HIGHLANDS NATURAL

MEAT & LIVESTOCK AUSTRALIA

Final Report

Beef Bone Broth Value Add Opportunities

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Abstract

The beef bone broth value-add opportunities research project undertaken by Highlands Natural and supported by Meat & Livestock Australia (MLA), was undertaken to address the growing consumer demand for premium, nutrient-dense bone broth and to explore its potential as a value-added product for the Australian red meat industry. The initiative sought to optimize bone broth production, aligning it with consumer preferences while creating a scalable model for integrating sustainable beef by-products into the retail market.

The project began with a comprehensive market analysis to identify product placement opportunities for Highlands Natural Bone Broth (BBB). A factory bench trial used the Highlands Natural recipe as a control to produce two variations: one with neck bones and another with a specified ratio of mixed organic grass-fed beef bones. Nutrient analysis revealed that the mixed bone sample delivered a superior amino acid profile, leading to its selection for further development. Prestige Foods Australia then scaled the recipe to produce a large-scale retail-ready batch, which was integrated into a market strategy informed by developing a detailed business model canvass.

Central to this phase upon the completion of a Business Model Canvass, was to encompass assumptions and key findings that address the desirability, feasibility, and viability of bone broth production.

Key outcomes included the creation of a nutritionally superior bone broth with high consumer appeal and strong alignment with sustainable beef production. The project provides the Australian red meat industry with an innovative pathway to maximize by-product utilization, increase profitability, and meet consumer demands for functional, ethical food products.

Image 1: Highlands Natural Organic Grass Fed Beef Bone Broth 250g

Executive Summary

Background

This research project, conducted by Highlands Natural and supported by Meat & Livestock Australia (MLA), aimed to explore value-add opportunities for beef bone broth (BBB) derived from sustainable beef production systems. The primary question addressed was: how can nutrient-dense, premium-quality beef bone broth be produced and positioned effectively in the functional food market? The target audience included health-conscious consumers and the Australian red meat industry, focusing on sustainability and profitability. The findings aim to support the development of a high-value product that aligns with consumer preferences and enhances industry profitability through efficient utilization of beef by-products.

Objectives

The project sought to:

- Define the competitive landscape and identify BBB's unique strengths and weaknesses.
- Develop and test a nutritionally superior Highlands Natural BBB.
- Create a business model canvas to support the product's market integration. All objectives were successfully achieved, leading to valuable insights and a retail-ready product.

Methodology

- A market analysis was conducted to assess the competitive landscape and identify key product opportunities.
- Benchtop trials were conducted to produce and analyse nutrient profiles of two BBB variations.
- Collaborated with contract manufacturer Prestige Foods Australia for batch production and quality assurance.
- Developed a business model canvas to evaluate market viability.

Results/Key Findings

- Nutrient analysis confirmed that a specified ratio of mixed organic grass-fed beef bones produced a superior amino acid profile, making it the optimal choice.
- Developed a retail-ready 1300L batch of Highlands Natural BBB with consistent nutrient quality.
- Completed a business model canvas, identifying a strong market position and profitability potential.

Benefits to Industry

This project highlights a scalable model for transforming beef by-products into premium functional food. It offers the Australian red meat industry new revenue streams, enhanced consumer trust in sustainable practices, and a pathway to meet growing demand for ethical, nutrient-rich products.

Future Research and Recommendations

Future research should:

- Explore consumer perceptions and preferences for functional beef products.
- Investigate additional uses of beef by-products to expand the sustainable red meat product portfolio.
- Develop strategies for broader market penetration.

These steps will build on the project's success and further support the integration of sustainable practices within the red meat industry.

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1. Background

The project addressed a critical gap in the Australian red meat industry: the under-utilisation of beef by-products and the increasing demand for sustainable, functional foods. Despite the growing market for bone broth, many existing products lack transparency in sourcing and nutrient consistency. This presented a unique opportunity to align product development with sustainable farming practices, addressing both consumer and industry needs.

The aim of the project was to:

- Develop a detailed nutrient profile and composition for Highlands Natural beef broth, ensuring it meets optimal human nutritional requirements.
- Analyse differences in 2 samples produced in the benchtop trial phase. One sample using neck bones only, and the second using a specific ratio of mixed bones. Looking specifically at differences in amino acid profiles, collagen content, and mineral content across various bones and joints to establish a hierarchy of nutritional value.
- Understand the competitive landscape of functional food products, identifying strengths and weaknesses of beef bone broth relative to alternatives.
- Assess the value chain and evaluate the potential value multiplier achieved by transforming low-value beef by-products into a premium consumer product.
- Integrate a Business Model Canvas that includes assumptions and key findings to capture a desirability-feasibility-viability criteria. A description of the product and yields of batches inclusive of nutritional value of different bones for dissemination to industry

The target audience included health-conscious consumers seeking nutrient-rich, ethical products and stakeholders in the red meat industry aiming to enhance profitability and sustainability. These results will inform the development of a robust value-added product that not only meets market demand but also supports industry-wide goals for resource efficiency and environmental stewardship. This project also aimed to uniquely integrate sustainable agricultural principles using Organic Grass fed beef bones, nutrient optimization, and market-driven insights to deliver a comprehensive solution.

2. Project Objectives

2.1 Introduction

The development of the following Business Model Canvass (BMC) for Highlands Natural Beef Bone Broth reflects a data-driven approach to aligning sustainable agricultural practices with consumer demand for high-quality, nutrient-dense products. This BMC was informed by critical findings from Milestone 1, which encompassed market analysis and nutrient analysis of bench-top trials, and Milestone 2, which focused on the development of a retail-ready batch of the product.

In Milestone 1, market analysis identified key consumer trends, including a growing preference for health-focused and environmentally sustainable products. Simultaneously, bench-top trials compared the nutritional profiles of two bone broth samples: Sample 1, made with neck bones only, and Sample 2, made with mixed beef bones. Nutritional analysis revealed that Sample 2 exhibited superior results, including eight times the glutamine content, underscoring the potential of mixed bone formulations to deliver enhanced health benefits. These findings provided valuable insights into the desirability of a high-quality bone broth product derived from regenerative beef systems.

Building on these insights, Milestone 2 involved the development of a retail batch of Highlands Natural Beef Bone Broth. This stage refined production methods, evaluated batch yields, and validated the scalability of the product, ensuring its feasibility in a commercial setting.

Together, these milestones laid the foundation for the Business Model Canvass, which systematically evaluates the desirability, feasibility, and viability of Highlands Natural's beef bone broth. The BMC incorporates key partners, key resources, key activities, value propositions, consumer reach channels, customer relationship, customer segments, cost structure and revenue stream. This introduction sets the stage for a detailed discussion of the assumptions, findings, and strategic direction captured in the Business Model Canvass.

2.2 Understanding the Competitive Landscape

An in-depth analysis of the competitive market landscape of beef bone broth, alongside similar products and categories with functional ingredients was undertaken in Milestone 1. This assessment successfully identified the strengths and weaknesses of beef bone broth compared to its competitors, to help position it effectively in the market. The report provided a clear understanding of the competitive landscape, emphasising Highlands Natural

BBB's unique positioning as a nutrient-dense, sustainably sourced product. This analysis identified both market opportunities and potential challenges.

2.3 Development of a Detailed Nutrient Profile

This project objective sought to identify key components such as amino acids, collagen, and mineral content alongside the development of a detailed Nutrition Information Panel. Nutrient profiles of BBB were rigorously analysed. Identification of the key macronutrients such as protein, carbohydrates and fat, and key micronutrients such as amino acids, collagen, and essential minerals according to NH&MRC. These findings offered a foundation for what information was selected to analyse for the benchtop trial samples. It also provided a basis for marketing claims that may enhance the credibility and appeal of BBB, alongside ensuring compliance with nutritional standards. This ensured the product meets optimal human nutritional standards. Milestone 1 successfully developed a nutrient profile for the Highlands Natural beef broth. The analysis highlighted its high nutritional value, particularly in amino acids and collagen.

