The Business Case for

Pulse Fractionation

in North Central Montana

Brett Doney, President & CEO
BDoney@GFdevelopment.org
1-406-750-2119

Jolene Schalper, Vice President
JSchalper@GFdevelopment.org
1-406-750-4481

Great Falls, MT
DEVELOPMENT
AUTHORITY

Contents

The Great Falls Development Authority (GFDA) is a public/private economic development partnership serving the 13 county Golden Triangle region of north-central Montana. Our mission is to grow and diversify the Great Falls regional economy and support the creation of higher wage jobs. We are a private-sector driven, award-winning professional economic development team that prides itself on providing excellent service to support long-term business success. We were the first economic development organization in the Rocky Mountain region to earn accreditation from the International Economic Development Council.

In Addition to World-Renowned Agricultural Production, we offer a range of support for agricultural and food processors, including workforce recruitment and training grants, land and equipment grants, access to low cost capital, low cost utilities, competitive shovel-ready rail-served manufacturing sites, abundance of spring and municipal water, the 6th best tax climate in the nation, and more! We are experts at structuring packages focused on long-term client success.

Purpose of This Business Case is to document the competitive advantages our region offers for niches in agricultural and food processing operations. We have developed business cases for a variety of other agricultural and food processing niches which may be of interest to you.

We look forward to learning about your company and how we may be able to find a great location for your start-up or expansion.

Executive Summary

The Great Falls Region is the premier location for the development of pea fractionation facilities for the following reasons:

- The Region is the site of abundant dry pea production giving pea ingredient producers an economic advantage through procuring peas directly from pea producers.

- The Region has one of the lowest combined costs of industrial energy in the nation including one of the lowest electrical rates for industrial use in pea growing areas in North America, which significantly reduces production energy costs. The Region also boasts low natural gas rates for industrial use, which is necessary for industrial drying purposes.

- The Region has plentiful labor resources that can be coupled with Montana-sponsored workforce training financial incentives.

- The Region has two impressive, shovel-ready industrial parks with required infrastructure to support a pea fractionation facility.

- The Region has the I-15 Interstate Corridor that interconnects with major highway systems for efficient transport of goods by truck throughout North America.

- The Region has BNSF rail service for efficient transport of goods by rail.

- The Region is serviced by dozens of Montana-based and out-of-state trucking firms for efficient and cost effective transport of goods by truck.

- The Region has traction in the Intermediate Industrial Products segment of food manufacturing.

This document outlines the justification for the start-up of a pulse crop fractionation facility. The opportunity that exists for processing pulse crops in Montana is uncommonly advantageous due to the rapidly increasing demand for pulse crop ingredients, the increasing availability of high quality pulse crops in Montana, and the relevant resources available in the Great Falls Region. Pulse crops are grown in large quantities in Montana and include dry peas, lentils, and chickpeas. The pulse crop technology that is featured in this business case is focused upon the fractionation of dry peas. Pea fractionated ingredients occupy the vast majority of pulse crop fractionated products and are in increasing demand in the pet food and human food marketplaces.

Agriculture is the number one industry for the Treasure State, Montana. According to the 2012 USDA Census of Agriculture, Montana's agriculture industry employed over 9.5 million acres to bring in over $4.2 billion in revenue to the state.[i] Agricultural producers and processors in

Montana have demonstrated the ability to efficiently grow and process agricultural commodities for shipment to customers throughout the world. The Great Falls Region is also an agricultural processing hub that excels in the conversion of Montana-grown commodities into intermediate products for food and feed industries.

The collection of food and feed component manufacturers in the Great Falls Region has been very successful in supplying food and feed supply chains with efficient production and shipment of a wide variety of intermediate products. Prime examples of bulk, intermediate products produced in the Great Falls Region are conditioned grains, oilseeds, and pulses; milled flours, durum semolina, pasta products, barley malt, vegetable oils, and honey. The Region is also home to a large scale egg production operation.

Companies that operate agri-processing operations in the Great Falls Region are:

General Mills	Pasta Montana	Malteurop
Cenex Harvest States	Cereal Food Processors	Columbia Grain
Great Northern Growers	Montana Milling	Montana Specialty Mills
JM Grain	Montana Eggs LLC	Montana Advanced Biofuels
Timeless Seeds	Giant Springs Water	Smoot Honey

Table 1: Great Falls Region Agri-processing Companies
Source: Great Falls Development Authority

The state of Montana has become the nation's leading producer of pulse crops. Montana is ranked number one in the production of dry peas and lentils. In 2014, Montana produced over 9 million hundredweight of peas (52% of U.S. production), over 1.7 million hundredweight of lentils (52% of U.S. production), and over 475,000 hundredweight of chickpeas (17% of U.S. production).[ii] In the U.S., pea prices have averaged $10.50/cwt ($6.30/bushel) over the last ten years.[iii] The commodity value of pulse crops harvested in Montana currently exceeds $100 million in sales.

Peas and pea components are rapidly gaining in favor with consumers worldwide as preferred food sources that are non-allergenic, non-GMO, high in protein, low-glycemic, and high in fibers. These vegan food sources are known to be agriculturally sustainable due to their nitrogen fixing ability and low agronomic requirements. Through technology, peas are now being successfully fractionated into high protein, low glycemic starch, and high fiber components for foods and feeds.

Relative output levels of protein, starch, and fiber in pea fractionation products are dependent upon the method of fractionation. The two methods currently in use today include a dry method that utilizes milling in combination with air classification and a wet method that utilizes protein precipitation chemistry in conjunction with decanting and separation of pea fractions.

The two pea fractionation technologies each have their appeal. Dry fractionation is the least cost alternative and currently has a high demand for its pea protein concentrate (55-60% protein) and pea fiber products for the pet food industry. Wet fractionation is a more expensive and complex process that has a requirement for natural gas for drying purposes. Wet fractionation products in demand are pea protein isolate (80-85% protein) and pea fiber for inclusion into food and nutraceutical products.

Both pea fractionation methods can be developed in the Great Falls Region due to energy and human capital economic factors. There is a current high demand for pea protein concentrates and isolates along with pea fibers in the pet food and in the human nutrition industries. The Great Falls Region boasts of a qualified labor force that has average hourly wages that are 79% of the national average.[iv] In fact, the Great Falls area has lower overall hourly wages than other metropolitan areas of Montana.[v]

The Great Falls Region has some of the nation's lowest industrial electrical costs.[vi] The City of Great Falls has the lowest industrial natural gas cost in Montana and that cost is lower than almost all industrial sites in the nation. With lower energy and human resources operating costs and operating within substantial pea production acreage, a pea fractionation operation in the Great Falls Region would have significant economic advantages to competition. A dry or wet pea fractionation facility in the Great Falls Region would have the opportunity to become the lowest cost producer of pea protein concentrates, isolates, fiber, and starches in North America.

Pea Production Resources in the Great Falls Region

Thirteen counties within the Great Falls Region trade area have experienced a significant growth in pea production over the past five years. The counties in the Great Falls Region trade area are Blaine, Cascade, Chouteau, Fergus, Glacier, Hill, Judith Basin, Lewis & Clark, Liberty, Meagher, Pondera, Teton, and Toole. Figure 1 shows the dramatic increase in pea production in the Great Falls Region from 65 million pounds in 2010 to over 245 million pounds in 2014.

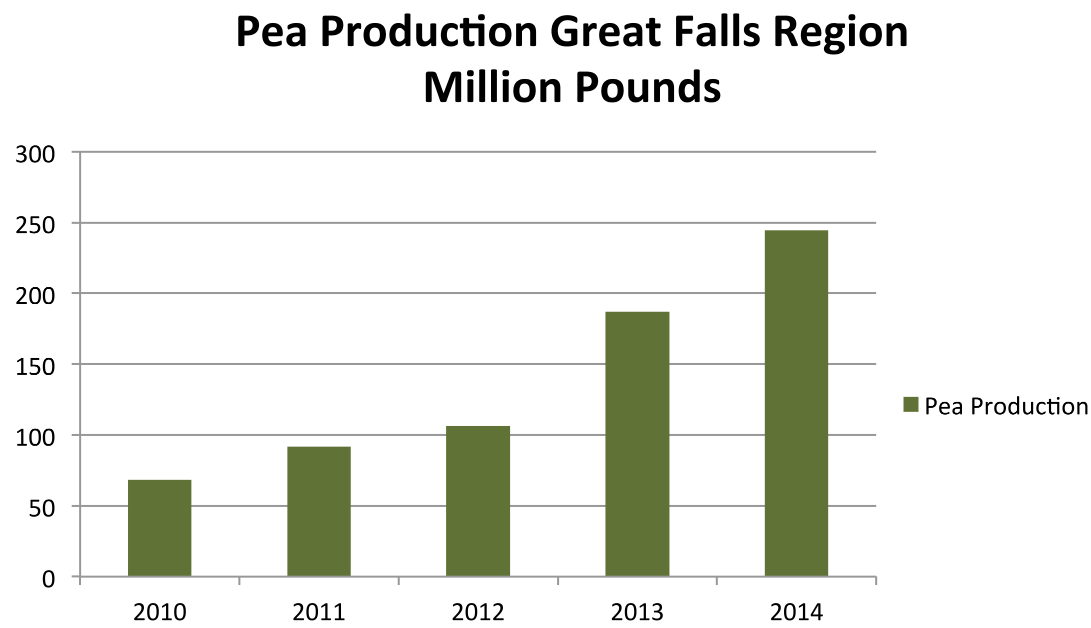

Figure 1: Great Falls Region – 13 County Pea Production Increase per Year
Source: USDA, NASS, 2010 to 2014 Data

In 2014, 31% of all pea acres harvested in Montana were in the Great Falls Region as shown in Figure 2. The widespread distribution of pea acres in the Great Falls Region is shown in Figure 3.

