cutting smaller timber to specific length. These saw have circular saw blades, instead of band saw, which have normally thicker saw kerfs and so producing more sawdust but, as with the delta tools, these are not being used on a regular basis.

Figure 6: Meber S.P.A vertical band saw

Meber S.P.A

Italian Meber Type SR 900 vertical band saw. Hardly used and in good shape. Able to rip-cut 10" to 15" dimensions. Having a 'normal' blade kerf producing sawdust and solid wood (in longer lengths in comparison with the general tools and table saws)

*Norwood**

The Lumbermate 2000 horizontal band saw. Hardly used (used when the *Cook* carriage it not able to carry the inbound lumber, so lumber over 65' long!) and in good shape. A smaller horizontal, portable band and handles up to 34" diameter lumber. At the time run to produce octagon shaped spars for an entertainment park. Cutting logs and beams thus, responsible for larger sized solid wood *off-cuts*. In comparison with a regular sawmill its blade kerf is 1/3 thinner and so resulting in less sawdust.

** Sawmill operator (applicable to Cook & Norwood machines)*

Beside from the machinery itself, the person who operates them is influencing the amount of residue by the decisions he has to make. There is one saw miller present at Macdonald & Lawrence. He is hired as 'timber framer' but previously had his own sawmill. Due to large saw kerf, it is a large circular saw, his mill became outdated. Although not hired for miller he has over 20 years experience and knows how to asses and saw inbound lumber.

§3.3 Timber output & Wood residuals

After the purchase and processing the timber the focus in this paragraph is on the 'output' side of the company. Which products do they make, what are the dimensions of the components and what is the consequence for the wood residuals?

§3.3.1 Timber products (output)

MacDonald & Lawrence timber framing Ltd. is not a regular wood processing company; it is a specialized carpentry firm. Products that leave the workshop are square timber needed for framing such as: beams, columns, posts, crucks, braces, joists, ties, trusses, stringers, collars, rafters, parlins , rails, treads, newels, pendants, balusters, ridges, plates, decking et all.

Figure 7: Timber products example

Depending on the projects nature MacDonald & Lawrence roughly specifies three product groups:

1. Residential frames: dimensions depend on the customer desired specifications. Possibilities from a 'straight forward' frame to a full customised house requiring larges dimensions, unique curves and finished moulding. Unique, one-of-a-kind dream houses.
2. Commercial frames: require larger dimensions because of the wide spans. Less design, more practical and safety requirements have priority.
3. Heritage: one of a kind customized and bespoke timber requirements. Ranging from replacing a single- or a couple pieces, whole sections or 90% of a structure.

Due to the unique and specification driven timber demand it is hard to quantify– qualify the amount of wood residuals. 65% of the timber intake is sawn, ready to use, timber. Resulting waste: trim-ends, shavings and sawdust, small amounts of low value waste.

Milling, and thus significant waste, is only done 'in-house' if sawmills are unable to supply timber in regard of lengths or 'special' dimensions. Within this context the 35% poles/log intake is interesting. The bulk is used for specific client, Wild Play element parks. The rough round wood is being transformed to sawn lumber; demanded dimensions are octagon shaped poles- or beams for their parks[4]. Therefore in addition to general waste enquiries, focus will be on Wild Play and 'their' waste.

Figure 8: Wild Play Spars

[4] See appendix II: Example lumber specification Wild Play, Kelowna BC

§3.3.2 Wood residuals

So what does this mean for the wood residuals accumulated from Macdonald & Lawrence operations? This section will take a look at wood residuals flows and indentifies- describes wood residual quantity, quality, handling and value.

Within the research period operations are followed and wood residuals tracked. These observations allowed specifying wood residual flows, quantities and qualities[5]. A simple graphic shows and pin-points MacDonald & Lawrence wood residuals structure.

Activity	Wood residue	Who?	Resources
[Frame dismantling]		MacDonald & Lawrence	
↓			
[Transport]		External transport	
↓			
Timber intake: Logs/turned poles Dimensioned lumber		External sawmill	Workshop
↓			
[re] Sawing	*Sawdust, fall-out, slabs*	MacDonald & Lawrence	Workshop, saw
↓			
Framing	*Shavings, trim-ends*	MacDonald & Lawrence	Workshop, tools
↓			
Transport		External transport	
↓			
Frame erection	*Project returns*	MacDonald & Lawrence	
↓			
Timber framed building			

Figure 9: Macdonald & Lawrence wood residuals structure

§3.3.3 Wood residuals: Quantity

The element of 'time' is essential to Macdonald & Lawrence operations. Wood residuals are therefore segmented into three 'time' segments of which they occur:

1. Daily: shavings, sawdust and trim-ends. Avg. 4,500 bf / 10 m^3 a month, covering all lumber processes.
2. Regularly: off cuts from milling, especially during Wild Play projects. To have an indication Wild Play, Kelowna BC has been monitored. Circa 8,500 bf / 20 m^3 solid timbers in various dimensions such as slaps, edged lumber and posts in 3 weeks for this particularly project.
3. Incidental: returns from project and -/ or 'special' timber from renovating- heritage projects. Estimated to be 38,000 bf / 90 m^3 in the past years, stocked at the workshop premises.

[5] See Appendix III + IV: Sawing octagon shapes + Evaluation

§3.3.4 Wood residuals: Quality

As mentioned in *§3.1 Lumber input, lumber dimensions* inbound lumber quality is graded to NLGA structural light framing structural joists and planks No.1 & Btr[6]. This particular quality grade is also applicable for the utility poles. Due to the milling the utility poles 'transform' from ANSI H1 Class for wooden utility poles to NLGA No.1 & Btr. construction lumber grade.

§3.3.5 Wood residuals: Handling

Figure 10: Regularly wood residuals

- Daily: No automatic shavings, dust handling. All is handled manually and dumped in [paid] container or given away to staff as fuel wood. Handled in such way represents no significant value.
- Regularly: Are bundled, [poorly] stacked- or just randomly set aside anywhere in- or outside the workshop. Due to several reasons; size, grain or texture represents at least the procurement value [= avg. purchase price poles $250 1000bf. x 8,5= $2150 for 8,500 bf. / 20 m^3]
- Incidental: Bundled and -/ or packed, stacked and stored on the premises surrounding the workshop. Has more value than the purchase price for grain, textures, history/heritage or emotional value reasons on top of the value of the raw material cost alone.

Note: As shown in Figure 10, wood residuals are bundled and stored in a rather unorthodox manner. There are a couple places as such present at the yard and workshop depicted in Appendix XI: Yard & Workshop lay-out.

[6] See appendix I: NLGA Construction timber No1. & Btr.

4. Possibilities for added- or customer value from M&L's wood residuals

After identifying Macdonald & Lawrence capabilities, the search for value starts. To collect possibilities, with the previous found capabilities as starting point, information is found in literature, employee interviews and benchmarks. With this input a mind map[7] is made and suitable uses particularly to Macdonald & Lawrence are derived with the help of scoreboards. After determination uses are described and quantified.

§4.1 Mind map: possible end-uses

Literature background on species

Both species, Douglas-Fir & Western Red Cedar, are known for their versatile timber usage. What Oak is for Europe, the Douglas-Fir is for Northern America being used in all possible timber applications, ranging from general building & construction, sashes, doors, windows, millwork, flooring, cabinets, veneer, vats, boat construction, transmission poles and marine pilings. Douglas-fir is available in the form of lumber, timber, pilings and plywood.

Douglas-Fir is known for its strength properties and workability. The wood dries rapidly with small dimensional movement. It is relatively easy to work but care for machinery due to resin content. It turns planes and shapes well and can be sanded to a smooth finish. The wood glues moderately easily, has moderate nail and good screw holding ability, and takes a good finish[8].

Western Red Cedar on the other hand is known for its durability and dimensional stability leading to uses such as roof shingles, exterior & interior siding, exterior cladding, decking, greenhouses, poles, posts, fencing, ship & boat building. Red Cedar is popular wood for outdoor furniture, playground equipment, sashes, doors, windows, ceiling, sauna-/ and wall panelling.

Western Red Cedar is a lightweight wood, which is moderately soft and low in strength. It is known for its excellent working properties, and its ability to take a smooth finish with sharp tools. It is relatively easy to work but care for machinery due to resin content. It planes and shapes well and can be sanded to a smooth finish. The wood glues easily, has moderate nail and screw ability, and takes a good finish[9].

Wood residual attitude

Throughout the company the idea of doing 'something' with their waste is extant. On an abstract level wood residual is "value but do not know how to package it"[10]. However using as much waste is an ideology perspective driven by cost of a paid waste bin. All employees share the thought of utilizing wood residuals and seeing potential in it. Under condition: residuals have sufficient quality, short handling time and easy access

[7] See Appendix X: Mind map possible end-uses
[8] Douglas-Fir Factsheet FPInnovations Forintek Canada Corp.
[9] Western Red Cedar Factsheet FPInnovations Forintek Canada Corp.
[10] Quote by Chris Tucker, project manager Macdonald & Lawrence Timber Framing Ltd.

Benchmark neighbouring companies

According to the company's size the extension of waste utilisation (or lumber yield) is higher. The smaller companies have straight forward, simple systems of automatic dust and shavings disposal. Trim-ends are used within their current production process or given away as firewood. Companies with more purchasing power are able to invest in possibilities such as finger jointing or pellets. All companies sell their dust, shavings to a third party. Principles behind waste remanufacturing have a pure economical base. Other reasons named are a zero waste policy or space/stock use[11].

§4.2 Suitable end-uses

§4.2.1 Suitable end-uses

In order to judge suitable end-uses, deducted from the mind map, products are rated according to several criteria. Before we start the following has to be taken into account: criteria and assigned scores are done in cooperation with Gordon MacDonald, highest points were given to the highest priority and most importance to Macdonald & Lawrence. Point rating of the scoreboard is done with the help of Chris Tucker, project manager (Scoreboard: see §4.2.2 Suitable end-uses scoreboard).

1. Cost effective: Is there an adequate financial return in relation to the costs?
2. Customer value: Does the end-use represent any value on top of its material cost?
3. Lumber grade: Does the product fit in light construction grade as in strength and appearance properties?
4. Marketable*: Is there an existing market, like Wild Play, or does the end-use be kept in stock and made according to specification?
5. Capabilities: To what extend is M&L capable of milling/producing the product?
6. Sustainable*: Is the material flow continuous?
7. Space: How much space does the end-use require?
8. Business model: Does the proposed end-use fit in with the current business model?

**Comments on criteria (as result of research*)

Client attitude towards waste manufacturing

For Canada natural resources are an essential part of their economy. Thus caring for nature or the environment is critical and related policies have grown into a basic requirement rather than a need. Local bars promote their compost programs, supermarkets have 'green' roofs and municipalities launch zero waste challenges. All clients relate to, implement own policies and cheer any effort reducing environmental impacts of others.