2.4 Analysis of Nutritional Differences in Bones and Joints

This project objective called to investigate the differences in amino acid profiles, collagen content, and mineral content among various bones and joints. The goal was to establish a hierarchy of nutritional value, enabling prioritization of specific bones and joints for broth preparation. A successful benchtop trial of the Highlands Natural Beef Bone Broth recipe was conducted, with samples of version 1 and version 2 analysed by NATA registered ALS laboratories. The nutrient profiles of the two broth versions were compared and from the data analysis, version 1 was selected as the preference for retail release. Differences in nutrient content across bones and joints were identified. A mixed ratio of organic grass-fed beef bones was found to yield the most balanced and superior amino acid profile, as opposed to sample 2 which contained neck bones only, guiding future processing decisions. Laboratory analysis validated the nutritional claims of BBB, providing empirical evidence for its benefits. This helps support marketing and health claims while maintaining regulatory compliance.

2.5 Value Chain Review and Multiplier Assessment

This project objective sought to evaluate the value chain to determine the economic and environmental benefits of converting low-value beef bones into premium consumer products, focusing on potential value multipliers. A comprehensive financial review was conducted after the first 1300L retail batch was manufactured in Milestone 2, confirming significant value multipliers achievable through the transformation of beef bones into high-value functional foods. These findings also supported the economic viability of scaling production.

2.6 Conclusion

All project objectives were successfully achieved. The research outcomes provide actionable insights for the development and marketing of Highlands Natural beef bone broth, highlighting its potential as a premium product in the functional food sector while promoting sustainability within the beef industry.

3. Methodology

3.1 Beef Bone Broth Market Report

3.1.1 Introduction

Bone broth, a nutrient-dense liquid made by simmering animal bones and connective tissue, has gained popularity for its numerous health benefits. This milestone report explores the key markets for bone broth, evaluates the competitive landscape of similar products with functional ingredients, and provides an assessment of beef bone broth's strengths and weaknesses relative to competing products.

3.1.2 Key Markets for Bone Broth

For identification of the key markets for bone broth, the market landscape will be segmented into the differing geographical and demographical categories:

3.1.2.1 Geographical Segmentation:

- North America: The largest market, driven by health-conscious consumers with disposable income to invest in functional health foods. The emergence of popular diet trends such as the paleo, ketogenic and carnivore diets has also increased demands
- Europe: Growing interest in natural and organic foods fuels market growth
- Asia-Pacific: Increasing awareness built on top of cultural culinary traditions in various Asian countries in particular Japan, Vietnam, China, Singapore and Indonesia of bone broth’s health benefits have boost demand for ready to consume convenient options for consumers with busy lifestyles to the traditional broth based dishes that require time, effort and culinary skills
- Australia: Local market opportunities have emerged with growing consumer awareness of the health benefits of consuming bone broth. An opportunity for a convenient single serve ready to drink product has been identified within this market that is currently dominated by powdered and concentrate derivatives that contain various downsides regarding flavour profile and health benefits
- Rest of the World: Emerging markets show potential for growth due to rising disposable incomes and increase in health awareness due to greater access to information on the internet

3.1.2.2 Demographic Segmentation:

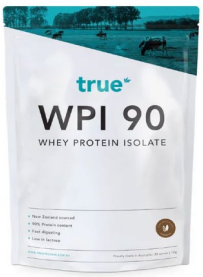
- Health Enthusiasts: Individuals focused on personal health and wellness, weight loss, and fitness.
- Ageing Population: Consumers seeking joint health, bone strength, and anti-aging benefits.
- Parents: Those looking for nutritious options for their children.

3.1.3 Competitive Landscape for Functional Products

The competitive landscape for bone broth includes the following products with functional ingredients:

3.1.3.1 Protein Powders:

- Widely popular among fitness enthusiasts for muscle building and recovery.
- Available in various sources: whey, plant-based, collagen.



3.1.3.2 Collagen Supplements:

- Primarily used for skin health, joint support, and anti-aging.
- Available in powders, capsules, and liquid forms.

3.1.3.3 Plant-Based Broths:

- Cater to vegetarian and vegan consumers.
- Often fortified with vitamins and minerals to enhance nutritional value.

3.1.3.4 Functional Beverages:

- Include kombucha, kefir, and other probiotic-rich drinks.
- Marketed for gut health, immunity, and overall wellness.

3.1.3.5 Nutritive Soups:

- Often positioned as convenient and healthy meal options.
- Include additional functional ingredients like turmeric, ginger, and adaptogens.

3.1.4 Assessment Of Beef Bone Broth

Bone broth and its derivatives such as broth powders and concentrates, have gained significant traction in the wellness and culinary markets in recent years. The following contains an assessment of their positioning and market dynamics:

3.1.4.1 Health Benefits and Consumer Appeal:

- Nutritional Profile: Bone broth is rich in collagen, gelatin, amino acids (such as glutamine, glycine and proline), and minerals (such as calcium, magnesium, potassium and phosphorus). These nutrients are touted for their benefits in joint health, skin elasticity, gut health, immunity and overall wellness.
- Health Trends: With the rise of diets like Paleo, Keto, and Whole30, bone broth fits well due to its high protein and low carbohydrate content. It is also valued in intermittent fasting for its nutrient density without high caloric load.
- Gut Health: Bone broth is often promoted for its gut-healing properties, appealing to consumers interested in digestive health and those with conditions like leaky gut, irritable bowel as well as inflammatory bowel diseases such as Crohn's disease.

3.1.4.2 Market Segmentation:

- Broth Powders: Convenient and shelf-stable, broth powders cater to busy individuals and those seeking easy incorporation of bone broth into their diets. They are positioned as an easy addition to smoothies, soups, and recipes.
- Broth Concentrates: These are marketed for their rich flavour and ease of use in culinary applications. They appeal to home cooks and chefs looking for high-quality, flavourful bases for dishes.
- Ready to drink (RTD) liquid format: This includes shelf stable and chilled formats usually stored in pouches, tetra packs or glass jars. Limitations have been identified due to serving sizes (typically found in 500ml-1000ml containers) and the need for chilled transportation in non-shelf stable products.

3.1.4.3 Product Positioning:

- Premium Products: Many bone broth products are positioned in the premium category due to their perceived health benefits and the quality of ingredients (e.g., grass-fed beef bones, organic chicken bones). This positioning allows for higher price points.
- Functional Foods: As a functional food, bone broth products are often marketed with claims highlighting their specific health benefits, such as joint support, enhanced hydration, muscle repair and gut healing properties.

3.1.4.4 Market Dynamics:

- Growth and Expansion: The bone broth market has seen substantial growth, driven by increasing consumer awareness of its health benefits. This has led to a

proliferation of brands and products, from traditional liquid broths to modern powders and concentrates.

- Innovation: Companies are innovating with flavours (e.g., turmeric, ginger), packaging (single-serve packets), and formulations (collagen-infused broths). This innovation helps in differentiating products in a crowded market.
- Retail and E-commerce: Bone broth products are widely available in health food stores, supermarkets, and online platforms. E-commerce has been a significant driver of sales, especially with the increasing trend of health-conscious consumers shopping online.

3.1.4.5 Consumer Perceptions and Challenges:

- Perception of Authenticity: There is a segment of consumers who prefer traditional, homemade bone broth due to scepticism about the nutritional integrity of processed products. Brands often counter this by emphasizing traditional preparation methods and high-quality sourcing.
- Price Sensitivity: While many consumers are willing to pay a premium for health benefits, there is also a price-sensitive segment that may opt for less expensive alternatives or only purchase these products occasionally.
- Regulatory Scrutiny: As with many health foods, claims made by bone broth products can attract regulatory scrutiny. Companies need to ensure that their marketing is backed by scientific evidence to avoid misleading consumers.

