BDO Zone Rating

'A'

The Town of Coronach, SK, BDO Zone for Flax Straw is rated 'A'. The long-term outlook on price and quantity is deemed stable. Key scale-up risks can likely be addressed with reasonable mitigation measures.

Rating Parameters

Feedstock Quantity	Feedstock Form	Price Range ($/ODMT)	BDO Zone Radius
55,000 ODMT/yr	Round/Square bales	$65–$85 delivered	140 km

BDO Zone Assets

- **There is a stable long-term outlook on feedstock price and quantity, with strong inventory management in place.**
- **Current BDO Zone estimates include both feedstock in Canada and the northern US border area.**
- **Ability to access larger supply basins at marginal increases in transport costs.**
- **Relatively large projected grower participation rate.**
- **No large-scale competition for Flax Straw.**
- **Positively rated infrastructure asset profile.**

BDO Zone Liabilities

- **Grower interest in supplying Flax Straw will require further direct validation.**
- **The region lacks Flax Straw collection and baling experience**
- **Year-to-year variation in feedstock availability poses a risk.**
- **High probability of the need to engage a third-party company to carry out harvest with square balers.**

BDO Zone Risk Rating

The Town of Coronach, SK, Bioeconomy Development Zone is rated 'A,' or *low risk,* for 55,000 ODMT/yr of Flax Straw at a price of $65 - $85/ODMT delivered.

Risk Rating Grades are defined as follows: AA (*very low*), A (*low*), Baa (*low-moderate*), Ba (*moderate*), B (*moderate-high*), or C (*high*).

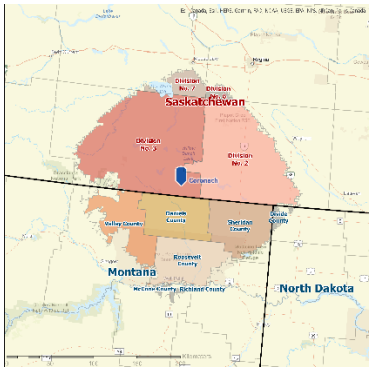
In assessing the biomass supply chain risk for the Town of Coronach, SK, Bio-economy Development (BDO) Zone, 48 Risk Indicators from the *Canadian National Standards for Biomass Supply* were applied. These BDO Zone Risk Indicators are the subset of BSCR Risk Indicators applicable to gauging feedstock risk within a BDO Zone.

Feedstock quantity is expressed in Oven-Dried Metric Tons (ODMT), while feedstock Price is expressed in Canadian dollars and delivered to the plant yard, assuming the plant is located centrally in the BDO Zone. Maximum transport distance is calculated assuming the maximum quantity in this BDO Zone Rating. Delivered feedstock costs for projects with lower volume requirements can be expected to be at the lower end of the BDO Zone's price range.

Scoring and Rating Methodology

The overall BDO Zone rating is based on an aggregation of the scores assigned to each BDO Zone Risk Indicator (RI) assessed in this report. First, each BDO Zone Risk Indicator is given a **Raw RI Score** based on the current undeveloped state of the supply chain and the uncertainty drivers within it. Raw RI Scores are scaled between 1 (*low risk*) and 10 (*high risk*).

Next, each Risk Indicator is discounted, or "notched," based on the degree to which the uncertainty drivers are deemed to be addressable and whether there is a reasonable expectation that mitigation measures could be put into place within the price parameters for this rating. The **Notched Salience Score** corresponds to the likelihood of each Risk Indicator's described risk materializing, given the implementation of reasonable mitigation measures. To arrive at the Notched Salience Score, Raw RI Scores are reduced based on the efficacy of the proposed mitigation measures. If applicable, notching occurs at one of four levels: *moderate* (25%), *significant* (50%), *broad* (75%), or *comprehensive* (100%).



The potential impact of each Risk Indicator on the supply chain is assessed and scored on a 10-point **Impact Level** scale as either *low (3.33)*, *moderate (6.66)*, or *high (9.99).* Impact Level scores are based on the assumption that key measures were implemented to mitigate uncertainty drivers in the BDO Zone but failed to do so.

The **Loaded RI Score** for each Risk Indicator calculated as the product of Notched Salience and Impact Level scores. For example, *Risk Indicator 3.2.2: Low Historical Demand for Feedstock in the Supply Basin* has a Notched Salience score of 4.5, and its Impact Level is deemed *low* (3.33 out of 10). The final Loaded RI score for RI 3.2.2 is, therefore, $4.5 \times 3.33 = 14.99$ (out of 100).

Loaded RI scores of 33.33 or less are deemed *low risk*; scores greater than 33.33 and less than 66.66 are deemed a *moderate risk*; and scores of 66.66 to 100 are deemed *high risk*.

The total risk rating for the BDO Zone is the average of all Loaded RI scores. **The BDO Zone score for the Town of Coronach is 16.68 out of 100, resulting in an 'A' designation.** All scoring and rationale for each Risk Indicator are provided in Appendix A.

Analyst Notes

The Coronach BDO Zone presents several strong assets, including a lack of competition for Flax Straw and an expected stable long-term outlook on feedstock price and quantity with strong inventory management practices. There are substantial, large growers and access to a larger supply basin at marginal increases in transport costs. The overall infrastructure is good.

Key Low-Risk Indicators

Most Loaded RI Scores are below 33.33 and are thus deemed *low* risk.

Risks related to competition are all scored as *low*. This is because no large-scale facilities consuming Flax Straw within the 300 km competition zone surrounding Coronach, SK, are currently in operation. Cattle feedlots are the only consumers of Flax straw in the region, intaking up to 5% of generated Flax Straw in the BDO Zone.

Most farms in the Coronach BDO Zone are large. Sizeable bio-based projects may still require aggregations of individual growers. The degree of management complexity for this is significant; however, it is likely manageable. A large pool of suppliers will also bring with it positive supply chain attributes, as the presence of many suppliers can increase supply chain resilience.

Key Moderate-Risk Indicators

We assess the Loaded RI Score of *Risk Indicator 1.8. Feedstock Production Priority* is 37.46, or *moderate*. While the initial grower outreach did not generate clear interest from growers, based on experience in adjacent areas, it is reasonable to assume that larger suppliers would become interested once a project is announced and/or commissioned.

The most significant risks in the Coronach BDO Zone Flax straw supply chain are 1) risks related to harvesting and collection equipment; and 2) risks related to natural events.