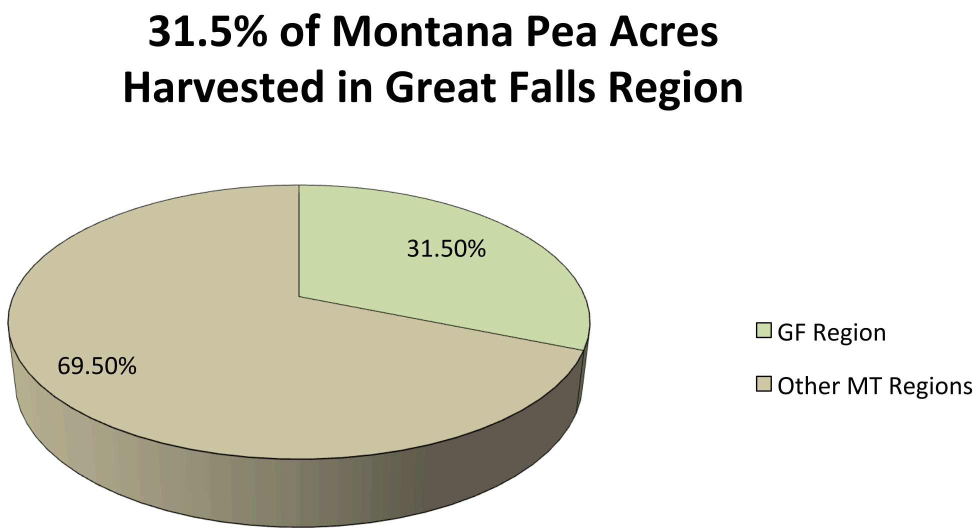

Figure 2: 31.5% of Montana Pea Acres Harvested in Great Falls Region Trade Area
Source: USDA, NASS 2014 Data

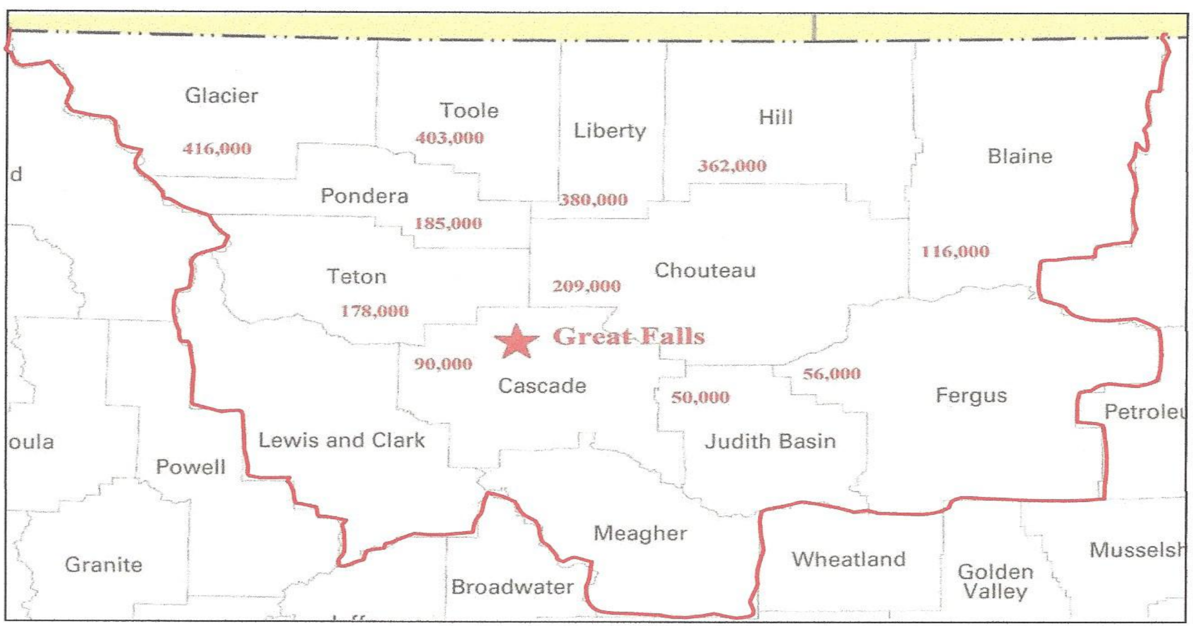

Figure 3: 2014 Pea Production in Hundredweights in the Great Falls Trade Area
(2.445 Million CWT/ 13 Counties)
Source: USDA, NASS, 2014 Data

The percentage of pea acres harvested in the Great Falls Region is projected to increase as Montana farmers embrace the economic opportunity to include raising peas into their wheat crop rotation. Montana State University recently studied the economic impact produced by the introduction of pea production crop rotation into traditional wheat production in Montana. Net farm returns were calculated for four rotation scenarios. Pea–wheat rotation consistently had the greatest net returns among six historical systems studied. The study concluded that pea–wheat systems can reduce net return uncertainties for Montana wheat farmers.[vii]

The thirteen county Great Falls Region had harvested 2.67 million acres of wheat in 2014, which accounted for 46% of all wheat acres harvested in Montana. The Great Falls Region harvested 158,700 acres of peas, which, comparably, was only 6% of wheat acreage. (Figure 4) Farmers in the thirteen county trade area will become more aware of the potential for higher on-farm net returns from pea production and are projected to increasingly adopt the practice of raising peas in their wheat rotation. Pea production in the Great Falls Region is projected to continue to increase as part of the economically and environmentally superior practice of rotating pea production with wheat production.

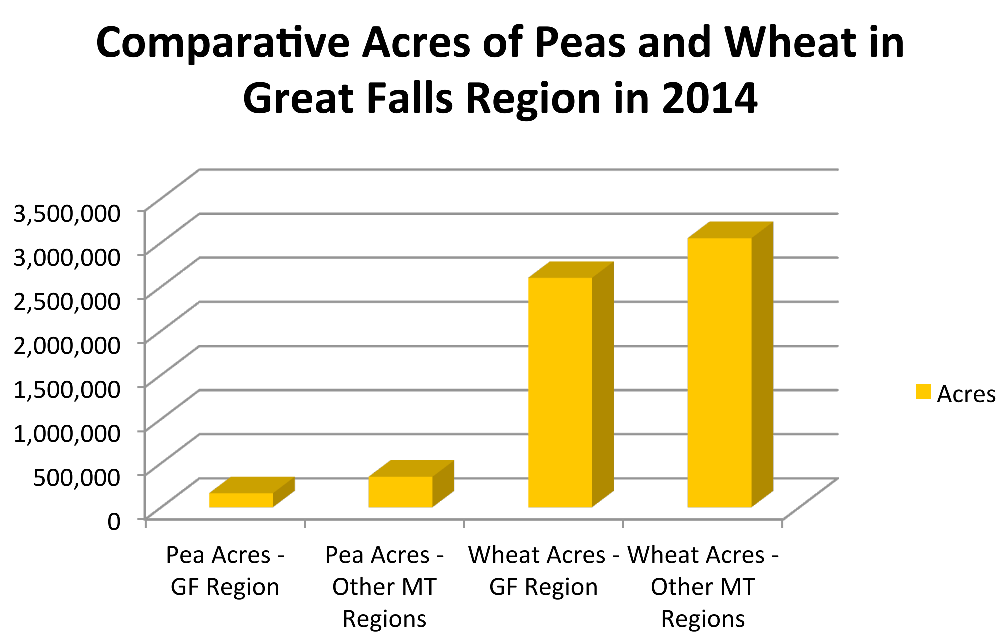

Figure 4: Pea and Wheat Acres Harvested in the GF Region and Other MT Regions
Source: USDA, NASS, 2014 Data

The Great Falls Region contributes toward Montana being the leading state in the production of dry peas, a statistic earned by the production of over 9 million hundredweight of dry peas in 2014. Montana has been producing about 50% of the nation's dry pea production. The state not only leads in production, but has shown consistent growth in pea production over the past five years compared to total U.S. pea production as shown in Figure 5.

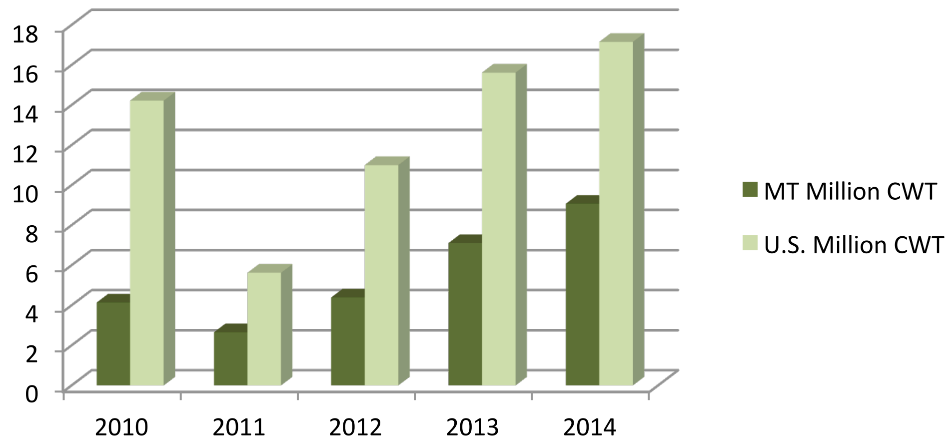

Figure 5: Montana and U.S. Pea Production: 2010 – 2014
Source: USDA, NASS, 2010-2014 Data

The availability of dry peas is not in question in Montana due to the widespread dry pea growing region within the state. In addition to abundant and increasing pea production in the Great Falls Region, pea production in Canada has also been increasing over the last decade. Dry pea production in Canada in 2014 totaled 75 million hundredweight.[viii] Dry pea production in Canada is adjacent to Montana primarily in the provinces of Saskatchewan, and Alberta with Saskatchewan production contributing 60% of Canada's output.[ix]

Proximity to Raw Materials

One massive benefit derived from operating a pea fractionation facility within pea agricultural production areas is that the pea fractionation company can contract and purchase its pea commodities directly from regional farmers. By receiving dry peas directly from regional farmers, the company can capture receiving, cleaning, and conditioning margins that can amount to greater than 10% of annual raw material costs.