3.1.4.6 Competitive Landscape:

- Key Players: Brands like The Stock Merchant, Good Bones by The Undivided Food Co, and Byron Bay Bone Broth are prominent in the Australian market. Each product has a distinct positioning ranging from the selection of high quality organic ingredients, to multiple ingredient recipes for high palatability, to convenience-focused products such as powders and glues. None however has yet to attempt at achieving all these desirable qualities in the one product.
- Small-Scale Artisans: There is also a significant presence of small-scale, artisanal producers who focus on traditional methods and local sourcing, appealing to the paddock-to-plate and sustainable living movements.

3.1.5 Relative Positioning of Bone Broth Against Competing Products

3.1.5.1 Protein Powders:

- Strengths: Beef bone broth offers additional health benefits beyond protein, such as collagen for joint health.
- Weaknesses: Less convenient and often more expensive than protein powders.

3.1.5.2 Collagen Supplements:

- Strengths: Bone broth provides a more holistic whole foods source of collagen along with other nutrients not available through Collagen powder

- Weaknesses: Collagen supplements are often more convenient and can be flavourless, appealing to a broader audience.

3.1.5.3 Plant-Based Broths:

- Strengths: Beef bone broth is superior in collagen, protein, amino acid profile and nutrient density.
- Weaknesses: Does not cater to vegetarian or vegan consumers.

3.1.5.4 Functional Beverages:

- Strengths: Bone broth offers unique benefits such as collagen, protein and amino acids that are not present in most functional beverages.
- Weaknesses: Functional beverages like kombucha are more popular for their refreshing taste and gut health benefits. They do not require heating before consumption therefor are a more convenient option for consumers.

3.1.5.5 Nutritive Soups:

- Strengths: Beef bone broth can be used as a base for highly nutritious soups, adding more value.
- Weaknesses: Ready-to-eat nutritive soups are more convenient for on-the-go consumption.

3.2 Development of a Detailed Nutrient Profile

3.2.1 Introduction

The nutrient profiles of beef bones, particularly focusing on amino acids, collagen and minerals can vary depending on the specific type of bone (e.g., femur, spine, neck). Australian beef, governed by the National Health and Medical Research Council (NHMRC) nutrition guidelines, provides a good baseline for understanding these nutrient profiles. Here's a detailed look into each component:

3.2.2 Amino Acids

Beef bones are rich in protein, which breaks down into essential amino acids. The major amino acids identified in beef bones include:

- Glutamine: Acts as a substrate for protein synthesis, aids in muscle repair. Acts as an anabolic precursor for muscle growth. Aids in acid balance in the kidneys. Provides

an oxidative fuel for the intestines and cells of the immune system. Aids in the repair of the intestinal lining. Provides a substrate for ureagenesis in the liver.

- Glycine: Important for collagen synthesis and joint health.
- Proline: Vital for collagen production and skin health.
- Hydroxyproline: Specific to collagen and connective tissues.
- Alanine: Plays a role in energy production.
- Arginine: Supports wound healing and immune function.

3.2.3 Collagen

Collagen is a primary component of beef bones, especially those such as the femur and spine, which contain a high amount of connective tissue. Collagen from beef bones is mainly type I, which is crucial for skin, tendons, ligaments, and bones. It is composed of amino acids like glycine, proline, and hydroxyproline.

3.2.4 Minerals

Beef bones contain several minerals essential for health, the key minerals identified to be most prominent include:

- Calcium: Critical for bone health and neuromuscular function.
- Phosphorus: Works closely with calcium to build strong bones and teeth.
- Magnesium: Essential for muscle function and bone formation.
- Potassium: Important for cardiovascular health and muscle function.
- Sodium: Necessary for nerve function and fluid balance.

3.2.5 Nutrient Profiles of Specific Bones

The following nutritional information of specific beef bones has been segmented into three categories: Neck bones, Femur bones and Spine bones (including associated ribs)

3.2.5.1 Neck Bones

Overview

Beef neck bones come from the cervical region of the beef carcass. This area consists of several vertebrae, which are the bones that make up the neck portion of the skeleton. The neck bones include the cervical vertebrae, which are smaller and more delicate compared to the thoracic or lumbar vertebrae. They are joined by intervertebral discs and have processes that provide attachment points for muscles and ligaments. The centre of these bones contains marrow, which is a soft tissue rich in fats and other nutrients. The bones have cartilaginous ends that provide smooth surfaces for joint movements. The outer layer of the neck bones is made of dense, hard bone that provides strength and protection. Inside the compact bone is a porous, spongy structure that contains red bone marrow. Surrounding the bones

are connective tissues, including tendons and ligaments that attach muscles to the bones.

Nutrient Profile

The nutrient profile of beef neck bones has been divided into macronutrients and micronutrients:

Macronutrients:

- Protein: High levels of collagen and other structural proteins can be found in beef neck bones
- Fat: The marrow content found in neck bones is rich in fats, primarily saturated fats and cholesterol. The marrow content within neck bones is considered moderate in comparison to the other bone categories, particularly the femur bones, due to the smaller central cavities found in the vertebrae.

Micronutrients:

- Minerals: Minerals such as Calcium, Phosphorus, Magnesium, Potassium, and Sodium are most prevalent in beef neck bones. Trace amounts of Iron, Zinc, Manganese, Copper and Boron can also be found.
- Vitamins: Vitamins such as vitamin B3 (Niacin), vitamin B4 (Choline), vitamin A and vitamin K can be found in trace amounts in beef neck bones
- Collagen: Collagen is a major component of connective tissues within the neck bones, providing structural support.
- Amino Acids: Glutamine, glycine, proline, and hydroxyproline are found within beef neck bones. The values of amino acids are specific to beef neck bones due to the different connective tissues and cartilage not found in other bone categories
- Fatty Acids: The marrow contains essential fatty acids, including omega-3 and omega-6

Table 1 NIP Beef Neck Bones

Name: Beef Neck Bones 100g	Amount	Unit
Water	56.5	g
Energy	257	kcal
Protein	25.9	g
Total lipid (fat)	16.5	g
Carbohydrate, by difference	0	g
Fiber, total dietary	0	g
Sugars, total including NLEA	0	g
Calcium, Ca	13	mg
Iron, Fe	2.18	mg

Name: Beef Neck Bones 100g	Amount	Unit
Magnesium, Mg	20	mg
Phosphorus, P	179	mg
Potassium, K	269	mg
Sodium, Na	357	mg
Zinc, Zn	5.06	mg
Copper, Cu	0.074	mg
Selenium, Se	28.1	µg
Vitamin C, total ascorbic acid	0	mg
Thiamin	0.067	mg
Riboflavin	0.188	mg
Niacin	5.42	mg
Vitamin B-6	0.474	mg
Folate, total	7	µg
Folic acid	0	µg
Folate, food	7	µg
Folate, DFE	7	µg
Choline, total	82.6	mg
Vitamin B-12	1.8	µg
Vitamin B-12, added	0	µg
Vitamin A, RAE	3	µg
Retinol	3	µg
Carotene, beta	0	µg
Carotene, alpha	0	µg
Cryptoxanthin, beta	0	µg
Lycopene	0	µg
Lutein + zeaxanthin	0	µg
Vitamin E (alpha-tocopherol)	0.31	mg
Vitamin E, added	0	mg
Vitamin D (D2 + D3)	0.2	µg
Vitamin K (phylloquinone)	1.4	µg
Fatty acids, total saturated	6.73	g
Fatty acids, total monounsaturated	7.35	g
Fatty acids, total polyunsaturated	0.727	g
Cholesterol	86	mg

* U.S. Department of Agriculture, 2024. FoodData Central: Food details for food item 2341249. [online] Available at: https://fdc.nal.usda.gov/fdc-app.html#/food-details/2341249/nutrients

3.2.5.2 Femur Bones

Overview

Beef femur bones are the largest and strongest bone in a beef carcass. It plays a crucial role in supporting the animal's weight and facilitating movement. The

structural characteristic of the femur bone includes the head, which fits into the hip socket to form the hip joint. The shaft, which is a long cylindrical part of the femur, providing structural support and strength. The distal end or the bottom end of the femur which articulates with the tibia and patella (kneecap) to form the knee joint.