Harvesting, Collection, and Transportation Equipment Risk Indicators

Due to a lack of present markets for Flax Straw regionally, suppliers in the Coronach BDO Zone are generally inexperienced in cost-efficient Flax Straw harvesting and baling, with minimum ash introduced to the collected bales. Additionally, few growers own the square baling equipment ideal for the storage and delivery of Flax Straw. Round balers are far more commonly used. Differences in baling equipment and harvest practices among growers may result in variations in delivered feedstock quality.

We assume that bio-based projects that locate in the Coronach BDO Zone will take measures to mitigate key risks. This expectation is indicated by the difference between Raw RI Scores and Notched Salience Scores for multiple Risk Indicators detailed in Appendix A.

The risks around harvesting and collection equipment can be substantially mitigated by the vertical integration of a bio-project with Flax straw harvest/baling processes or by engaging credible third-parties to conduct harvest/baling activities. Scoring and this rating assume that such measures will be implemented.

We assess a moderate scale-up risk for *Risk Indicator 3.30. Capacity of Supply Chain Components and Equipment to Scale* with a Loaded RI score of 39.96. This indicator presents a salient risk even with mitigation measures and a high impact if mitigation measures were to fail.

Natural Event Risk Indicators

Natural events can have significant impacts on Flax straw supplies in the Coronach BDO Zone. This category of risk presents the highest risk scores for this BDO Zone rating, with a Loaded RI Score of Risk Indicator *3.5 Year-to-year variation in feedstock availability (score of 39.96)*; *3.20. Seasonal Weather Impacts on Feedstock Supply (34.97); and 3.21 Long-Term Weather and Climate Trends (34.97)* all relating to risks associated with natural events. Specific projects may be able to effectively mitigate these risk indicators through strong inventory management practices and an expansion of the supply basin.

Other *moderate* Risk Indicators (scoring between 33.33 and 66.66) include *1.6. Fundamental Feedstock Production Experience; and 3.9 Diesel, Oil, and Producer Price Index (PPI).* Mitigation measures are somewhat limited by the external nature of these risk indicators.

BDO Rating Parameters

In the interest of avoiding undue market influences and prejudicing a project's ability to negotiate with suppliers, BDO Zone rating reports do not provide information on total feedstock cost breakdowns obtained during the assessment. This includes all costs associated with the engagement of a third party, as well as, the development of a vertically integrated supply chain.

For this rating, we had received some limited feedback from growers augmented by proxy prices for grower ask and baling costs from adjacent growing areas. Transportation costs were calculated using average distances based on the supply curves and trucking costs typical for the region.

The rating of the Coronach BDO Zone is based on total delivered costs of the feedstock in a price range of $65-85/ODMT and at a distance range of 140 km for a total of 55,000 ODMT/yr. The rated quantity assumes an 80% participation rate, as well as 1.2x, required feedstock redundancy (BAM – Biomass Availability Multiple). Phytosanitary requirements do not appear to be a major risk.

Infrastructure Asset Profile

Town of Coronach's infrastructure assets was scored on a scale of 0–10, with scores defined as follows: 0 (very good), 2 (good), 4 (reasonable), 6 (fair), 8 (poor), and 10 (insufficient). Overall, the Town of Coronach has a profile of positively rated infrastructure assets, with an average score of 1.9 out of 10. This score supplements the Town of Coronach BDO Zone rating and supports its low-risk designation. The full infrastructure asset profile is detailed in Table 2.

Contact Info:
Marcin Lewandowski
Senior Director, Operations & Risk
Ecostrat Inc.
marcin@ecostrat.com

Jordan Solomon
President & CEO
Ecostrat Inc.
Jordan.solomon@ecostrat.com

Figure 1 - Risk Indicators (sorted by risk level)