Dry pea price projections are estimated to be $10.80 per hundredweight in 2015.[x] Recent historical prices per hundredweight for on-farm dry peas ranged from $14.80 in 2011 to $10.60 in 2014. Pea fractionation companies are located within pea growing regions as confirmed by competitors in Saskatchewan, Manitoba, North Dakota, France, Belgium, and China. By locating pea fractionation in the Great Falls Region, a pea fractionation company would be operating in close proximity to raw materials and thereby driving down the company's highest volume direct cost, dry pea commodities.

Pea Processing in the Great Falls Region

The dry pea production and processing value chain consists of five business groups that interact to supply a range of pea-based product ingredients to food, feed and pet food manufacturers. Figure 6 shows the roster of dry pea industry participants involved in delivering pea-based consumable products to livestock, poultry, pets, and humans.

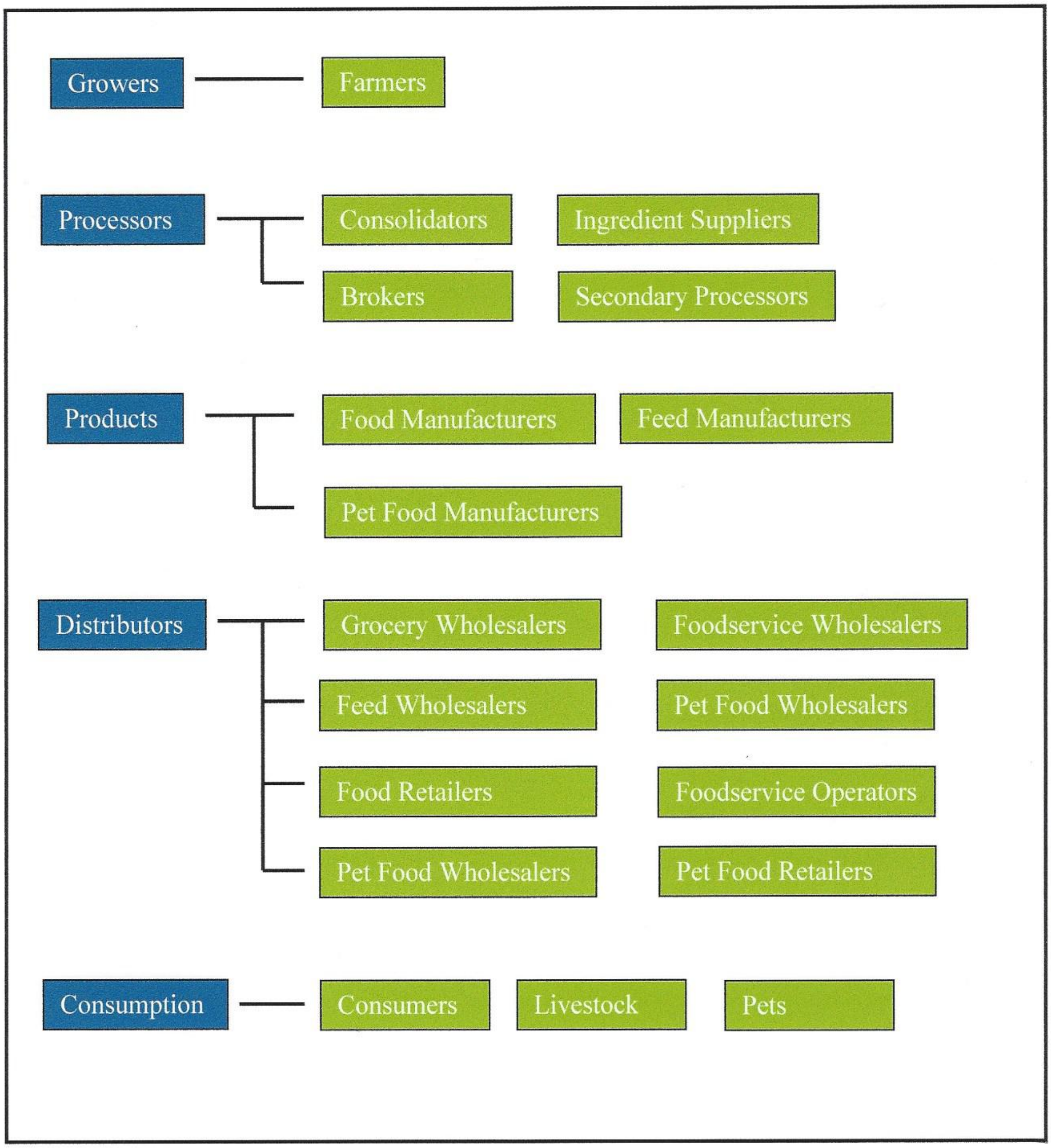

Figure 6: Pea Processing Value Chain Participants in the Great Falls Region

Participants in the pea processing value chain in the Great Falls Region are shown in Figure 7. The Great Falls Region has a significant number of pea producers that are increasing in number and acreage every year. Family farmers and Hutterite colony farm organizations grew over 245 million pounds of dry peas in 2014. The vast majority of dry peas grown in the Great Falls Region are purchased by a diverse collection of dry pea consolidators.

Consolidators purchase dry peas for themselves or for clients and proceed to grade, clean, and condition dry peas in preparation for export or domestic use. Some consolidators are engaged in further value added processing of dry peas including de-hulling/splitting, color sorting, and custom packaging. Consolidators in the Great Falls Region represent the vast majority of companies that participate in the processing segment of the pea crop value chain in the Great Falls Region.

Consolidators listed in Figure 7 and mapped in Figure 8 have facilities in the Great Falls Region and are actively engaged in primarily receiving, cleaning, and conditioning bulk dry pea commodities. The consolidators with physical assets in the Region include Columbia Grain, Chinook and Ledger, MT, which is a large grain procurement company headquartered in Portland, OR. Belle Pulses USA, Hingham, MT, is a subsidiary of Belle Pulses, Ltd., St. Isidore de Bellevue, SK, Canada. Regional consolidators include Stricts, Inc., Chester, MT, Northern Seed LLC, Shelby, MT, Sunburst Grain Inc., Sunburst, MT, Pardue Grain Inc., Cut Bank, MT, Hodgskiss Seed, Choteau, MT. Global Agro Commodities, Chester, MT is a subsidiary of Bespoke Group, LLC, Irving, TX, which is an exporter of pulse crops primarily to India.

Listed in Figure 7, as Exporters/Brokers, are several companies that consolidate dry pea commodities but may or may not have facilities in the Region. Companies engaged in foreign commerce in the Great Falls Region are classified as Exporters. Exporters have the option of purchasing and taking title of commodities or acting as an agent for purchasers for a brokerage fee.

Exporters are charged with ensuring procurement and delivery of commodities to purchasers in foreign markets. Exporters who have facilities in the Great Falls Region include Columbia Grain, Chinook and Ledger, MT, Belle Pulses USA, Hingham, MT and Global Agro Commodities, Chester, MT. Other major exporters operating in the Great Falls Region include JM Grain, Great Falls, MT with headquarters in Garrison, ND, and Commercial Lynks, Inc., Cut Bank, MT with headquarters in Alexandria, VA.

Consolidators, exporters, and brokers purchase and re-sell dry pea commodities primarily to intermediate product processors and finished product processors. Processors that purchase dry peas are primarily located in foreign markets, however, food, feed, and pet food manufacturers in the U.S. are increasingly using dry peas and dry pea fractionation ingredients in current and new formulations.

Pea procurement companies that operate as consolidators, exporters, or brokers in the Great Falls Region rely upon a reliable network of pea producers to ensure adequate quantities of dry peas consistently each crop year. Pea procurement companies are in business to connect pea producers to commodity buyers to ensure pea crop commodities are efficiently delivered to expanding markets.