The composition of the femur bone comprises of compact bone which is the dense outer layer that gives the femur its strength and rigidity. Spongy bone, which is the inner, porous layer that contains red bone marrow and contributes to the bone's lightweight nature.

Nutrient Profile

Table 2 NIP Grass Fed Marrow Bones 100g

Name	Amount	Unit
Energy	301	Kcal
Protein	30.1	G
Total lipid (fat)	19.5	g
Carbohydrate, by difference	0	g
Fiber, total dietary	0	g
Total Sugars	0	g
Sugars, added	0	g
Calcium, Ca	17	mg
Iron, Fe	2.65	mg
Potassium, K	240	mg
Sodium, Na	372	mg
Vitamin D (D2 + D3)	0	µg
Fatty acids, total saturated	7.96	g
Fatty acids, total trans	1.33	g
Cholesterol	119	mg

*U.S. Department of Agriculture, 2024. FoodData Central: Food details for food item 2630491. [online] Available at: https://fdc.nal.usda.gov/fdc-app.html#/food-details/2630491/nutrients

The nutrient profile of femur bones has been divided into macronutrients and micronutrients:

Macronutrients:

- Protein: High levels of collagen and other structural proteins can be found in beef femur bones
- Fat: The high marrow content found in femur bones is rich in fats, primarily saturated fats and cholesterol. The marrow content within the femur bones is larger to the other bone categories due to the larger central cavity found in the shaft.

Micronutrients:

- Minerals: Minerals such as Calcium, Phosphorus, Magnesium, Potassium, and Sodium are most prevalent in beef femur bones. Trace amounts of Iron, Zinc, Manganese, Copper and Boron can also be found.
- Vitamins: Vitamins such as vitamin A and vitamin K can be found in trace amounts in beef femur bones
- Collagen: Collagen is a major component of connective tissues within the femur bones, providing structural support.
- Amino Acids: Glutamine, glycine, proline, and hydroxyproline are found with a makeup of values specific to beef femur bones due to the different connective tissues and cartilage not found in the other bone categories
- Fatty Acids: The marrow contains essential fatty acids, including omega-3 and omega-6.

3.2.5.3 Spine Bones

Overview

Beef spine bones are comprised of the vertebral column and associated ribs. These bones provide structural support, protect the spinal cord, and facilitate movement and respiration.

The vertebral column is categorised into the following sections:

- Cervical vertebrae, which is the neck region consisting of seven vertebrae.
- Thoracic vertebrae, which is the twelve vertebrae to which the ribs are attached.
- Lumbar vertebrae, which is the five larger vertebrae in the lower back that provides support and flexibility.
- Sacral vertebrae which are fused to form the sacrum, connecting the spine to the pelvis.
- Caudal vertebrae which form the tail.

The associated ribs are categorised into the following sections:

- True ribs which are the first seven pairs, attached directly to the sternum.
- False ribs which are the next three pairs, connected to the sternum indirectly.
- Floating ribs which are the last two pairs, not attached to the sternum.

The composition of beef spine and rib bones includes compact bone which is the dense outer layer that provides strength and protection. Spongy Bone which is the inner porous layer containing red bone marrow. Bone marrow which is located within the cavities of the bones. Cartilage which is present at the ends of the ribs and vertebrae, facilitating smooth joint movements.

Nutrient Profile

The nutrient profile of spine bones has been divided into macronutrients and micronutrients:

Macronutrients:

- Protein: High levels of collagen and other structural proteins can be found in beef spine bones
- Fat: Marrow within the spine and ribs are rich in fats, particularly saturated fats and cholesterol.

Micronutrients:

- Minerals: Minerals such as Calcium, Phosphorus, Magnesium, Potassium, and Sodium are most prevalent in beef spine bones. Trace amounts of Iron, Zinc, Manganese, Copper and Boron can also be found.
- Vitamins: Vitamins such as vitamin A and vitamin K can be found in trace amounts in beef spine bones
- Collagen: Collagen is a major component of connective tissues within the spine bones, providing structural support.
- Amino Acids: Glutamine, glycine, proline, and hydroxyproline are found within beef spine bones
- Fatty Acids: The marrow within the spine bones contain essential fatty acids, including omega-3 and omega-6.

3.3 Analysis of Nutritional Differences in Bones and Joints

3.3.1 Introduction

The following lab results were derived by sending the benchtop trial samples conducted at Prestige Foods Australia. Version 1 was cooked using the Highlands Natural Beef Bone Broth recipe as the control, with the variable being the bone types used containing equal quantities of neck bones, spine (including ribs) and leg bones with the total quantity of bones equating to 20kg as per recipe specification. Version 2 was cooked again using the Highlands Natural Beef Bone Broth recipe using only neck bones with the total quantity of bones equating to 20kg as per recipe specification.

3.3.2 Amino Acid Profiles of Versions 1 & 2

Table 3 Highlands Natural BBB (V1)

Histidine	<50	mg/kg
Serine	900	mg/kg
Arginine	2000	mg/kg
Glycine	5800	mg/kg
Aspartic Acid + Asparagine	1400	mg/kg
Glutamic Acid + Glutamine	27000	mg/kg
Threonine	540	mg/kg
Alanine	2700	mg/kg
Proline	2900	mg/kg
Lysine	640	mg/kg
Tyrosine	320	mg/kg
Methionine	220	mg/kg
Valine	520	mg/kg
Isoleucine	320	mg/kg
Phenylalanine	510	mg/kg
Leucine	770	mg/kg
Taurine	<50	mg/kg
Hydroxyproline	2100	mg/kg

Table 4 Highlands Natural BBB (V2)

Histidine	220	mg/kg
Serine	850	mg/kg
Arginine	1700	mg/kg
Glycine	4400	mg/kg
Aspartic Acid + Asparagine	1600	mg/kg
Glutamic Acid + Glutamine	3300	mg/kg
Threonine	530	mg/kg
Alanine	2200	mg/kg
Proline	3500	mg/kg
Lysine	810	mg/kg
Tyrosine	210	mg/kg
Methionine	170	mg/kg
Valine	500	mg/kg
Isoleucine	320	mg/kg
Phenylalanine	460	mg/kg
Leucine	820	mg/kg
Taurine	120	mg/kg
Hydroxyproline	2200	mg/kg

Key Findings: Version 1 overall contained the superior amino acid profile. The key amino acids identified in section 2.3.2 being glutamine, glycine, alanine, proline, hydroxyproline and arginine are prevalent in significant amounts for both versions 1 & 2. The most notable difference however, being the glutamine content for version 1 was 8x the amount than in version 2, containing 27,000mg/kg and version 2 containing 3300mg/kg. (For full lab analysis refer to appendix 9.1 and 9.4)

Comments: Version 1 produced the superior amino acid profile, most notably the glutamine content which contained 8.2x the amount found in version 2.

