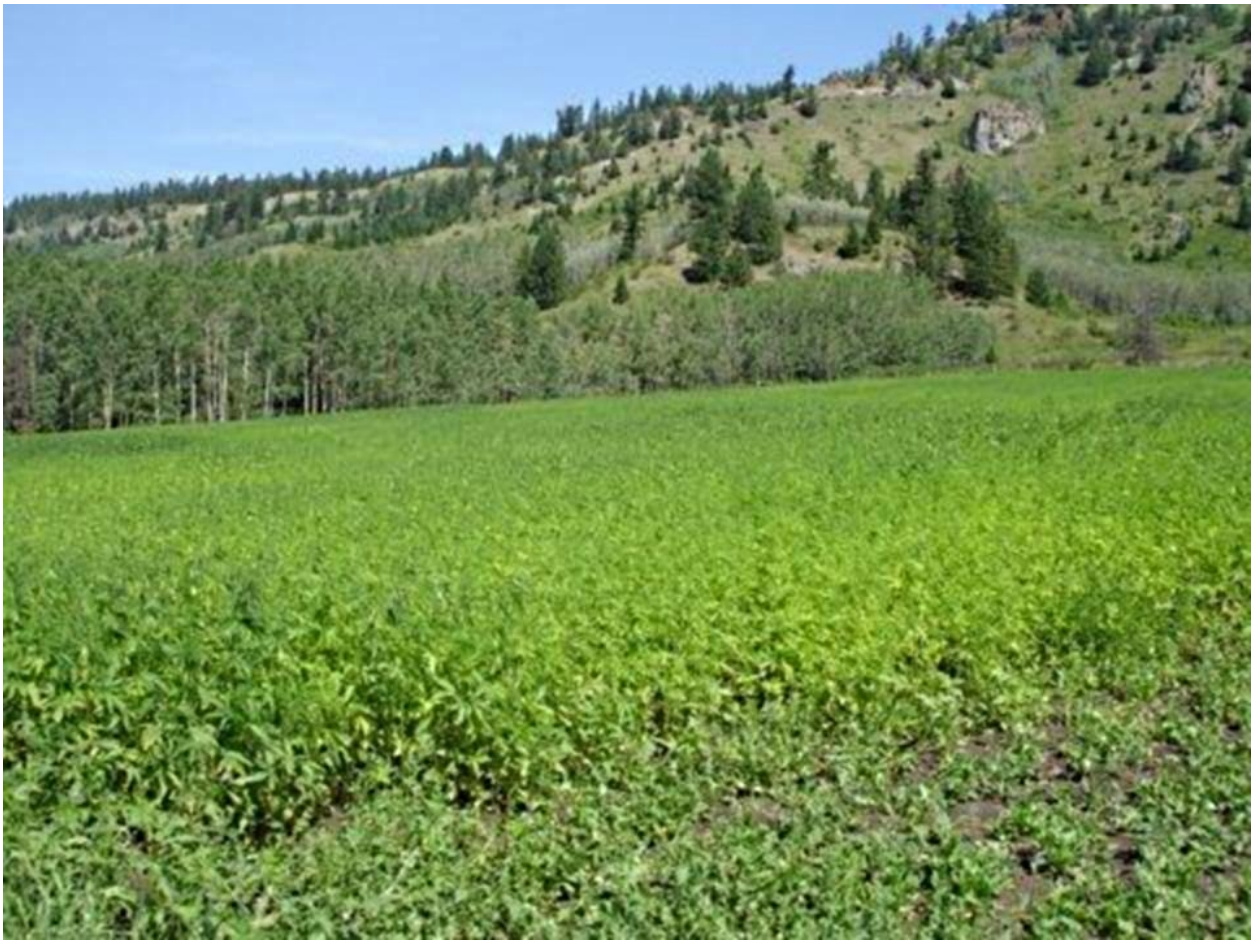
District of 100 Mile House
Industrial Hemp Pilot Project
2009-2010 Report



Prepared for:
100 Mile House Industrial Hemp Steering Committee

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Northern Development INITIATIVE TRUST

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Executive Summary

The 2009 Industrial Hemp Pilot Project initiative in 100 Mile House BC consisted of several objectives or links that when connected with each other form an industrial hemp processing value-chain. The project was organized and executed so all links could run independently from and parallel to each other. This approach enabled us to present information and discuss in detail production, processing, marketing, and investment opportunities without having to rely on harvested crop or requiring up-front investments into processing technology.

Within this project, both industrial hemp grain and hemp fibre processing opportunities were explored. Due to the local crop production practices that are limited by the elevation the primary focus was industrial hemp fibre production and the secondary focus was on industrial hemp grain production. Both organic and conventional production methods were practiced.

At first glance, especially from a Canadian Prairie or Ontario perspective, 100 Mile House is not an obvious place to produce industrial hemp on a large scale. Nevertheless, due to new made-in-Canada primary processing technology developments, the economic delivery radius of material from production site to secondary processing facility has been increased from 60 to 200 miles. Instead of transporting unprocessed industrial hemp fibre straw with limited delivery radius we are now able to transport primary-processed fibre or core economically over a greater distance. This places 100 Mile House in an advanced position to draw semi-processed hemp materials from a large production area along the highway 97 corridor, from the irrigated land base along the Thompson River in the South, Fraser Canyon in the West, to (non-)irrigated land all the way up to Prince George in the North. Having access to a large production area where both hemp grain and fibre or just fibre can be produced makes the town of 100 Mile House an excellent hub for a secondary hemp processing facility.

A secondary hemp processing facility located on BC's Interior North South highway and train corridor in the town of 100 Mile House is well-positioned for the "eco-focused" B.C. Lower Mainland, the U.S. Pacific Northwest market and beyond.

During the course of the project, including three public meetings, "Open Days" have created public awareness in B.C., Canada, and abroad. The project has attracted interest from the investment community and a feasibility study has been completed.

Through evaluating experience of management practices gained in 2009 and transferring production know-how to a larger group of producers outside the 2009 focus area the 100 Mile House pilot project is well-positioned to move forward in 2010 and transform from a publicly-funded project to an investor-driven project.

During the 2010 transformation phase it is of great importance that the momentum gained in 2009 is maintained or, better yet, increased.

Background and Location

100 Mile House

The South Cariboo is situated in the Central Interior of British Columbia. The District Municipality of 100 Mile House with elevation of 927 m (3,041 ft) is situated on Highway 97, BC's main arterial north-south route. It lies northeast of Vancouver and south of Prince George.

100 Mile House has its roots in the 1860 gold rush. Between 1862 and 1870, over 100,000 people traveled the Cariboo Wagon Road from Lillooet, making their way north into Cariboo country to Barkerville. 100 Mile House, South Cariboo's dominant community, was originally a stopping and supply point along the Road. 100 Mile House received its name because it is located 100 miles from Lillooet (Mile 0) of the Cariboo Wagon Road.

As the gold rush subsided, ranchers began to settle the surrounding area. Today, the South Cariboo consists of a number of small unincorporated communities in the outlying area surrounding the District Municipality of 100 Mile House and has a population greater than 20,000. Major communities include the 108 Ranch development, Forest Grove, Lone Butte, Bridge Lake, Deka Lake, Sulphurous Lake, Canim Lake, 70 Mile House, Sheridan Lake , Lac La Hache, and the areas surrounding Horse Lake. South Cariboo extends from 70 Mile House in the south to Lac La Hache in the north and from Bridge Lake and Canim Lake in the east to the Fraser River in the west. The region is covered by hundreds of lakes of various sizes and wetlands, all of which are part of the Fraser Basin drainage system.

100 Mile House, with a population of about 2,000 residents, acts as the primary service centre for the South Cariboo by providing commercial services, regional secondary schools, community facilities, health care, financial services, regional policing, government offices, and shopping for area residents and tourists. A satellite extension centre of the Thompson Rivers University, the 100 Mile House Training & Education Centre, is also located here. Recently, 100 Mile House has begun to attract retired and semi-retired migrants from other parts of B.C. and Europe.

Primary Economic Activities of the South Cariboo Region

Forestry

Forestry and forest-related industries have been the traditional mainstay of the local economy. The forest sector represents approximately 30% of the total employment in the South Cariboo. The 100 Mile House Timber Supply Area includes all of the South Cariboo; a 1994 study reported that approximately 30% of the total employment of the area is in this sector. Sales revenues are over $175 million annually and major forest products facilities account for approximately 500 person years of employment. The secondary wood products manufacturing sector accounts for over 130 person years of employment and generates approximately $11 million in sales annually. Harvesting and other forestry operations employ an estimated 350 person years.

The South Cariboo is one of the principal areas of log building production in British Columbia. 100 Mile House is designated the Hand Crafted Log Home Capital of North America; there are currently thirteen log home construction businesses operating in the South Cariboo.

Agriculture
Agriculture was one of the first industries to be established in the South Cariboo, beginning well over 100 years ago. Ranching remains one of the cornerstones of the local economy. Soil and climatic conditions are limiting diverse agricultural activities. Most of the 256 agricultural operations in the South Cariboo are cattle or hay ranches.

Tourism
Tourism is a well-established and fast growing four-season economy in the South Cariboo. The natural environment may be one of the area's greatest attractions, with access to year-round outdoor recreational activities and services. 100 Mile House is a centre for outdoor activities and is becoming increasingly known for its richness of bird life. The surrounding area features many lakes for boating and fishing including Lac La Hache, Canim Lake, Horse Lake, Green Lake, and Bridge Lake. The Cariboo ski marathon attracts a large and international field of cross-country (Nordic) skiers as well as German, Swiss, and Austrian tourists.

Threat to Economic Stability of the South Cariboo

This generally favorable and stable socioeconomic picture of the South Cariboo, unfortunately, began to change dramatically after the turn of the century, to the short and long-term detriment of forestry and forest products industries and the Ranching business. This threat is in the form of the mountain pine beetle for the forest industry and Mad Cow decease for the beef industry. At the present time in early 2010, the mountain pine beetle has killed a billion trees in B.C. The export ban of Canadian beef that was implemented after the discovery of Mad Cow decease had a devastating impact on the Canadian beef industry in general that is still felt 8 years later even that the export restrictions have been somewhat lifted.

Governmental Responses to the Economic Effects of the Mountain Pine Beetle and Mad Cow Disease

In 2006, the federal government announced funding to combat the Mountain Pine Beetle infestation, strengthen the long-term competitiveness of the forestry sector, and support worker adjustment[1]. The Community Economic Diversification Initiative is an important component of the federal Mountain Pine Beetle Program. It is a two-year federal contribution program aimed at helping to diversify the economic foundation of forest-dependent communities and contribute to their long-term stability[2].
At the regional level an important response was the establishment of the Cariboo-Chilcotin Beetle Action Coalition (CCBAC)[3] to work with governments, groups and individuals to help

[1] http://www.mpb.cfs.nrcan.gc.ca/index_e.html
[2] http://www.mpb.cfs.nrcan.gc.ca/diversification_e.html
[3] http://c-cbac.com/index.php

ensure that these communities not only survive but prosper, during and after the pine beetle infestation and effects of the Mad Cow decease.