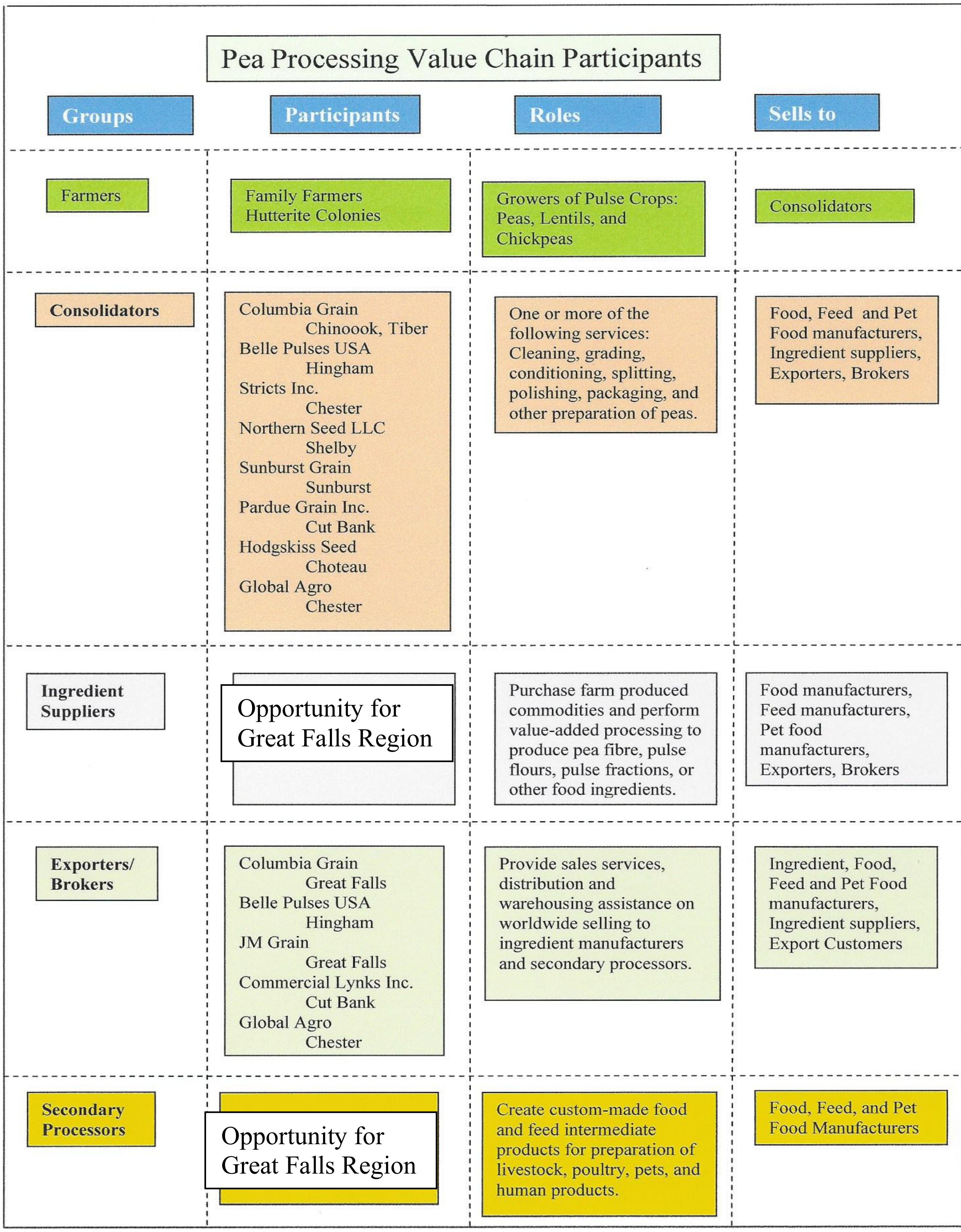

Figure 7: Pea Processing Value Chain Participants in the Great Falls Region

Figure 8: Pea Consolidation Locations in the Great Falls Region

Business Opportunity

By employing the combination of the Great Falls Regional resources, a start-up pea fractionation facility can become the lowest cost North American producer of pea protein concentrates, fiber, and starches. The Great Falls Region has some of the nation's lowest industrial electrical costs.[xi] The City of Great Falls has the lowest industrial natural gas cost in Montana and that cost is lower than almost all industrial sites in the nation. With lower energy and human resources operating costs and operating within substantial pea production acreage, a pea fractionation operation in the Great Falls Region would have significant economic advantages to competition.

Pea Fractionation Products Trends

Pulses are members of the legume family. The term "pulse" refers strictly to dried seeds from legumes. Dry peas, edible beans, lentils and chickpeas are the most common types of pulse crops. Compared to grains, pulses are higher in protein and fiber, lower in fat and have the bonus of being nitrogen-fixing crops that improve the environmental sustainability of annual farming systems. Pulses also have high levels of minerals such as iron, zinc, and phosphorous as well as essential vitamins such as folate and other B-vitamins.[xii]

Pulses contain attributes that apply directly to the eight major trends that are occurring within the food and nutrition marketplace. The list includes foods and feeds that have increased demand and consumption that are:

Vegetarian
High Protein
High Fiber
Gluten Free (Grain Free)
Non-allergen
Non-GMO
Low Glycemic
Demonstrates Ecological Sustainability

Pea protein concentrates (55%-60% protein content) and isolates (80%-85% protein content) have been utilized in food and feed formulations to address all marketplace trends shown above. Pea starch and pea fiber ingredients address most of the major trends as well by being vegetarian, gluten free, non-allergen, non-GMO, low glycemic, and sustainable in both human foods and pet foods. Pea starch is used in the food industry as a gelling or thickening agent. Pea starch is used as an ingredient in sauces, gravies, soups, noodles, and batters. Pea fiber is an excellent fiber source that is used in breads, cookies, and pasta.

Pea protein concentrates and isolates are viable alternatives to soy concentrates and isolates. The soy protein products marketplace has been predicted to continue to grow to annually be worth $9.2 billion by 2018.[xiii] The soy concentrate, soy isolate, and textured soy protein marketplace has been estimated to exceed 1 million metric tons per year and occupies 56% of the world output of vegetable-based proteins.

In contrast, pea protein has less than 1% of the world output of vegetable-based proteins.[xiv] Soy protein manufacturing technologies and marketing efforts have had a lengthy head start over pea proteins over the last 50 years. However, pea protein processing technologies have advantages in that peas are very low in fat and do not require an oil extraction stage, that employs hexane, and in comparing soy products to pea products, pea products have much lower anti-nutritional factors for humans and animals.

Frost and Sullivan's Global Program Manager for Food and Nutrition, Chris Shanahan, stated in a recent April 2015 speaking engagement at the International Marketplace Trade Show, that the annual growth rate demand for pea protein concentrates will be 11.3% through 2020. He stated that the demand for pea protein could rise as much as 15% to 20% per year through 2020. Mr. Shanahan stated that pea proteins are perfect examples of freedom foods, which are free from health worries, ethical worries, and food safety worries. Mr. Shanahan also stated that protein producers who own the source of their raw materials will dominate their markets in the long run.[xv] This observation confirms the strategic thinking of pea fractionation facilities that have all placed their production facilities in pea growing regions.

A recent survey by Global Food Forums, St. Charles, IL, 78 protein-oriented food scientists were asked which protein source would see an increase in usage in the next few years. The scientists gave pea protein the highest score with 89% of the scientists indicating pea protein would see annual increases in usage. Soy protein was only identified as increasing by 36% of the scientists. This may be reflective of soy-based allergies and GMO affiliation by soy protein, where pea protein has very low allergenicity and is not encumbered by GMO issues.[xvi]

Pea protein products are derived from the components in peas (Figure 9) and are currently concentrated or isolated in three forms: pea flour (22% protein content), pea protein concentrate (55-60% protein content), and pea protein isolate (80-85% protein content). Pea flour is prepared by milling de-hulled dry peas. Pea protein concentrate is normally prepared using dry fractionation methodology and pea protein isolate is prepared using wet processing methodologies.

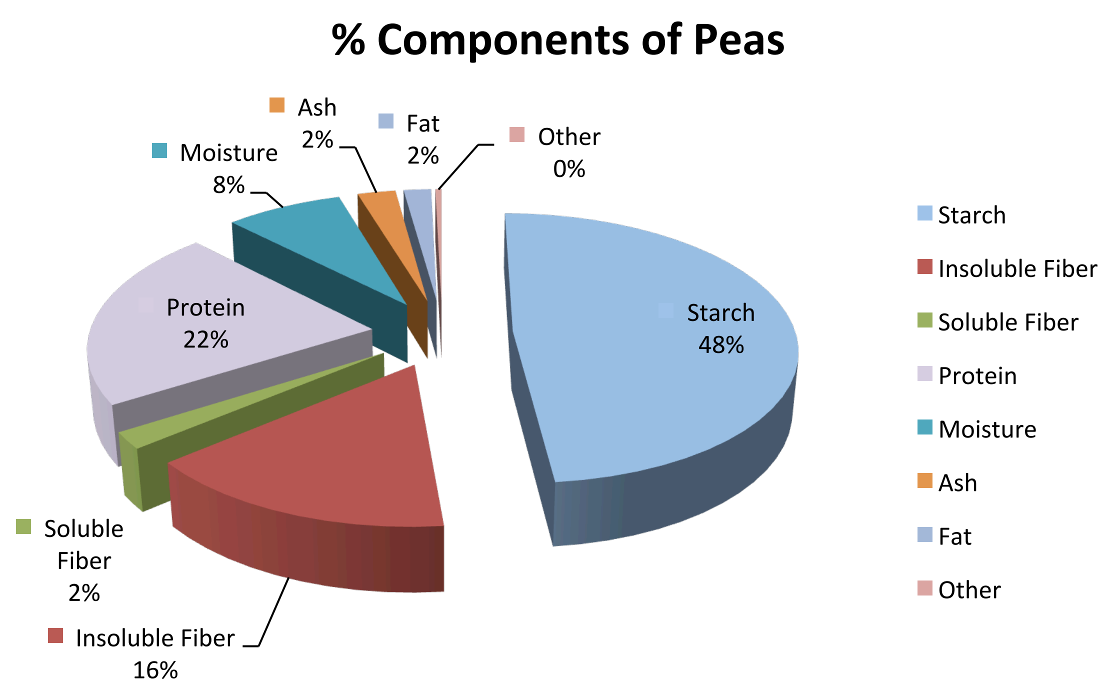

Figure 9: % Components of Peas
Source: USDA Nutrient Database

Pea Protein for Food Trends

The annual consumption of protein foods by humans are continuing to increase by at least 5% per year. Frost and Sullivan published the following information on worldwide protein consumption.

Animal Protein Consumption Volume

2.3 million metric tons (2012) with a 5.5% to 6% CAGR (2012-2018)

Total Plant Protein Consumption Volume

1.7 million metric tons (2012) with a 5.0% to 5.5% CAGR (2012-2018)

Plant Protein Consumption Rankings - % of Total Plant Protein Consumed

Soy – 66%; Wheat – 43%; Other – 1%; Pea - <1%

Table 2: Worldwide Protein Consumption

Source: Frost and Sullivan

It was estimated by Frost and Sullivan that in 2014 greater than 10 million metric tons of pea protein products were produced with Canada producing 3 million metric tons and France, Belgium, China, and the U.S. producing the rest.[xvii] Pea Protein volume growth was estimated by Frost and Sullivan to exceed 10% per year.[xviii] Cosucra, Warcoing, Belgium, recently invested over $40 million in 2013 in a second processing line to keep up with their 20% annual growth in pea protein isolate sales.[xix]

Pea Protein and Fiber in Pet Food Trends

The majority of pea protein concentrates and pea fibers are sold into the pet food marketplace. Pea fractionation companies using the dry fractionation method sell protein concentrates (55-60% protein) and pea fiber to the growing pet food marketplace. Figure 10 shows the recent growth of food consumption in the pet food marketplace. Figure 11 shows the projected, continued growth in pet foods and treats through 2017.