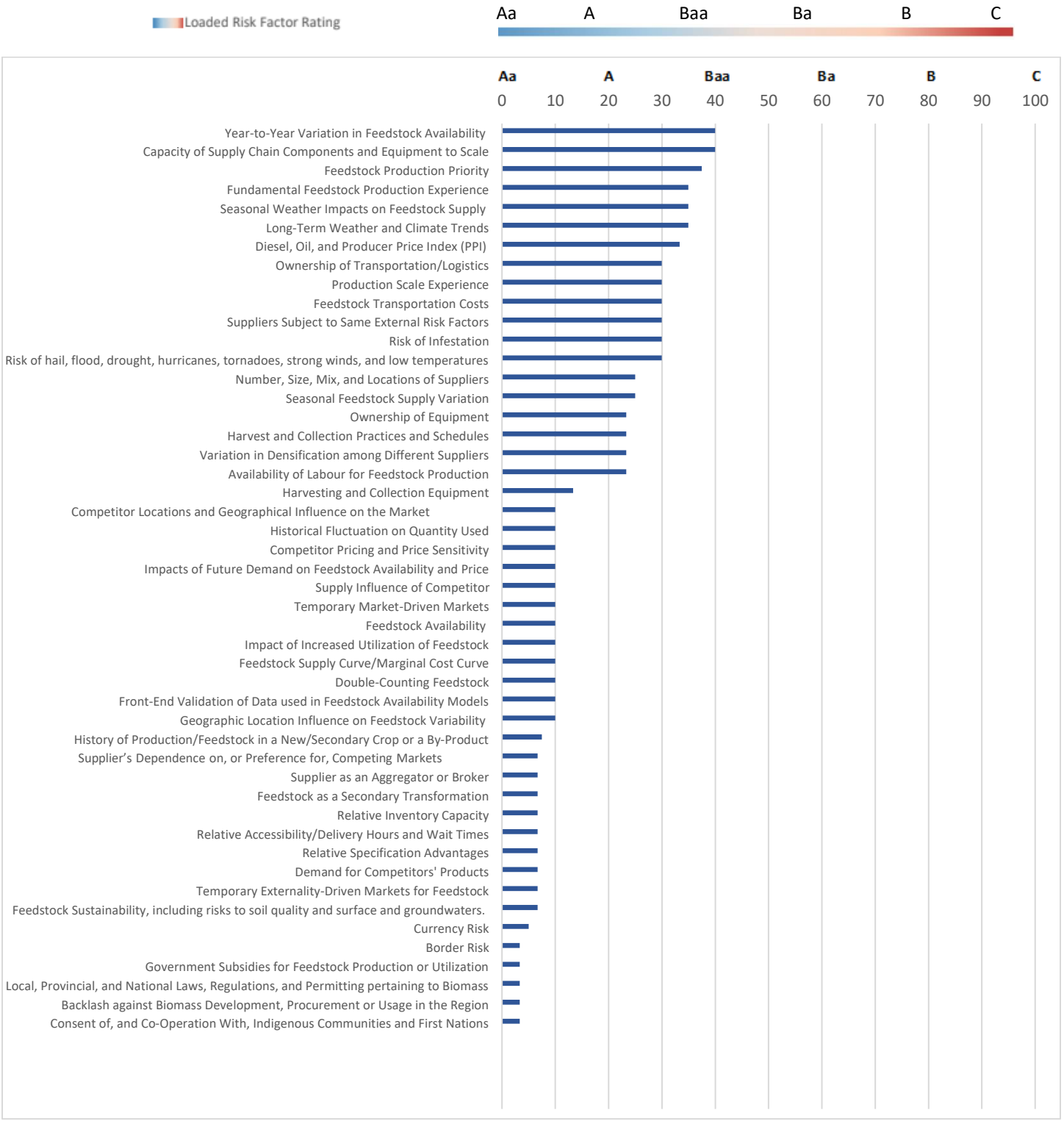


Table 1 - Risk Indicators

Feedstock Supply Chain Risk Indicators	Raw RI Score	Notched Salience	Impact Level	Loaded RI Score
Category 1: Supplier Risk				
Supplier's Dependence on, or Preference for, Competing Markets	2	2.0	3.33	6.66
Ownership of Equipment	7	3.5	6.66	23.31
Ownership of Transportation/Logistics	6	3.0	9.99	29.97
Supplier as an Aggregator or Broker	1	1.0	6.66	6.66
Feedstock as a Secondary Transformation	2	1.0	6.66	6.66
Fundamental Feedstock Production Experience	7	3.5	9.99	34.97
Production Scale Experience	9	4.5	6.66	29.97
Feedstock Production Priority	5	3.75	9.99	37.46
Category 2: Competitor Risk				
Competitor Locations and Geographical Influence on the Market	1	1.0	9.99	9.99
Historical Fluctuation on Quantity Used	1	1.0	9.99	9.99
Competitor Pricing and Price Sensitivity	1	1.0	9.99	9.99
Impacts of Future Demand on Feedstock Availability and Price	1	1.0	9.99	9.99
Supply Influence of Competitor	1	1.0	9.99	9.99
Temporary Market-Driven Markets	1	1.0	9.99	9.99
Relative Inventory Capacity	1	1.0	6.66	6.66
Relative Accessibility/Delivery Hours and Wait Times	1	1.0	6.66	6.66
Relative Specification Advantages	1	1.0	6.66	6.66
Demand for Competitors' Products	1	1.0	6.66	6.66
Category 3: Supply Chain Risk				
Feedstock Availability	1	1.0	9.99	9.99
Impact of Increased Utilization of Feedstock	1	1.0	9.99	9.99
Feedstock Supply Curve/Marginal Cost Curve	1	1.0	9.99	9.99
Seasonal Feedstock Supply Variation	5	2.5	9.99	24.97
Year-to-Year Variation in Feedstock Availability	8	4.0	9.99	39.96
Double-Counting Feedstock	1	1.0	9.99	9.99
Front-End Validation of Data used in Feedstock Availability Models	1	1.0	9.99	9.99
History of Production/Feedstock in a New/Secondary Crop or a By-Product	9	2.25	3.33	7.49
Diesel, Oil, and Producer Price Index (PPI)	5	5.0	6.66	33.30
Currency Risk	3	1.5	3.33	4.99
Border Risk	2	1.0	3.33	3.33
Temporary Externality-Driven Markets for Feedstock	1	1.0	6.66	6.66
Harvest and Collection Practices and Schedules	7	3.5	6.66	23.31
Harvesting and Collection Equipment	8	2.0	6.66	13.32
Variation in Densification among Different Suppliers	7	3.5	6.66	23.31
Availability of Labour for Feedstock Production	7	3.5	6.66	23.31
Feedstock Transportation Costs	3	3.0	9.99	29.97
Number, Size, Mix, and Locations of Suppliers	5	3.75	6.66	24.98
Suppliers Subject to Same External Risk Factors	9	4.5	6.66	29.97
Seasonal Weather Impacts on Feedstock Supply	7	3.5	9.99	34.97
Long-Term Weather and Climate Trends	7	3.5	9.99	34.97
Risk of Infestation	4	3.0	9.99	29.97
Risk of hail, flood, drought, hurricanes, tornadoes, strong winds, and low temperatures	3	3.0	9.99	29.97
Government Subsidies for Feedstock Production or Utilization	1	1.0	3.33	3.33
Local, Provincial, and National Laws, Regulations, and Permitting pertaining to Biomass	1	1.0	3.33	3.33
Backlash against Biomass Development, Procurement or Usage in the Region	1	1.0	3.33	3.33
Consent of, and Co-Operation With, Indigenous Communities and First Nations	1	1.0	3.33	3.33
Feedstock Sustainability, including risks to soil quality and surface and groundwaters.	2	2.0	3.33	6.66
Geographic Location Influence on Feedstock Variability	1	1.0	9.99	9.99
Capacity of Supply Chain Components and Equipment to Scale	8	4.0	9.99	39.96
			Average	**16.68**