The Coalition invited individuals to bring forward ideas that could positively counter some of the devastating effects the Pine Beetle infestation and Mad Cow decease had on the local economy and environment.

It was during this consultation process that Industrial Hemp was introduced as both a crop diversification opportunity for the local ranchers and a food and industrial processing development opportunity for the local community. The idea of growing industrial hemp was initially met with skepticism which changed slowly to curiosity. The local newspaper ran a story about the many end-use application opportunities that could be derived from processed industrial hemp. It was when the mayor of 100 Mile House met in 2005 with a representative from the department of BC Agriculture and Lands that the concept of local industrial hemp production and processing progressed and the process of applying for funding started.

> *A new idea is first condemned as ridiculous and then dismissed as trivial, until finally, it becomes what everybody knows.*
> William James

Industrial Hemp Industry Overview

Current status

In Canada, the main focus of the industrial hemp industry is hemp grain production and hemp grain processing for food products. Industrial hemp fibre processing of residual straw (co-product), making hemp a dual purpose crop, is underdeveloped. The production of a single purpose crop, for fibre only, is non-existent.

Until the U.S. legalizes the production of industrial hemp, Canada is uniquely positioned to market processed industrial hemp products into the U.S.

In the late 90s, Canadian and European governments reintroduced industrial hemp (Cannabis Sativa) under strict regulation through licensing and inspections. The U.S. has not started with the re-introduction of industrial hemp but it is very possible that limited production and processing of industrial hemp will start up in as soon as four years from now, coinciding with the second term of the Obama government.

Lack of general fibre processing know-how, lack of affordable processing technology, and very importantly, lack of market development/information are among the contributing factors.

The Canadian Hemp Industry is slowly showing signs of internal collaboration. Thus far, industrial hemp business development has been more focused on and successful for industrial hemp grain processing, aimed at food industry development, as compared to industrial hemp fibre processing.

Instead of focusing on building a national hemp fibre industry, the development of the fibre processing industry to date has been hampered by regional competitiveness. Throughout the last 10 years, regional Canadian industrial hemp fibre industry business development plans, supported by federal and provincial funding options, have not yet resulted in the start-up of fibre processing businesses.

Assisting the industry's development is the Canadian Hemp Trade Alliance (CHTA). It is a Canadian organization representing all facets of the Canadian industrial hemp industry. Formed in 2003, it is a non-profit national group of hemp processors, marketers, farmers and information specialists. CHTA organizes annual Hemp conferences inviting national and international quest speakers enabling excellent opportunities for industrial hemp networking and development. www.hemptrade.ca

In summary, the Canadian hemp industry development is progressing slowly and is expected to within the next 10 years. Nevertheless, its development is very dependent on the length of time it takes the US-government to allow the start-up of U.S. industrial hemp production.

- The District of 100 Mile House has established a leadership role in B.C. in introducing industrial hemp production to British Columbia and is recognized for their efforts at all levels of government and across Canada.
- A crop production knowledge base is being established in and around 100 Mile House.
- Within the 100 Mile House industrial hemp project, a strong Native and non-native project-interaction has been developed on which further crop production and processing expansion can take place.

Hemp Grain & Food Industry

Currently, the North American market for industrial hemp food products is growing in the range of 30% annually. Other statistics are given in Table 1. The industry is characterized by relatively small processors and marketers, with limited financial capability (Table 2). Products include Hemp Seed Oil, Shelled Hemp Seed, Hemp Seed Butter, Hemp Protein Powder, Hemp Protein Powder with Fiber, Hemp Seed Flour and Hemp Bliss, a substitute for milk.

Table 1. **Industry Structure – 2009** (Estimated Values by North American Industrial Hemp Council)

- Farmgate value: CA $7 million, US $0
- Export Value to US (hemp seed, hemp oil, hemp cake) greater than CA $10 million
- Number of hemp marketers and exporters in Canada – 5
- Number of hemp grain contractors, i.e. processors – 3-4
- Employees per operation – 2 to 8
- *Return on investment – estimated at less than 15%*

Entry into hemp grain production, processing and marketing for food production can be done through three mechanisms:

1. From the ground up, developing a start-up company
2. Take-over of existing hemp food processor /marketer with brand name recognition and established distribution network
3. Take over/partner with well established specialty food marketer with established distribution network. Develop and introduce own brand of hemp food products.

Table 2. Hemp Food Processors

Manitoba	Manitoba Harvest	- www.manitobaharvest.com
	Hemp Oil Canada	- www.hempoilcan.com
	Charles Holmes, Living Harvest - http://life-enthusiast.com/index/Brands/LivingHarvest/	
	Farm Genesis	-www.farmgenesis.com
Alberta	Rocky Mountain	-www.buyhemphearts.com

The start-up company approach involves developing hemp food products through collaboration with a private or public "Food Development Centre" and having the products packaged by a third party processor. It is critical that management attracts a person with first-hand experience preferably in hemp specialty food product development. It is anticipated that this business approach will take as long as three years for the development of a business plan involving product development, brand name recognition development and gaining access to the marketplace. The estimated cost would be in the range of $500,000 per year. At the end of a 3 year period a go/no go decision is made to invest in infrastructure. The product development success will be measured by the "true uniqueness" of the hemp product in the market place. Copying of an existing hemp food product and re-branding will not bring success. It is critical that during this process a successful Canadian and US distribution network be established.

Currently, those in the relatively small group of five Canadian hemp grain processors has each developed a marketing approach by selling shelf-ready products at the retail level and/or providing processed ingredients such as oil, de-hulled seed, seed cake, or protein powder at the wholesale level to food processors. The majority of existing Canadian hemp food companies have not changed ownership since their start-up less then 10 years ago. In general, none of the existing hemp food processing companies in Canada has the financial strength and access to capital to further expand through take-over. So far, none of the existing Canadian hemp food processing companies have attracted take-over interest by the established North American food industry.

If the U.S. government were to make a distinction between hallucinogenic, THC-containing hemp and industrial hemp, this would start industrial hemp production in the U.S. with larger food companies potentially taking over existing Canadian hemp food businesses.

Estimated take over costs would vary between $500,000 to $2 million (excl. inventory, building or equipment) depending on the type of company being taken-over and its strength.

The success of a 100 Mile House B.C.-based hemp food business will be mostly determined by the uniqueness of the hemp food products and the degree of access to a large distribution network with the main market focus in Canada and the U.S.

The start-up success of a food processing business in 100 Mile house will be determined by:

- Access to the marketplace, e.g., shelf space or processors
- The level of acceptance of the hemp food product in the market place.
- Successful managing of raw material supply.
- financial depth

It is strongly recommended that during the start-up period of a 100 Mile house food processing business that hemp grain delivery will be secured through delivery contracts with some of the existing hemp grain contractors and that during this period a carefully guided local hemp grain production program is started.

Hemp grain production in Canada now mainly takes place in Manitoba and Saskatchewan. Over the last 4 years, we have seen varying yields of hemp grain per acre and fluctuating total acres seeded. Hemp production in Canada peaked in 2006, at about 20,000 hectares, but has fallen to about 3300 hectares in 2008. The strong variations in yield and acres seeded results in overproduction of hemp grain and with the result that in following year fewer acres are seeded. Surplus or below standard (rejected) hemp grain is sold into the European bird seed market at prices below cost of production.

It is expected that in future higher and more consistent hemp grain yields will lower the costs of production, and increase the marketing opportunities. One of the first markets then to be explored will be animal nutrition.
Research has started to examine the benefits of adding hemp grain to poultry feed rations with the objective of enhancing poultry meat products. The current farm-gate market price for Canadian hemp grain is $0.55 - 0.60 per lb for conventional and $0.90 - 1.00 per lb for certified organic produced. Hemp grain for the European bird seed market sells for $0.30 per lb.

In September 2009 at production site V a hemp grazing trial took place in collaboration with Thompson Rivers University. As part of a grass-fed finishing trial beef cattle was allowed to graze matured (short stand) hemp plants. The objective was to examine the influence of their diet on the beef composition.

The hemp food industry is currently characterized as a fragmented industry, without a well-defined marketing and distribution system in place, and with no dominant companies having emerged as the industry leaders.

Hemp Fibre Industry

Overview

Since the reintroduction of industrial hemp in Canada during the late 1990's, the hemp fibre processing has not developed to the same extend as the hemp grain industry mainly due to lack of fibre processing know-how combined with affordable fibre processing technology. So far, in Canada, several attempts have been made by local interests groups to develop business plans incorporating European fibre processing equipment but none have succeeded so far. Some of these plans call for over $20 million investment capital.

When we compare the European industrial hemp fibre industry with the Canadian industrial hemp fibre industry we notice that the European industry is further developed.

Main reasons are:

- Europe has a well established flax fibre production, processing and processing equipment/technology manufacturing in place. Due to similarities between flax fibre and hemp fibre processing and end-use applications this existing fibre know-how enabled them to more rapidly develop the industrial hemp fibre processing and marketing.
- Canada does not have a developed flax fibre processing know- how and/or industry
- In order to qualify for government subsidies in Europe for the start-up of a fibre processing business, the minimum private capital investment level is considerably lower in Europe than is required in Canada.
- Europe has an existing and more advanced/ better-developed fibre end-user market in place as compared to North America. This enables European start-up companies to market their fibre products to existing end-users.
- Canadian fibre processors do not have access to a well developed natural fibre end-user market in North America.
- European subsidy supports the industrial fibre industry both at farm level and at processor level. After 2011 this subsidy might be reduced or eliminated.
- Canada does not provide subsidy support to industrial hemp fibre producers or processors

Therefore, the European primary fibre processing business model does not apply to the Canadian situation. Nevertheless, selective European business models of secondary processing are of interest to us, for example, natural fibre incorporated pellet production for the extrusion market, matting, and some others.

When we compare the European and Canadian industrial hemp fibre industry developments with the Asian industrial hemp fibre industry we notice the following:

Technology

- Europe +Canada versus – Fully mechanized harvesting and processing
- Asia (China) – Harvesting and processing strongly dependent on (cheap) hand labour combined with non-sophisticated technology

Product

- Europe and Canada versus – "Short" industrial hemp fibre processing and marketing opportunities
- Asia (China) – "Long" industrial hemp fibre processing and marketing opportunities

Markets

- Europe + Canada versus – Industrial application – construction materials, composites, paper production
- Asia (China) – Textile application

In Europe limited scale experiments take place to explore the viability of fully mechanized "long" industrial hemp fibre harvesting and processing using linen flax lines, so far this development has not gained momentum. In Canada there are no linen-flax processing lines in use at this moment.

Natural fibers, in general, and industrial hemp fiber, in particular, are gaining national and international market interest due to "Greening" of the market place. Nevertheless, due to the lack of established fibre processing capacity in Canada, potential industrial end-users of hemp fibre do not have access to readily-available fibre sample material to be tested in a wide range of industrial application processes.

One of the first hurdles the 100 Mile House industrial hemp project overcame was gaining access to sample material produced by a made-in-Canada fibre processing system containing non-overseas components. The ability to provide commercial scale samples plus the ability to adjust the fibre processing equipment in order to fulfill specific demands has drawn industry attention to the developments in 100 Mile House. This has resulted in many requests for specific fibre sample material that has led to discussions of commercial-sized product delivery contract.