Market developments regarding waste manufacturing

Beside public and governmental pressure companies identify benefits such as 'feel good' feeling[12], reduced environmental impacts and sustainability not as direct impact on their business model, customers are not willing to pay a premium. They do see direct advantages in cost savings (in waste disposal, transport costs), the increased competitiveness in comparison with other industries and the potential of 'green' marketing as a promotional tool. According to market researcher Mintel about 12% of the U.S population can be identified as 'True Greens' [seeking and regularly buy so-called green products] another 68% can be classified as 'Light Greens', buying green sometimes.

Sustainable: continuous raw material flows

As a whole wood residuals are 'produced' in reasonable amounts. Saw dust, shavings and trim-ends could fill one container on a monthly basis. Waste quality however, for 'appearance' product groups rather than construction grades, material flows look doubtful. Apart from the earlier named daily shavings, saw slabs, project returns and salvage/heritage pieces material flows will be irregular

[11] Also see Appendix VI: Company visits [comments]
[12] Source: Appendix I: interviews outline & Appendix VI: Company visits [comments]

§4.2.2 Suitable end-uses scoreboard

End-use	1	2	3	4	5	6	7	8	Total
Points	30	20	15	10	10	5	5	5	
Components									
Treats		-20	+15		+10	+5	+5	+5	+20
Furniture	+30	+20		+10	+10	+5			+75
Community	+30	+20	+15	+10	+10	+5	+5		**+95**
Framing	+30	+20	+15	+10	+10			+5	**+90**
Salvage		+20		+10	+10	+5		+5	+50
Wild Play	+30		+15	+10	+10	+5	+5	+5	**+80**
Packaging			+15		+10	+5			+30
Shop			+15		+10	+5			+30
Products									
Chips		-20	+15	+10	-20	+5	+5	-5	-10
Shavings		-20	+15		+10	+5	+5	-5	+10
Logs	+30	+20	+15	+10	+10	+5		-5	**+85**
Solid wood									
Craft- art	+30	+20	-15		+10		+5		+45
Interior		+20	-20		+10			-5	+5
Exterior									
Frame	+30	+20	+15		+10	-5	-5	+5	+70
DIY	+30		+15		+10		-5		+50
Furniture	+30	+20	+15		+10	-5			+70
Garden	+30		+15	+10	+10	+5		-5	+65
Decorative framing	+30	+20	+15	+10	+10	+5		+5	**+95**

Table 1: End-uses scoreboard

Legend: **First priority** Second priority Third priority

§4.3 End-use description

This paragraph will describe the suitable end-use to Macdonald & Lawrence Timber Framing Ltd. Descriptions per product group, quantities, costs and dimensions.

§4.3.1 Suitable end-uses specific to Macdonald & Lawrence

The following suitable end-uses are deducted and ranked according to priority:

1. Community: All former 'waste' products; edged boards, beams, logs etc for community uses or fire wood.
2. Decorative framing: short/smaller lumber sizes for non structural purposes like knee braces or porches.
3. Frame: most frequent uses framing dimensions[13].
4. Logs/beams: pedestals, bollards, stools.
5. Wild Play: octagons, decking.
6. Furniture: table tops, table legs, doors, flooring, panelling, siding sizes.
7. Maintenance & Packaging: general repairs on and at the workshop, sawhorses, jigs, package covers and stackers.

[13] Based on projects; Birds eye cove barn, Sunset drive, Greg's RV, Cowichan martime centre and Aaron & Aubrey's.

Note: At all times there should be a clear distinction, in wood, between 'just' wood, heritage-/ conservation, appearance boards, interior and exterior use. In personal observations and interviews customer value could be considered higher when a timber piece is manufactured out of a heritage piece (sentimental value).

§4.3.2 Suitable end-uses: Quantities

This section confronts the available capabilities versus the required lumber grade, labour and machinery requirements per product group.

End-use	Required			Available			
	Grade	Labour	Machinery	Lumber	Grade	Labour	Space
Community	-	5 h.	3 h.	√	√	√	-
Decorative frame	-	5 h.	2 h.		√	√	12,500 bf.
Frame	NGLA	5 h.	2 h.		√	√	13,500 bf.
Logs/beams	-	1 h.	1 h.	√	√	√	8.500 bf.
Wild Play	NGLA	5 h.	4 h.		√	√	7,500 bf.
Furniture	-	10 h.	3 h.	√		√	8,000 bf
Maintenance & Packaging	-	1 h.	1 h.	√	√	√	2,000 bf

Table 2: Producing end-uses

Grade: Due to the 'creation' of products, lumber grades needs to be formulated from MacDonald & Lawrence perspective and has the NLGA No.1&Btr grade as a base[14]. Labour and Machinery estimates concern handling time and machine use per product group. For example 'creating' boards (a couple planks) have more handling and sawing time than frame dimension lumber (one 'big' beam).

Space: Although there is a total 12,000 square feet workshop + yard space an estimated 3,000 square feet is possible storage space. Main criteria were; accessibly, ground surface and height. 3,000 square feet allows a minimum of 9,000 ft.^{3} [250 m^3] with 3 ft. [1 m] heights to maximum 20,000 ft.^{3} [550 m^3] if stacked properly and ground surface can cope with the weight.

§4.3.3 Suitable end-uses: Costs

In order to estimate the costs of producing the following parameters are taken into account determining the costs. Available [theoretical] space is divided by 1.6 (a theoretical space is 'compact' timber however has 'air/space' incorporated in the stacks). The amount of lumber is multiplied by $770, - MBf. the average purchase price of poles/logs and sawn lumber. Work hour rate; $25, - machinery: $15, - per hour.

End-use	Costs			
	Lumber	Labour	Machinery	Investment
Community	$ -	$ -	$ -	No
Decorative frame	$6005, - [7,800 bf.]	$2250,-	$540,-	No
Frame	$6545, - [8,500 bf.]	$2500,-	$600,-	No
Logs	$4080, - [5.300 bf.]	$312,5	$187,5	No
Wild Play	$3540, - [4,600 bf.]	$1250,-	$600,-	No
Furniture	$3850, - [5,000 bf.]	$2750,-	$495,-	No
Maintenance & Packaging	$960, - [1,250 bf.]	$75,-	$45,-	No

Table 3: Estimated costs

[14] See §4.3 Suitable end-uses section Grade & Dimensions page 18.

§4.3.4 Suitable end-uses: Grade & Dimension

Product group	Grade description	Dimension indication
Community	'Look good grade' meaning; no loose knots, large/deep checks, no stain, properly stacked. Sellable for consumer eyes.	1'', 2'' boards in trade lengths [per foot], edged or un-edged, small sized logs/beams, poles, fence material briefly all ready consumer items.
Decorative frame	Disregarding NLGA No.1 is possible due to non construction requirements. More defects are allowed if not decreasing the saleability of the product	3'' to 6'' thick by 6'' to 8'' widths and 3' up to 8' lengths.
Frame	NLGA No.1	Frequently used standard frame sizes; 8''x8'' posts, 5''x8'' plates, 3''x4'' rafters,3''x5'' studs in 7' up to 20' lengths.
Logs	Minimal 1' Ø with bark, beams or smaller sizes posts joint together.	1' Ø, 12''x12'' beams or joint together smaller posts. In 1' up to 4' lengths.
Wild Play	NLGA No.1	Octagon spars, beams and decking [see Wild Play lumber specification on page 13.]
Furniture	Appearance grade, clears [edged grain, 75% defect free] rustic [small knots] no sapwood allowed [unless wane includes in piece] figured grain or colour schemes. And special attentions for salvaged/heritage pieces.	In accordance with timber frame identity thick/bulky or solid looking. In standard furniture length dimensions.
Maintenance & Packaging	No particular quality grade needed.	Small, thin leftovers sawhorses repairs, jigs, package covers and-/ or stackers.

Table 4: product group, grade & dimensions

§4.4 Individual business case: flooring

Macdonald & Lawrence Timber Framing Ltd. felt the need for an individual business case to verify found data on micro level. After a discussion, management chose to focus on flooring out of Douglas-Fir.

§4.4.1 Product description

- Flooring: Grade: Mixed Grain, Rustic (North America usually uses edge- or vertical grain)
  Type: Tong & Groove
  Widths: 3 ¼", 5¼" (VG) and 7"
  Lengths: 3' to 12'

Figure 11: Douglas flooring

Figure 12: Tong & Groove

§4.4.2 Production costs

The following parameters are taken into account: Lumber price = avg. purchase price, Milling/handling/loading=sawing time, time to transport to storage and loading before transport to secondary processing. Transport to secondary wood processing company and back again. Drying, moulding costs charged by the wood processing company.

Costs per MBF	Macdonald & Lawrence	Random Supplier
Lumber	$770,-	
Milling/handling/loading	$150,-	
Transport	$75,-	
Drying, moulding	$50,-	
Transport	$75,-	
Total price	$1120,-	$400 – $500,-
Total price [without lumber]	$350,-	

Table 5: Cost estimate Douglas fir flooring

Note: To set everything is the 'right' perspective: the MBF of M&L is theoretical. Within this comparison the Random Supplier is 'existing'- or 'real' MBF. If there is enough material (see §3.3 Timber output & Wood residuals section Quantity) including the fall-out (due to timber distortion) and no costs are calculated for storage, one could give an estimation of costs.

5. Organisation of wood residuals

The previous chapters showed Macdonald & Lawrence capabilities, characterize its wood residuals and found suitable end-uses for these wood residuals. This chapter organises the match between Macdonald & Lawrence's capabilities on one hand and the suitable use of wood residuals on the other. After indentifying chances and problems, the organization of the products and the benefits for both the company itself and its client are described.

§5.1 Organizational issues

After getting an insight in the companies important wood residual capabilities in relation with possible end-uses one could quick and explicitly filter and search essential issues in need to overcome.

'Chance' fields

- Multipurpose lumber [Douglas-Fir, WRC]
- Dimensioned lumber [less waste]
- "Small- or thin" kerf [less sawdust]
- Sawmill operator [experienced]
- Craftsmanship, handmade [core business]
- Project-based [unique, tailor made]
- Storage space [workshop premises]
- Mind-set [employee, customer attitude]
- Workshop location [marketing perspective]
- Benchmark [possibilities]
- 'Green', environmental awareness [trend]

'Problem' fields

- Dimensioned lumber [less flexible]
- Saw mill [misfit, set-up]
- Sawmill operator [1 present]
- Waste dimensions [small size & quantity]
- Material flow [not continuous]
- Construction grade [limited end-use]
- Storage/stock [inefficient]
- Lumber storage [degrading]
- Sizes [tailor made, no standards]
- Unique selling point [difficult]
- Competition [intensive]
- Location/island [transport costs]

§5.2 Wood residual management system

As shown in §5.1 Organizational issues certain 'problems' need be overcome so products could lead to customer- or added value. But besides this incentive, a management system that monitors wood residuals is desired. Furthermore a system is designed to streamline[15] current material flow systems.