Table 2: Infrastructure Asset Indicator

Infrastructure Assets	Overview	Score
Category 1: Physical Infrastructure		
1.1 Land Parcel	The Town of Coronach has a land area of 2.34 Km^2 (0.90 sq mi), and the RM of Hart Butte has a land area of 839.22 Km^2 (324.02 sq mi).	1
1.2 Industrial Land Use Zone	Currently, there is 1 Industrial area located in the Northern part of Coronach. There are also 3 other land parcels falling in FUD (Future Urban Development) close to the boundaries of the town. The Government is in the process of site selection and development of an Industrial Park in the RM of Hart Butte.	2
1.3 Natural Gas Line	SaskEnergy Natural Gas Company in Coronach, SK, provides gas to residential and commercial areas.	1
1.4 Electrical	SaskPower and SaskEnergy are the primary utility service providers, and electricity in the Town of Coronach is produced from coal. The Poplar River Power Station produces approximately one third of the electricity produced by Saskatchewan, that generates up to 24.2 TWh through different means - 41% from coal, 40% natural gas, 15% hydro, 3% wind and 0.5% through biomass. For Life Cycle purposes, potential projects may prefer a higher proportion of Renewable Energy.	1
1.5 Fresh Water Supply Line	Coronach has a water supply of 600,000 gallon wells. The Town's waterworks department supplies treated water that meets the regulated drinking water quality guidelines.	1
1.6 Sewage Disposal	Coronach will replace its sewer lines in the Downtown area, as some of the lines are almost 60 years old. The Phase 1 of underground construction was done in Summer 2022, and $48,000 was allocated for the installation of the ventilation system for Wastewater in the West Lift Station.	2
1.7 Drainage	The Town of Coronach has received $ 5.9 million in funding to support the renewal of downtown, over the next two years for drainage improvement and other initiatives. The funding will be utilized for 2023-2024.	1
1.8 Stormwater Management	Funding to support capital investment and operations for stormwater infrastructure and flood protection services is being managed by the Department of Storm Water Management.	1
1.9 Available ICT (Information & Communication Technology) Services	Telecommunication services are provided by SaskTel, Wood River Controls and Access Communication. Currently, the broadband connection has a download speed of 450 MGB. The Town of Coronach is expecting to upgrade to fibre in the coming months through multiple government grants.	1
1.10 Landfill/waste disposal	Coronach has a Landfill/Transfer Station. The Landfill accepts all kinds of materials. Loraas Disposal carries out single stream recycling and collects all recyclable materials such as fiber, plastics, tin, aluminium, glass, cardboard and paper.	1
Category 2: Logistics		
2.1 Highway Access and Intersection	The Town of Coronach is located on secondary Highway 18. The community is easily accessible to major centers in Saskatchewan, Montana, and North Dakota. The Town of Coronach is 158 Km from Moose Jaw, 211 Km from Regina, 240 Km from Williston, 273 Km from Swift Current, 286 Km from Minot, 384 km from Saskatoon, 611 Km from Winnipeg, 647 Km from Calgary, and 745 Km from Edmonton.	1
2.2 Ocean/River Access	The closest port is the Port of Saskatoon and is 384 Km from the townsite.	4
2.3 Accessibility to Airport	The closest airports are in Regina, SK and Minot, ND. The Town of Coronach is 136 Km from Canadian Forces Base, Moose Jaw (to be used in case of emergencies), 159.3 Km from Regina International airport, 185.7 Km from Estevan Airport, and 393 Km from Minot International Airport (MOT).	4
2.4 Railway Service	The Town of Coronach has a 606 Km short line owned by Great Western Railway, which operates trains on behalf of the Fife Lake Railway. Coronach is 34 Km from Rockglen station and 78 Km from Assiniboia owned by Great Western Railway, and is 58 Km from Bengough having CP line. Goods can be transported towards the north and west through the Great Western Railway, connecting the CP line. Additionally, goods can be transported to the east and south have to be trucked to Bengough station that connects the CP line to CN line and Stewart Southern Railway.	4
2.5 Logistics - Construction	Projects are mainly done by contract, where sub-contractors are usually from the neighbouring region. Labour in construction industry is not very high within the town.	3

Category 3: Social Infrastructure		
3.1 Quality of Life	Coronach has a Livability score of 73/100, which is considered excellent. The Cost of Living in Coronach is 12% lower than Saskatchewan average, and 4% less than the National average.	**1**
3.2 Education	Coronach has a daycare and a K-12 school, Coronach Early Learning Center, and Coronach School & Adult Learning. Saskatchewan is home to two world-class Universities: The University of Regina, and the University of Saskatchewan (Saskatoon). The Southeast College in Assiniboia campus is 79 Km, Weyburn campus is 176 Km, Estevan campus is 209 Km, and Whitewood campus is 382 Km from the Town of Coronach. Other Colleges closer to Coronach are Saskatchewan Polytechnic, Moose Jaw Campus is 161 Km and University of Regina is 209 Km.	**3**
3.3 Local Retail	The Town of Coronach and RM of Hart Butte have local groceries, convenience stores, restaurants, and other outlets managed mostly by small and family-owned businesses.	**2**
3.4 Culture and Recreation	Old Coronach Street Festival is an arts and culture event celebrated every year in August. The community offers many facilities – Poplar River Community Park, Big Muddy Tours, Golf Club, Swimming Pool, Parks, Playgrounds, Rural community Orchard, and z Sportsplex.	**1**
3.5 Hospital and Doctors	The Coronach Health Center was built in 1992 and became a part of the Sun Country Health Region. It consists of 12 long-term care beds, 4 multi-purpose beds, and a laboratory. Physicians from neighbouring regions visit the health centre twice a week. The closest hospital is Assiniboia Union Hospital which is 78 Km from the Town of Coronach.	**4**
3.6 Housing Availability	According to Statistics Canada 2021, the average home value in Coronach is $ 153,000, and $ 180,000 in RM of Hart Butte, compared to Saskatchewan average of $ 301,467 and $ 632,802 in Canada. Currently, the percentage of housing and farmland available for sale in Coronach is 11%.	**1**
3.7 Crime Rate	Coronach Crime Rates are 70% lower than Saskatchewan average, and 43% lesser than the National average.	**1**
Category 4: Workforce		
4.1 Labour Rates	The Government of Saskatchewan has announced a minimum wage of $13 from October 2022, $14 from October 2023 and $15 from October 2024. The proposed plant would likely be able to pay above, or at least the average hourly rate.	**1**
4.2 Employment Rates	The average salary is $ 61,423 yearly, and average hourly rate is $ 20 in the Town of Coronach. The employment rates had an average growth of 0.06% per year from 2006 to 2016.	**1**
4.3 Available Skilled Labour	In Coronach, 35.1% residents have completed high school, 19.5% have Apprenticeship, 7.8% have College Degree and 5.2% have attended University. Whereas, in RM of Hart Butte, 37.2% of the population have attended high school, 18.6% hold a College diploma and 4.6% hold a University degree. On average, about 25% of the population work in the management of various sectors of manufacturing, finance, mining, and professional services.	**3**
4.4 Available Unskilled Labour	Most unskilled labour would come from agricultural and mining industries.	**2**
4.5 Workforce- Size	According to Statistics Canada 2021, the total labour force is 325 in Coronach, with an employment rate of 64% and an unemployment rate of 3.3%. Whereas, the total labour force is 140 in RM of Hart Butte, with an employment rate of 82.1% and an unemployment rate of 5.4%.	**2**
	Total	***1.9***


BIOECONOMY DEVELOPMENT ZONE PROGRAM
CERTIFIED 'A'

APPENDIX A: SCORING PROTOCOLS, RATIONALE, AND RATINGS

The objective of this Bioeconomy Development Opportunity (BDO) Zone assessment is to assess Flax Straw biomass supply chain risks for the Town of Coronach, SK. **The BDO Zone rating for Flax straw in Coronach, SK is 'A'**.