3.3.3 Nutritional Information Panel including collagen content of Version 1 & 2

Table 5 Highlands Natural BBB Version 1

Moisture (Air drying)	96.1	g/100 g
Ash	0.7	g/100 g
Carbohydrates	0.9	g/100 g
Total Sugars	<0.1	g/100 g
Energy	54	kJ/100 g
Monounsaturated Fatty Acids	<0.1	g/100g
Polyunsaturated Fatty Acids	<0.1	g/100g
Saturated Fatty Acid	<0.1	g/100g
Trans Fatty Acids	<0.1	g/100g
Total Fat	<0.1	g/100 g
Sodium	200	mg/100g
Protein (Dumas)	2.3	g/100g
Collagen	20.3	mg/g

Table 6 Highlands Natural BBB Version 2

Moisture (Vacuum Drying 70°C)	95.8	g/100 g
Ash	0.8	g/100 g
Carbohydrates	1.0	g/100 g
Total Sugars	0.1	g/100 g
Energy	58	kJ/100 g
Monounsaturated Fatty Acids	<0.1	g/100g
Polyunsaturated Fatty Acids	<0.1	g/100g
Saturated Fatty Acid	<0.1	g/100g
Trans Fatty Acids	<0.1	g/100g
Total Fat	<0.1	g/100 g
Sodium	220	mg/100g
Protein (Dumas)	2.4	g/100g
Collagen	19.8	mg/g

Key Findings: The Nutritional Information Panels for version 1 and 2 produced near identical results. With the only noticeable differences being version 2 containing a slightly higher sodium content (20mg/100g). Version 1 contained 0.1g/100g less protein, however the collagen content was higher (0.5mg/g) than version 2. (For full lab analysis results, refer to Appendix 9.1, 9.2, 9.4 & 9.5)

Comments: The NIP's and collagen content results were comparable with only minor differences noted in favour to version 1. From this point of the test results to date, based on the review of the results from sections 4.2.1, 4.2.2 and 4.2.3 that version 1 of the Highlands Natural BBB was selected as the version to be further tested, and used to produce the final NIP for the retail version of Highlands Natural BBB

3.3.4 Mineral Content Analysis of Highlands Natural BBB Version 1

Based on the research findings in section 2.3.4 Minerals, a sample of version 1 was sent to Symbio Laboratories to test the content of the following key minerals identified in beef bone broth:

Table 7 Mineral content version 1 sample

Compound/	Analyte Method	LOR	Units	Mg Per 100g	Mg Per 250g serve
Calcium (Ca)	LTM 188 - Determination of Acid Extractable Elements by ICPOES	0.1	mg/100g	9.8	24.5 (2.45% RDI)
Magnesium (Mg)	LTM 188 - Determination of Acid Extractable Elements by ICPOES	0.05	mg/100g	4.86	12.15 (3.28% RDI)
Potassium (K)	LTM 188 - Determination of Acid Extractable Elements by ICPOES	0.2	mg/100g	51	127.5 (3.86% AI)
Phosphorus (P)	LTM 188 - Determination of Acid Extractable Elements by ICPOES	5	mg/100g	6.47	16.18 (1.62% RDI)

* RDI's for minerals were based on values provided by 'Nutrient and Reference Values for Australia and New Zealand 2006, version 1.2 taking the average RDI or AI between Men and Women aged 19 and above

Key findings: The minerals identified in section 2.3.4 were found present in the sample. The most prominent mineral found in the Highlands Natural BBB was potassium, providing 127.5mg per 250g serve which represents 4.9% of the recommended daily intake of potassium. Magnesium content was second most prominent at 3.92% RDI per serve, followed by Calcium and Phosphorus at 2.45% and 2.3% respectively of the RDI per serve. (For full lab analysis report refer to Appendix 9.3)

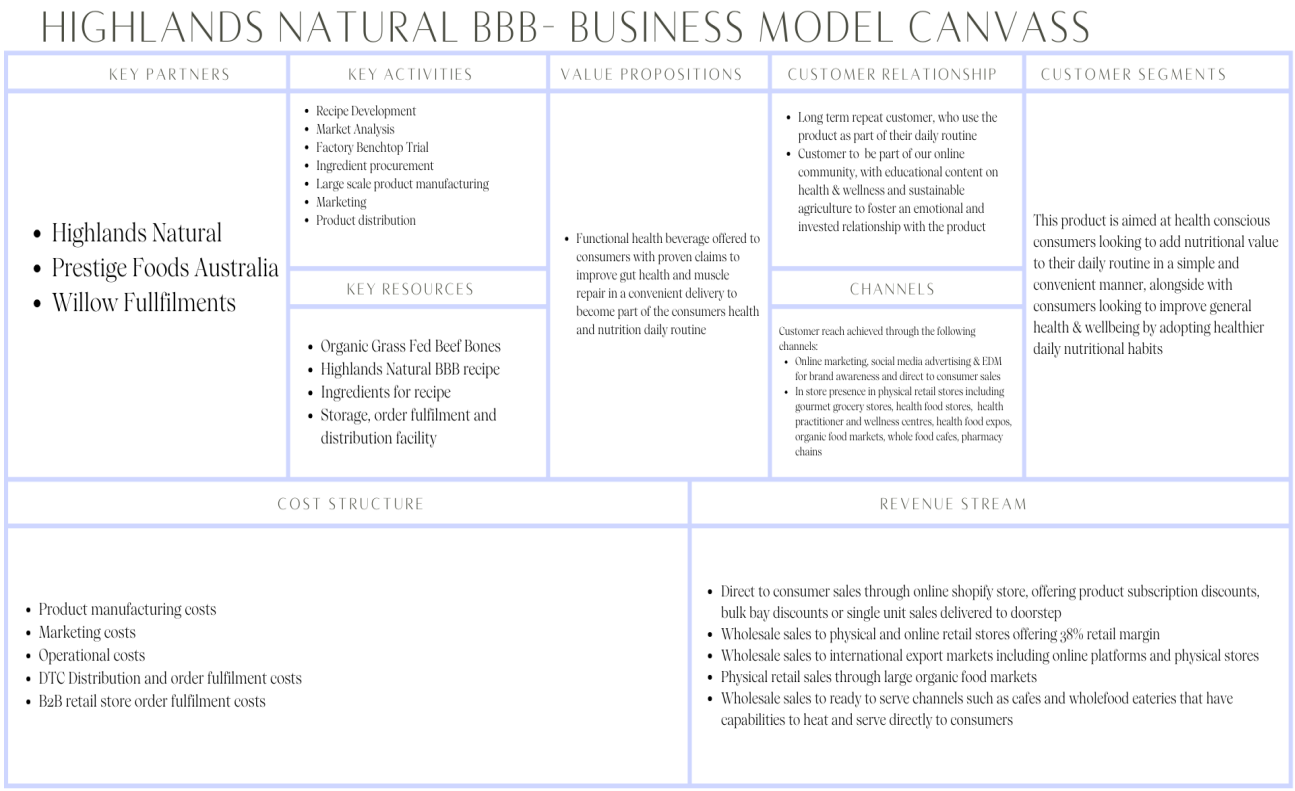
Comments: Highlands Natural contained all key minerals identified in beef bones, however translation to a total contribution of the RDI's for these minerals would be considered minimal.

3.4 Value Chain Review and Multiplier Assessment

The Value Chain Review and Multiplier Assessment focused on leveraging the economic potential of Highlands Natural beef broth by converting low-value beef bones into a premium consumer product. To achieve this, a business model canvas was developed, integrating insights from market analysis and production data. This tool captured critical elements such as desirability, feasibility, and viability, ensuring a strategic approach to product positioning.

Additionally, financial data from the first retail batch of Highlands Natural beef bone broth was meticulously reviewed. By analyzing production costs, retail pricing, and profit margins, the project calculated a value multiplier for beef bones, demonstrating their transformation from low-value by-products into high-value, nutrient-rich functional food. This comprehensive review highlights the scalability and profitability of this innovative approach within the beef industry.

3.4.1 Highlands Natural BBB Business Model Canvass



Appendix 1: Highlands Natural BBB Business Model Canvass (refer to section 3 Methodology for detailed analysis of the components of the BMC)

3.4.2 Business Model Canvass Components

3.4.2.1 Key Partners: Who is needed to deliver the product

- Highlands Natural: Highlands Natural is responsible for the product recipe development, branding, marketing, operational logistics management and financing of the product

- Prestige Foods Australia: PFA are responsible for the contract manufacturing of the Highlands Natural BBB, which includes ingredient procurement, production and packaging of the broth.

- Willow Fullfilments: Willow Fullfilments are responsible for safe HACCP accredited storage of the product, alongside the processing and dispatch of direct-to-consumer retail orders, and wholesale purchase orders for retailers.