A wood residual system can be expressed as the organisational structure (consisting of a process, procedures and instructions) needed to implement wood residual management. The overview of the wood residuals process could be viewed in:

- Appendix VII: Wood residual system process*: a total overview of the business process*.
- Appendix VIII: Wood residual system procedures*: explanation per business activity*.
- Appendix IX: Wood residual system documents: *documents used in the business activities*.

To ensure that processes, needed for a wood residue management system, are established, implemented and maintained, management should appoint a member of the organisation having the responsibility and authority required16. This role (named shop manager in Appendix VIII: procedures) has the responsibility for developing, revising and implementing wood residue standards and policies in the organisation. This position is the link with management and mainspring of team motivation.

[15] As part a new set of rules for storage in the yard and workshop are made, see Appendix XII: New yard + Workshop lay-out.
[16] See ISO 9001:2008 [Quality Management] *Indicator 5.2.2*

§5.3 Macdonald & Lawrence benefits

Due to the hard conditions, as elaborated in chapter 4: Possibilities for added- or customer value from M&L's wood residuals[17], the direct benefits for Macdonald & Lawrence are limited to the following:

- Less waste disposal service costs; by [re] using, wood residuals, paid disposal could be reduced to virtual zero. For example following cutting 38 octagon spars for Wild Play Kelowna18 resulted in a full 10 yard container which costs the company $500 a month for pick-up, disposal and renting an empty one. All neighbouring companies sell their fir saw dust for $250 to $350 per container. A simple calculation: instead of a $6000, disposal bill an extra $3000, - receiving's could be made.
- 'Wasted' labour & production costs; in interviews and observations personnel 'waste' time to find 'tally' to frame or move existing stock around to create framing space. For example; a group of 5 carpenters work average 4 months per project is 3 project a year. Having 30 employed carpenters makes a total 18 projects. 2 full days 2 carpenters of tally search or rearranging the yard per project at $25 per hour 10 hour days makes $18,000 bill which could be saved on a yearly basis. Of this total bill a significant share could be saved.
- 'Soft' benefits: Improved workplace safety: employees are less likely to trip, fall or cause machine malfunction. Possible extra revenue: if products sold extra turnover is realised. Improve work efficiency and productivity: Employees are less likely to be moving stock, wood residuals or waste.

§5.4 Customer benefits

Due to the hard conditions, as elaborated in chapter 4: Possibilities for added- or customer value from M&L's wood residuals, and thus extensive market research only a brief customer research is executed. The following customer benefits are identified:

- Green, environmental and ecological marketing: opportunities to differentiate from existing marketing seeking, and challenge, to provide a substantially different perspective. Address in a green, environmental way the ecological and social realities in the current market environment. In addition of the 4p's, the 3p's of Public, Partnership and Policy should be added to the marketing mix. Describing 'green' affiliated people/groups, initiatives and corporate policies.
- Positive community relations, image and goodwill: By waste reducing policies or compliance to local waste challenges companies accepts civic responsibility and takes active interest in the well-being of its community. Community involvement builds public image, employee morel and good which contribute to long-term success

[17] Also see §6.2 What could be possibilities for customer- or added value from Macdonald & Lawrence Timber Framing Ltd. wood residuals?
[18] Also see Appendix VII: Lumber specification Wild Play Kelowna, BC

§5.5 Implement, evaluate and monitor

The successful implementation of revised strategies- or business policies requires four critical steps;

1. Integrate the new strategy in the current business processes.

To achieve this, time and training investments in the systems, corresponding to the previously designed in paragraph 6.3 inside-out: residue process described waste process, procedures and instructions, are necessary. A *top-bottom* approach should be sufficient, where management shows and appoints wood residuals system to the shop manager who in turn briefly instructs the working carpenters.

2. Execute the new policies suitable to the organisation.

The company's strong heterogeneous, unique and 'tailor made' approach conflicts with a homogeneous, commodity production way of thinking. To be able to execute the procedures right, MacDonald & Lawrence should approach product development/production as *project*. Inbound timber should be assessed and out of this timber a certain amount of products are manufactured. Time, tools and carpenters should be allocated to this project exactly as current business procedures.

3. Actual execution needs to lead to customer- or added value.

In order to lead to customer- or added value products produced need that typical 'tailor made', handmade and craftsmanship character. This requires a solid base, for working with 'waste' [implying more handling, 'dirty' lumber, misfit dimensions etc] among employees. Brainstorming with- or appointing a single member to craft certain products, close to their speciality, increases willingness, motivation and triggering [- or appeal to] the sense of creativity.

4. Evaluate and control the executed activities.

To be able to evaluate and control the progress again four steps should be taken into account:

1. Formulate performance criteria [for later benchmark]
2. Information collection [per criterion]
3. Analyse found information [indentify results]
4. Evaluation audit

A simple but fast and easy to use instrument to control and evaluate is a *balanced scorecard*[19].

[19] Kaplan, R.S., en D.P. Norton, Translating strategy into action: the balanced scorecard, Harvard Business School Press, 1996

6. Conclusions

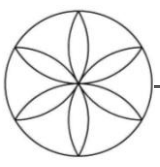
"What could be suitable end-uses for Macdonald & Lawrence Timber Framing Ltd. wood residuals, organised leading to customer- or added value?"

The use of Coastal Douglas-fir & Western Red Cedar makes a wide range of end-uses possible. In combination with the positive attitude and Macdonald & Lawrence Timber Framing Ltd.' craftsmanship this should result in customer- or added value. However due to the quality grade, appearance- or fine carpentry etc in brief 'higher' end-uses are ruled out. In addition Macdonald & Lawrence is a non-traditional business and its clients require unique, individual and tailor made products. 'Labour', 'raw material' and 'resources' are allocated to every project. Wood residue likewise comes in all size and shapes. Within this context Macdonald & Lawrence' carpenters do not have the time- nor the pay check for handling, processing or stocking these unique wood residuals. The end-uses should be simple, 'low' grade and easy to handle:

- Community: A product which posses abstract values rather than its tangible product. It is the combination of all MacDonald & Lawrence's wood residuals for 'community' or 'privates'. Being able to sell local people firewood, [un] edged boards for their garden or other do-it-yourself jobs for instance or helping out the local community organising a fair. Rooted into the community, enhancing brand awareness and getting rid of wood residuals at the same time.
- Logs: or large dimension beams- or blocks to use in public spaces such as parks for decoration, in retail shops as window dressing, art galleries as pillar or just as a stool
- Maintenance & Packaging: When timber framing timbers need to be lifted to level out, frames need bundling to be send to the site and wood residuals need stacking. There is a need for jigs, sawhorses, stackers and covers for internal use.
- Disposables: following the neighbouring companies, the small, small pieces and- or timber which does not fit in the above mentioned product groups should be grinded to chips and be sold by the container including the sawdust- and shavings.
- Craftsmanship: Every once in a while a magnificent piece of wood passes along, when cutting a custom beam, shaping a timber frame or replacing lumber in conservation projects. Throwing pieces with beautiful grain- or an extraordinary pattern in the trash is a waste in more than one way. These one of a kind pieces deserve to be transformed into doors, tables or counters for example, products which catch the eye. Furthermore one of the carpenters could be appointed- or volunteer for such a project, exhibiting his- or her skill.

When taking a closer look at the organisation of particularly the wood residuals several shortcomings need to be addressed. Macdonald & Lawrence tackles every 'problem' individually resulting in irregular raw material flows (read wood residuals), no automatic dust/shaving disposal- or 'waste' protocol as a whole. Proposed products need these matters to be overcome. This will not only be positive to the proposed products, the firm and its relations could all benefit by implementing:

- Wood residuals as individual project: None of MacDonald & Lawrence customers required that standard product, all wanted that specific, tailor made and unique solution for their needs. Refurbishing wooden bridges, building high-end houses and canopy entertainment parks all need that bespoke fit, allocating the right people, tools and time to each stand alone project. Within this business model standard production lines do not fit in, not in the workshop [as in space and set-up] and in the mind-set of its employees. Wood residuals should be organised as such.
- Wood residuals waste management system: Wherever there is no waste protocol in effect, lumber is all over the place and trim-ends end up in the same bin as sawdust and possible valuable timber piece deteriorate poorly stacked. Setting up a waste management system for wood residuals results in cost reduction, efficiency and work place safety benefits for MacDonald & Lawrence and 'green' marketing, image and goodwill opportunities for its relationships.



§6.1 What are Macdonald & Lawrence Timber Framing Ltd. current lumber input, timber processing and wood residuals output capabilities?

The use of Coastal Douglas-fir makes a wide range of end-uses possible. But due to the construction grade, appearance- or fine carpentry are ruled out. Uses that do not require direct engineering and a more rustic appearance seem likely. 65% of the timber intake has been dimensioned to size and thus waste timber components could be made from the 35% logs, pole intake, with special attention for Wild Play entertainment parks.

Most valuable, in the form of solid wood, 'waste' is handled by an experienced saw miller who is able to push the mills to their maximum abilities. His decision making and the octagon shaped beams, demanded by Wild Play, leave 'space' for extra cuts and thus possible timber waste components.

Shavings, sawdust and trim-ends are not automatically dissolved resulting in a [paid] mixed waste dump. The same occurs with 'waste' which represents the highest possible customer value; 'nice' cut-offs, project returns and valuable heritage timbers. Timber pieces are randomly set- or laid aside without proper preserving methods.

§6.2 What could be possibilities for customer- or added value from Macdonald & Lawrence Timber Framing Ltd. wood residuals?

As mentioned earlier Douglas fir and Western Red Cedar are multi purposes wood species but current purchase specifications limits possible end-uses to 'low grade' outside use. This in order to reduce handling costs, maintain margins and customer value.

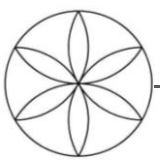
Employees are enthusiastic about re using or re manufacturing the companies' wood residue. The practical side is that employees are tripping over and have no clue what to do with wood residue due to a lack of protocol. This problem could be dissolved by using the space surrounding and in the workshop more effectively. Framing requires vast amounts of space which is available if there was a ground plan for stocking, properly stacked wood residue.

Current wood residue does not represent significant value or continuous material flows resulting in added value. To reduce the impact of these factors to a minimum, creating a stock is desired. Because the value of wood residue is hard to measure by economical methodology focus should be on the ethical, philosophical client benefits rather than direct impact on business profitability.