Category 1: Supplier Risk

1.1. Supplier's Dependence On, or Preference For, Competing Markets

Rationale: Suppliers may have a vested interest or preference to supply to specific competitors for biomass feedstock. Preferences may be due to historical, long-term, or personal relationships, less stringent feedstock quality requirements, more flexible operating hours by competing markets, or supplier's dependence on competing markets to accept or purchase other products/by-products. During periods of feedstock shortage suppliers may be more likely to allocate the scarce supply to a competitor, resulting in supply disruptions for the Proponent.	**Score**
Raw RI Score: There are no large-scale consumers of Flax Straw in the region. Only small local demands for Flax Straw exist, such as the cattle bedding market, which is estimated to consume approximately 5% of all generated Flax Straw. An amount too small to pose a significant risk. Raw RI Score is deemed *low*.	**2**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 2, as they are already the lowest risk.	**Score 2.0**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score 6.66**

1.2. Ownership of Equipment

Rationale: In most cases, suppliers that own or lease equipment for harvest, collection, and processing of feedstock are lower risk than those who do not. For example, third-party harvesting equipment may not be available when required, meaning that short harvest windows may be missed if a farmer and contractor cannot schedule convenient harvest times, resulting in quantity shortages. In some circumstances, relying on third-party equipment to harvest or produce feedstock can decrease supply chain risk. For instance, when harvesting agricultural residues such as corn stover, the use of third-party companies with standard equipment specializing in harvesting, collection, and transportation may decrease quality variations (e.g., ash content) of final feedstock.	**Score**
Raw RI Score: Two types of balers exist: round and square. Round balers are generally more common in farm communities for harvesting crop residues such as Flax Straw as they are cheaper than large square balers. Square bales are preferred as they produce bails which are easier to stack and store than round bales, increasing the number of bales per trailer. Also, square bales usually have higher bulk density compared to round bales, decreasing storage and transportation costs. Square balers are not in use in Coronach as there is currently no market for baled Flax Straw (other than the sporadic animal bedding market). As few producers own this equipment, engaging a third-party company with suitable baling equipment is likely required. Several third-party baling companies exist within the region, which could generate a pool of service providers to mitigate risk.	**7**

However, two major risks exist when engaging third parties to harvest Flax Straw in the BDO Zone: First, using a third-party baler will likely increase feedstock costs, skewing the estimates in this report. The additional cost associated with engaging a third-party (or by vertically integrating a similar service) is estimated at $10–20/bale. Second, not all growers will accept Flax Straw harvesting by third parties, so grower participation rates could be lower than expected. Raw RI score is deemed high.

Notched Salience: RI 1.2 could be significantly mitigated by involving an experienced third-party baling company or vertical integration within the project. Additionally, the lower participation rate can be mitigated by organizing outreach events and demonstration projects with the third party and farmers to address any concerns that farmers may have regarding the use of third-party harvest equipment in their fields. That said, the risks with respect to engaging a third-party baler would still be present. A new Flax Straw processing plant may mitigate the risk associated with baling equipment ownership by purchasing its own equipment, or financing growers to do so. Given that this rating is for 55,000 ODMT/yr of Flax Straw, acquiring baling equipment for such relatively small quantity should be feasible. As a result, Raw RI Score is notched down by 50%: Notched Salience is 3.5.	**Score 3.5**
Impact Level: A third-party baling company may not be available during the harvesting season, or its cost may be prohibitive. If so, the local supply chain would need to scale up and acquire the necessary baling equipment. It remains unclear whether local growers would have an appetite to invest in such equipment. RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 23.31 out of 100.	**Score 23.31**

1.3. Ownership of Transportation/Logistics

Rationale: In most cases, suppliers that own or lease equipment necessary to transport biomass from forest or field are lower risk than those who do not. However, in some circumstances, reliance on third parties to transport biomass is considered common practice and does not contribute to risk.	**Score**
Raw RI Score: The Flax Straw currently being sold is transported by growers, but the total number of trucks and trailers owned by growers is insufficient to support a large straw consumer. Although growers may invest in equipment once Flax Straw demand and confidence in the project increases, the lack of widespread ownership of transportation equipment and likely need to hire third-party transportation companies poses a distinct risk to the supply chain. This risk is heightened by the fact that the harvesting season is only a few weeks long, meaning that sufficient transport equipment must be moved into the region in a short period of time. Raw RI score is deemed 6 out of 10.	**6**
Notched Salience: Sufficient transportation equipment can likely be obtained from other custom haulers, with some companies offering custom baling and hauling services. Several well-known trucking companies currently transport other products using flatbed and super B flatbed trailers capable of transporting bails. Secondary research indicates that the existing trucking infrastructure should be able to support a large-scale project, since trucks mobilized to the region from other parts of Saskatchewan. However, due to national and provincial truck shortages, a large-scale biomass project may have difficulty of securing enough truck drivers to meet their bale transportation demands throughout the year. As a result, Raw RI Score is notched down by 50%: Notched Salience is 3.0.	**Score 3.0**

Impact Level: A potential lack of transportation infrastructure would pose a significant risk to the supply chain. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 29.97 out of 100.	**Score 29.97**

1.4. Supplier as an Aggregator or Broker

Rationale: Aggregators may effectively provide supply chain redundancy and eliminate the risk and complexity of dealing with multiple sources of supply by combining them into a single master contract. Aggregators can add much needed stability into biomass supply basins by increasing the offtake stability for both suppliers and markets. An aggregator can be a more reliable long-term offtake solution for suppliers by having access to multiple markets. Parallelly they are also more reliable long-term suppliers for markets by having multiple suppliers – i.e. when a single supplier breaches, the aggregator can source from another. Both aggregators and brokers are intermediaries. Aggregators consolidate and manage feedstock procurement from a number of smaller suppliers. While, brokers often act as intermediaries between a single source of supply, brokers of multiple sources of feedstock are also common. Aggregators act as principles in the supply of feedstock and assume the contractual obligations of a direct supplier, whereas, brokers do not. Definitional confusion between aggregators and brokers is common. If an aggregator does not assume the supply risk of sub-contractors, then they are more accurately deemed either a "procurement manager" or "broker". Aggregators add more value in terms of risk mitigation than other intermediaries. Thus, an aggregator premium should relate to the degree to which they are able to mitigate feedstock supply risks. **Raw RI Score:** There are no aggregators in the area. However, the presence of a large number of growers allows for the spread of supply sources and reduces the risk of supply shortages. Some balers have collaborated on a business to business(B2B) basis and aggregators may not be necessary. Raw RI Score is deemed *low*.	**Score** **1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: Although we are certain that there is a large number of flax growers willing to aggregate and supply Flax Straw, a potential failure by the growers to aggregate Flax Straw poses a risk. RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score 6.66**