Raw Material Supply - Single Purpose Crop (fibre only)

Industrial hemp is a new crop to the area and potential local producers require assistance. Besides financial incentives, they require time to become familiar with specific requirements to produce a high-yielding quality crop. Without good agronomic leadership and financial commitment from hemp fibre processors and investors, the farm community will not be interested in changing their crop rotation to accommodate industrial hemp. In due time, when farmers have become familiar with the industrial hemp crop and have positive experience with selling the product to the processor, the crop production incentives can be scaled back.

Growing of the biomass, fibre only, cannot succeed without leadership through the provision/transfer of crop production knowledge.

At the starting stage of commercial production, it is not advisable to grow dual-purpose industrial hemp, meaning growing hemp for grain and using the straw co-product for fibre.

Industrial hemp grain production is only recommended when grain production know how and grain production equipment is in place, including grain drying capacity

Estimated return on investment at this stage is a maximum of 10%.

Industrial hemp crop production and primary fibre processing offers business development opportunities for collaboration between Native and non-Native groups.

Primary Processing

The industrial hemp fibre decortication process starts with hemp fibre straw in round bales introduced into the processing system. Here, mechanical forces, no chemicals are added, separate bast fibres from core fibres. The efficiency, as in the cleanliness of core and fibre, and the speed at which the technology can accomplish this, dictate the overall efficiency of the operation. Since no major hemp fibre industry development has taken place in Canada 100 Mile House is in a position to be the pioneer by leading the hemp fibre industry development in North America. Unknown risks to which this project is exposed should be managed through a phased business development approach. An initial responsible/sustainable business approach is based on matching fibre processing equipment investment size with the target markets.

During the course of the District of 100 Mile House Industrial Hemp project, the following preliminary crop production/processing model has been developed:

- Initial processing capacity of 1.5 to 2.0 tonnes of raw material per hour, based on the Emerson Hemp Distribution Company model

This scale of operation and the investment level required would make this model well suited for on-farm primary processing focusing on providing the "Green building" industry with primary processed fibre and core and the (local) animal bedding market with core. Depending on the investment developments this could potentially be managed by the local producer group

Secondary Processing

It is strongly recommended for prospective investors to focus on the secondary processing of fibre material by transporting primary processed fibre materials to the 100 Mile House processing location. The strength and level of return on investment will be determined by the level of success of adding value to the primary processed fibre materials.
Value added products: packaged hemp core for the small animal bedding industry, extrusion pellets for the "plastic" industries, and matted fibre for the insulation markets.

European business models can be copied to speed up the secondary processing business development in 100 Mile House.

Return on investment at this stage is 20-30 %.

During the course of the project representatives met with European Fibre processor and European fibre processing equipment company to discuss accessing European secondary processing technology. This resulted in the signing of a Memorandum of Understanding.

A potential business model for 100 Mile House:

- Production of biomass industry hemp straw at best suited growing locations along the highway 97 corridor with 100 Mile House as the secondary processing hub
- Primary processing at or near the production areas, with transportable decortications equipment. This would involve the processing of hemp fibre into round bales of primary-processed fibre and core products. No major infrastructure is required.
- Secondary processing of the primary processed core and fibre into value-added products would take place at an indoor facility in 100 Mile House.

Table 5. Canadian Primary Processing Industrial Hemp Fibre Initiatives

Quebec	Lanuapole (www.lanaupole.com) Current status: unknown
Ontario	Stemergy – Pilot plant co-founded by Geof Kime (www.stemergy.com) – expansion plans – announced May 27 2008 Current status: stalled Stonehedge – Initiative by John Baker – plant construction announcement made in 2007. (www.stonehedgebio.ca/news.html). Current status: stalled
Manitoba	Emerson – Emerson Hemp Distribution Company founded by Wally Empson. Commercially active processor, provider of primary processed hemp products for 100 Mile House project in collaboration with Bio-Mass Fractionation Canada (www.emersonhemp.com) Current status: active Dauphin – Parkland Industrial Hemp Growers (http://www.pihg.net/) Co-operative initiative have developed fibre processing plans since 2000. Current status: stalled Gilbert Plains – Plains Industrial Hemp Processor (http://sites.google.com/a/hemplains.com/plains-industry-hemp-processing/resources) Current status: stalled
Alberta -	Vegreville– Alberta Research Council in collaboration with Alberta department of agriculture developed a fibre processing initiative. Current status: partial decortication line, batch configuration located in Vegreville not in operation (due to budget cuts)

Fibre Processing Technology

North-western Europe has a long history of growing and processing, by decortication, bast fibre, particularly linen flax. The fibre processing experience gained resulted in local manufacturing of decortication equipment. The Belgium-located company, Van Dommele Engineering, for example has been in the business of manufacturing decortication equipment for over 100 years and is still going strong.

When the European industrial hemp production gained momentum it was the linen flax fibre processing manufacturing businesses that converted "lin" lines to hemp processing lines. During the last 10 years, the hemp fibre processing technology has further evolved and some of the newer hemp decortication technologies are designed from the ground up and are no longer converted "lin"-lines.

- In Europe the producer receives a subsidy, so does the processor
- Without the subsidy, industrial hemp production would be severely impacted and probably cease to exist

European Technology

A German manufacturer presented the following price quote in 2009:

Price level for decortication line (primary processing technology)

Input of straw per hour	Operators	Investment
5-6 tonne capacity	4-5	6.7 million Euro
10 tonne capacity	5-6	9.9 million Euro

(including baling of fiber and core)

Hemp fibre insulation production line (secondary processing technology)

Input of prim. Fibre per hour	Operators	Investment
1.2 tonne/hour	5	8.9 million Euro
2 tonne/hour	7	9.2 million Euro

The above quotes do not include the transportation cost of equipment, commissioning of processing line or building and site construction or preparation costs.

- The above price quote is a higher end one compared with other European bast fibre processing equipment manufacturers.
- The price range for European decortication equipment (primary processing) is between 1 and 2 million Euro per metric tonne of capacity

The price build-up of a fully operational plant is:

1/3 of total cost is equipment
1/3 of total cost is building
1/3 of total cost is installation, hook-up, infrastructure

The capital investment requirement places European technology beyond reach of a Canadian start-up company. Once a hemp fibre processing company has established itself solidly in a stable marketplace, this sort of technology might become of interest. Hempcore in the UK made a technology investment in 2007 but did not survive the 2009 economic downturn after being in business for a decade, mainly due to an untimely decortication line investment. Hempcore has re-started under new ownership.

Made in Canada Decortication Technology

The technology and equipment that have been developed are best defined as smart-technology and they are economically priced. The specific application is the establishment of systems for use on-farm or in other rural locations. The scale of the plants that are considered most feasible is in the range of plants that can process 3-4 tonnes of raw material straw per hour that would run typically for up to 200 days per year, and produce for 7 hours per day. This implies on-farm plants that would process in the range of up to 5600 tonnes per year.

This scale of plant is suggested to reduce the risks and costs of the raw material supply, and is more adaptive to serve local and specialized markets. This scale of plant would need to draw its raw materials from about 2000 acres of land under production. The vision for the design of these plants is that the producers would be in close proximity to the processing plant, and therefore minimize the raw material transportation costs.

The existing footprint of a current industrial fibre core processing plant, producing approximately 1.5 tonne per hour is:

Width: 10 feet
Length: 18 feet
Height: 7.5 feet.

The footprint does not include the area for raw material storage and preparation, or area for finished goods bagging, baling, and storage.

The current plant is diesel powered. Future plants could be either powered by diesel, or adapted to electricity. A further adaptation would be, if feasible, to be electrically powered, through a co-generation unit fueled by using the residual waste material from the fibre processing line, i.e., about 10% of the raw material, as a source to power a generator.

The processing line that has been developed is a specifically designed, modular concept, for processing flax fibre/shives and hemp fibre/core products. The equipment materials are light weight, strong and versatile consisting of an assembly of locally-available components that have

been modified. The modules are designed to be scaled up without jeopardizing processing efficiency and can be made transportable. The technology can be patented, if required. The processing line can handle round bales. Current capacity is max. 2 tonnes per hour in continuous-flow operation. Capacity increase is possible.

A scaled down version of the decortication processing line consists of an assembly of locally-available components that have been converted or adapted to meet specific fibre processing requirements. The current components, i.e., modules, can be integrated into a full-scale processing line.

The scale of a plant can be increased by the addition of modules, without the need for a re-design or discarding the primary starting scale of plant. Through the use of additional models, both the degree of fibre and core separation can be improved, as well as the throughput. An existing pilot plant can produce fibre with 80% purity. As well, this plant can produce a range of fractions, different lengths, and standards of the core materials. This provides adaptability to serve the diverse quality needs of various markets.

The plant and equipment can be readily transported and made mobile including using two 20 foot containers as part of the basic production unit.

Processing costs are estimated as $60 - $70 per tonne of straw based on 2 tonne /per hour capacity.

Other decortication equipment that is available in Canada:

- Kenex has decommissioned processing lines, both primary and secondary for sale and is actively marketing the equipment. Most of the equipment originated from European “lin” lines.

- After Hempcore, United Kingdom, commissioned their new decortication line in 2007, they were interested to transfer their old decortication to the Stonehedge project in Ontario. Due to the insolvency of Hempcore in 2009, this plan stalled.

Pilot Production
Industrial Hemp Production Project Management Approach

Introduction to the Project at Town Hall Meeting

A publicly-announced town hall meeting was held on February 18, 2009 at the 100 Mile House District Chamber to present the start of the Industrial Hemp Pilot Project Initiative and to introduce the Project Manager, Erik Eising, to the potential local producers and other interested persons. During this all-day event held from 10:00 am to 8:00 pm, one-on-one discussions and groups presentations were conducted. The topics included the application procedure for Industrial Hemp Production Permit from Health Canada and recommended agricultural production practices. As well, it showcased primary processed hemp products such as fibre and core and secondary processed products such as particle board, matting and food products.

Results from the meeting included:

- Ten producers were interested to further discuss potential industrial hemp production at their ranches in 2009.
- During the initial conversations with interested ranchers, it became apparent that seed-ready fields for the 2009 crop production year were not available, other than for 1 to 10 acre plots. Irrigation equipment was not available. On none of the fields had soil been recently sampled and analyzed.
- Discussion of a previous small-scale industrial hemp production project in 2006 (the report was not in 100 Mile House archive). The very preliminary results from this indicated that industrial hemp for grain production is not a preferred option for the South Cariboo region due to the impact of the area's elevation on the length of the growing season and the occurrence of late or early frosts.

Conclusions from the meeting included:

- Lack of prepared seed beds ready for seeding and the lack of available irrigation increased the risk associated with growing industrial hemp crops.
- Producers were struggling with the decision to turn over productive hay-producing fields for the hemp pilot project and were leaning more towards providing their less-productive hay land.
- The 100 Mile House industrial hemp project had gained momentum, as well as, recognition and support in the town and from a group of community-minded producers located near town or affiliated with the community. Thus far, the project had not attracted the interest of ranchers located further away from town, such as in the Fraser canyon.
- Potential producers were not primarily interested to support the project and commit to production just because of funding support. Their commitment was going to be gained upon their understanding of the total chain of events starting with production and followed by information on processing, marketing, and the requirements for financial investment needed for hemp processing.