§6.3 How could Macdonald & Lawrence Timber Framing Ltd. organise wood residuals, if customer- or value added products are found?

In order for MacDonald & Lawrence to organise its wood residuals leading towards customer- or added value, results from the confrontation between §6.1 and §6.2 [organisational issues] need to be overcome. Assessments of the waste structure and current workshop arrangements required specific use of the limited available space, as shown in appendix I, II. Due to the lack of wood residual protocols a wood residual system, a framework of process, procedures and instructions, must be designed to lead to added- or customer value.

If MacDonald & Lawrence implements [and evaluates!] this previously mentioned wood residuals system, as designed in tables 11 until 17, in combination with their key strength [project based, tailor made] and taken customer requirements in account, the given possible products produced should result in short-term decrease waste disposal, labour and production costs. In the long run results are increasing safety, extra revenue, and efficiency benefits specific to MacDonald & Lawrence and on the other hand creating 'green' marketing, enhancing image and goodwill opportunities for all relationships



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Contacts

▪ Gordon Macdonald	Macdonald & Lawrence Timber Framing Ltd.
▪ Steve Lawrence	Macdonald & Lawrence Timber Framing Ltd.
▪ Chris Tucker	Macdonald & Lawrence Timber Framing Ltd.
▪ Jeff Fraser	Macdonald & Lawrence Timber Framing Ltd.
▪ Present employees	Macdonald & Lawrence Timber Framing Ltd.
▪ Angelo Mansueti	Victoria Truss
▪ Mike Taylor	Seasonal Cedar
▪ Murray Logan	Dogwood Lumber
▪ Alexander Deather	Canadian Bavarian
▪ Owner	S&A Wood processing
▪ Owner	Millinear Lumber
▪ Owner	Cowichan millworks

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Appendix

Appendix I: Interview outlines

- Introducing myself & thesis research
- General inquiries in relation to work, hobbies
- What kind of job/ company (description)
- How frequent and where do wood residuals occur
- How do you handle wood residuals
- Which quantities (if applicable which quality)
- How do you perceive wood residuals
- feeling towards the use of residuals
- is their market for residuals based products
- how would you market residuals
- which products which residuals as base would you think of
- which products which residuals as base would you recommend
- How would you organize these products

Appendix II: NLGA Construction timber No1. & Btr

Rate of growth	Medium in DF
Pockets	Large
Shakes and checks	Several up to 2' long, none through
Skips	Hit & miss – 1/16" maximum 4' length
Splits	Short
Slope of grain	1 in 10
Stain	Allowed in any amount
Wane	¼" thick x ¼" with in addition ½" thick x 1/3" width x ¼" length in 5% of pieces
Pin holes	30 per square feet worst face
Grub or Teredo holes	Twelve ¼" holes per inch of hole permitted measured of worst face
White specks	Not allowed
Honeycomb	Not allowed
Peck	Not allowed
Unsound wood	Not allowed
Knots	Sounds, firm, encased and pith knots allowed if tight and well spaced ¾" up to 3 ¾" in widths 3" to 12".

Appendix III: Lumber specification Wild Play, Kelowna BC

Spars	Bottom: Ø 14" / 35 cm	Top: Ø 9½" / 24 cm	Length: 20- 65' / 6- 19 m.
Poles, beams	2½" / 625 mm 3½" / 875 mm 4½" / 1125 mm 5½" / 1375 mm		Length: 6- 9' / 180- 270 cm
Decking	1" / 25 mm x 5½" / 1375 mm		Length: 5- 6' / 150- 180 cm

Appendix IV: Task description: sawing Wild Play octagon shapes

Task: Making 3½" by 3½" octagons 20/ 9' lengths
Making 5½" by 5½" octagons 50/ 6.6' lengths
All out of present wood residuals, two men job + saw miller

Day 1

07.00	Start day
07.30	End briefing
08.00	
08.30	
09.00	
09.30	End sorting tally, chainsaw on length and transport
10.00	
10.30	End setting up mill/re saw + break
11.00	
11.30	Made 18 octagon pieces 3½" diameter
12.00	
12.30	Made 32 octagon pieces 3½" diameter
13.00	
13.30	End cleaning-up, setting up saw for 5½" diameter + break
14.00	
14.30	
15.00	
15.30	
16.00	
16.30	Sawing, change of saw blade + break
` 17.00	
17.30	End day

Day 2

07.00	Start day
07.30	End briefing
12.30	Cutting octagons on exact lengths, packaging, bundling, clean-up and waste handling

Appendix V: Evaluation of sawing Wild Play octagon shapes

Tally search	+ seems enough material present, good (large) dimensions available
	- material not sorted stacked, not covered from weather, laying everywhere
Transport	+ possible man handling
	- unable to reach with forklift due to mess
Cut freeze	+ quick chainsaw, little waste (just dust), small off cut direct waste
	- chainsaw safety, sawdust in open air,
Cut octagons	+ a lot of small size waste (stackers?), quicker sawing is possible (but less precise)
	- a lot handling time (turning), no stackers present, no convenient way waste handling
Handling	+
	- saw destruction (moisture contents), labour intensive, too much muscle handling
Packaging	+ looks good, stacked with direct waste
	- move to different place for packaging
Waste	+ positive mindset
	- not significant in quantity, no instructions or management regarding residue

Appendix VI: Company visits [comments]

S&A Wood processing [doors, windows, custom milling] 4 Employees

- Dust and shavings sold, circa 30 yards a month -> there is a fair demand of KD dust/shavings
- Smaller trim ends are given away within the companies as firewood
- All machines are connected to main pipe and blown into container outside. Rest is collected and thrown in.
- Have a small grinder which they do not use anymore

Victoria Truss [truss manufacturer, 3 locations in Canada] <15 Employees

- Everything that leaves is accounted for (for HQ)
- 1 bin for only sawdust cirica $250,-
- 1 bin for firewood along the road, take away
- Small ends as 3' re manufactured
- Currently installing a finger joint machine to make standard 2x4 and 2x6 for wall beams
- Sawdust will eventually be sold as pellets (company policy)
- Zero waste, waste manufacturing etc is company policy and part of a continuous improvement program (time and money are allocated)

Millinear Lumber [small re manufacturer, band saw, planner/moulder] 3 Employees

- Recently bought a grinder at an auction for $2400,-, firewood piece where given away and small piece remained, perfect to grind….more spave
- All machines connected and dust is blown into outside container
- All green lumber: fir, cedar and hemlock
- Pays somebody to get and rent the container in return receives "a penny" for the chips, break-even

Cowichan Valley Millworks [custom cabinetmaker] 1,5 Employees

- 6 yard bin a month including plastic
- Uses mainly plywood
- Smaller pieces incorporated in cabinets
- Dust is sucked into small dust collector
- Everything goes into the waste bin due to the limited waste

Canadian Baverian [custom saw- planner mill] <15 Employees

- 'European' residuals handling
- Used to heat drying kilns, if more used for pellets
- Everything handled automatic

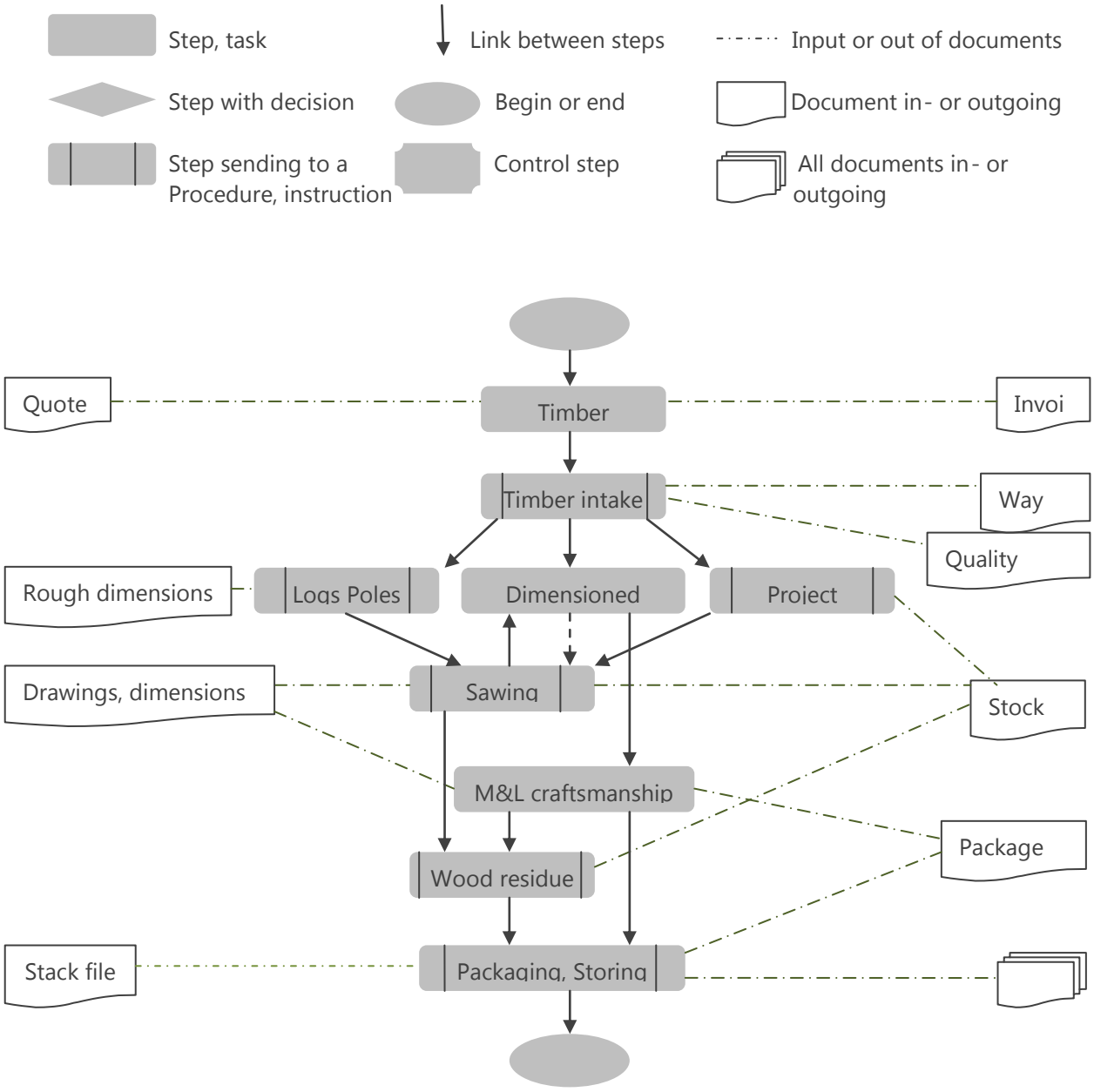
Dogwood lumber [custom mill, wood mizer] 5 Employees