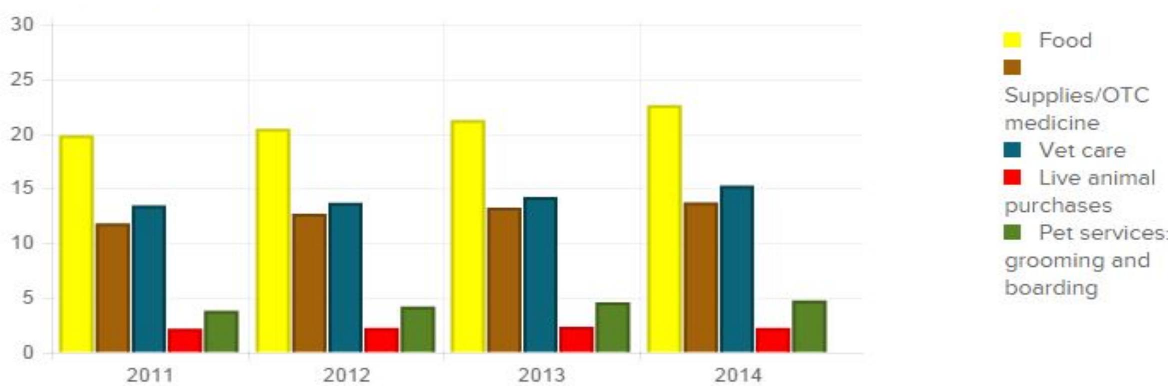

Figure 10: U.S. Pet Market Sales by Category 2011-2014 ($ Billions)

Source: American Pet Products Association

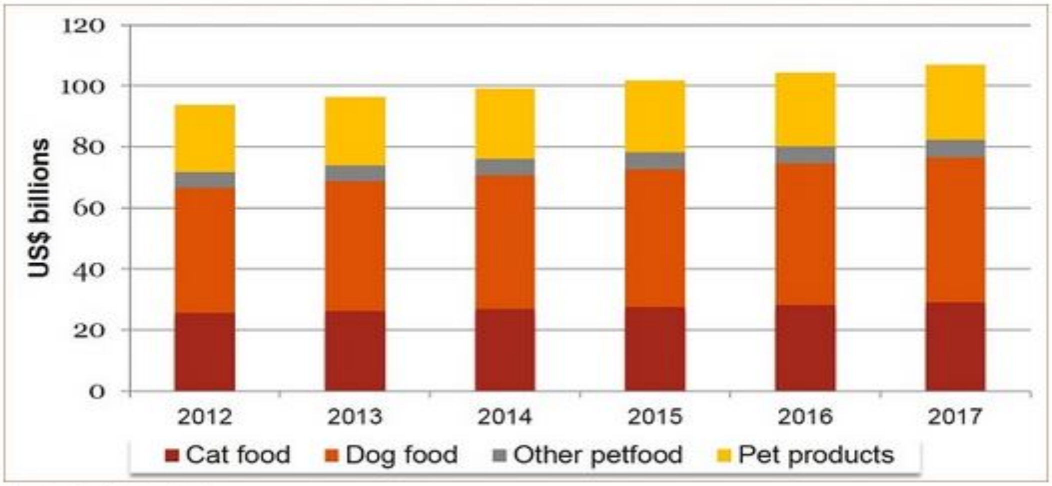

Figure 11: U.S. Pet Product Growth Projections 2012-2017
Source: Euromonitor International

Maria Lange, Director of Client Services and Analytics for GFK Research, New York, NY, tracks retail sales of pet products in over 11,000 retail outlets across the United States. Ms Lange stated that grain-free pet foods now occupy over 30% of the pet food marketplace. Grain-free pet food sales totalled over $2.2 billion in 2014 with a 23.9% growth rate. Even in the "natural pet food" marketplace, grain-free pet foods are growing at a 23.4% annual rate.[xx] Pea proteins and fibers are considered "grain-free" and also "natural," which explains the increasing demand for pea proteins and fibers in the pet food industry.

Fractionation Options

Dry Pea Fractionation

Pea Protein Concentrate Production

Shown in Figure 12 is a Pea Fractionation Process – Dry Method diagram. The diagram includes the processing steps for the production of pea fiber fraction, pea starch fraction (12% protein), and a high protein pea concentrate fraction (>53% protein).

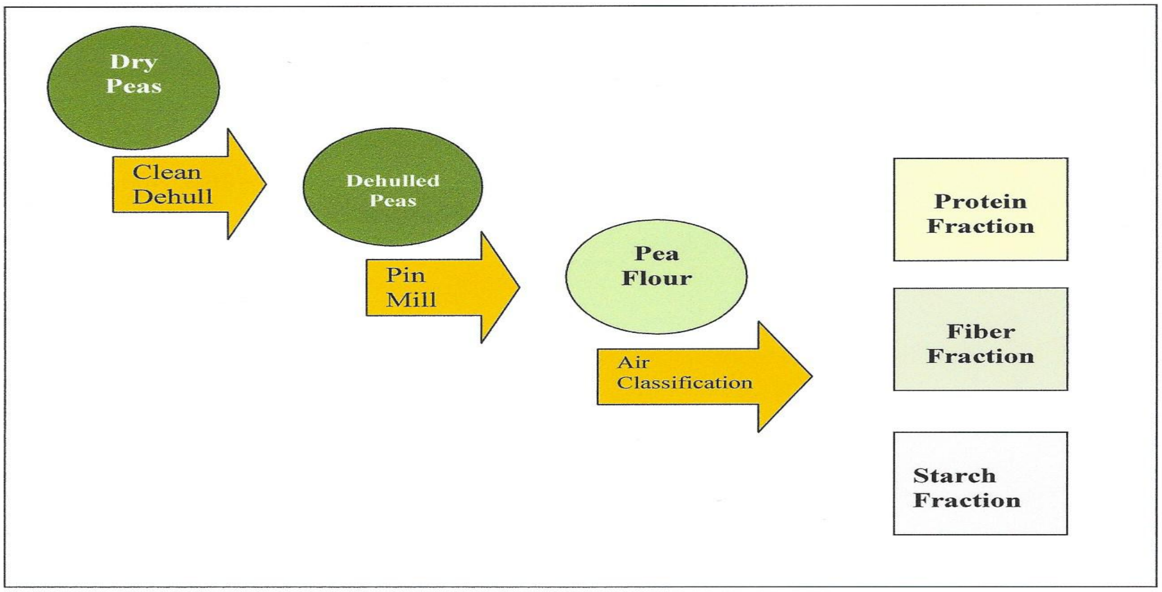

Figure 12: Dry Pea Fractionation Process

Pea ingredient fractions derived from the dry fractionation process are shown in Table 3. The dry process of de-hulling, pin milling and air classifying peas results in pea fractions that have higher concentrations of specific pea components. The high protein fraction has a protein content concentrated to 53% as compared to whole peas at 22%. Also, the high carbohydrate fraction has a starch/sugar content concentrated to 75% compared to whole peas at 48%. The dry process and wet process both produce a fiber fraction that has a fiber content of 87%.

Product	% Moisture	% Protein	% Starch/Sugars	% Fiber	% Ash	% Fat
Whole Peas	8	22	48	18	2	2
Protein Fraction	9	53	30	1	5	2
Fiber Fraction	8	2	1	87	2	0
Starch Fraction	9	12	75	1	2	1

Table 3: Dry Fractionation Process – Fraction Nutrient Composition
Source: Pulse Canada

The respective fractions derived from the dry fractionation process are shown in the following figures. The protein rich fraction has a composition illustrated in Figure 13. The fiber rich fraction has a composition illustrated in Figure 14. The starch rich fraction has a composition illustrated in Figure 15.