- The objective of gaining access to a field with irrigation, preferably pivot, was expressed by the Project Manager.
- During the February Open Day, the plan was presented to producers that the period between the then and snow melt would be used for further discussions detailing the Health Canada application process and the support available to individual ranchers for crop production. Support involved activities associated with land preparation, seed procurement and delivery, and the seeding strategy.
- The economic down-turn had an impact and made some producers hesitant to commit.

Follow-up Activities to the Town Hall Meeting

From April 24 – 28, 2009, meetings were held at the 100 Mile House District office and local ranchers were visited on-farm by the project manager. Activities included field tours of potential production locations. Of the initial ten interested producers, four committed to production of industrial hemp.

On April 28, a meeting was held at 8:00 am at the 100 Mile House Red Coach Inn attended by four producers, the 100 Mile House District Planner and the Project Manager. A list of commitments was presented by the District planner and it was verbally agreed by the four producers that they would commit sufficient land to grow between 150 and 200 acres of industrial hemp. The variation in the acreage was due to the uncertainties in the seeding opportunity due to the flooding and an anticipated late Spring. One producer travelled 160 km (one way) to attend this crucial meeting!

- The production locations made available to the project by the ranchers offered a wide range of soil types and management practices.
- No field selection process took place due to limited offering of production sites.
- Concern for limited hay production and economic down turn prevented a number of ranchers to participate.

Crop Demonstration

The 5 production locations consisted of a wide range of soil types and elevations managed under conventional and organic (not certified) production methods. Four industrial hemp varieties, Anka, Carmen, Alyssa and USO14 were used. At one location, site II, a no-till system experiment took place using a desiccant for weed-control. At all locations, except one, several varieties were seeded using variable seeding rates and fertilizer rates. Each producer was responsible for documenting the specific locations and rates of the seeded varieties.

The start of seeding season was severely delayed due to wet field conditions. After seeding had been completed the seed germinated well and emerged at all locations. Due to cold and wet weather following the emergence of the seed, many plants died off. At the initial plant development stage the hemp is very susceptible to excess rain and low temperatures.

During the (late and wet) seeding period which stretched out over a period of 17 days hands-on help and advice was provided to the individual producers by the project manager.

All fields were inspected by project manager together with the producer at the following stages: pre-seeding, seeding, early crop development (beginning of July), mid-crop development (Aug), and late crop development/harvest.

Practical experience gained on one production location was handed over to the next. Also producers were assisted in establishing working relationships with each other this resulted in the start-up of a industrial hemp producer group (January 2010).

The initial Crop demonstration, Field Day, was planned for mid July, due to poor crop development the Crop Demonstration was delayed and took place on August 18th 2009.

Due to the overall poor crop performance mainly, but not only, due to weather related stress it was decided in early July to focus on visiting the field near Canim Lake, site II, and the Canada wide varietal test plot, site I, near Horse Lake.

In early October, during a producer group meeting a field visit was made to site II to look at the field on which the crop was drying in swath ready to be baled. Due to late seeding of this field combined with an early frost the industrial hemp crop, variety USO 14, originally destined for grain production had been mowed down to be baled for hemp straw when sufficient dry.

During the August and October field trips the visitors were made aware of the importance of proper nutrient management. Through hands-on approach visitors were demonstrated soil –core sampling to see to what depth the root zone had developed. And soil samples were taken to be analyzed in order to provide producers with valuable nutrient information.

During the January 27 2010 Open day a crop evaluation Power Point overview was presented to an audience of existing and potential new industrial hemp producers. During the power-point

presentation the focus was on proper nutrient management both for organic and conventional production methods all based on 2009 crop production experiences and backed up by pictures taken at the production sites.

Producer training

Throughout the course of the project (Feb 09-March10), ranchers received on-site, hands on production assistance, and were provided with agronomic information as part of producer training. Experiences gained throughout the project were shared amongst the producers and presented during Open days in the form of crop evaluation, presentations highlighting sustainable nutrient management, crop rotation planning and proper field tilling practices.

The Feb.18, 2009, "Open Day" attracted producers who were willing to explore participation in the pilot project. Through one-on-one discussions and interviews, as well as presentations by the project manager, the producers gained a better understanding of the scope of the project. Not all interested producers were able to participate in 2009. During the "Open Day", interested producers were presented with the proposed producer training program, which focused on on-site training. In collaboration with the interested producers, a work plan was developed.

Prior to the first planned on-farm visit, the interested producers would receive training through one-on-one telephone and conference calls with the project manager. The first farm visits by the project manager took place as soon as most of the snow had melted. This was followed by more on-farm visits during critical moments of the crop production, such as field preparation and seeding time, crop development evaluation, pre-harvest and post-harvest evaluation. During the on-farm visits, the project manager provided the producer with agronomic training and would also share experiences gained by other project participants, or from other production areas of Canada and Europe.
Included in the project was participation of a Canadian-wide varietal testing program, two Summer students received training in test plot management.

During the August 18, 2009, Open Day, producers participated in an industrial hemp tour at a First Nation crop production site and a varietal test side. At both location producers gained training in crop evaluation, including sustainable nutrient management.

On October 8, 2009, project participants met for a post-harvest producer meeting at a South Cariboo First Nation. In collaboration with extension staff of the BC Deparment of Agriculure and Lands, producers and First Nation staff participated in post-harvest evaluation, including a soil coring, soil sampling and crop rotation planning training

On January 27, 2010, a crop evaluation overview was presented to the 2009 project participants, interested First Nations delegations and private producers. During this training session, all crop production sites were being evaluated and recommendations for 2010 industrial hemp production were presented.

During the many site visits, not only with ranchers that participated in the project, but also those genuinely interested, an increased awareness was created to further advance the ranchers' skills for the practice of sustainable agriculture that reaches beyond the production of industrial hemp. Through close collaboration with ranchers, trust was gained. This resulted in on-site training on how to improve their field-crop production capacity, thereby improving their revenue generating capability, not only for industrial hemp, but also for pasture and / or hay production. The project stimulated the on-going drive towards crop diversification in general, and industrial hemp in specific, in the South Cariboo region.
During this process, a bond was created that was instrumental in the formation of the industrial hemp producer group which took place during the Jan 27, 2010 meeting.

Based on the experiences gained during the crop production and the frequently asked questions by interested new growers a production guide was developed to assist the landowner in making a knowledgeable decision in prior to starting with industrial hemp production. (See appendix 4)

Economic Parameters

The Cariboo region experienced adverse weather conditions during the 2009 crop production year. Hay production, being the main crop was down to 30% - 50% of long term average production in most of the region.
In spring seed bed preparation for the industrial hemp project was delayed and when finally seeded the fresh emerged industrial hemp plants were exposed to a prolonged cold and wet period. Recently emerged industrial hemp plants are very sensitive to cold and wet weather under such conditions the growth development potential will be severely affected. After the cold and wet period the crops were exposed to extended periods of no or limited rain.
As result, the sites did not yield any reliable production information due to crop failure, mainly due to adverse weather. The site III production field was harvested for biomass; it is expected that yield figures are available after March 2010.

Cost of Production (COP)

During the course of the project a COP- template has been developed based on a model created in Manitoba by the department of Agriculture (MAFRI).
This template has been modified and is currently being used by the newly formed industrial hemp producer group. The Excel COP-template assists producers with input cost and investment cost calculation as they relate specifically to their own ranch operation the template will calculate the minimum yield required to reach a break-even points.

The 2009 crop year produced no reliable industrial hemp production data. Through this set back we are not able to start with establishing yield expectations for the production sites in the region. Without data we can not analyze the effects of the different varieties, management practices, variable seeding and nutrient rates.

We do have access to general information from Manitoba

Hemp straw component break down:

- One metric tonne of primary processed hemp (decorticated) will yield:
  30% fibre, 60% core, 10% dust
- Current farm-gate price of hemp straw per metric tonne:
  $60 per m/tonne for dual purpose hemp straw (hemp grain is an main revenue source, hemp straw is co-product) average yield 2 tonnes/acre
  $100-130 per m/tonne for single purpose hemp straw (bio-mass production) average yield 3 – 4 tonnes/acre, as high as 6 tonnes recorded
- Value at farm gate:
  $180 - $240 per acre for dual crop hemp straw
  $300 to $400 for single purpose hemp straw.

Table 4. Primary Processing Economic Parameters

- Revenue per tonne of straw:
  - Fibre $120 to $450 (.3 MT, sells at $400 to $1500 per MT, depending of level of decortication).
  - Core $120 (.6 tonnes , sale price of $200 per MT).
  - Total revenue per tonne of raw material varies from $240 to $570, depending on level of decortication of the raw material.
  - Conservative average revenue of $375 per tonne.

- Primary cost of production (direct costs only)
  - Raw material - $130 per tonne (single purpose cost of $100 per tonne plus transportation cost of $30/tonne).
  - Direct processing costs $60 -70 per tonne, based on processing capacity of 2 tonnes per hour.
  - Therefore, total direct cost of primary processing of $190 to $200 per tonne of raw materials.

- Gross margin: $175 per tonne ($375 per tonne revenue, less $200 direct costs. The gross margin must cover overhead costs of marketing, investment, management, etc.

The primary processing technology that would be utilized can process about 2 tonnes per hour of raw material with potential to be expanded based on market need.
The South Cariboo region is best suited for industrial hemp bio-mass production (fibre) whereby the hay harvesting equipment and hay storage shed already in use at the ranch can be utilized. Producing either small square-bales destined for the "bale-house" construction market (niche market) or round bales for the hemp fibre processing (industrial market). Industrial hemp production would be integrated in a (alfalfa) hay production rotation with proper nutrient and soil tilling practices in place.
The strength of the local or BC "bale-house" market has not been determined yet. Due to overall shortage of straw in BC the average price for grain straw is around $5- $6 per small square bale, it is within reason to set the price for hemp square bales at $10.The projected farm-gate revenue for small square bales is $ 10.00 plus per 50 lb-bale (20 cents/lbs). Even at straw yields of 2 metric tonnes per acre the revenue will around $ 900.00/acre. Managing the unknown demand of the small square market can be achieved by baling surplus hemp straw into round bales for fibre processing (estimated revenue at 5 cents/lb).

Product Development/Test Marketing

Industrial Hemp Fibre Products and Their Marketability

The level of decortication, whether primary only or primary and secondary combined, determines the market options available to an industrial hemp fibre processor.

Primary processing

A wide range of applications are available following primary processing of hemp fibre (Table 1).