- No automatic handling
- Very small mill + site
- Dust is left and mix in soil
- Yield is increased by cutting planks and sold individually

Seasonal Cedar [custom mill, wood mizer] 3 Employees

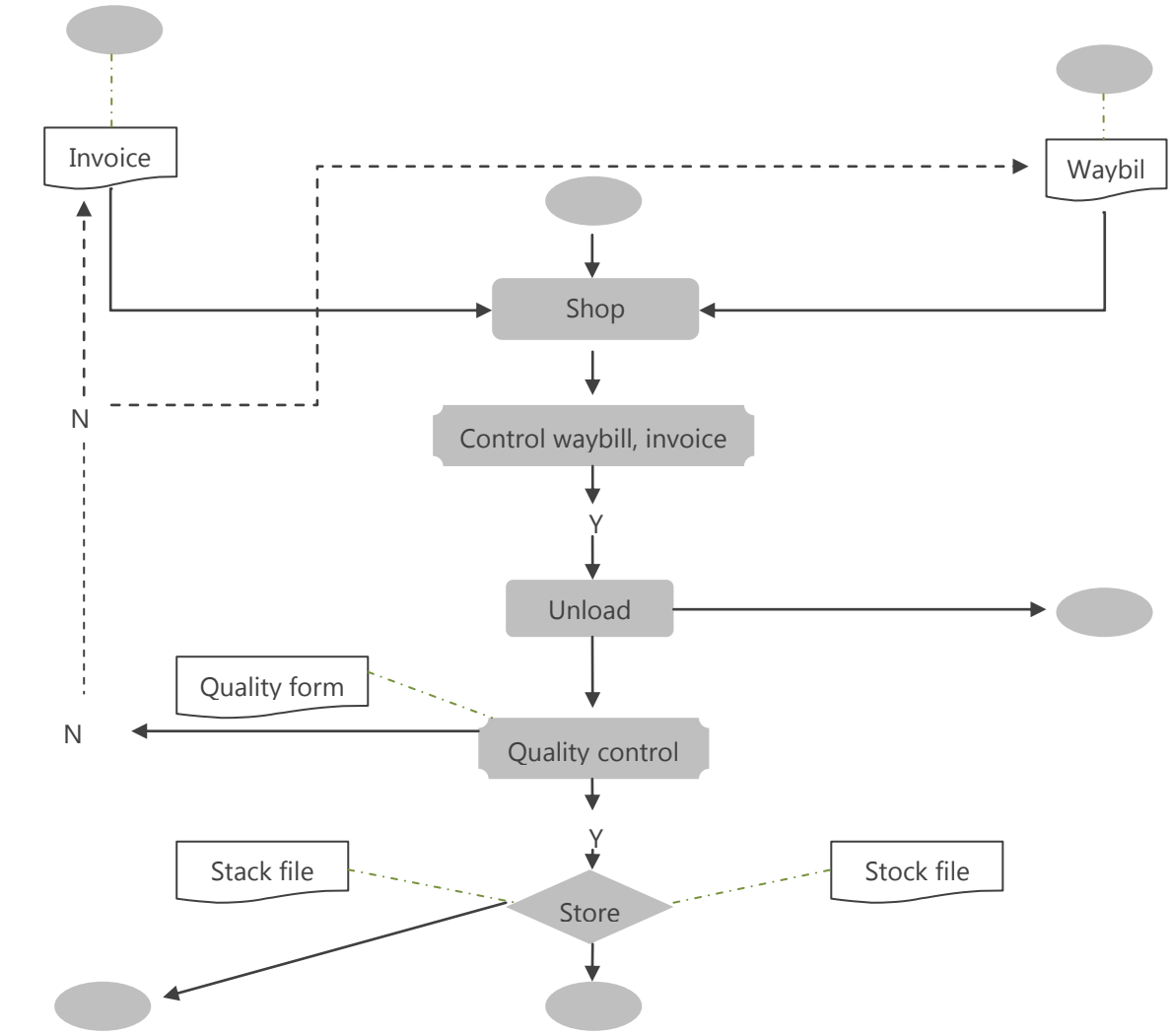
- No handling, thrown on a big pile and the neighbour picks it up (big chip plant)
- Very small mill + site