3.4.2.2 Key Resources: What is needed to make the product work

- Highlands Natural BBB recipe: The Highlands Natural Beef Bone Broth recipe is a key resource in the Business Model Canvass as it encapsulates the unique value proposition of the product, leveraging sustainable beef practices and optimized nutritional formulations to meet consumer demand for sustainable, health-focused food products.

- Ingredients for recipe: The specific ingredients of the Highlands Natural Beef Bone Broth (BBB) recipe are a key resource in the Business Model Canvas, as they ensure a superior nutritional profile such as elevated glutamine levels, while embodying the sustainable farming ethos that differentiates the product in a competitive market.

- Storage, order fulfilment and distribution facility: The storage, order fulfilment, and distribution facility is a key resource in the Business Model Canvas as it ensures efficient inventory management, seamless delivery to customers, and the ability to scale operations while maintaining product quality and freshness.

3.4.2.3 Key Activities: How the key resources are being utilised

- Recipe Development: The original Highlands Natural BBB recipe, developed by co-founder Jake Campbell was developed and finalised over a couple of years to arrive at the final product ready for manufacturing. Key indicators identified on consumer needs were used as markers to arrive at the final product recipe for large scale production.

- Market Analysis: A thorough market analysis was conducted in Milestone 1 to gain insight to the product landscape and its competitors, alongside what the key markers were for consumer demand to help shape the marketing strategy and product packaging.

- Factory Benchtop Trial: Further recipe development was undertaken by Prestige Foods Australia to develop the large-scale production recipe, using specific formulas and methods used to convert a small scale 70L benchtop trial recipe into the final large scale 1300L recipe to ensure the exact nutrients, taste and yield is converted based on the original recipe.

- Ingredient procurement: Ingredient provenance was identified as the crucial component to the ingredient procurement process. Prioritising nutrient density, and the agricultural methods used to produce the ingredients over financial sensitivities. PFA were given a specific brief from Highlands Natural and secured sources for the ingredients that will be able to support the production of the BBB at large scale.
- Large scale product manufacturing: PFA were selected as the preferred contract manufacturer with their exemplary proven track record and reputation of producing high quality bone broths at a large scale. The continued partnership with this manufacturer has been identified as a key activity to ensure the long and sustained success of the Highlands Natural BBB in the retail market.
- Marketing: Utilising the data derived from Milestone 1 in conjunction with previous sales reports a marketing strategy was developed to target the specific consumer bracket that will form the foundation of product sales
- Product Distribution: Willow fulfilments were engaged to provide 3pl storage, order processing and distribution for Highlands Natural BBB. Finding a fulfilment service that could offer services in all these departments was key to the products operational success by having all services available in the one facility ensured a streamlined financial viability to the products success.

3.4.2.4 Value Proposition: The benefits consumers can expect to get from your product

Highlands Natural BBB has been developed to provide consumers a functional health beverage with proven health claims to improve gut health and muscle repair, in a convenient delivery method to become part of the consumers daily health and nutrition routine.

3.4.2.5 Channels: How the consumer is reached

- Online: Online marketing, social media content and EDM for brand awareness, direct to consumer sales from the Shopify website and other online retail sales

- Physical: In store presence in bricks and mortar retail stores including gourmet grocery stores, health food stores, health practitioner and wellness centres, health food expos, organic food markets, whole food cafes and pharmacy chains. These retailer categories have been identified as potential targets for retail sales through the wholesale division.

3.4.2.6 Customer Segments: Who the product is aiming to help

Highlands Natural BBB is helping health-conscious consumers looking to add nutritional value to their daily routine in a simple and convenient manner, alongside with consumers looking to improve general health & wellbeing by adopting healthier daily nutritional habits.

3.4.2.7 Customer Relationship

Through marketing and social media content we aim to cultivate a deep, long-term relationship with our customers, encouraging them to integrate our beef bone broth into their daily routines as a cornerstone of their health and wellness journey. Our vision is to build a community of repeat customers who see our product not just as a nutritional staple but as a reflection of their values. Through engaging and educational online content, we seek to foster an emotional and invested connection by sharing insights on the health benefits of bone broth, practical wellness tips, and the regenerative agricultural practices that make our product unique. By inviting customers into this shared narrative of sustainability and well-being, we aim to create a loyal community that values Highlands Natural as an integral part of their lifestyle.

3.4.2.8 Cost structure

Key components were identified to derive how much the product costs Highlands Natural to get to the final consumer. These components include:

- Product manufacturing costs: A per unit rate for procurement, manufacturing and packaging and freight to Willow Fulfilments was produced by Prestige Foods Australia based on a 250g pouch cooked in 1300L batches.
- Marketing costs: A percentage rate per unit was derived based on the marketing costs quoted from Fuji social media and marketing management services
- Operational costs: A percentage rate per unit was derived based on the operational costs to run the business and support the retail sales of Highlands Natural BBB
- DTC Distribution and order fulfilment costs: A per unit rate was derived based on Willow Fulfilments costings to store, pick and pack and dispatch direct to consumer orders through the Highlands Natural online store.
- B2B Distribution and order fulfilment costs: A per unit rate was derived based on Willow Fulfilments costings to process, pick and pack and dispatch wholesale orders to retailers.

3.4.2.9 Revenue Streams

The following revenue streams were identified as key channels to get Highlands Natural BBB to the Consumer:

- Direct to consumer sales: Through online shopify store, offering product subscription discounts, bulk bay discounts or single unit sales delivered to doorstep
- Wholesale sales: Bricks & mortar, and online retail stores offering 38% retail margin
- Wholesale sales to international export markets including online platforms and physical stores
- Physical retail sales through large organic food markets
- Wholesale sales to ready to serve channels such as cafes and wholefood eateries that have capabilities to heat and serve directly to consumers

3.4.3 Beef Bone Value Multiplier Analysis

Table 8 displays the value multiplier of beef bones when used to produce Highlands Natural Beef Bone Broth. The analysis considers the wholesale cost of bones, the production cost per unit, the final retail price of the broth, and the final retail value of the beef bones used to produce Highlands Natural BBB.

3.4.3.1 Value Multiplier Analysis

The value multiplier table highlights the significant economic potential of transforming Australian organic grass-fed beef bones into Highlands Natural Beef Bone Broth. 600 kilograms of beef bones were used to produce 5,784 units of broth (250g each). This yielded a total retail revenue of $54,948, achieving a **value multiplier of 18.32x** when comparing retail revenue to the initial cost of the beef bones.

Beef bones contributed 14.82% of the total production cost per batch. This represents a **2.7x increase in value** from the wholesale cost of beef bones to their contribution at the retail level. The analysis further demonstrates a **58.32% value increase** when comparing the wholesale value of beef bones to their retail contribution, reflecting their enhanced economic importance in the production process.

This transformation underscores the ability of Highlands Natural Beef Bone Broth to add considerable value to what is traditionally considered a byproduct, offering the Australian red meat industry an opportunity to leverage sustainability while boosting profitability.

4. Results

4.1 Highlands Natural BBB product brochure

ORGANIC GRASS-FED BEEF BONE BROTH

- Contains 6.75g of gut healing glutamine & 5.1g Collagen per serve
- 100% Natural Ingredients
- Gluten & Preservative Free
- Rich In Collagen, Amino Acids & Electrolytes
- Nutrient Dense
- Umami Rich

BROTH

	Average Quantity per Serving	Average Quantity per 100g
Energy	135kJ	54kJ
Protein	5.8g	2.3g
- Gluten	Not detected	Not detected
- Glutamine & Glutamic Acid*	6750mg	2700mg
- Glycine*	1450mg	580mg
- Proline*	725mg	290mg
- Alanine*	675mg	270mg
- Hydroxyproline*	525mg	210mg
- Arginine*	500mg	200mg
Fat, total	less than 0.2g	less than 0.1g
- saturated	less than 0.2g	less than 0.1g
Carbohydrate	2.2g	0.9g
- sugars	less than 0.2g	less than 0.1g
Sodium	500mg	200mg

* Indicates average values based on typical testing

Our Highlands Natural signature grass fed & finished beef bone broth is a culmination of hundreds of hours in the kitchen in search of the perfect balance of flavour complexity & nutrient density, resulting in a deeply flavoured, beautifully fragrant & umami rich Asian style beef bone broth. Our unique blend of ayurvedic herbs & spices, with certified organic vegetables have been carefully selected to work in perfect harmony with nutrient dense certified organic grass fed & finished beef bones. The ingredients are slowly simmered in filtered water & certified organic apple cider vinegar to maximise nutrient extraction. The celtic sea salt packed with trace minerals charge the broth with electrolytes to further optimise the amazing health benefits and flavour profile creating a highly nutritious, immune supporting and gut healing bone broth.