Table 5. Products and their applications resulting from primary processing of hemp fibre

Market	Product description	Application
• Construction materials	Hurd with some fibres attached and with dust particles hurd, small size	Hempcrete Hemp plaster
• Bedding material	Regular hurd–free of fibre free of dust, bulk/small pack* Small hurd–free of fibre and free of dust	Horse bedding Small animal bedding
• Specialty Paper	Fibre, 80% free of hurd	Paper
• Recycling	Hurd/fibre	Paper, rubber
• Horticultural	Hurd Fibre	Decorative mulch Container garden
• Non-woven**	97 % free of hurd	Natural fibre insulation
• Industrial textile***	"Wool" type fibre	Commercial carpet

* Small pack requires additional equipment
** With addition of cleaning module fibre can be upgraded for this purpose
*** With addition of an other module

Product/Market development efforts for primary processed hemp fibre have resulted in:

- Product development participation project is being negotiated between the 100 Mile House District Hemp Steering Committee and the Alternative Village of the University of Manitoba with respect to the product development of an engineered hempcrete and/or plaster product.

- M.O.U. with European industrial hemp fibre processor to collaborate on secondary processing of BC grown and primary processed industrial hemp fibre to be processed into insulation products and matting products

- BC Poultry research request for access to non-woven hemp fibre mats.

- Request for hemp core products by "Green" building construction customers

- Display of primary processed industrial hemp fibre and core samples

- Display of secondary processed industrial hemp samples: insulation products (Germany), matting product for automotive composites industry (Mercedes), hemp core particle board.

Technology transfer opportunities are in the process of being developed:

- With a well-established European hemp fiber processor for:
  future staff training
  fibre evaluation of Canadian primary processed fibre
  utilizing European secondary processing line

- With European Equipment manufacturer for:
  technology evaluation of secondary processing equipment
  evaluate accessing bio- plastic end-users

The fibre processing industry is well known for safeguarding and not sharing in-house developed modifications to existing technology.

Industrial hemp processors in Europe are faced by limited crop production due to small scale farm operations and uncertain future for subsidy support. They receive frequent request for their products from North American customers. Many of the secondary processed products have a low density, shipping them from Europe to North America is too costly.

European Industrial Hemp processors are interested in exploring collaboration opportunities with up-coming Canadian fibre processing companies, including 100 Mile House, through technology transfer, partnerships and ultimately gaining access to the North American market from a Canadian base.

Agronomic Research

On-Farm Research

During the preparation phase from 18 February until mid April, a strategy was developed to compare the performance of several varieties each applied with varying seed rates per acre and grown side by side in large scale plots. The individual producers were to observe the plots and keep records with the intention of comparing the crop development during the growing season. The results would create a wealth of information regarding the suitability of the South Cariboo for industrial hemp production.

The producers welcomed the on-farm research component of the project, covering both organic and conventional production methods. Research included the one-pass combination of no-till seeding, fertilizer application, and desiccant application at an erosion prone hill side with rocks.

The 100 Mile House Industrial Hemp Pilot project also participated in the Canadian-wide varietal test plots, first time trials in B.C.

Table 6. 100 Mile House 2009 crop production sites overview

Site	Location	Size	Farming practice	Seed bed prep.	Seed date	Elevation
I	Horse Lake	100 ft x 130 ft (test plot)	conventional	rotavator09	June 16	3556 ft
II	103 Mile Lake	62 acres	conventional	chem.-till 09	June 01	3241- 3308 ft
III	Canim Lake	10 acres org	organic	tilled 08	June 16	2582 – 2609 ft
IV	Lake	20 acres conv.	conventional	chem.- till 09	June 07	3432 ft
V	Big Lake	65 acres org	organic	no-till, rotavator	June 19	2215 ft

Industrial Hemp Variety Selection

In consultation with Canadian industrial hemp plant breeders, it was suggested to use the following industrial hemp varieties, taking into account the latitudes of the production sites.

Alyssa	– PIHG Dauphin	best suited for fibre
Carmen	– Ontario Hemp Alliance	best suited for fibre
Anka	– Ontario Hemp Alliance	best suited for fibre
USO 14	– Original from Oekraine	best suited for grain

Due to the relatively late starting date of February 2009 when farmers signed up for industrial hemp production, there was a limited offering of land available at that time. In 2009, it was not possible to do a timely proper assessment of land suitability, in general, and fertility, in particular. Compounding these factors in 2009 was an exceptionally late and wet Spring season in the Cariboo region.

Evaluation of available land preparation and seeding equipment was conducted in March 2009.

Tillage –	3 pt. hitch rotovator, harrows	– common
	tandem/offset disc	– less common
	plough	– rare
Seeding –	3 pt. hitch broad cast seeder	– common
	drill	– common-less common
	press drill	– rare

It was recommended to the participants to seed with a press-drill. The participants secured a press drill at a local agricultural rental shop within a one hour drive at a cost of $20 per acre.

During the April 24 - 28 field inspection, when all fields were to wet to access, it was decided that the rotovator was the most common piece of equipment and, therefore, best suited under the current circumstances for preparing in spring a seed bed for Sites 1, III & V. This is not necessarily a long-term recommended or sustainable option for seed bed preparing. In fact, fall preparation is recommended instead.

For Sites II & IV, it was decided that tilling was not an option. The landowner of Site II allowed the project to utilize his land under the strict condition that no tillage took place. Previously, he had his field rolled to press surface stones into the topsoil to prevent damage to his haying equipment. Site IV soil consisted of a 6 ft thick or more layer of peat. This field was not able to support any equipment until the beginning of June.

It was decided to apply a forage desiccant in one-pass by means of a sprayer mounted in front of the tractor and pulling the press-drill behind the tractor. This is a very unusual practice due to the unique situation of not being able or allowed to till the field prior to hemp seeding.

Due to weather conditions, seeding could not start till the very end of May. Seeding at Site II was completed on June 1. The other sites were too wet then to start seeding. Hemp is a day-length sensitive plant, therefore, crop yield is reduced when seeding starts late, such as in June.

It is very important for producers to provide Health Canada with accurate GPS locations of their field(s). This can only be achieved by using a professional instrument!!!

Site-specific Results

Site I

Site I was located close to a well-established farm yard near Horse Lake, 20 min driving distance from 100 Mile House. The farm practice was conventional. The farm was involved in the Canadian-wide Hemp Variety test plot (see attachment for details). This fenced-off area was chosen due to close proximity to water and short walking distance from the residence of the plot supervisor. The site was used in the past as a holding pen for horses and beef cows. No soil samples were taken prior to seeding due to time constraints. The site was prepared by several passes of a 3 pt. hitch rotovator.

Site I. July 27. Uneven growth pattern starting to develop.

Site 1. August 16. Showing a combination of stunted and lush growth development.

Site I. Aug. 16 Tallest plants are 2.6m high.

Site I. Cores with root development to 75 cm deep and good stand of hemp. Taken at lush growth plot.

Site I. October 7

Site I. Detailed picture showing root development issue with non-permeable layer. (Second core from left)

Site I. Second core from right has non-permeable layer preventing proper root development

Strong recommendation

For 2010 to establish at the same location a varietal test plot incorporating some of the new management practices gained from the 2009 crop production year.

Seeding

Prepackaged seed for each of the 60 beds plus detailed instructions were provided by the organizers of the Canada wide 2009 Hemp Variety Characterization Project. The 60 beds consisted of three groups of 20 beds, each bed measuring 5 x 20 ft laid out in accordance with the Canada wide varietal test plot design. The supplied varieties were seeded on June 16. The equipment used for seeding the individual test plots was the Earthway Garden precision Seeder using a no.1002 22 disc. The disc was slightly modified to suit the specific seeding requirement for hemp seed. Every other seed opening was taped over with Scotch tape on back side of disc. It took two students 1 full day to seed the 60 plots.

Due to very dry weather conditions, the hemp seed germination was uneven. The volume of the on-site water supply was not sufficient to maintain a proper soil moisture level under these extreme conditions.

In early August, it was mutually agreed upon to withdraw from the Canadian hemp variety characterization program due to very uneven plant development. The results from the test plots would not be statistically reliable and therefore could not be entered in the project's data bank. The approach was taken to further investigate the reason for such a great variation in plant development in such a small area of 100 ft x 130 ft.

In order to explain the great difference in crop development within such a small area it was decided that:

a) Soil samples would be taken from three locations within the test plot each representing
   1) Poor/no crop development
   2) Mediocre crop development
   3) Good crop development

Soil samples were shipped to a soil lab for analysis

b) Soil core samples would be taken from the same locations as the soils samples.
Core samples were visually inspected for depth of root penetration.

The results of both sample methods showed:

- Poor crop development in low organic content soil (12.4% OM) with deficient N (19) coincides with poor root depth development to 12 cm due to subsoil barrier.

- Mediocre crop development in higher organic soil (15.9% OM) content and slightly less N deficiency (36). Root depth development to 30 cm

- Good crop development to height of 8 ft in organic soil content (14.2% OM), optimum N (192). Root development to 75 cm

Site II

Site II was a 15 minute driving distance from 100 Mile House. Farm practice on this site was conventional. This south sloping hillside was seeded with the varieties Alyssa, Carmen and Anka. The method of seeding was a unique one pass, no-till seeding while at the same time applying desiccant to suppress existing light stand pasture, and also applying fertilizer was an very cost efficient method. This eliminated the costly fall tilling of up to $ 150/acre, and reduced the erosion risk. Following a long-awaited, short rainfall the hemp seeds did germinate and emerge. After that the plants did not develop beyond 18 in height due to the extreme weather conditions during June, July and August.

This field can be categorized as having a poor alfalfa crop production history. This location, according to anecdotal information, receives considerably less rainfall than the surrounding area. Due to the poor crop development, no further research could be conducted such as $comparing varietal differences, variation in seeding rate, or variation in the amount of applied fertilizer. No soil sample results are available at this moment.

Nevertheless, despite negative production results due mainly to lack of rain, the results stand that no-till chemical vegetation control in one work pass did result in a good density hemp plant population. It is worthwhile to consider this option when incorporating hemp with an alfalfa rotation under pivot irrigation.

Site II. July 27 Crop is suffering from drought.

Site II. August. No rain.

Site II. July 27 Due to stress the plants are going pre-mature into seed

Site III

Site III is located at a 40 minute driving distance from 100 Mile House. Farm practices are organic, not certified. The field was tilled properly in Fall 2008, but just prior to seeding time, the field had been tilled aggressively for organic weed control. This tilling was too deep and had a negative impact on the firmness of the seedbed. It was recommended by the Project Manager to pack the loose soil down with a locally-available land roller. Once the seed bed had been compacted, seeding of USO 14 variety commenced. The seed bed was relatively dry, in fact, too dry for immediate germination of the seed. A timely rain within the first week after seeding resulted in an even germination of the seed and quick emergence of the young plants. This relative evenness of plant development maintained itself throughout the growing season.

Due to the late seeding date the crop did not fully mature. After careful evaluation, it was recommended that the crop be mowed down, swath dried and baled. It was proposed that the hemp straw be baled into a few round bales, destined for fibre processing and the remainder be baled in small square bales destined for a proposed demo- hemp straw bale house construction. During an October visit, the straw was inspected and it was recommended that baling could start immediately. Due to missed opportunity, this crop has not been harvested and baled.