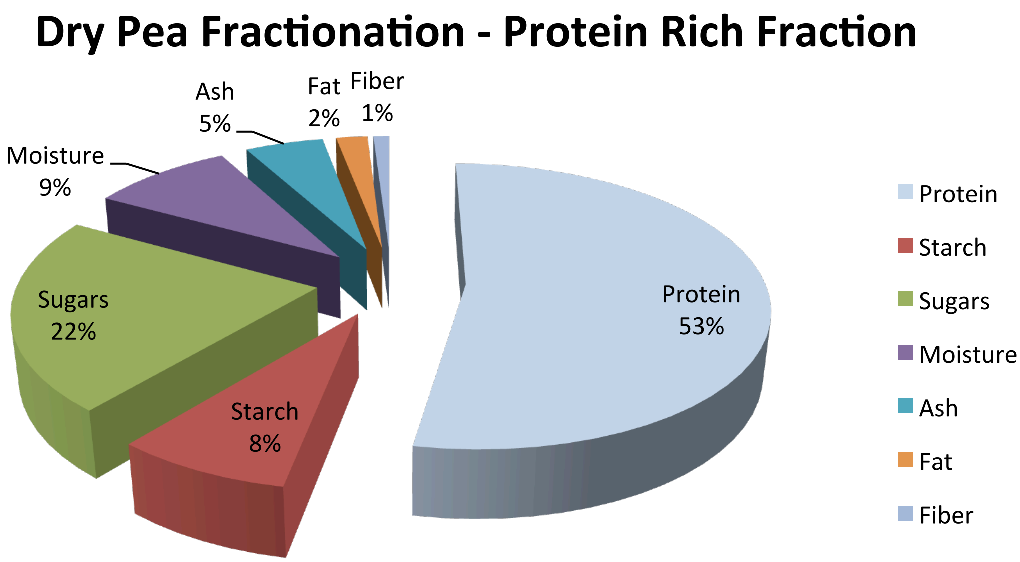

Figure 13: Dry Pea Fractionation – Protein Rich Fraction
Source: Pulse Canada

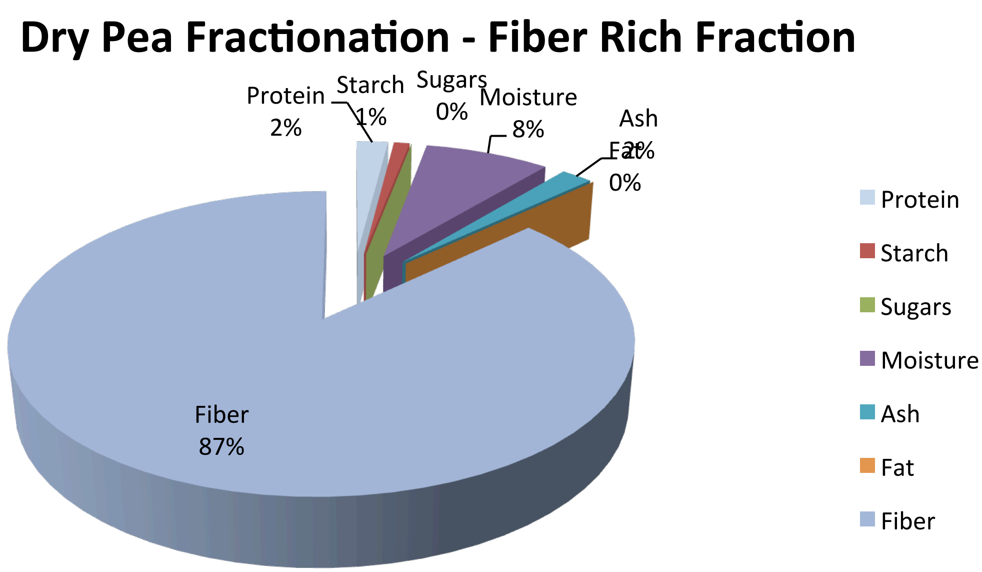

Figure 14: Dry Pea Fractionation – Fiber Rich Fraction
Source: Pulse Canada

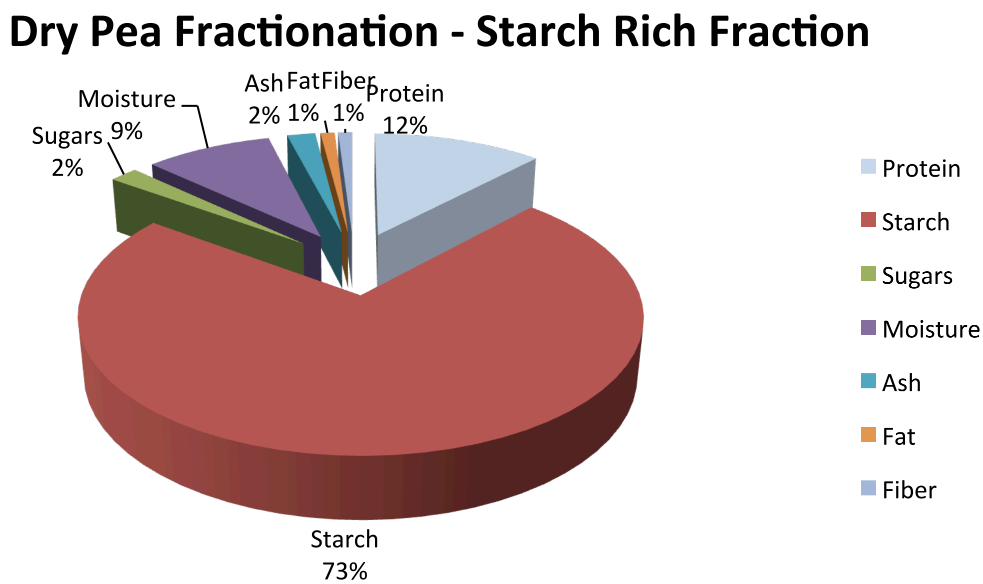

Figure 15: Dry Pea Fractionation – Starch Rich Fraction
Source: Pulse Canada

Shown in Figure 16 is a Hosokawa Alpine Pea Fractionation Production diagram. The diagram includes equipment names and placement for the production of pea hulls, low protein fraction (15% protein), and a high protein fraction (>55% protein).

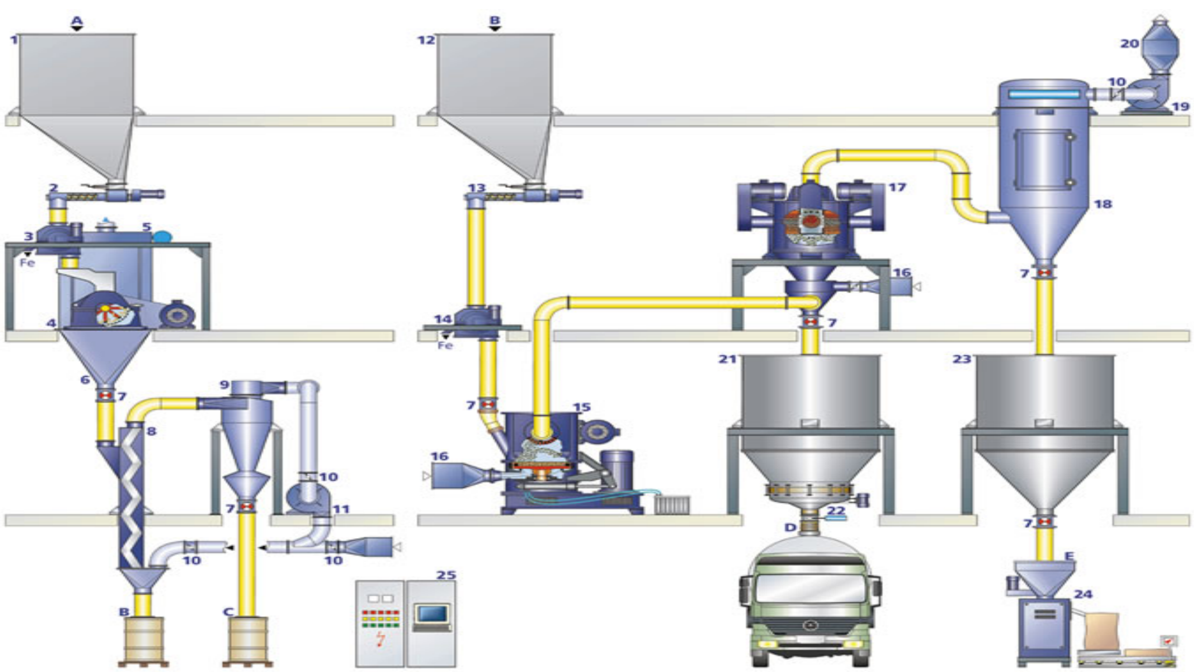

Figure 16: Hosokawa Alpine: Milling and Air Classification System – Up to 5,000 Kg/hr[xxi]

Source: Hosokawa Alpine

Hosokawa Equipment List

1 = Feed Bin (Whole Peas)	17 = Turboplex Ultrafine Classifier ATP
2 = Feed Metering Unit	18 = Automatic Reverse Jet Filter
3 = Metal Separator	19 = Fan
4 = Hammer Mill	20 = Outlet-side Silencer
5 = Dust Extraction Unit	21 = End Product Silo (Low-Protein Flour)
6 = Material Collection Bin	22 = Shut-off Valve
7 = Rotary Valve	23 = End Product Silo (High-Protein Flour)
8 = Zigzag Classifier MZM	24 = Packing Machine
9 = Cyclone	25 = Control Cabinet
10 = Butterfly Valve	
11 = Fan	A = Feed Product
12 = Feed Bin (Dehulled, Crush)	B = Precrushed, Dehulled Peas
13 = Feed Metering Unit	C = Pea Hulls
14 = Metal Separator	D = Low-Protein Pea Flour Fraction
15 = Zirkoplex Classifier Mill ZPS	E = High-Protein Pea Flour Fraction
16 = Suction-side Silencer	

Table 4: Hosokawa Equipment List
Source: Hosokawa Alpine

The following Table 5 is a range of costs for processing and ancillary equipment for a dry fractionation facility. The equipment shown would process a minimum of 10,000 bushels of peas per 24 hour day.[xxii] Precise equipment quotes can be obtained once the developing entity decides the finished product output requirements. Also, the purchase of used or reconditioned equipment would substantially reduce capital equipment costs.

Pea Cleaning and Conditioning Equipment	\$1.75 - \$2.5 million
Bins, Cleaning Equipment, Classification Equipment	
Pelleting Equipment	\$0.20 - \$0.30 million
Binds, Pellet Mill, Conditioner, Cooler	
Fractionation Equipment	\$2.0 - \$3.0 million
Mills, Classifier, Dehuller	
Ancillary Equipment	\$0.5 - \$1.0 million
Compressors, Lift Equipment, Weigh Scale	
Total Estimated Equipment Costs	**\$4.45 - \$6.8 million**

Table 5: Dry Fractionation Equipment Range of Costs

A factor of 4.55 is applied to equipment costs to arrive at a total plant cost.[xxiii] In addition to equipment costs, total plant costs include equipment installation, instrumentation, piping, electrical supplies, buildings, land, yard structure, rail improvements, engineering, supervision, construction, contractor's fees, contingency fee, certifications, taxes, and working capital. Total plant costs are estimated to range from $20 million to $30 million. The proposed facility would be designed as an FDA human food facility in order to address pet food, animal feed and human food markets.

Financial Illustration – Dry Method

The summary financial Table 6 shows a potential cash flow forecast for a 10,000 bushel per day dry pea fractionation facility. Assumptions include debt paid back over 7 years at a 5% interest rate, plant operation at 50% capacity. All pea fractionation products are sold F.O.B. factory at $0.60/lb for pea protein concentrate (19% of peas), $0.09/lb for pea starch (76% of peas), and $0.25/lb for pea fiber (5% of peas). Assumptions include the ability to sell 100% of starch produced. If sales are not generated from all of the derived pea fractions, a dry fractionation facility could experience profitability challenges.

Equity Investment	$15,000,000
Debt	$15,000,000
Total Investment	$30,000,000

	Year 1	Year 2	Year 3
Sales	$14,100,000	$17,500,000	$18,000,000
Cost of Sales	$8,685,600	$10,780,000	$11,099,000
Gross Margin	$5,414,400	$6,720,000	$6,901,000
Operating Expenses	$3,536,000	$3,650,000	$3,700,000
EBITDA	$1,878,400	$3,070,000	$3,201,000

Table 6: Dry Fractionation Financial Illustration Summary

Wet Pea Fractionation

Shown in Figure 17 is a GEA Westfalia Pea Fractionation Production – Wet Method diagram. The diagram includes the processing steps for the production of pea fiber fraction, pea starch fraction (1% protein), and a high protein pea isolate fraction (>80% protein).