Image 2: Highlands Natural Beef Bone Broth Marketing Brochure and NIP

4.1.1 Nutritional Information Analysis for retail product Highlands Natural Beef Bone Broth 250g

Table 9: Nutritional analysis for Highlands Natural Beef Bone Broth represented as a 250g serve

Servings per pack:	**1**					
Serving Size	**250g**					
	per 250g serve	**per 100g**	**RDI Men 19-70yrs ***	**%RDI per serve**	**RDI Women 19-70yrs ***	**%RDI per serve**
Energy	135kj	54kj	8700kj *	1.55%	7200kl *	1.88%
Protein	5.8g	2.3g	130g (25% of daily Kj)	4.50%	108g (25% of daily kj)	5.30%
Carbohydrates	2.2g	0.9g	286.5g (55% of daily kj)	0.80%	237g (55% of daily kj)	0.90%
Total Sugars	0.25g	<0.1g	52g	<1%	43g	<1%
Saturated Fatty Acid	<0.25g	<0.1g	23g	<1%	19g	<1%
Total Fat	<0.25g	<0.1g	46g (20% of daily kj)	<1%	38g (20% of daily kj)	<1%
Sodium	500mg	200mg	2000mg	25%	2000mg	25%
Glutamine	6750mg	2700mg	6000mg	113%	6000mg	113%
Glycine	1450mg	580mg	4000mg	36%	3000mg	48%
Proline	725mg	290mg	1000mg	73%	800mg	91%
Alanine	675mg	270mg	600mg	113%	550mg	123%
Hydroxyproline	525mg	210mg	NA		NA	
Arginine	500mg	200mg	750mg	67%	650mg	77%
Asparagine	350mg	140mg	1000mg	35%	900mg	39%
Serine	225mg	90mg	2250mg	10%	1920mg	12%
Leucine	193mg	77mg	3150mg	6%	2688mg	7%
Lysine	160mg	64mg	2850mg	6%	2432mg	7%
Valine	130mg	52mg	1425mg	9%	1216mg	11%
Collagen	5.1g	2.04g	8.75g	58%	7.46g	68%
Calcium	24.5mg	9.8mg	1000mg	2.50%	1000mg	2.50%
Magnesium	12.15mg	4.86mg	410mg	3%	315mg	4%
Potassium	127.5mg	51mg	3800mg	3%	2800mg	5%
Phosphorus	16.18mg	6.47mg	1000mg	2%	1000mg	2%

*Indicates value based on average weight of 75kgs for men and 64kgs for women at a PAL of 1.2 Mj/day from Table 3 Estimated energy requirements of adults Nutrient Reference Values Guidelines for Australia and New Zealand (2014)

4.1.2 Key Findings from the Nutritional Information Panel for Highlands Natural Beef Bone Broth

Energy and Macronutrients:

Energy: With only 135kJ per 250g serving, the beef bone broth is a low-calorie option, contributing just 1.55% and 1.88% to the daily energy intake for men and women, respectively.

Protein: Each 250g serve provides 5.8g of protein, meeting 4.5% of the RDI for men and 5.3% for women. This suggests that the broth is a modest source of protein.

Carbohydrates and Sugars: The broth is low in carbohydrates (2.2g) and sugars (0.25g), contributing less than 1% of the daily recommended intake.

Fat: The broth contains very low amounts of fat and saturated fatty acids (<0.25g), contributing less than 1% to daily fat intake.

Sodium

Sodium content is moderately high, providing 500mg per serve, which is 25% of the daily recommended intake for both men and women.

Amino Acid Profile

The broth is particularly rich in Glutamine (113% RDI for both men and women), Alanine (113% RDI for men, 123% for women), and Proline (73% RDI for men, 91% for women), which are key amino acids associated with gut health, collagen synthesis, and muscle repair. Other amino acids like Glycine, Arginine, and Valine also show significant contributions, ranging from 36% to 77% of the RDI, supporting the broth's role in muscle repair and immune function.

Collagen

The broth provides 5.1g of collagen per serve, meeting 58% of the daily collagen requirement for men and 68% for women. This makes the broth a valuable source of collagen, which is beneficial for skin, joints, and connective tissues.

Mineral Content

While the broth contains some minerals, including Calcium (24.5mg), Magnesium (12.15mg), and Potassium (127.5mg), these contribute only a small percentage of the daily recommended intake, indicating the broth is not a significant source of these minerals. Phosphorus is present at low levels (2% RDI).

Conclusion

Highlands Natural beef bone broth is a low-calorie, nutrient-dense product with a strong amino acid profile, making it beneficial for collagen production, gut health, and muscle recovery. However, its high sodium content should be considered for consumers limiting

sodium intake. The broth's contribution to mineral intake is relatively modest, suggesting it is more valuable as a source of protein, amino acids, and collagen.

4.2 Desirability-Feasibility-Viability Criteria for Highlands Natural Beef Bone Broth

4.2.1 Desirability: The Highlands Natural Beef Bone Broth stands out in the market for its exceptional quality, using mixed organic grass-fed beef bones to deliver a nutritionally superior product compared to its counterparts. Enhanced by additional cooking steps, the broth boasts a rich flavour profile and nutrient density that positions it as highly desirable for health-conscious consumers seeking a premium, daily-use product. This focus on quality and repeat consumption aligns with the growing demand for convenient and nutrient-rich wellness foods.

4.2.2 Feasibility: While the cost of production at $3.50 per 250g unit creates challenges for integrating with large-scale distributors due to high markups, the use of proprietary distribution channels offers a practical solution. By reaching consumers directly through online platforms and targeting select retailers, Highlands Natural can maintain product quality, control costs, and effectively position itself in the premium segment. A wholesale strategy that supports a 38% retail margin allows for feasible retail pricing while preserving brand integrity and product accessibility.

4.2.3 Viability: With a recommended retail price (RRP) of $9.50 per 250g unit, the Highlands Natural Beef Bone Broth remains financially competitive within the premium product landscape. This pricing strategy, supported by efficient direct-to-consumer sales and selective wholesale distribution, ensures a sustainable business model. Positioned as a top-tier product for convenience, flavour, and nutritional excellence, Highlands Natural Bone Broth can attract a loyal customer base and generate consistent revenue streams while maintaining profitability.

4.3 Product yield

The first retail batch of Highlands Natural Beef Bone Broth, prepared using the Kettle D 1600L kettle, yielded a total of 1,446 litres of product. Following the recipe requirements, the batch utilized 600 kilograms of mixed organic, grass-fed beef bones (neck, spine and femur), resulting in a final production of 5,784 individual 250g units. This demonstrates efficient utilization of raw materials and production capacity, aligning with the operational targets for batch scalability and market supply needs.

5 Conclusion

The achievement of the project objectives for the Highlands Natural Beef Bone Broth (BBB) research project reflects a culmination of efforts undertaken across the project's earlier milestones and the comprehensive analyses conducted throughout its development. Success has been realised by integrating findings from Milestones 1, 2 & 3 with targeted analyses in key strategic areas.