Site III. July 27. Crop is developing well under dry conditions.
Un-even nutrient up take by the plants
light colored plans are slightly N-deficient

Site IV

Site IV is 30 minutes driving distance from 100 Mile House. Farm practices are conventional. This site is peat land with limited access due to surface water drainage. Early in the spring, remaining excess water is drained by a strategically-located drainage ditch. This field was not accessible till June 7. The combination of elevation and soil type, i.e., peat, made this field highly susceptible to year-round frost. The plants germinated and emerged shortly after seeding in five days but could not withstand 4 nights of -4º temperatures in late June.
No further research was conducted.

Site V

Site V is 90 minutes driving distance from 100 Mile House. The farming practice was organic (not certified). Seed bed preparation was done by rotovator with two passes, followed by compacting the seedbed with a roller. Also, at this location limited organic no-till seeding was done in pasture land by flattening the existing vegetation. Due to the wet and late spring, seeding could not start until well into the first week of June 2009, and then only on small selected plots in the field. On the third day after seeding, hemp plants emerged. On June 17 it started to rain for several days and temperature dropped to just above 0º C. Many plants did not survive the 10-day damp and cool period. This was followed by above average dry and hot weather that resulted in a further set back of the crop development. The disappointing results in this field can be linked to the low organic content, nutrient deficiency, aerobic bacteria not in growth mode, and too low fungal biomass.

The landowner has dedicated 20 acres to green manure production with the intention to seed hemp in 2010 incorporating production knowledge gained in 2009.

Site V. Effects of soil compaction. Hemp does not tolerate soil compaction, in this case, caused by a tractor tire mark during seeding. July 31

Site V. Core sample shows sandy soil. Field has been seeded with green manure crop (fall rye) and is intended for hemp production 2010. This picture goes with Soil Foodweb analysis

Site V - hemp grazing project as part of Thompson Rivers University grass fed beef project

Site V Field intended for hemp production in 2010

Feasibility Assessment Summary

100 Mile House Integrated Hemp Fibre, Oil and Food Investment Opportunity

An assessment was completed in 2009, and finalized in March 2010 on the feasibility of an industrial hemp processing plant being established in the 100 Mile House region of British Columbia.

The primary result of this assessment is that there is an opportunity for the investment into and establishment of an integrated hemp industrial fibre and oil processing and marketing enterprise, focused on developing and marketing industrial products into primarily the green building materials sector, taking advantage of the current and likely long term excess hemp oil supply in Canada.

This assessment is based on taking advantage of industry and market characteristics that include:

The Canadian hemp industry at this point in constrained by not having access to, or having developed viable primary hemp fibre processing technologies and systems for separating the bast fibre from the core fractions. Through Emerson Hemp Distribution Company, who now operate a primary processing plant in Manitoba, this technology is available.

The hemp industry is oversupplied with hemp oil into the food market. With expansion by Hemp Oil Canada, for purposes of the production of hemp protein powder, the excess oil supply over the next year will continue to expand, driving the price of the oil down. This excess oil has potential uses in other industrial applications in the green building materials and energy sectors.

Little product development work has been done on the development of new and innovative green building and other sector products, which integrate both the hemp, fibre, core, and oil co-products.

There is a gap within the green building material markets within Canada and the US for green building materials based on the use of renewable natural materials, that are more carbon friendly. Current green building standards, technologies, and products, are more based on the reduction in the use of concrete, versus the innovation of green building materials which are renewable and carbon friendly.

The focus of the investment opportunity is first on the establishment of the primary industrial hemp processing capacity, concurrent with the development and market evaluation of integrated green building materials and products. This would be followed by the evaluation of and possible establishment of secondary processing capacity for value added products such as hemp insulation, hemp structural insulated panels (SIP's) and/or natural construction panels, reinforced hemp bioplastics, based on market demand and prices.

The important part of this opportunity and investment strategy, is that the primary processing plant be established first, which can generate cash flow to support the product and market development, and then the secondary value added processing plant later.

This approach is conditional on the primary industry hemp production capacity being established in advance of, and concurrently with the primary and secondary processing plant establishment. The investment costs of a primary processing plant will be under $2.0 million, and would provide returns on total investment in the range of 25%.

An investment in a primary processing plant will generate economic impacts both upstream and downstream in the local and provincial economy. The estimated direct, indirect, and induced economic impacts resulting from the establishment of an industrial hemp processing plant are estimated to reach over $ 9 million, and provide employment to 123 people.

Conclusions

The Industrial Hemp Pilot Project has increased the awareness at the provincial, national and international level of the 100 Mile House objective to secure the development and construction of an industrial hemp processing facility. 100 Mile House is being recognized for its leadership role in introducing industrial hemp fibre processing into British Columbia. Potentially 100 Mile House could be come the leader in bringing industrial hemp fibre processing capabilities to Western Canada.

The project enabled 100 Mile House to further expand it's industrial hemp network in not only in North America but into Asia and Europe as well.

The initiative resulted in creating investor interest, preliminary meetings have taken place. The project received positive news coverage by the local media

Through the unique processing approach 100 Mile House is ideally situated to become a processing hub centered along the highway 97 corridor.

For the short term the crop production area will most likely be under-developed, for the mid and long term the production near the highway 97 corridor will be sufficient to provide adequate supply of industrial hemp raw materials.

Recently an industrial hemp producer group has been formed to further increase the production area and transfer production know-how to new and existing producers. Due to the downturn in the beef industry ranchers are seriously exploring viable crop diversification opportunities.

The initial product marketing focus is on the "Green" building market through a collaboration opportunity with the University of Manitoba the objective is to introduce engineered hemp building products into the market place. The "Green building" objective fits well within the locally established log house building and timber frame industry.

Through the 2009 -2010 project there was good collaboration between all level of governments, strong support from the local community and excellent dedication from the participation producers including a First Nation.

Recommendations

Production

Further develop the capacity of the newly formed industrial hemp producer group (as part of the Agricultural Enterprise Centre development)
Manage data development of Cost Of Production template
Centralize industrial hemp license applications through producer group
Centralize seed procurement through producer group
Centralize nutrient procurement through producer group
Promote sustainable nutrient management program

Crop demonstration

2010 participation Canadian wide industrial hemp varietal trials
2010 July Field day
2010 September Harvesting day

Economics

2010 Establish crop production parameters

Product development

Establish collaboration with University of Manitoba Alternative Village
2010 July Hemp Building Symposium in 100 Mile House
Decorticate 100 Mile House harvested fibre straw and arrange for secondary processing into insulation products and matting products
Development of application technology to process hemp oil

Agronomic Research

Expand On-Farm research locations from Prince George area in the North of Ashcroft in the South

Appendix 1

Integrated Hemp Fibre, Oil and Food Investment Opportunity

Feasibility Assessment

Prepared for:

100 Mile House Industrial Hemp Steering Committee
Regional District of 100 Mile House, B.C.

Prepared By:

Natural Fibre Industries
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Confidential and Not For Distribution

March, 2010

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Industry Overview And Analysis

As a major part of an assessment of the possible investment opportunities for hemp industrial and food processing, a number of consultations has been taken with the major hemp processors in Canada and Europe, producers, researchers, end users, and marketers across Canada. In addition, secondary research and strategic business contacts have been established with European processors, technology developers, and markets.

From these assessments, the following major observations are made, important for evaluating the opportunities and challenges for new investment being attracted to this industry.

- Hemp production in Canada has been volatile in Canada over the past 12 years. Hemp production peaked in first 1999, at over 14,000 hectares, and then declined due to the influence of the California based Consolidated Growers and Processors (CGP), who tried to establish operations in Manitoba and then failed. A second peak occurred in 2006, again influenced by perceived industry processing opportunities by Parkland Hemp Producers, which has stalled out for the moment. Current levels of production are in the range of 3,500 hectares, which is around 8000 acres.

Table 1: Hemp Production in Canada, 1998 - 2008 (Hectares)

Year	BC	AB	SK	MN	ON	QE	NB	NS	PEI	YK	CDN
1998	72	38	263	606	1,163	23.89	214	19	0	0	**2,400**
1999	225	754	3,096	8,889	1021	86	4	126	4	0	**14,205**
2000	291	306	1,426	2,902	217	239	1	102	2	0	**5,485**
2001	96	113	392	472	209	30	0	0	0	4	**1,312**
2002	200	123	449	597	142	19	0	0	0	0	**1,530**
2003	7	153	672	1,468	397	13	4	18	0	0	**2,733**
2004	18	639	1,004	1,655	183	10	4	18	0	0	**3,531**
2005	0	916	3,429	5,018	251	74	19	18	0	0	**9,725**
2006	111	2,103	6,025	10,705	398	91	8	18	0	0	**19,458**
2007	70	1 455	2 293	2 088	40	182	4	0	0	0	6 132
2008	5	582	1 537	993	8	134	0	0	0	0	3 259

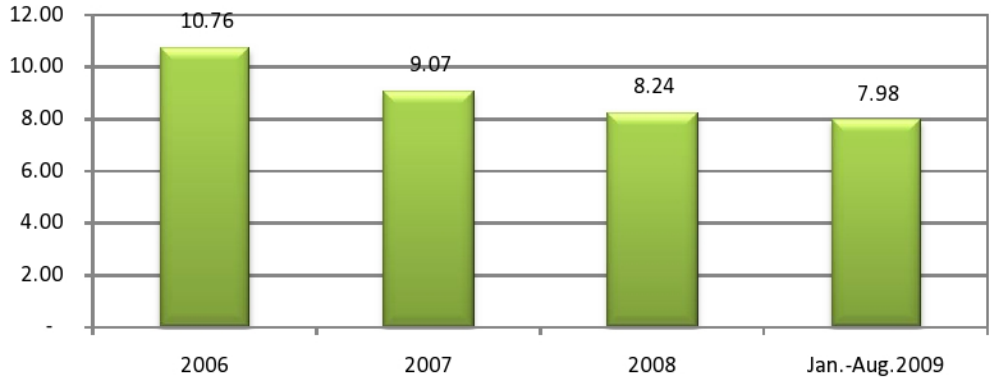
Source: Health Canada

- Industry hemp exports have been averaging about 100 tonnes (100,000 kgs) per year recently. With a value growing value per unit of about $1.90 per kgs or $1,900 per tonne in 2009.

Unit Value ($/Kgs) of Canadian Hemp Fibre Exports

- Hemp oil exports have also averaged about 100 tonnes per year, with the potential to exceed 125 tonnes in 2009. The unit price of exported oil is now about $8 per kilogram.