1.5. Feedstock as a Secondary Transformation

Rationale: A secondary transformation is dependent upon the production of primary products, e.g. Flax straw resulting from the production of flax. Risks are higher if feedstock is a secondary transformation of a primary, more valuable product. It may not be economical for suppliers to produce biomass on their own in the absence of markets for the primary product. In the case of agricultural feedstocks such as Flax Straw, the feedstock is a by-product of a primary crop. Since the primary crop is significantly more lucrative than the residue, it is the producers' priority. If production of a primary crop requires resources to be taken away from the production of a secondary crop (e.g., in case of shorter harvesting windows due to weather), the secondary feedstock supply will suffer. In times of stretched resources, suppliers may perceive harvesting and collecting the feedstock (secondary product) as a nuisance, potentially decreasing production levels. **Raw RI Score:** Flax Straw is a byproduct of flax, a primary crop. As a result, producers will always prioritize producing flax grain, with straw as a potential secondary/by-product. However, since 2002, flax production has been steadily increasing, as has the production of Flax Straw. Oilseed flax has a significant percentage of long tough stem fibres that decay slowly over time. This makes it difficult to incorporate flax straw into the soil after harvest since the fibres wrap themselves around and plug disks, wheels, and seeder-shanks. Burning flax straw is still the most common straw management practice among flaxseed growers due to the lack of stable and large-scale markets for flax straw. Raw RI Score is deemed *low*.	**Score** **2**
Notched Salience: RI 1.5 could be further reduced by broadening the supply basin and possibly of using other crop residues in the region, if acceptable by the end user. In the event of a feedstock shortage due to low flax production, more feedstock can be obtained from areas outside the core supply basin. When compared to the total cost of feedstock, the cost of additional transportation is relatively low (e.g., at 50 km from Coronach the transportation cost makes up 15 percent of the total cost). To further mitigate Flax harvest shortfalls, an on-site inventory of 12-18 months of feedstock could be kept under cover. As a result, Raw RI Score is notched down by 50%; Notched Salience is 1.0**.**	**Score** **1.0**
Impact Level: There is a risk that some growers would prefer continue burning Flax Straw onsite as opposed to baling it to supply processors. Although this risk is already calculated in our grower participation rate assumption, nonetheless the RI Impact Level is deemed *moderate*.	**Score** **6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score** **6.66**

1.6. Fundamental Feedstock Production Experience

Rationale: Risk is higher when a supplier has limited experience with planting, growing, harvesting, processing, and/or collecting biomass. Limited experience may be common for agricultural residue supply chains where farmers may have no previous experience. In cases where experience is lacking, Proponent should show that steps have been taken to ensure proper training, knowledge dissemination, and monitoring.	**Score**

Raw RI Score: The supply chain has little experience producing, storing, and handling commercial quantities of Flax Straw as the only consumers are local spot markets such as cattle bedding. Many individual growers have never baled Flax Straw, though some have baled straw from other crops. Raw RI Score is deemed *high*.	**7**

Notched Salience: RI 1.6 could be significantly reduced by enlisting the services of an experienced third-party baling company (or companies) or by providing similar services by establishing a vertically integrated bio-project. As a result, Raw RI Score is notched down by 50%: Notched Salience is 3.5.	**Score 3.5**
Impact Level: There is a risk that a third-party baling company could not be enlisted, or its cost would be prohibitive. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 34.97 out of 100.	**Score 34.97**

1.7. Production Scale Experience

Rationale: Scale-up entails risk. Risk is higher when suppliers have limited experience with production at the quantity of feedstock required.	**Score**
Raw RI Score: Production-scale experience with Flax Straw is lacking in the region. The transition from current Flax straw production levels to those required for a large-scale facility would be significant. Raw RI Score is deemed *high*.	**9**

Notched Salience: RI 1.7 could be reduced by outsourcing harvest and collection to credible third-party baling companies or by providing similar services through a vertically integrated bio-project. As a result, Raw RI Score is notched down by 50%: Notched Salience is 4.5.	**Score 4.5**
Impact Level: There is a risk that a third-party baling company could not be enlisted, or its cost would be prohibitive. RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 29.97 out of 100.	**Score 29.97**

1.8. Feedstock Production Priority

Rationale: When biomass feedstock is a secondary or non-core line of business, or when it is a by-product /residual from a more valuable primary product, suppliers may not put sufficient effort into consistently producing it. Risk of breach increases when production and/or delivery of feedstock compromises supplier's ability to make a primary product. When biomass feedstock is a by-product of another main higher margin or main product (e.g. Flax Straw), supply may not be a top priority for a supplier.	**Score**
Raw RI Score: The production of oilseed flax has been quite stable in the region in the last decade. Due to the fact long tough stem fibres that decay slowly over time burning flax straw has become the most common straw management practice among flaxseed growers. This is primarily due a lack of stable and large-scale markets for flax straw. Therefore, many flax growers have indicated interest in supplying Flax Straw to a commercial scale biomass processing facility. Flax straw could become a significant source of on-farm income for farmers currently burning this biomass resource. Moreover, having a long-term solution for Flax Straw can encourage more production of oilseed flax in the region.	**5**

This risk is exacerbated because the harvesting window is relatively short, 4 to 6 weeks. As a result, suppliers will prioritize grain production and will only supply Flax straw when it does not interfere with their ability to harvest grain efficiently. Raw RI Score is deemed *moderate*.

Notched Salience: Based on experience from adjacent regions, face-to-face meetings with potential suppliers and providing them with several year contracts would likely yield positive interest. Outsourcing harvest and collection to a reputable third-party baling company or providing similar services through a vertically integrated bio-project could help to mitigate this risk. As a result, Raw RI Score is notched down by 25%: Notched Salience is 3.75.	**Score 3.75**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 37.46 out of 100.	**Score 37.46**

Category 2: Competitor Risk

2.1. Competitor Locations and Geographical Influence on the Market

Rationale: Competitors' locations relative to a Proponent can affect the viability of procuring feedstock and feedstock cost. Accurate and detailed competitor mapping provides an understanding of the geographical influence a competitor may have, including competitive advantages such as short hauling.	**Score**
Raw RI Score: There are no large-scale competitors for Flax Straw in the region. Raw RI Score is deemed *low*.	**1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: If a large-scale competitor enters the market, the impact would be significant. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