Appendix VII: Wood residual system: process

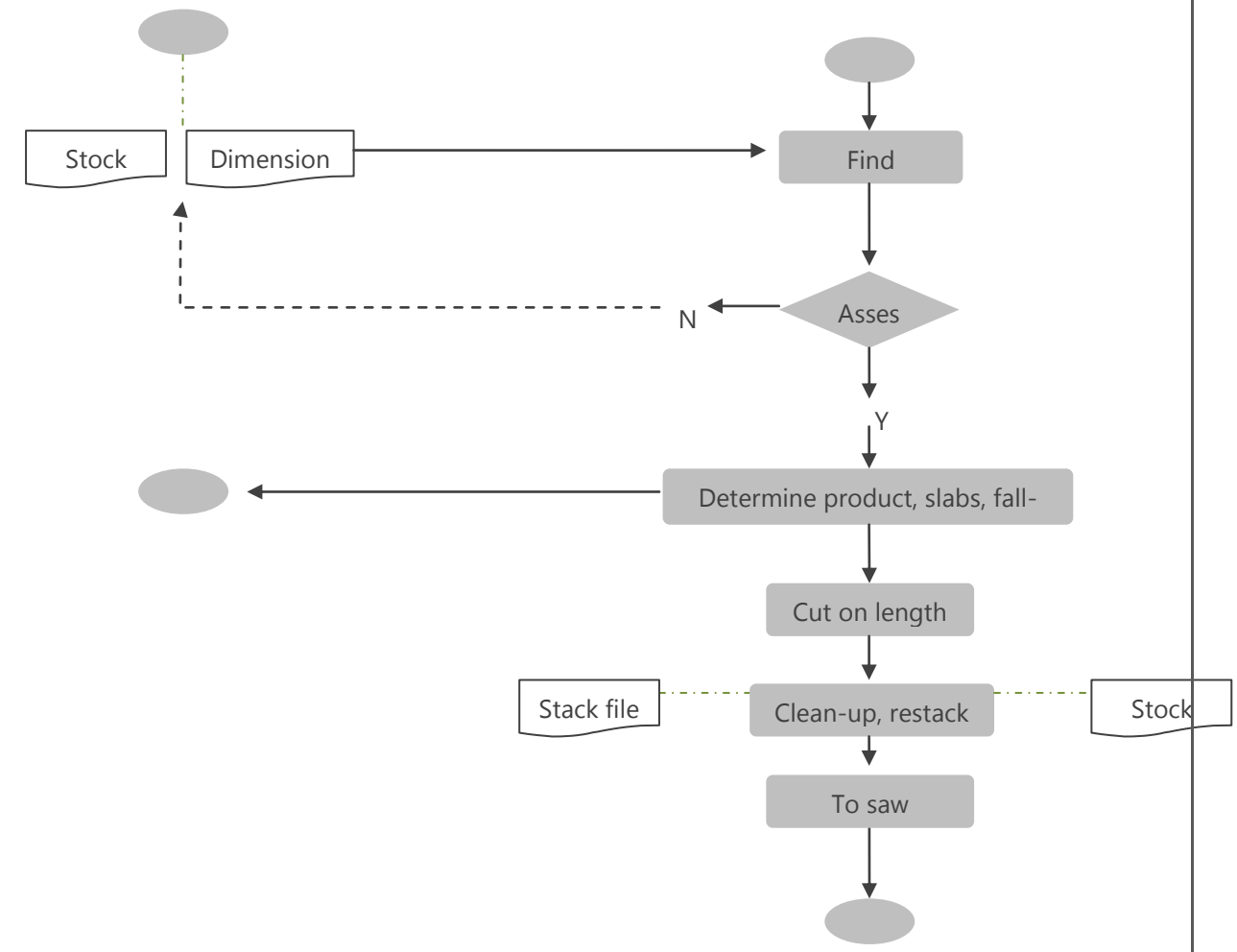


Appendix VIII: Wood residual system: procedures

Timber intake procedure

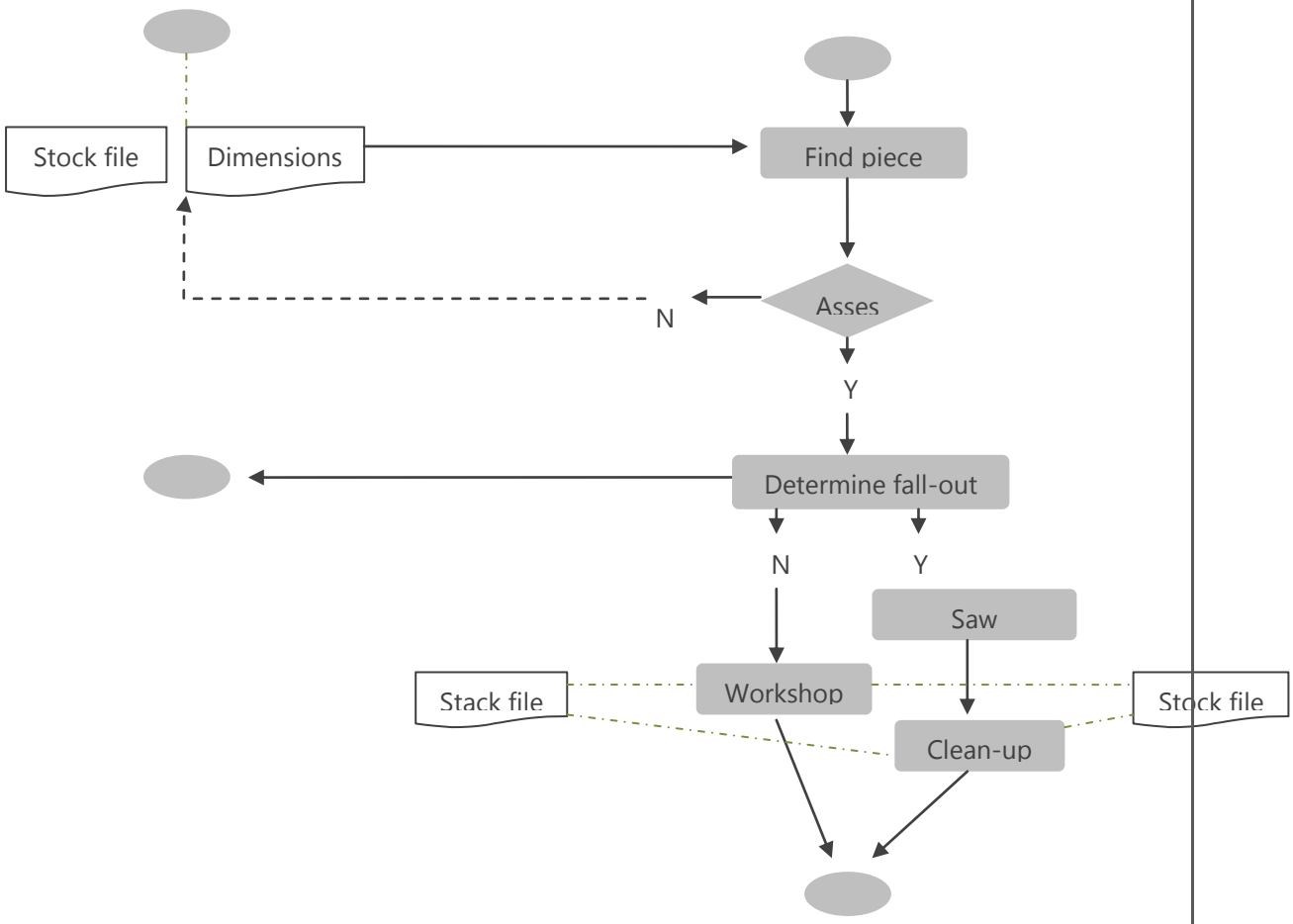


Log/ pole procedure



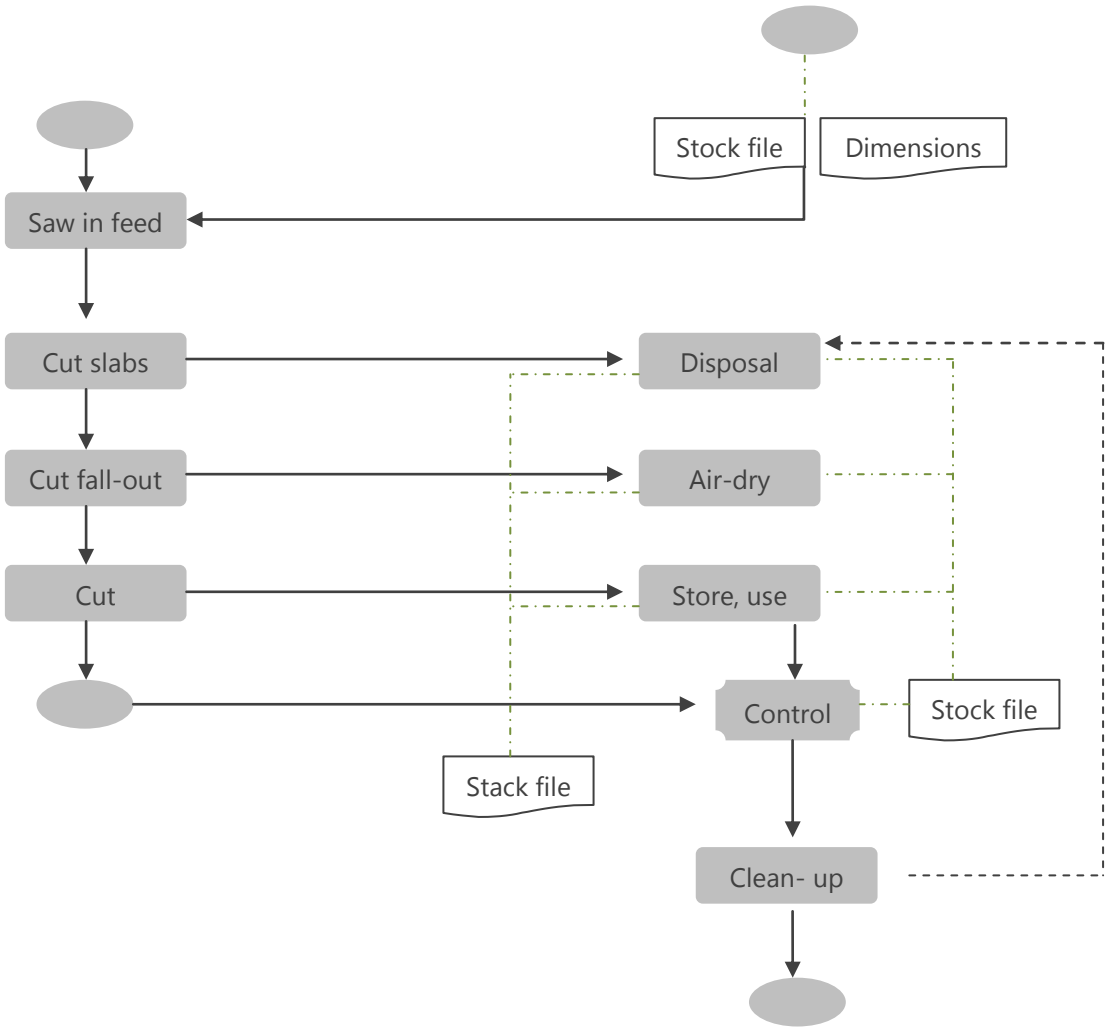
Project return procedure

Management | Carpenter



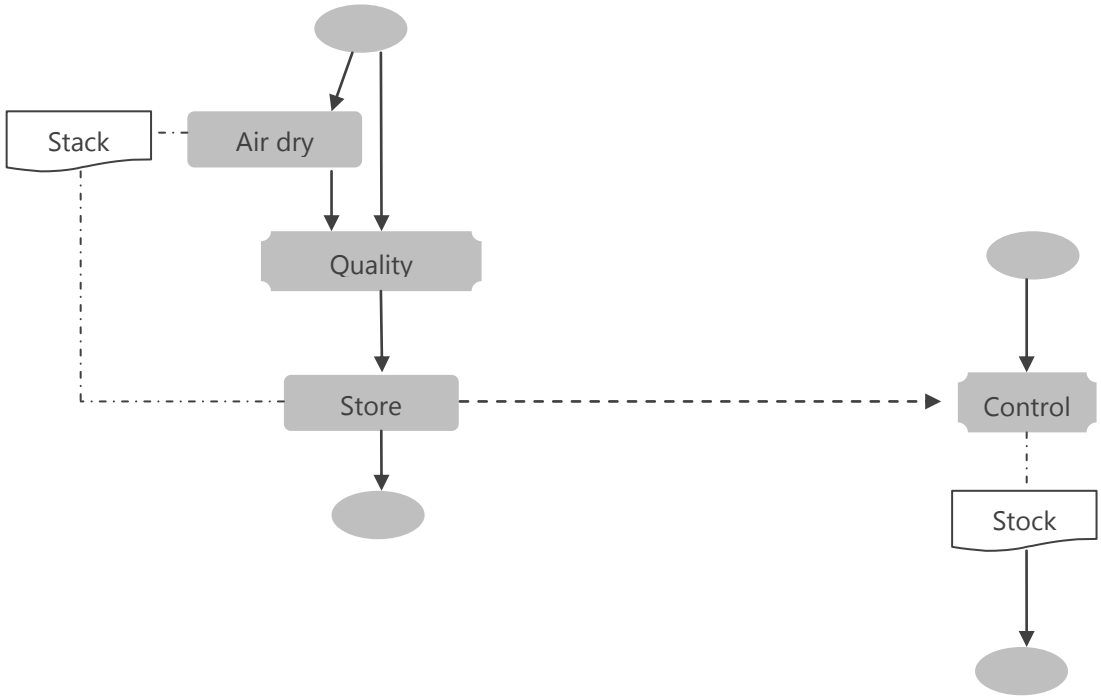
Saw procedure

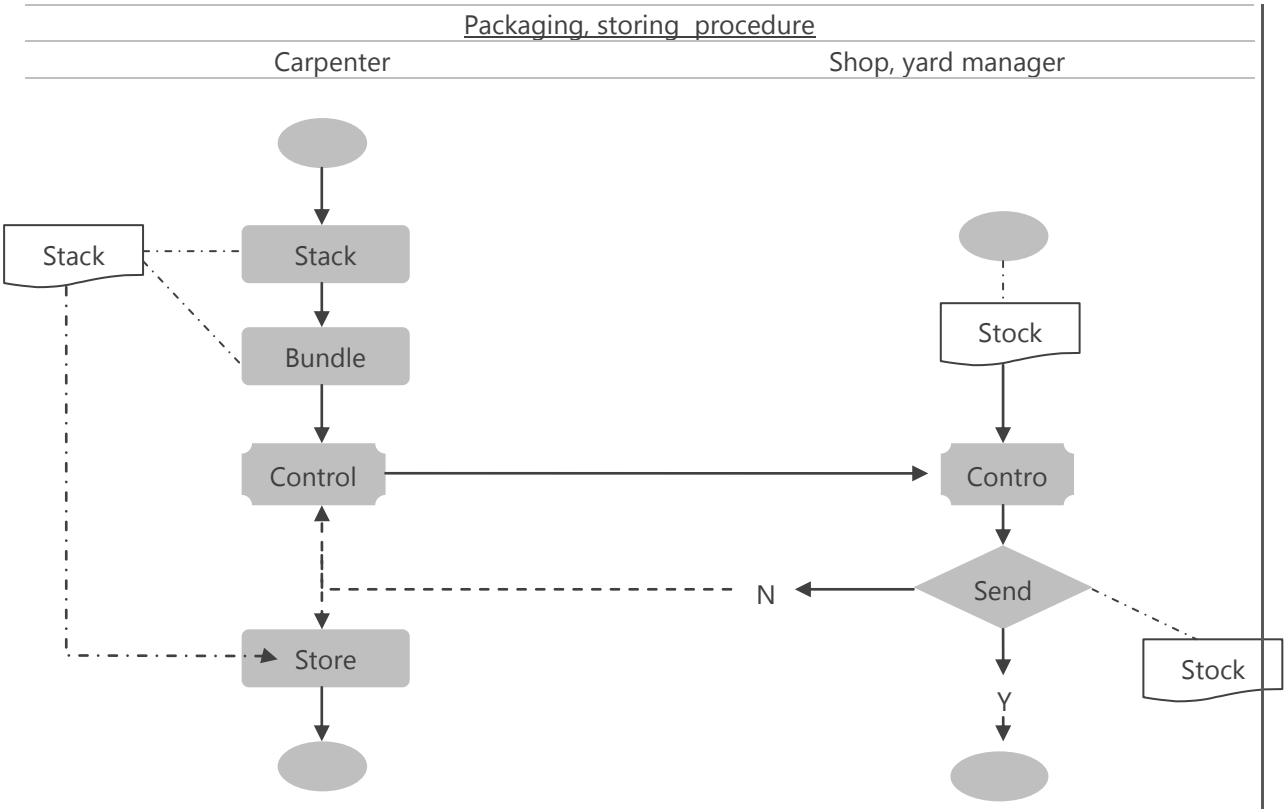
Saw mill	Carpenter



Wood residuals procedure

Carpenter	Shop, yard manager





Appendix IX: Wood residual system: documents

- Existing external documents: quotation, invoice, way bill.
- Internal existing internal documents: Rough sawing dimensions, frame drawings, finished dimensions, package list.
- Internal revised documents:

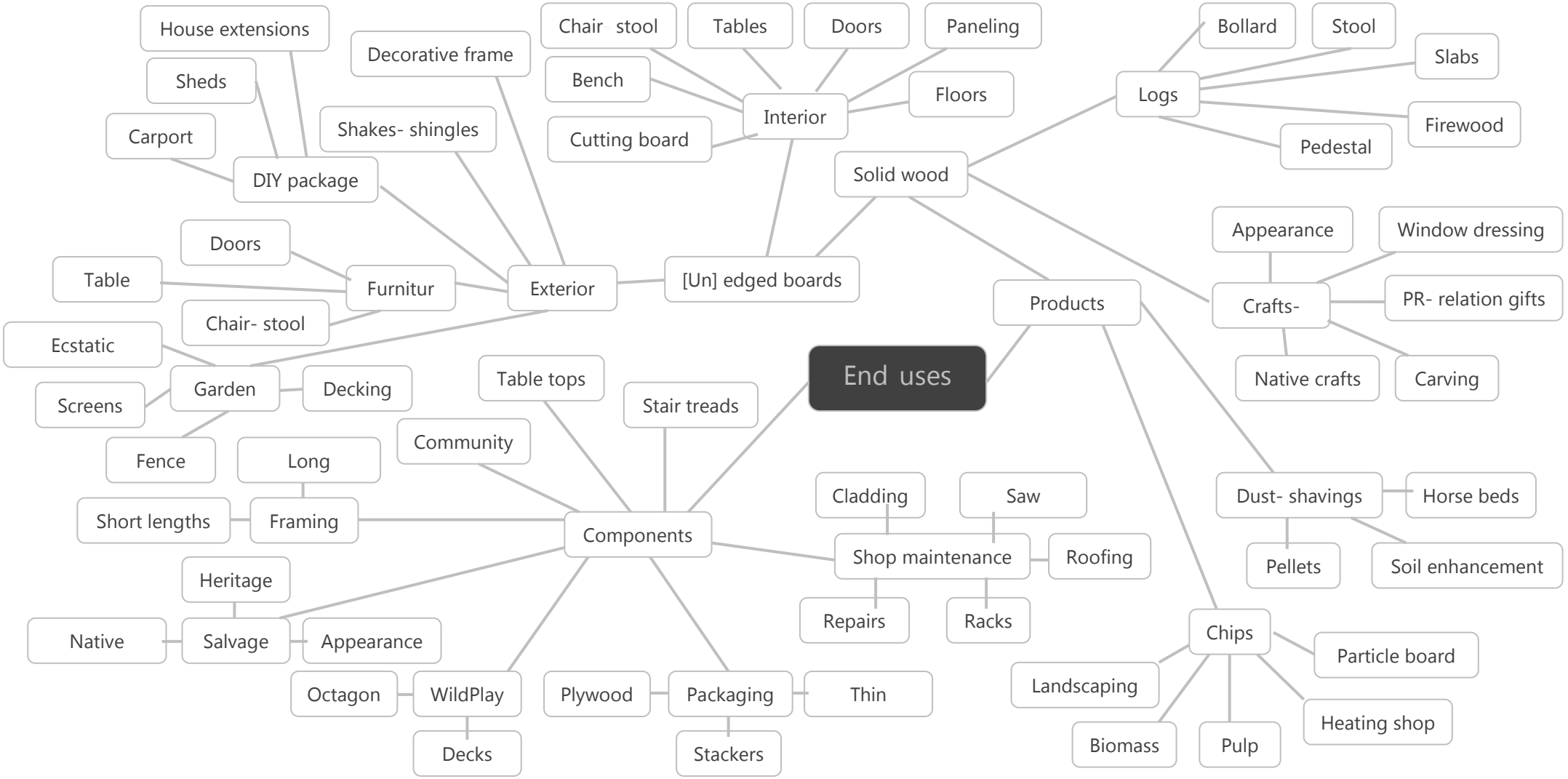
One sheet with the possibly to comment on inbound timber which consists of 3 sections:

1. Quality control: remarks about the timber quality focus on colour, producing defects and packaging.
2. Stack file: instruction on how, where and what to stack properly preventing later timber distortion.
3. Stock file: section to show before use, where certain pieces are and after use, in which parts timber has been divided and where these 'fall-out' parts are.

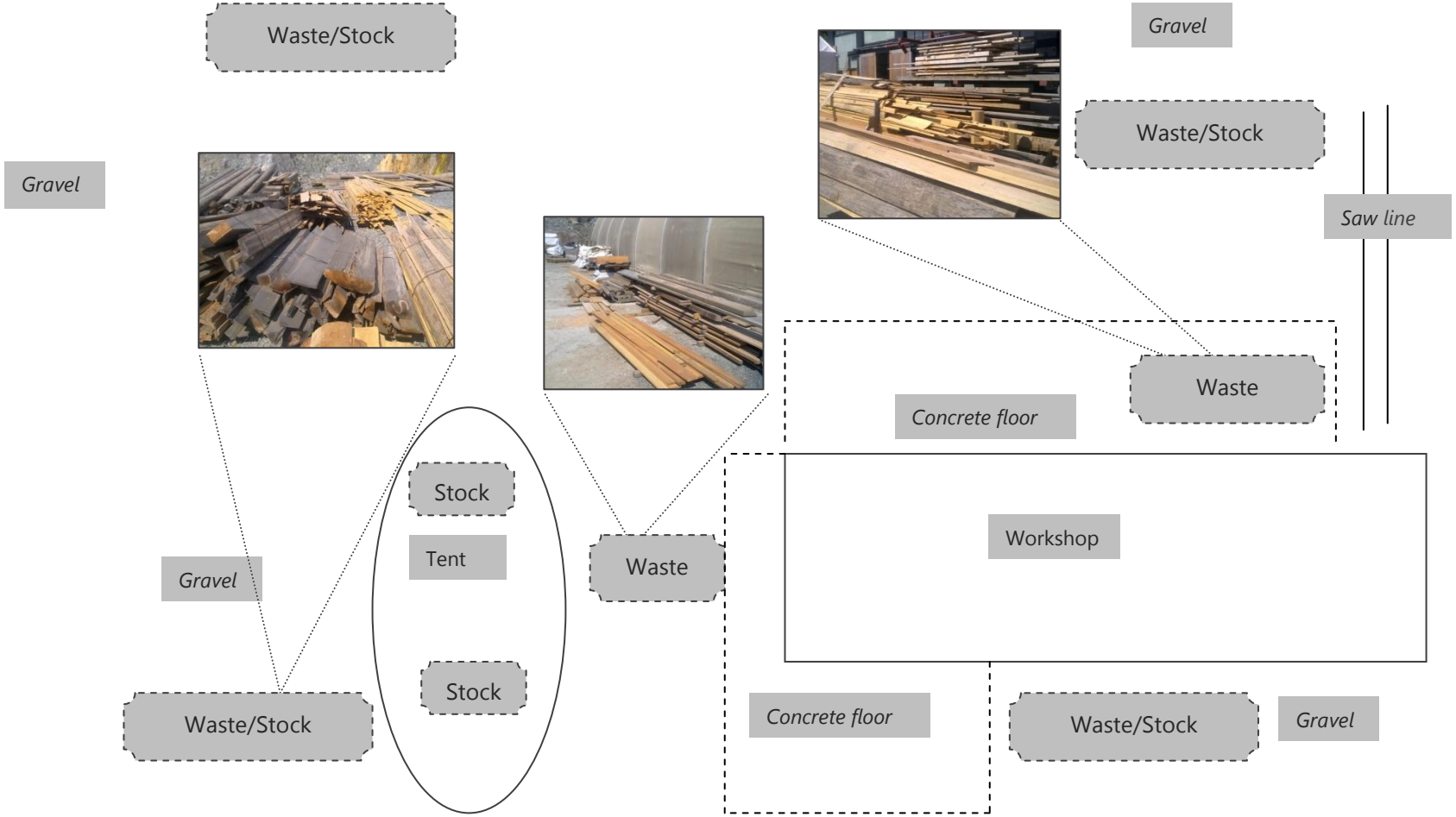
When completed and -/ or fully updated the document should be handed in to shop, yard manager to be uploaded in order for the design department/management to know what pieces are available for concept drawings.

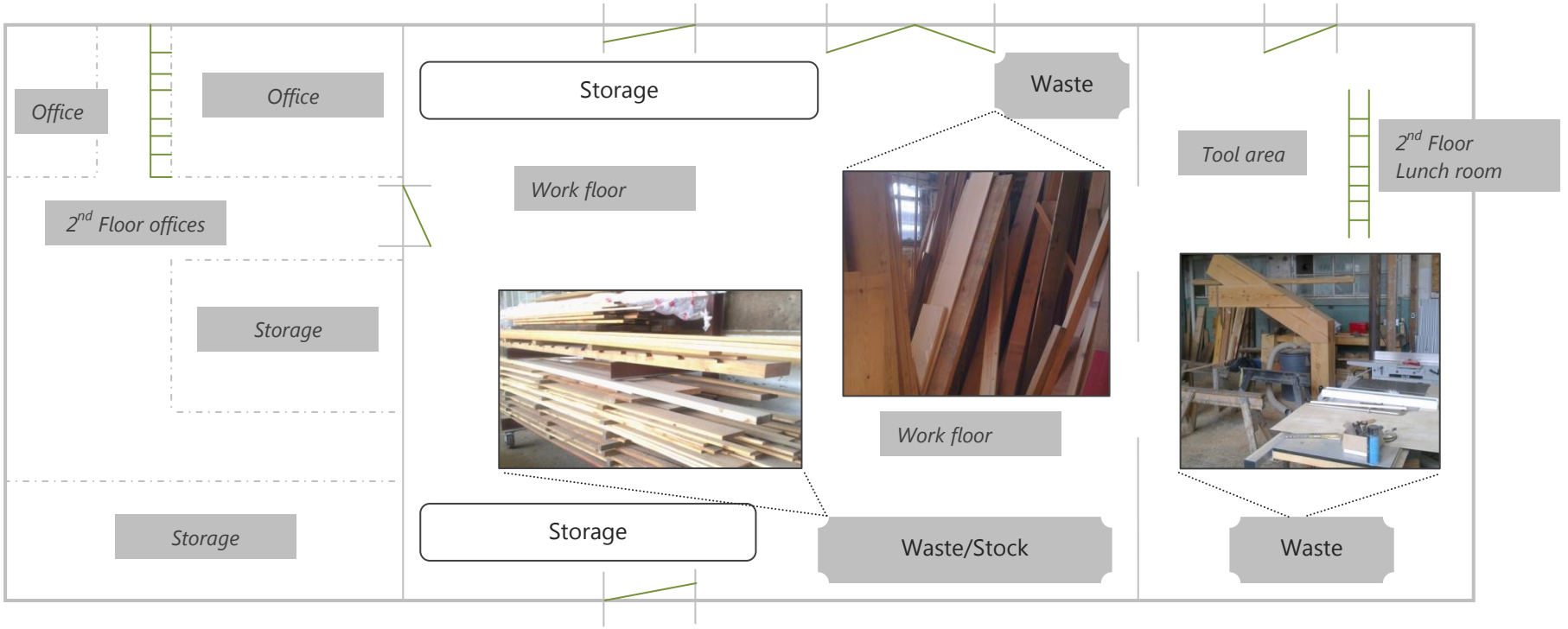
Macdonald & Lawrence
Timber Framing Ltd.