Hemp Oil Export Value/kg



- The total hemp industry size at the farm gate, including both industrial and food products is in the range of 20,000 acres per year.
- The current hot market focus on the food side is for hemp protein powder. The production of the powder from the cake that is produced from the oil extraction process, is creating an excess of oil in the market. Hemp Oil Canada is currently expanding their operations (4th such expansion) to be able to produce more protein powder.
- The current surplus of hemp oil is in the range of 20,000 per month. With the planned expansion by Hemp Oil Canada, monthly excess oil on the market could reach 100,000 litres per month or 1.2 million litres per year. This oil is available at $2/litres, but this is considered likely to decline in value.
- The major hemp food processors and marketers in Canada are Hempola Valley Farms; Manitoba Harvest Hemp, Fresh Hemp Foods; Ruths Hemp Foods; HMF Sales and Marketing; Hemp Oil Canada; Cool Hemp; and Natures Path, Natural Advanced Technologies and others.
- The major challenge on the industry hemp industry side remains the lack of primary processing capacity. There are few effective technologies that are available in Canada, with the exception of the system now operating by Emerson Hemp Distribution in Manitoba. There are several systems in operation in Europe, with investment costs that begin in the range of $5-6 million, and which has hourly capacity not substantially different from the Emerson system.
- Natural Advanced Technologies (Crailar Fibre Technologies) of Vancouver, is one company that has for some time been undertaking research to add value to hemp and flax fibres to develop products into the textile, composite and auto markets. This company appears to yet be some years off from establishing a profitable business model, concentrating on importing fibres from Europe, for further processing. It is understood their intent is to eventually establish the primary processing capacity for hemp.
- There has not been any significant effort to develop and commercialize an integrated hemp industrial and food manufacturing business model in Canada.
- There is a gap in the development of unique and value added products from hemp, when considering both the industrial fibres and the oil fractions of the plant. Previous investment has independently been focused on either industrial or food opportunities, but not both or integrated.

Market And Product Possibilities

There are three catagories of possible market opportunities for investment in the hemp industry.

Hemp Fibre Markets

The value of hemp straw (and flax as well) in industrial markets can only be realized when the straw raw material is processed through a process of decortication[1] and fractionation which separates the outside bast fibre from the inside core, producing a range of fibre and core fractions of varying quality and value.

Through this process of decortications or separation, the following component parts or fractions result:

- The outside bast fibre (about 30% of the mass,)
- The inside core, (representing about 60% of the mass),
- The residual 10% dust, and can be pelletized as a fuel, or is wasted.

The outside bast fibre can be applied into many markets including:

- Textiles
- Composite materials (non-woven) into the automotive, carpet, insultion, environmental blankets, etc.
- Pulp and paper industry products

The hemp core has market application in:

- Geeen building materials – hemp concrete, concrete blocks, sprayed on concrete, structural and non-structural panels, structural insulated panels (SIP's), roofing tiles
- Pet, poultry, and large animal bedding
- Bioplastics
- Energy pellets.

Hemp Oil Markets

The other set of products that can be derived from hemp originate from the use of the seed. The processing steps to generate products from the seed are:

- De-hulling of the seed
- Pressing of the oil (cold pressing) to generate unrefined crude oil
- Further oil processing to generate refined oil,
- Further processing of the residual oil cake generated as a co-product from the oil refining process, to generate livestock feed, flour, and/or protein powder.

[1] Decortication is the primary straw processing step in which the flax and/or hemp outside bast fibres are separated from the inside core material, called hurds in the case of hemp, and shives in the case of flax. The further processing of the core material into specific lengths and purity, to maximize their use and utility within specific market applications is known as fractionation.

The products that can be generated from the seed and oil are:

- Food, and functional/nutraceutical food products - hemp cooking oil, hemp seeds, butter, protein powder, hemp flour
- Hemp milk
- Cosmetics, aromatherapy, shampoos, moisturizers, etc
- Industrial products and ingredients as are used in paints, varnishes, surfactants, lubricants, biodiesel, etc.
- Biopolymers for the production of bioplastics.

Integrated Hemp Products

This third category of products, which is more the focus of this feasibility assessment, is the set of products which can be developed which integrate both the industrial fibre and oil into new products.

These include:

- Green building materials which include:
  - Family of products integrating hemp fibre and core with concrete and other construction matrixes, including reinforced concrete panels, blocks, sprayed on concrete, etc
  - Structural insulated panels (SIP's), with hemp bat insulation inserted between two structural panels.
  - Structural and non-structural panel boards
  - Roofing tiles
  - Carpets.
- Reinforced bioplastic products – integration of fibre with hemp oil based biopolymers, for production of a range of products – building materials, biodegradable plastics bags, counter tops, car parts, computer cases, etc.
- Natural binders for panel board manufacturing.
- Energy pellets – pelletizing of hemp core fractions using hemp oil ingredient lubricant.

Proposed Investment Model

General

Based on the analysis and research, an investment approach and model is proposed that will take advantage of the existing strengths and weaknesses in the hemp industry and markets.

The investment model is based on exploiting the following industry and market characteristics:

- The Canadian hemp industry at this point in constrained by not having access to, or having developed viable primary hemp fibre processing technologies and systems for separating the bast fibre from the core fractions. Through Emerson Hemp Distribution Company, who now operate a primary processing plant in Manitoba, this technology is available.
- The hemp industry is oversupplied with hemp oil into the food market. With expansion by Hemp Oil Canada, for purposes of the production of hemp protein powder, the excess oil supply over the next year will continue to expand, driving the price of the oil down. This excess oil has potential uses in other industrial applications in the green building materials and energy sectors.
- Little product development work has been done on the development of new and innovative green building and other sector products, which integrate both the hemp, fibre, core, and oil co-products.
- There is a gap within the green building material markets within Canada and the US for green building materials based on the use of renewable natural materials, that are more carbon friendly. Current green building standards, technologies, and products, are more based on the reduction in the use of concrete, versus the innovation of green building materials which are renewable and carbon friendly.
- Strategic market, and technology partners have been identified, who wish to use, market, demonstrate, and develop new products. These include HempFlax (Holland), several green builder companies in BC and other parts of Canada, University of Manitoba BioEngineering Department, TTS Industries, Alberta, Hemp Oil Canada, Manitoba Harvest, as well as others.

Investment Opportunity

There is the opportunity for the investment into and establishment of an integrated hemp industrial fibre and oil processing and marketing enterprise, focused on developing and marketing industrial products into primarily the green building materials sector, taking advantage of the current and likely long term excess hemp oil supply in Canada.

The focus of the investment is first on the establishment of the primary industrial hemp processing capacity, concurrent with the development and market evaluation of integrated green building materials and products. This would be followed by the evaluation of and possible establishment of secondary processing capacity for value added products such as hemp insulation, hemp structural insulated panels (SIP's) and/or natural construction panels, reinforced hemp bioplastics, based on market demand and prices.

The important part of this opportunity and investment strategy, is that the primary processing plant be established first, which can generate cash flow to support the product and market development, and then the secondary value added processing plant later.

APPROACH

The suggested business investment approach is in two stages as described below.

Stage One – Primary Processing and Product/Market Development

This stage is segregated into two components.

Primary Hemp Processing Plant: envisions the establishment of a primary processing plant in the 100 Mile House area. The plant would be designed with an hourly capacity in the range of 2 tonnes of raw material per hour. The plant would be modular, to allow expansion of capacity for the future. The initial products produced would be into existing identified markets, as more value added products are being developed, over the first several years. These initial markets include products into the building materials markets (reinforced concrete, etc), animal bedding, etc. This will provide a level of cash flow for the early stages of the project. This initial phase sees the selling of commodities to existing secondary processors and users.

Product and Market Development: concurrent with the establishment of the primary processing plant, a focused program of developing proprietary products, of integrated fibre and oil co-products will be undertaken. These will include, based on market needs, structural insulated panels, insulation, hemp – concrete products, bioplastics, natural binders, and or energy pellets. Hemp milk opportunities, may be considered, based on further market assessments. There are a number of government support programs to complement the private sectors investment in this area.

Stage Two – Value Added Secondary Processing

Based on the outcomes of the product and market development activities in Stage One, a secondary processing plant for value added green building materials or bioplastics can be established.

This may be a SIP plant, reinforced hemp bioplastics plant, and non-woven insulation plant are possibilities. The potential for hemp milk processing may be considered, based on further market assessments.

The period of time to establish the primary hemp processing plant would be within one year.

Concurrent with this plant construction, the primary production capacity in the 100 Mile House region would need to be established. The amount of hemp straw requirements at this initial scale of plant is in the range of 3000 tonnes per year (2 tonnes per hour, 7 hour/day, and 200 days annually). This would require approximately 1200 acres of hemp on dry land (2.5 tonnes per acre), or 600 acres on irrigated land (5 tonnes per acre).

INFRASTRUCTURE REQUIREMENTS

The infrastructure requirements of the primary industrial hemp processing plant are summarized below.

Labour: up to five – seven full time employees – plant manager, bale processor and screening operator, materials loading operator, processed product management and packing, maintenance. This does not include the secondary processing plant labour requirements.

Land : minimum land area one acre, with expansion capability of additional 1 acre.

Location: preferably rural location, minimizing distance from and access to agricultural production area.

Site specifications: well drained, all weather road access, water, power.

Power: three phase

Water: minimum requirements, at level of single household.

Economic Impacts

This integrated industrial hemp opportunity will have significant direct and indirect impacts into the 100 Mile House region, both from the Stage I primary processing plant opportunity, followed by the impacts from the Stage II secondary processing plant.

These include direct and indirect impacts are summarized, using agricultural industry multipliers within the agricultural industry.

The direct impacts, based on the primary and secondary plant expenditures are estimated in the range of $4 million annually. To this can be added the indirect and induced impacts which the plants will create on the provincial economy of almost $10 million (inclusive of the direct impacts).

The total direct and indirect employment impacts are estimated to be in the order of 123 full time equivalent positions, which would generate employment income of nearly $2.8 million annually.

100 Mile House Industrial Fibre Industry Impacts (annual)

Direct Impact- Primary processing	$	1,452,361
Direct Impact - secondary processing	$	2,579,000
Total Direct Impact	$	4,031,361
Direct,Indirect and induced provincial impacts	$	9,675,266
Employment Impact (FTE's), direct		18
Employment Impacts (indirect + induced)		105
Total employment(FTE)		123
Direct employment income	$	585,600
Indirect and Enduced employment income	$	2,208,000
Total employment income	$	2,793,600

FTE's - full time equivalents

Appendix 2

Seed & Treatment
Per Acre

Crop	Seeding Rate per Acre	Price per Unit	Cost per Acre
Hemp Oil	18 lb	$1.75 /lb	$31.50
Hemp Fiber	36 lb	$1.35 /lb	$48.60

Fertilizer

Price of Fertilizer	$/lb	$/kg	
Nitrogen	$0.400	$0.88	$0.46 *
Phosphorus	$0.370	$0.82	
Potash	$0.420	$0.93	
Sulphur	$0.300	$0.66	

Amount of Actual Pounds of Elements Applied Per Acre

Crop	Nitrogen		Phosphorus		Potash		Sulphur		Total
	lbs	$/acre	lbs	$/acre	lbs	$/acre	lbs	$/acre	$/acre
Hemp Oil	80	$32.00	30	$11.10	0	$0.00	0	$0.00	$43.10
Hemp Fit	80	$32.00	30	$11.10	30	$12.60	0	$0.00	$55.70

Chemicals
Per Acre

Crop	Weed Control $/acre	Disease Control $/acre	Insect Control $/acre	Total Cost $/acre
Hemp Oil	$0.00	$0.00	$0.00	$0.00
Hemp Fiber	$0.00	$0.00	$0.00	$0.00

Note:

Pre-emergent burn off ($5/acre) and/or pre-harvest desiccation ($10/acre) not included in weed control.

Chemical costs do not include year end rebates or bundling discounts.