2.2. Historical Fluctuation of Quantity Used

Rationale: A clear understanding of key competitors' consumption of each type of feedstock is essential to quantifying the risks associated with each competitor. Understanding historical trends of feedstock utilization can provide valuable information about feedstock price elasticity during shortages and insight into events that may impact future supply conditions. This allows for more accurate estimates of the sensitivity of feedstock availability to potential future consumption levels or due to the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change).	**Score**
Raw RI Score: There are no major historical competitors for Flax Straw. Local markets such as cattle bedding market are the only current local consumers of Flax Straw, consuming up to 5% of all Flax Straw generated. Raw RI Score is deemed *low*.	**1**

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

2.3. Competitor Pricing and Price Sensitivity

Rationale: Understanding how much competitors pay for different feedstock types is essential to determining competitiveness of Proponent. Historical prices paid by competitors provide insight into their procurement behaviors and willingness to pay premiums for feedstock and exert pressure on the Proponent's suppliers during times of feedstock shortage. Competitors that can offer higher prices for feedstock during shortages can pose significant risks to the Proponent. Knowledge of competitor pricing and price sensitivity is an essential prerequisite to formulating a feedstock cost curve which can enable predictions of feedstock redundancy; i.e., how much feedstock could become available at different pricing levels (see Category 3–Supply Chain Risk 3.1.3).	**Score**
Raw RI Score: There are no significant competitors for Flax Straw in the region. Raw RI Score is deemed *low*.	**1**

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

2.4. Impacts of Future Demand on Feedstock Availability and Price

Rationale: Future competitors for feedstock or an expansion of feedstock demand by current competitors can cause feedstock market disruption. Even before new competitors become operational, high interest in a supply basin can make suppliers overconfident, leading to a supplier-controlled market where short-term contracting becomes the norm and supply chain reliability is compromised for the Proponent. Once operational, new competitors increase demand on feedstock, potentially lowering availability and increasing cost. Existing competitors may seek to expand operations, increasing consumption of feedstock.	**Score**
Raw RI Score: There are no large-scale potential competitors for Flax Straw proposed. Flax straw can be found all over the province. The risk that, once a project is located in the BDO Zone, another project will be located in the same BDO Zone is likely low. Flax straw's cattle bedding market is unlikely to grow significantly in the future due to its low quality compared to other types of straw (e.g., wheat, oat, etc.). The raw RI Score is deemed low.	**1**

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: A new, large-scale processor would pose significant impact to the supply chain. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

2.5. Supply Influence of Competitor

Rationale: In some cases, competitors may exert high degrees of pressure over local suppliers, effectively enabling them to control feedstock, especially during shortages. This control can stem from previous relationships between suppliers and competitor, often from verbal or "understood" agreements, or from a competitor being able to assist suppliers in times of surplus by maintaining large inventories enabling suppliers to continue supplying when other markets impose quotas. Understanding and planning around such soft risk factors is important. If such relationships exist in the Proponent's procurement area, they may indicate increased risk of feedstock shortage or pricing changes.	**Score**
Raw RI Score: Flax straw has no large-scale competitors. Flax straw is widely available throughout the province, so competitors for Flax straw are unlikely to locate in the same BDO Zone. Raw RI Score is deemed low.	**1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

2.6. Temporary Market-Driven Markets

Rationale: Alternative, non-traditional, market-driven competitors for feedstock can drive feedstock demand in unusual circumstances. A Proponent using corn stover as a feedstock, for example, would not typically compete with higher-end animal feed markets due to quality issues. However, in times of significant hay shortage (e.g., during drought), farmers use corn stover in place of hay, driving up the price of feedstock and decreasing availability for bio-projects (Bergtold 2018).	**Score**
Raw RI Score: There are no non-traditional or market-driven markets for feedstock. Raw RI Score is deemed *low*.	**1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: Medium or large-scale temporary markets would pose significant impact to the supply chain. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

2.7. Relative Inventory Capacity

Rationale: Storing inventory enhances one's competitiveness. The ability to store large inventories allows biomass Proponents to purchase inventory when prices are low, yielding economic advantages. Additionally, the ability to store inventory during feedstock supply surpluses enables competitors to continue to intake feedstock when the Proponent (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity thereby creates supplier loyalty, increasing reliability while decreasing risk.	**Score**
Raw RI Score: Flax Straw presently has no large-scale suppliers. There is relatively little demand for the feedstock so no current need for large-scale inventory. Cattle feedlots typically stockpile up to a year's worth of feedstock but are a relatively small market for Flax Straw, consuming only 5% of all locally generated feedstock. The raw RI Score is deemed *low*.	**1**

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score 6.66**

2.8. Relative Accessibility/Delivery Hours and Wait Times

Rationale: The value attributed by suppliers to local markets is often directly related to the degree of flexibility the market provides in terms of delivery hours and the efficiency of discharge.	**Score**
Raw RI Score: There are no large-scale competitors for feedstock in the region. Raw RI Score is deemed *low*.	**1**

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score 6.66**

2.9. Relative Specification Advantages

Rationale: When choosing a market, suppliers look at price as well as relative quality requirements or specifications. It is important to understand a competitor's feedstock quality specifications to accurately quantify the risk that a competitor can exert on the Proponent's supply chain.	**Score**
Raw RI Score: There are no large-scale competitors for feedstock in the region. The cattle bedding market is tolerant of poor feedstock quality and accounts for only up to 5% of total Flax Straw generated locally. The raw RI Score is deemed low.	**1**

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score 6.66**

2.10. Demand for Competitors' Products

Rationale: Increased demand for competitor's product can cause an increased demand for feedstock by the competitor, given the competitor can increase its production capacity easily. For example, an increased demand for biofuels due to a clean fuels policy can cause increased biofuel production by the competitor, thereby increasing demand for feedstock.	**Score**
Raw RI Score: There are no large-scale competitors for Flax straw in the region. Raw RI Score is deemed *low*.	**1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score 6.66**

Category 3: Supply Chain Risk

3.1. Feedstock Availability

Rationale: Feedstock availability is calculated based on three variables: i) feedstock generation in addition to current markets; ii) Biomass Availability Multiple (BAM); iii) supplier participation rate. Biomass Availability Multiple (BAM) indicates the degree of redundancy in a Proponent's supply chain. While, supplier participation rate indicates the proportion of suppliers that likely to supply to a new project.	**Score**
Raw RI Score: There is no large-scale competition for Flax Straw within the region. It is conservatively assumed that 5% of generated Flax Straw is used as animal bedding, and 5% is left in field or tilled. Secondly, due to the fact that there are no current markets for Flax Straw and because it is a nuisance to growers, a Biomass Availability Multiple (BAM) of 1.2x is adequate to provide for enough feedstock redundancy to de-risk the feedstock supply. Finally, based on market indications, grower participation rate (the proportion of growers that would supply Flax Straw to a new project) is anticipated to be 80% (assumptions are further discussed in Appendix B). Applying the above assumptions, we estimate that there is 55,936 ODMT/yr of Flax Straw is available within 140-km drive distance from Coronach (see Appendix B for details on feedstock availability calculations). Therefore, since this BDO Zone is rated for 55,000 ODMT/yr, the Raw RI is deemed *low*.	**1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: Our estimates are based on Flax Straw generation, consumption, and participation rate assumptions. If our assumptions are significantly off, the impact to feedstock availability can be significant. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 19.98 out of 100.	**Score 9.99**