5.1 Key Findings

5.1.1 Milestone 1

Foundational insights were obtained through a thorough market analysis that highlighted consumer demand for premium, health-focused, and sustainable products. This was complemented by bench-top trials assessing the broth's flavour profile and nutritional values. These trials revealed the superior performance of mixed beef bones, with significantly higher levels of key nutrients such as glutamine, validating the product's desirability and differentiation within the competitive market landscape.

5.1.2 Milestone 2

Focusing on scaling production through the development of a retail batch using Kettle D 1600L. This step ensured the feasibility of producing Highlands Natural BBB at a commercial scale while maintaining its high flavour and nutritional quality. The data collected during this phase, including product yields, confirmed operational efficiency and informed cost analysis.

5.1.3 Milestone 3

Insights and data obtained from previous milestones were synthesized into strategic frameworks to solidify the product's market position. A Business Model Canvas was developed to articulate the product’s value proposition, customer relationships, revenue streams, and cost structures. This was complemented by a desirability-feasibility-viability review, which validated the broth's potential to meet consumer needs, be operationally scalable, and remain financially competitive through direct-to-consumer and selective retail strategies. Additional analyses included a detailed product yield review, confirming efficient utilization of resources, and a value multiplier of beef bones analysis, which demonstrated the significant economic uplift. The data suggests that by transforming beef bones into a high-margin premium product, a **2.7x increase in value** is represented from the wholesale cost of organic grass fed beef bones to their contribution at the retail level.

5.2 Benefits to the Red Meat Industry

The successful completion of the Beef Bone Broth Value Add Opportunities research project underscores the project's potential to positively impact the Australian red meat industry and support its ambitious target of doubling the value of Australian red meat and becoming carbon neutral by 2030. By transforming sustainably sourced Organic grass fed beef bones—a traditionally low-value byproduct—into a premium, high-margin product, the project demonstrates how innovative utilisation of Australian beef bones create a 2.7x value multiplier, contributing substantially to economic and environmental benefits to the industry.

The integration of sustainable agricultural practices in the production of Highlands Natural BBB not only enhances soil health and biodiversity but also aligns with consumer demand for sustainable and nutrient-rich products. The value multiplier analysis highlights how this approach elevates the profitability of red meat production while contributing to waste reduction and a circular economy.

Furthermore, the Business Model Canvass and desirability-feasibility-viability analysis provide a replicable framework for scaling sustainable innovations in the industry. By leveraging efficient production practices, direct-to-consumer distribution channels, and market differentiation through superior flavour and nutritional profiles, Highlands Natural BBB exemplifies how red meat producers can align profitability with environmental stewardship.

In supporting the Australian red meat industry’s carbon neutrality goal for 2030, this project showcases how value-added products like Highlands Natural BBB can drive sustainability, enhance consumer trust, and contribute to a more resilient agricultural future.

6 Future Research & Recommendations

Building upon the findings of this project, several potential areas for future research and development have been identified:

6.1 Consumer Insights and Market Trends: A comprehensive study on consumer preferences, perceptions, and purchasing behaviours related to functional food products like beef bone broth. This would help refine product development and marketing strategies to align with evolving market demands.

6.2 Broader Applications of By-Products: Explore additional uses for beef by-products, such as creating complementary functional food or health supplement lines, to maximize resource utilization and expand product offerings.

6.3 Optimization of Nutritional Content: Investigate the potential for enhancing nutrient profiles through innovative processing techniques and the integration of other functional ingredients to further differentiate Highlands Natural BBB in the marketplace.

6.4 Scaling and Export Opportunities: The investigation and development of strategies for scaling production while maintaining quality and sustainability standards. Assess opportunities for international market entry, particularly in regions with high demand for functional and sustainable food products.

6.5 Environmental and Economic Impact Assessment: A detailed analysis of the environmental benefits of using regenerative and sustainable agricultural practices in bone broth production. This includes quantifying carbon footprint reduction and assessing long-term economic impacts on the beef industry.

7 References

1. P.PSH.1509 Milestone 1 Report
2. P.PSH.1509 Milestone 2 Report

8 Appendices

Appendix 1: Highlands Natural BBB Business Model Canvass

HIGHLANDS NATURAL BBB- BUSINESS MODEL CANVASS

KEY PARTNERS

- Highlands Natural
- Prestige Foods Australia
- Willow Fullfilments

KEY ACTIVITIES

- Recipe Development
- Market Analysis
- Factory Benchtop Trial
- Ingredient procurement
- Large scale product manufacturing
- Marketing
- Product distribution

KEY RESOURCES

- Organic Grass Fed Beef Bones
- Highlands Natural BBB recipe
- Ingredients for recipe
- Storage, order fulfilment and distribution facility

VALUE PROPOSITIONS

- Functional health beverage offered to consumers with proven claims to improve gut health and muscle repair in a convenient delivery to become part of the consumers health and nutrition daily routine

CUSTOMER RELATIONSHIP

- Long term repeat customer, who use the product as part of their daily routine
- Customer to be part of our online community, with educational content on health & wellness and sustainable agriculture to foster an emotional and invested relationship with the product

CHANNELS

Customer reach achieved through the following channels:

- Online marketing, social media advertising & EDM for brand awareness and direct to consumer sales
- In store presence in physical retail stores including gourmet grocery stores, health food stores, health practitioner and wellness centres, health food expos, organic food markets, whole food cafes, pharmacy chains

CUSTOMER SEGMENTS

This product is aimed at health conscious consumers looking to add nutritional value to their daily routine in a simple and convenient manner, alongside with consumers looking to improve general health & wellbeing by adopting healthier daily nutritional habits

COST STRUCTURE

- Product manufacturing costs
- Marketing costs
- Operational costs
- DTC Distribution and order fulfilment costs
- B2B retail store order fulfilment costs

REVENUE STREAM

- Direct to consumer sales through online shopify store, offering product subscription discounts, bulk bay discounts or single unit sales delivered to doorstep
- Wholesale sales to physical and online retail stores offering 38% retail margin
- Wholesale sales to international export markets including online platforms and physical stores
- Physical retail sales through large organic food markets
- Wholesale sales to ready to serve channels such as cafes and wholefood eateries that have capabilities to heat and serve directly to consumers

Appendix 2: Highlands Natural Beef Bone Broth Marketing Brochure and NIP

ORGANIC GRASS-FED BEEF BONE BROTH

- Contains 6.75g of gut healing glutamine & 5.1g Collagen per serve
- 100% Natural Ingredients
- Gluten & Preservative Free
- Rich In Collagen, Amino Acids & Electrolytes
- Nutrient Dense
- Umami Rich

BROTH

	Average Quantity per Serving	Average Quantity per 100g
Energy	135kJ	54kJ
Protein	5.8g	2.3g
- Gluten	Not detected	Not detected
- Glutamine & Glutamic Acid*	6750mg	2700mg
- Glycine*	1450mg	580mg
- Proline*	725mg	290mg
- Alanine*	675mg	270mg
-Hydroxyproline*	525mg	210mg
- Arginine*	500mg	200mg
Fat, total	less than 0.2g	less than 0.1g
- saturated	less than 0.2g	less than 0.1g
Carbohydrate	2.2g	0.9g
- sugars	less than 0.2g	less than 0.1g
Sodium	500mg	200mg

* Indicates average values based on typical testing

Our Highlands Natural signature grass fed & finished beef bone broth is a culmination of hundreds of hours in the kitchen in search of the perfect balance of flavour complexity & nutrient density, resulting in a deeply flavoured, beautifully fragrant & umami rich Asian style beef bone broth. Our unique blend of ayurvedic herbs & spices, with certified organic vegetables have been carefully selected to work in perfect harmony with nutrient dense certified organic grass fed & finished beef bones. The ingredients are slowly simmered in filtered water & certified organic apple cider vinegar to maximise nutrient extraction. The celtic sea salt packed with trace minerals charge the broth with electrolytes to further optimise the amazing health benefits and flavour profile creating a highly nutritious, immune supporting and gut healing bone broth.