Appendix X: Mind map possible end-uses



Appendix XI: Yard & Workshop lay-out

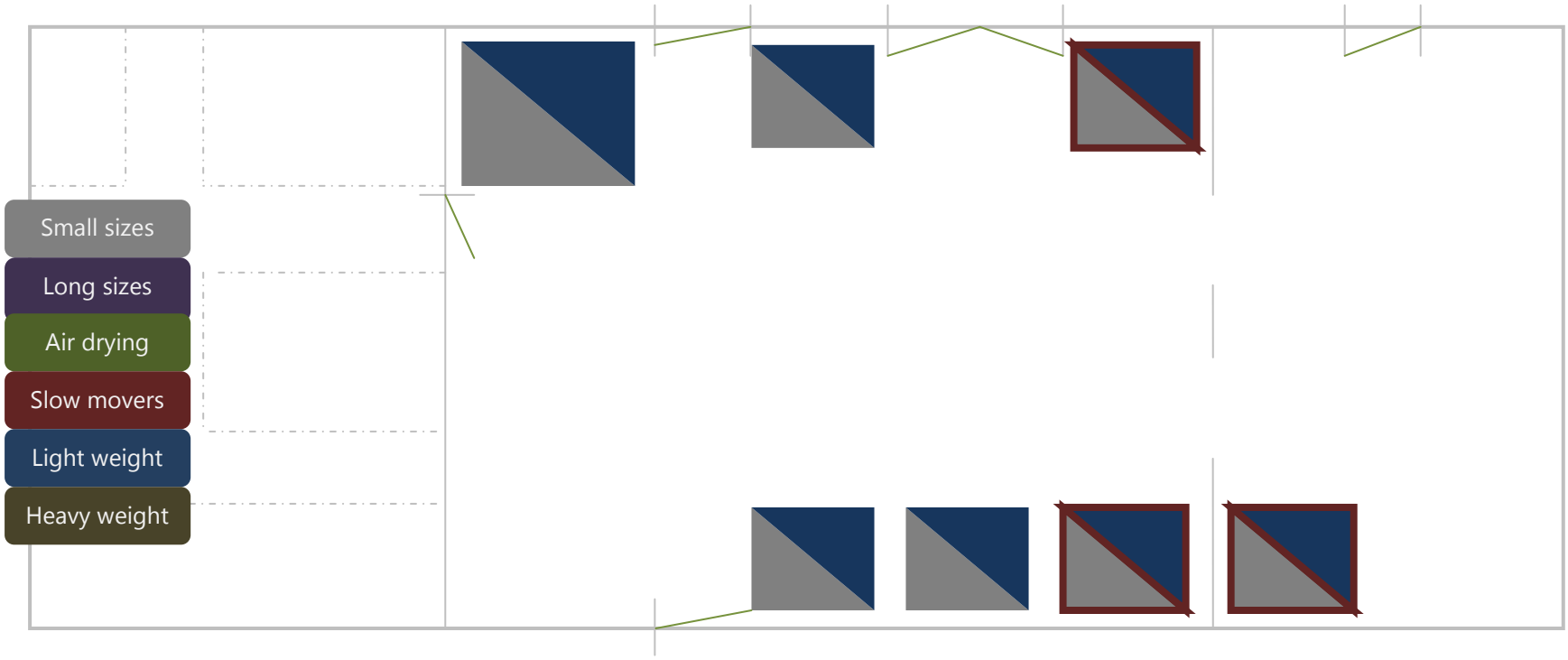


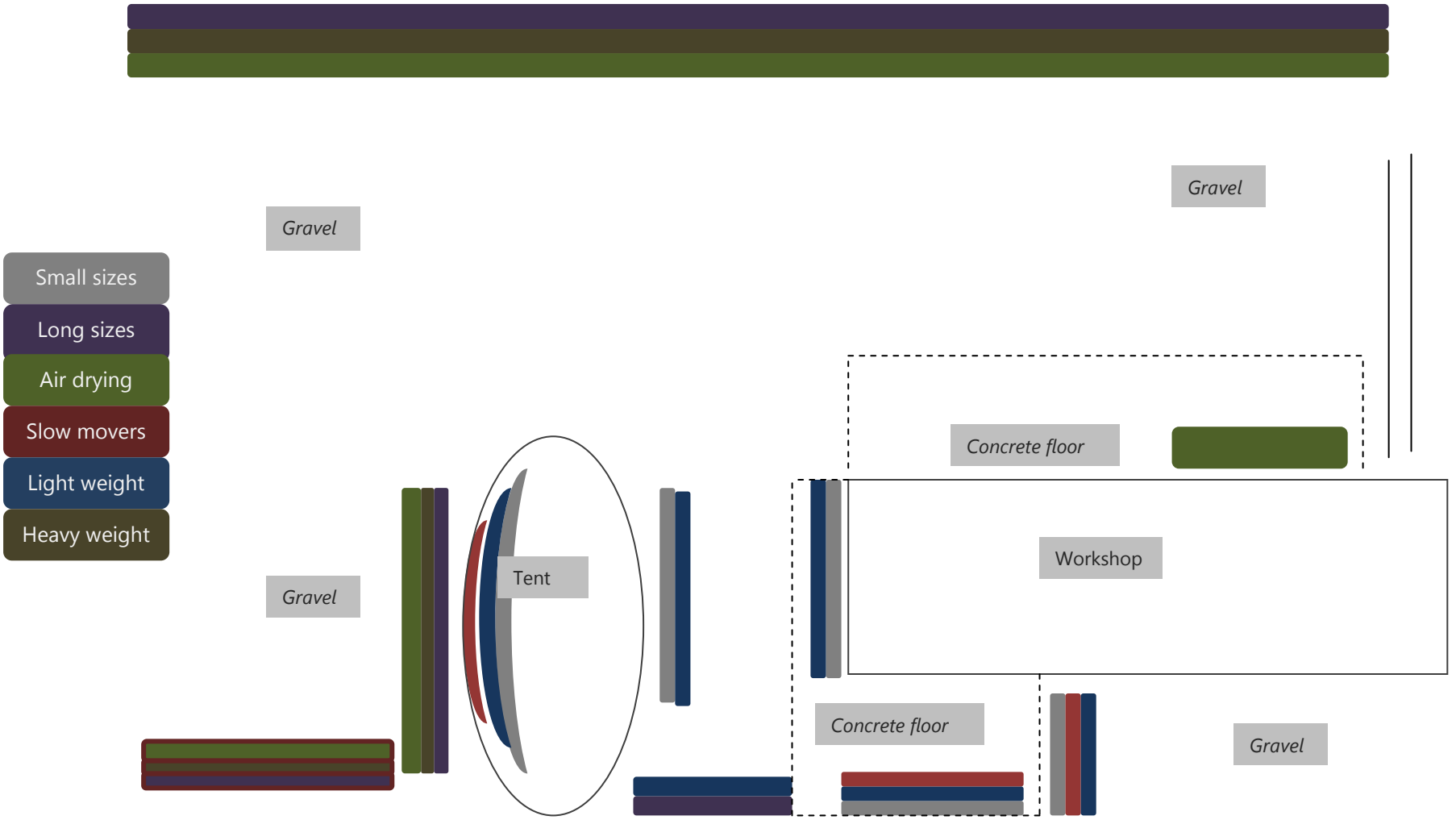

Office
Office
Storage
Waste
Tool area
2nd Floor
Lunch room
Work floor
2nd Floor offices
Storage
Work floor
Storage
Storage
Waste/Stock
Waste

Appendix XII: New yard + workshop lay-out

Five key areas were assessed:

- Surrounding workshop: A paved strip of 1,750 square ft at the east and north side of the workshop could be used longer and smaller timbers. An area directly in front could be used as 'distribution centre' where inbound timber can be assed and moved to it designated storing place. The south side should have space to stack slabs from sawmill and a [new to construct] air drying rack for usable wood residue saw mill fall outs. The north side can be used to store smaller, light and green timbers due to a concrete floor accessible for the forklift. Air drying possibility if kept out of direct sunlight and stacked properly. The west side has a small slope and a rocky surface accessible for the tally handler. Storing midsize, dry or- green and slow moving timbers is desirable. Air drying possibility if kept out of direct sunlight and stacked properly.
- Inside workshop: An all paved surface to frame with the possibility of 600 $ft.^2$ storing single, special, air dried pieces vertical against the walls or the creation of elevated storage space accessible for the small forklift, without blocking the sunlight from the high glass windows. In contradiction to the main hall the joining area should be free to use the machines however there is room for storing smaller single pieces vertical against the wall.
- North side tent: a large area of 10,500 square ft easily accessible because of two adjoin gravel roads ideal for timber framing, storing raw material and larger dimension wood residue. Because of large surface 'driving' roads/instructions needed to utilise space as efficient as possible. Air drying possibility if kept out of direct sunlight and stacked properly.
- Inside tent: The oval strip of 450 square ft is suitable for small, light, dry and slow moving lumber. The tent has a gravel surface and is only accessible by the small forklift. Timber framing is its main purpose and due to insufficient ventilation and irregular temperatures storing green timbers is not desirable.
- East side sea shore: a long strip of 2,750 square ft easily accessible and suitable for long, heavy and- or green timber. Air drying possibility if kept out of direct sunlight and stacked properly. Due to adjacent gravel road covering timber is desirable to prevent the timber from becoming dusty.


Small sizes
Long sizes
Air drying
Slow movers
Light weight
Heavy weight


Small sizes
Long sizes
Air drying
Slow movers
Light weight
Heavy weight
Gravel
Gravel
Gravel
Tent
Concrete floor
Workshop
Concrete floor
Gravel