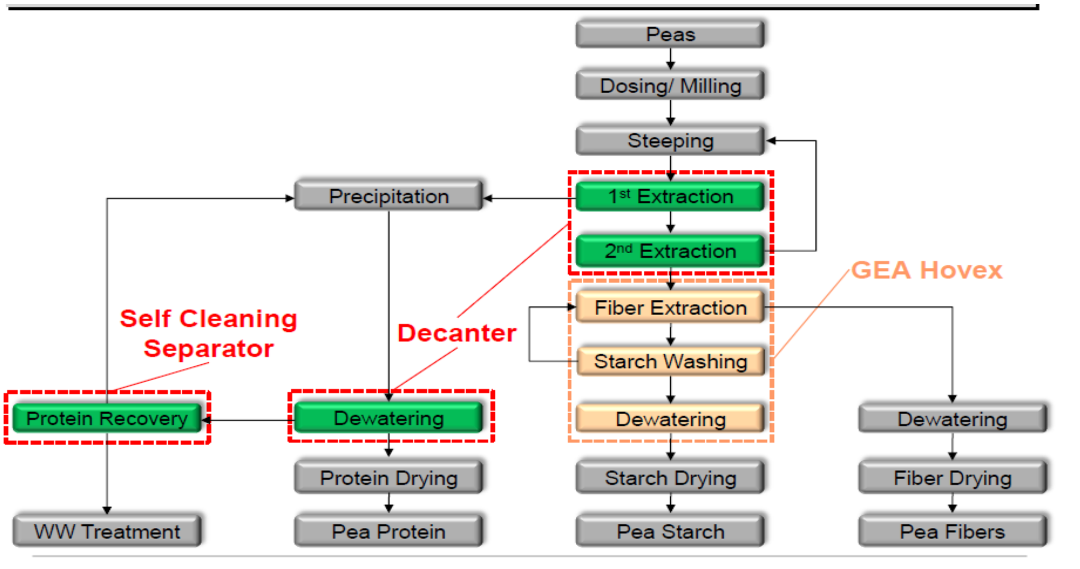

Figure 17: Pea Fractionation Process Diagram – Wet Method
Source: GEA Westfalia

The following procedure can be used to fractionate peas using isoelectric precipitation, decanting, dewatering and drying.

Starting material: Dehulled, ground peas inn batch extraction where particle size has little effect on protein extraction yield, if extraction time is over 30 minutes.

Protein extraction: Pea meal is mixed with water in agitated, heated vessels (80°C) where water, to which an alkali such as sodium hydroxide, lime, ammonia or tri-basic sodium phosphate has been added, so as to bring the pH to neutral to an alkaline reaction where the majority of the proteins go into solution along with sugars and other soluble substances.

c- Solid-liquid separation after extraction: The extract contains considerable amount of fine particles so that the fine solids are separated to improve the purity of the final product.

Precipitation: The protein is precipitated from the extract by bringing the pH down to the pea protein isoelectric region.

Separation and washing of the curd: The precipitated protein (curd) is separated from the supernatant (whey) by filtration or centrifugation. The curd must be washed in order to remove residues of whey solubles. Thorough washing is most important for the production of high purity pea protein isolate.

Drying: The usual method for drying the washed curd is spray-drying.

The wet fractionation methodology described above has been employed within the soybean isolate industry over the past fifty years. The USDA Northern Regional Reseach Laboratory (now the National Center for Agricultural Research Utilization) provided energy and water input requirements for the isolation of protein from soybeans. Isolation of protein from pulse crops, including peas, would utilize similar levels of energy and water during the wet fractionation process.[xxiv] Wet fractionation processes operate continuously. Energy and water estimates are shown below for a continually processing 300,000 lb/day of dry peas. (Table 7)

Input	Amount
Peas	300,000 lb/day
Water	900,000 gallons/day
Natural Gas	1,400,000 cubic feet/day
Electricity	40,000 kWh
Steam	400,000 lb/day

Table 7: Wet Fractionation Process – Estimated Input Amounts for Water and Energy
Source: USDA, National Center for Agricultural Research Utilization

Pea ingredient fractions derived from the wet fractionation process are shown in Table 8. The wet process of milling, steeping, precipitation, decanting, dewatering, and drying of peas results in pea fractions that have high isolations of specific pea components. The high fiber fraction has a protein content isolated to 85% (dry basis) as compared to whole peas at 22%. Also, the high carbohydrate fraction has a starch/sugar content isolated to 99% (dry basis) compared to whole peas at 48%. The dry process and wet process both produce a fiber fraction that has a fiber content of 87%.

Product	% Moisture	% Protein	% Starch/Sugars	% Fiber	% Ash	% Fat
Whole Peas	8	22	48	18	2	2
Protein Fraction	Dry Basis	85	8	1	4	2
Fiber Fraction	8	2	1	87	2	0
Starch Fraction	Dry Basis	1	99	0	0	0

Table 8: Wet Fractionation Process – Fraction Nutrient Composition
Source: USDA Nutrient Database for Standard Reference

The respective fractions derived from the wet fractionation process are shown in the following figures. The protein rich fraction has a composition illustrated in Figure 18. The fiber rich fraction has a composition illustrated in Figure 19. The starch rich fraction has a composition illustrated in Figure 20.

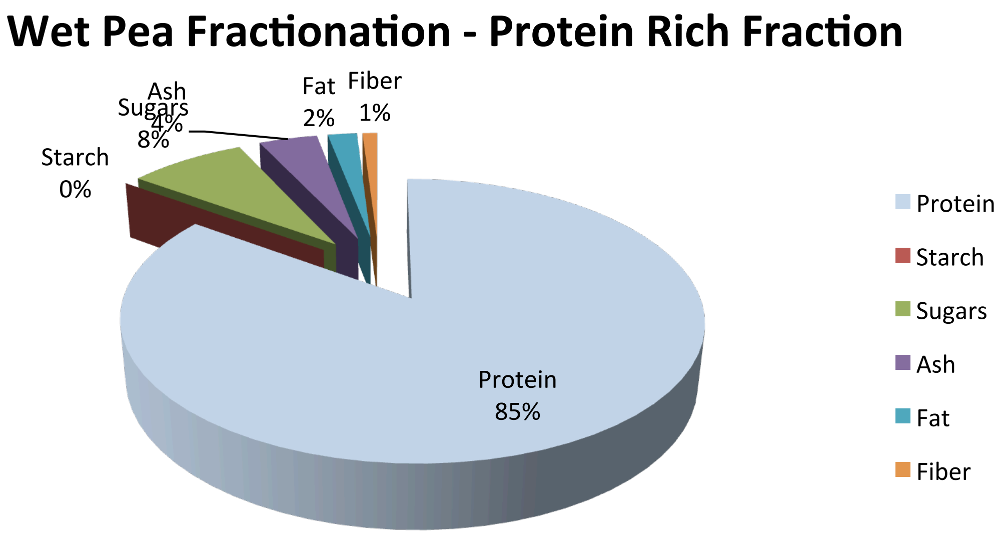

Figure 18: Wet Pea Fractionation – Protein Rich Fraction (Dry Basis)
Source: Pulse Canada