Crop Production Costs 2010 Guidelines (Dollars Per Acre)

	Hemp Oil	Hemp Fiber	Your Farm	Your Farm
A. Operating Costs				
Seed & Treatment	$31.50	$48.60		
Fertilizer	$43.10	$55.70		
Herbicide	$0.00	$0.00		
Fungicide	$0.00	$0.00		
Insecticide	$0.00	$0.00		
Fuel	$16.25	$16.75		
Machinery Operating	$13.50	$13.50		
Crop Insurance	$19.82	$0.00		
Other Costs	$7.50	$7.50		
Land Taxes	$5.55	$5.55		
Drying Costs	$20.00	$0.00		
Interest on Operating	$4.13	$3.87		
Total Operating Costs	**$161.35**	**$151.47**		
B. Fixed Costs				
Land Investment Costs	$32.00	$32.00		
Machinery Depreciation	$31.00	$27.00		
Machinery Investment	$12.40	$10.80		
Storage Costs	$4.02	$4.02		
Total Fixed Costs	**$79.42**	**$73.82**		
Total Operating & Fixed	**$240.77**	**$225.29**		
C. Labour	$18.00	$18.00		
Total Costs	**$258.77**	**$243.29**		
Estimated Farmgate Price				
$ per unit	$0.55 lb	$0.05 lb		
$ per tonne	$1,213 t	$110 t		
Breakeven Yield				
Operating Costs	293 lb	3029 lb		
Operating & Fixed Costs	438 lb	4506 lb		
Total Costs	**470** lb	**4866** lb		

Disclaimer: This budget is only a guide and is not intended as an in depth study of the cost of production of this industry. Interpretation and utilization of this information is the responsibility of the user.

Appendix 3. Open Day August 18, 2009

Open day topics

The conference started at 9:00 am and ended at 4:45 pm. Opening and introductions were conducted by MLA Donna Barnett followed by Mayor Mitch Campsall and Mr. Jammi Kumar, B.C. Agriculture and Lands First Nations Agrologist. Project Manager Erik Eising provided the project update and details of the Open day program. About 40 people, with diverse backgrounds, attended the day-long event that included four guest speakers.

Crop Production- Update

Highlights of the 2009 season so far were:

- There was a late start of seeding due to flooding, followed by a cold and wet period during early plant develop and drought in July and August
- Great variation in crop development within a field/test plot
- Industrial hemp field crop tour was conducted of site IV, visited 40 people in carpools

There was knowledge transfer to producers of recommended organic and conventional seeding practices and requirements for soil nutrient information, such as soil analysis, low organic matter issues, green manure, and crop rotation planning.

Industrial Hemp Fibre Processing- Information

- On-farm, on-site primary processing with Canadian technology
- Introduction to industrial hemp processing involving decortication by Wally Empson, Emerson Hemp Distribution Company. In a hands-on approach, including fibre sample demonstration, the audience was introduced to how fibre products produced by made- in-Canada technology are currently marketed throughout Canada and the U.S.

Market Development

- A preliminary search of B.C. market entry points for primary processed fibre products the key sector identified construction.

Fibre products presentations

- Bowen Island based hempcrete founder, Jayeson Hendyrsan presented his practical experience in hemp construction techniques. Jayeson also provided detailed information of the upcoming green-building conference in Ireland of which Jayeson was a co-organizer.

- Calgary-based Riva's EcoStore was represented by Shayne Korithoski who provided information of the Riva's EcoStore's interest to retail "Eco –friendly" building products including hemp.

Hemp food presentation

- Charles Holmes, founder of Living Harvest, and hemp food processor with a facility in Manitoba presented his vision on the important factors of life and how he incorporates that vision into his own life, including his commercial food processing.

Moving Industrial Hemp Pilot project Forward

- Moderator David Zirnhelt presented all attendees with an opportunity to voice their opinion and present suggestions of how best to move forward.

For the guests an appreciation supper was held near one of the production sites.

Overall, the Open Day was a great success and increased awareness for the project. The media coverage resulted in overseas interest in the progress of this B.C. project.

Appendix 4. Industrial Hemp Crop Production Management Guide for the South Cariboo Region

Introduction

Agricultural production in the South Cariboo region is dominated by ranching. Local agricultural producers have limited crop production experience, other than re-seeding of hay land, and thereby using a cover crop to enhance establishment of a good hay field.
Limited general crop production experience combined with very limited on-farm availability of general soil tillage equipment and corresponding lack of practical experience with soil tillage equipment create a hurdle for producers to participate in industrial hemp fibre production.

The following information and recommendations are a step-by-step guide for prospective industrial hemp producers. While this is a general guide, it is the responsibility of the individual producers to make decisions that are best suited for their own ranch.

Prior to Deciding to Grow Industrial Hemp

1) Take sufficient representative soil samples and have them analyzed at a recognized laboratory.
2) For either organic or conventional production methods, take sufficient soil core samples to determine the depth of development through on-site visual inspection. Preferably, root development occurs down to 70 cm below field level
3) Evaluate soil sample results and establish that the nutrient levels listed in Table 1 can be achieved.

Table 1. Recommended nutrient levels in soil for industrial hemp production

	Actual N.	P	K
Grain	80	30	20
Fibre	120	30	20 units?

Recommendation for First Time Producers

For first time producers, seed the minimum number of acres. Apply for a **research** permit from Health Canada. This enables the producer to grow small plots instead of the minimum 10 acres required for a **regular** commercial production license.

General Key Rules for Industrial Hemp Production

1. Do not grow industrial hemp on land that is NOT capable of producing a sustainable alfalfa crop.
2. Do not grow industrial hemp destined for fibre processing on land with rocks or, pebbles. Stones will damage fibre decortication equipment.

3. “Early fields” as in well-drained fields are recommended. Sandy soil is least suitable, loam/clay containing soils are preferred. Look at the crop production history of the field and have detailed maps indicating of crop production limitations
4. Fields that have a pivot irrigation system in place are recommended above other irrigation systems. Make sure that you have valid irrigation license.

Rules for Successful Conventional and Organic Industrial Hemp Production

1. Know your field, its limitations and capabilities. It takes a generation to improve on soil conditions!
2. Think long term. Have a crop rotation plan in place. Growing hemp after hemp indefinitely is not recommended.
3. Think sustainably. Take soil samples, manage the nutrient balance, recycle nutrients, and manage weed populations. Small hemp plants are very poor weed competitors but established hemp plants 6o cm tall are strong weed competitors.
4. Maximize field work in late summer and fall and avoid spring.
5. Plan ahead. Apply for license at Health Canada after January 1 of your crop production year. Order seed and nutrients well in advance. Be ready for seeding well in advance of seeding.
6. Minimize field work in spring. Prepare seed bed through shallow working of soil (harrow). Prevent drying out of the seed bed in spring by working soil to deeper depths. Prevent soil compaction in wet springs.
7. Perform on-farm crop research through a) varietal test comparison, b) green manure comparison
8. Compare results among fields, such as by comparing with neighbors and exchanging results
9. Work with Mother Nature, not against her.
10. Perform field work when the work is due. Do not postpone work and do maintain equipment.

Tillage

Background

Soil tillage success and efficiency are determined by matching the right sized tractor with the proper piece of tillage equipment operated at the correct speed for the existing conditions by a skilled driver. Through evaluation, a plan should be made to establish, firstly, what equipment is required and, secondly, how to access this equipment by owning or renting it or by contracting for custom work. During the equipment evaluation process, it is important to establish the tillage capacity of the unit expressed in acres per hour and the fuel cost per acre. When tilling large fields, the capacity per hour becomes more important than when tilling a small field.

Mechanical Tillage

The equipment recommended is a tractor equipped with dual tires, heavy duty tandem disc or even a moldboard plow, a deep tiller, and (roller) harrows. As result of many years of hay harvesting and equipment traffic, the alfalfa field may suffer from soil compaction. In that case, a moldboard plow might be preferred over a heavy duty tandem disc. After the initial break up of the sod, it is recommended to remove subsoil hard pan, which acts to prevent proper root development, by one or even two passes with a deep tiller or, ripper in a direction diagonal to the initial sod-breaking driving direction. Always make sure that the tillage action results in smoothing of the field. That is the reason for driving in a different direction during the sequent tillage operations.

Chemical No-Tillage

Due to a land owner's specific request of using a no-till seeding practice a trial program was developed. A tractor was equipped with a front-mounted sprayer while pulling a press-drill seeder. The sprayer applied a desiccant at the same time the hemp seed and fertilizer was placed in the ground by the press drill. The industrial hemp crop emerged well and experienced no weed competition. Due to extreme dry conditions the crop did not develop well. It might be of interest to repeat this chemical no-till method under irrigation.

Seeding Operation

Recommended equipment is a tractor equipped with dual tires and harrows with packer rolls. A press drill is recommended. A firm seedbed is required to facilitate proper germination. When proper tilling has been completed in fall, the soil will settle during the winter months and should require only minimal tillage prior to seeding. In general, harrowing in combination with packer rolls will be sufficient to establish a firm seed bed. The recommended seeder is a press drill, seeding depths ½ to 3/4 inch deep. Calibration of the seeder (establishing seed dispersal quantity) is very important when using a specific seeder for the first time.

For the calibration of the seeder, have a tarp, marker, hydraulic jack, blocking material, calculator, scale, and pail available. An example of the calibration process is given:

1. place small amount of seed in hopper, just enough for the seeder to work properly
2. lift drive-wheel of seeder off the ground, properly securing or blocking the seeder to prevent it from falling down.
3. place clean tarp or plastic under seed pipes/coulters
4. establish width of collection area by how many coulters and how wide
5. establish outside circumference from drive wheel
6. mark tire wall with a chalk line.
7. turn wheel and count 10 rotations. 10 rotations x circumference = distance covered
8. distance covered x width of seed collection area on tarp = area seeded
9. carefully move tarp away from under the seeder and collect seeds in a small container

10. establish weight of container with seeds. Next, remove seeds and scale. Empty container and establish weight of seed in container
11. seeding rate for area is calculated: area seeded x weight of seed.

Crop rotation plan

Industrial hemp processors of both grain and fibre rely on a reliable yearly delivery of quality industrial hemp products from the fields to their processing facility. This enables them to maintain the required efficiency and stay competitive in the market place. It is critical that the processor is able to deliver quality products in a timely fashion to the market place.

Table 2 provides an industrial hemp crop rotation plan for a ranch located in the interior of B.C. based on a 6-year rotation of industrial hemp and alfalfa. It involves 300 acres.

Table 2. Industrial hemp crop rotation plan

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
50 acres/@					
Field 1 hemp	alfalfa	alfalfa	alfalfa	alfalfa	alfalfa 1cut
Field 2 alfalfa	hemp	alfalfa	alfalfa	alfalfa	alfalfa
Field 3 alfalfa	alfalfa	hemp	alfalfa	alfalfa	alfalfa
Field 4 alfalfa	alfalfa	alfalfa	hemp	alfalfa	alfalfa
Field 5 alfalfa	alfalfa	alfalfa	alfalfa	hemp	alfalfa
Field 6 alfalfa	alfalfa	alfalfa	alfalfa	alfalfa	hemp

During the final year of alfalfa production, year 5, only one cut will be harvested. The re-growth will be incorporated as green manure.