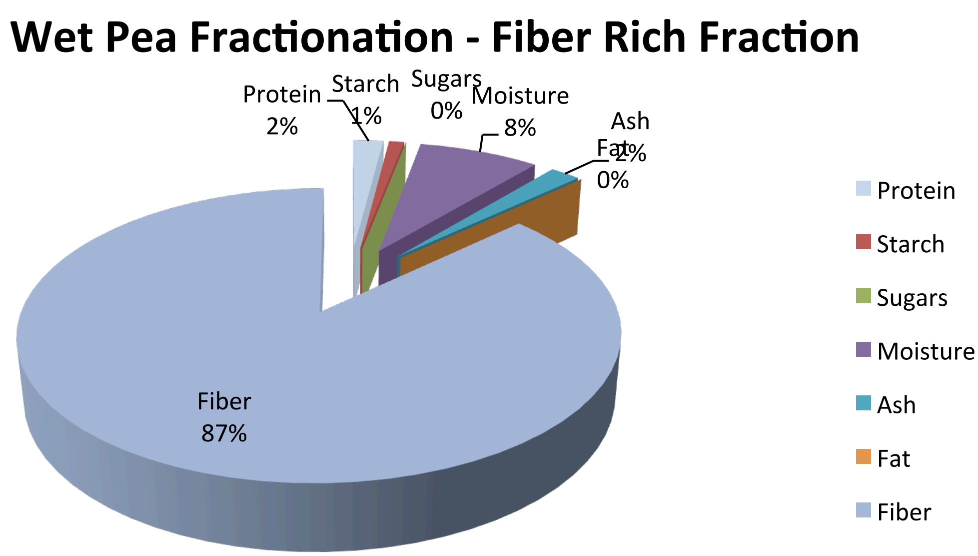

Figure 19: Wet Pea Fractionation – Fiber Rich Fraction
Source: Pulse Canada

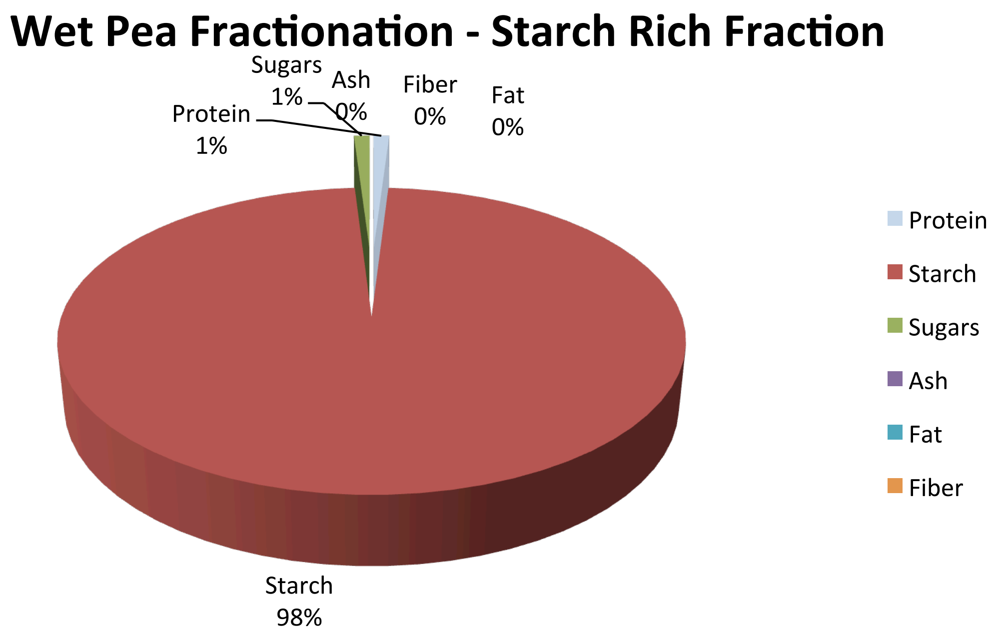

Figure 20: Wet Pea Fractionation – Starch Rich Fraction
Source: Pulse Canada

The following Table 9 is a range of costs for processing and ancillary equipment for a wet fractionation facility. The equipment shown would process a minimum of 5,000 bushels of peas per 24 hour day.[xxv] Precise equipment quotes can be obtained once the developing entity decides the finished product output requirements. Also, the purchase of used or reconditioned equipment would substantially reduce capital equipment costs.

Pea Cleaning and Conditioning Equipment
Bins, Cleaning Equipment, Classification Equipment
Pelleting Equipment
Binds, Pellet Mill, Conditioner, Cooler
Fractionation Equipment
Mills, Tanks, Decanters, Separators, Driers
Water and Waste Treatment Equipment
Ancillary Equipment
Compressors, Lift Equipment, Weigh Scale
Land and Building
Infrastructure Improvements
Total Estimated Equipment Costs = $40 million to $60 million

Table 9: Wet Fractionation Equipment Range of Costs[xxvi xxvii]

In addition to equipment costs, total plant costs include equipment installation, instrumentation, piping, electrical supplies, buildings, land, yard structure, rail improvements, engineering, supervision, construction, contractor's fees, contingency fee, certifications, taxes, and working capital. Total plant costs are estimated to range from $40 million to $60 million. The proposed facility would be designed as an FDA human food facility in order to address pet food, animal feed and human food markets.

Financial Illustration- Wet Method

The summary financial Table 10 shows a potential cash flow forecast for a 5,000 bushel per day pea processing/wet fractionation facility. Assumptions include debt paid back over 7 years at a 5% interest rate, continuous plant operation, and that all pea fractionation products are sold F.O.B. factory at $1.00//lb for pea protein concentrate (19% of peas), $0.10/lb for pea starch (76% of peas), and $0.25/lb for pea fiber (5% of peas). Assumptions include the ability to sell 100% of starch produced. If sales are not generated from all of the derived pea fractions, a wet fractionation facility could experience profitability challenges.

Equity Investment	$30,000,000
Debt	$30,000,000
Total Investment	$60,000,000

	Year 1	Year 2	Year 3
Sales	$18,500,000	$24,000,000	$26,000,000
Cost of Sales	$11,396,000	$14,784,000	$15,904,000
Gross Margin	$7,104,000	$9,216,000	$10,096,000
Operating Expenses	$4,648,000	$5,244,000	$5,244,000
EBITDA	$2,456,000	$3,972,000	$4,672,000

Table 10: Wet Fractionation Financial Illustration Summary

Summary

The Great Falls Region is well suited for the development and operation of pea fractionation facilities. The Region has the advantages of an abundant supply of high quality pea commodities; low cost electrical and natural gas inputs; shovel-ready, fully equipped industrial parks; robust transportation system; plentiful labor resources, and a pro-business attitude.

Pea fractionation operations in the Great Falls Region would have the opportunity to obtain high quality pea commodities directly from agricultural producers. Pea procurement transportation costs in the Great Falls Region would be low relative to competitors located outside of pea-growing areas. On-farm storage of commodities throughout the Great Falls Region provide year around access to pea commodity deliveries to pea fractionation facilities.

The combination of cost effective energy, water, property, pulse commodities, and human resources all work together to provide a superior business environment for the establishment of profitable pea fractionation operations in the Great Falls Region. The Region can provide an optimum environment for dry and wet pea fractionation operations

References

[i] USDA, 2012 Census of Agriculture, www.agcensus.usda.gov

[ii] USDA, National Agricultural Statistics Services, Quick Stats, http://quickstats.nass.usda.gov/results/896B90BB-B9C7-36E6-B841-42716144AE6D

[iii] Legumematrix.com, December 10, 2014, http://www.legumematrix.com/images/563/12-10-14.pdf

[iv] U.S. Bureau of Labor Statistics, Occupational Employment Statistics, May 2014. www.bls.gov/regions/mountain-plains

[v] Montana Department of Labor and Industry, Montana Labor Market Information, http://lmi.mt.gov/

[vi] U.S. Energy Information Agency, April 27, 2015, http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a

[vii] Pea in Rotation with Wheat Reduced Uncertainty of Economic Returns in Southwest Montana, Perry R. Miller, et. al., Crop Economics, Production & Management, Agronomy Journal, V. 107, Issue 2, February 25, 2015, https://www.google.com/webhp?sourceid=chrome-instant&rlz=1C1AVSX_enUS413US416&ion=1&espv=2&ie=UTF-8#q=Pea+in+Rotation+with+Wheat+Reduced+Uncertainty+of+Economic+Returns+in+Southwest+Montana

[viii] Production of Principle Field Crops, November 2014, Statistics Canada, Catalog No: 11-001-X, http://www.statcan.gc.ca/daily-quotidien/141204/dq141204a-eng.pdf

[ix] Canadian Grain Commission, Quality of Western Canadian Peas 2014, February 9, 2015, http://www.grainscanada.gc.ca/peas-pois/harvest-recolte/2014/hqp14-qrp14-1-en.htm

[x] North Dakota State University Extension Service, Lower Crop Prices Projected, January 2015, Ron Haugen, January 26, 2015, http://www.ag.ndsu.edu/news/newsreleases/2015/jan-12-2015/ndsu-extension-service-projects-lower-crop-prices-but-higher-livestock-prices-for-2015

[xi] U.S. Energy Information Agency, April 27, 2015, http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a

[xii] Pulse Canada, What is a Pulse, http://www.pulsecanada.com/food-health/what-is-a-pulse.

[xiii] Soy Protein Ingredients Market by Types (Isolates, Concentrates, and Others), Applications, and Geography – Global Trends and Forecasts to 2018, Marketsandmarkets, September 2013, http://www.marketsandmarkets.com/PressReleases/soy-protein-ingredients.asp

[xiv] Protein Trends & Technologies Seminar, Global Food Forums Inc., April 2013, http://www.globalfoodforums.com/wp-content/uploads/2013PTT-Strategic-Insights-into-the-Global-Protein-Ingredient-Market-C.Shanahan.pdf

[xv] Dialing Into Plant Based Protein, Food Business News, Jeff Gelski, April 9, 2015, http://www.foodbusinessnews.net/articles/news_home/Consumer_Trends/2015/04/Dialing_into_plant-based_prote.aspx?ID=%7B0E001034-9186-4B91-8CF1-65B782298ED5%7D&cck=1

[xvi] Pea Protein is Coming Up Strong, Nutritional Outlook, Michael Crane, May 13, 2015, http://www.nutritionaloutlook.com/1505/PeaProtein

[xvii] Fortifying Your Products with Plant Protein, Global Food Technology and Innovation Summit 2, March 3, 2015, London, UK, http://www.slideshare.net/PaulHart1/plant-proteins-wtg-03-0315-london-em

[xviii] The Global Protein Ingredients Market, Natural Products Insider, Christopher Shanahan, July 11, 2013. http://www.naturalproductsinsider.com/articles/2013/07/the-global-protein-ingredients-market.aspx

[xix] Cosucra Invests €30 million to Expand Pea Protein Production, Food Product Design, September 6, 2013, http://www.foodproductdesign.com/news/2013/09/cosucra-invests-30-million-to-expand-pea-protein.aspx

[xx] Grain Free Pet Food is Here to Stay, Pet Food Industry, Debbie Phillips-Donaldson, May 4, 2015, http://www.petfoodindustry.com/blogs/7-adventures-in-pet-food/post/5157-grain-free-pet-food-is-here-to-stay-as-are-pet-treats

[xxi] Powder and Particle Processing, Alpine Classifying Technology, Hosokawa Alpine, Augsburg, Germany, http://www.easyfairs.com/uploads/tx_ef/classifiers.pdf

[xxii] Private Communication and Communication with Hosokawa Alpine Corporation.

[xxiii] Peters, M., K. Timmerhaus, and R. West. 2003. Plant Design and Economics for Chemical Engineers, 5th ed. New York:McGraw Hill.

[xxiv] Soy Processes, Equipment, Capital, and Processing Costs, G.C. Mustakas and V.E. Sohns, Engineering and Development Laboratory, Northern Regional Research Laboratory, http://naldc.nal.usda.gov/naldc/download.xhtml?id=29440&content=PDF

[xxv] Private Communication and Communication with Hosokawa Alpine Corporation.

[xxvi] Cosucra Invests €30 Million Euro to Expand Pea Protein Production, Food Product Design, September 6, 2013, http://www.foodproductdesign.com/news/2013/09/cosucra-invests-30-million-to-expand-pea-protein.aspx

[xxvii] Solbar Industries Soy Protein Isolated Plant, USA, Food Processing-Technology.com, March 2012, http://www.foodprocessing-technology.com/projects/solbar-plant/