3.2. Impact of Increased Utilization of Feedstock

Rationale: Feedstock utilization in a supply basin can change over time. Existing consumers of feedstock can expand operations or new facilities may enter the market. Increased utilization puts additional pressure on feedstock and can lead to higher prices, feedstock disruptions, shortages, or supplier breach.	**Score**
Raw RI Score: Currently, there is no existing substantive Flax Straw market in the region and considerable supply of the feedstock is available. We did not identify any proposed projects planning to utilize Flax Straw from the Coronach region.	**1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: Although it is unlikely that a new large-scale Flax Straw consumer would enter the market, in such a case the impact to the supply chain would be significant. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 29.97 out of 100.	**Score 9.99**

3.3. Feedstock Supply Curve / Marginal Cost Curve

Rationale: The greater the feasible transport distance, the greater the amounts of feedstock accessible to the Proponent, but at a higher delivered cost. The feedstock supply curve, also referred to as the marginal cost curve, is a function of feedstock availability over its cost, which is primarily, but not exclusively, a function of distance. The feedstock supply curve is used to determine the availability of redundant feedstock at various price points and the cost of replacing feedstock with substitutes located at different distances. Feedstock cost curves are useful in determining supply chain resilience. They provide information about the cost of feedstock availability in times of supply disturbance. Biomass supply chains are prone to supply disturbances over time. For instance, suppliers can become insolvent, or weather events can temporarily disrupt feedstock availability. When a disturbance occurs, the Proponent may need to source replacement feedstock from different suppliers at different locations and costs. A biomass supply curve indicates quantities of feedstock available at various price levels from suppliers generally located farther away than core suppliers.	**Score**
Raw RI Score: We estimate that the cost to transport Flax Straw an additional kilometer is $0.025/ODMT, or 25 cents per 10 km per ODMT. Therefore, the cost to access additional Flax Straw outside of the BDO Zone is relatively low. The raw RI Score is deemed *low*.	**1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: If there is no Flax Straw outside the BDO Zone, RI 3.3 would become significant. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

3.4. Seasonal Feedstock Supply Variation

Rationale: Biomass supply can present significant seasonal supply variations. When combined with limitations associated with longer-distance transportation and storage, this can result in regional biomass supply imbalances (Golecha & Gan 2016) and can manifest as supply shortages and higher costs for Proponents.	**Score**
Raw RI Score: Flax straw is only available between late August and early October. Harvesting typically begins four weeks earlier in Coronach's northern regions than in the southern regions, with a four-week gap between them. The harvesting window varies from season to season due to weather. As a result, this risk indicator's Raw RI Score is deemed *medium*. The risk of a short harvest window has been factored into the RI 1.8 score above.	**5**
Notched Salience: Changes in seasonal feedstock supply variation can be mitigated by sourcing Flax Straw from outside the BDO Zone. Due to low marginal cost to transport Flax Straw additional distance, we consider this as a feasible mitigator. The Raw RI Score is notched down by 50%: Notched Salience is 2.5.	**Score** **2.5**
Impact Level: Weather can have significant impact on flax production and therefore RI Impact Level is deemed *high*.	**Score** **9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score** **24.97**

3.5. Year-to-Year Variation in Feedstock Availability

Rationale: Biomass can have significant year-to-year supply variations due to variability in yield from biomass harvesting operations, particularly with agricultural biomass.	**Score**
Raw RI Score: The variation in feedstock supply from year to year is determined by the number of Flax acres planted, the proportion of generated Flax Straw left in the field, and the harvesting window. The figure below shows annual variation of Flax seeded since 1976. Annual variations can be significant. For instance, between 2018 and 2019 there was an increase in seeded Flax by 8%, while between 2019 and 2021 there was a drop of 18%. These variations pose a significant risk to Flax Straw supply. Dry weather can reduce the availability of Flax Straw because it reduces Flax yields and because drier straw is more difficult to bale Raw RI Score is deemed *high*.	**8**
Notched Salience: Changes in seasonal feedstock supply variation can be mitigated by sourcing Flax Straw from outside the BDO Zone. Due to low marginal cost to transport Flax Straw additional distance, we consider this as a feasible mitigator. As a result, Raw RI Score is notched down by 50%: Notched Salience is 4.0.	**Score** **4.0**
Impact Level: Low-yield year can have a significant impact on the availability of Flax Straw, especially that low yields may extrapolate to surrounding regions, limiting the mitigation strategy mentioned above. RI Impact Level is deemed *high*.	**Score** **9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 39.96 out of 100.	**Score** **39.96**

3.6. Double-Counting Feedstock

Rationale: Aggregators, intermediaries, or brokers organize and distribute feedstock produced by suppliers. If such sources of supply are used in assessing feedstock availability for BAMs or supply curves, the Proponent should be sure not to double count feedstock produced by one supplier and traded/supplied by an intermediary.	**Score**
Raw RI Score: Feedstock availability estimates are based on estimates of what is directly available from growers and results from adjacent regions. There is no risk of double counting in our method. Raw RI Score is deemed *low*.	**1**

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

3.7. Front-End Validation of Data Used in Feedstock Availability Models

Rationale: Feedstock supply models can be complex. A lack of clarity about model assumptions and baseline data can result in confusion on the part of the capital markets and drive financing costs for biomass projects. The adequacy and credibility of assumptions and baseline data is paramount to credible model outputs.	**Score**
Raw RI Score: Appendix B of this rating contains a list of all assumptions used in the development of feedstock supply curves. The assumptions are based on verbal feedback from a number of local growers in the BDO Zone. Other theoretical approaches, such as the BIMAT (Biomass Inventory Mapping and Analysis Tool) model, were used to validate these assumptions. Raw RI Score is deemed *low.*	**1**

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: Uncertainty in assumptions pertains to increased risk. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

3.8. History of Production / Feedstock Is a Secondary Crop or a By-Product

Rationale: If feedstock is a new secondary crop or a by-product, suppliers may either lack sufficient experience to mitigate risk or be unable to react to it. Producers are also unlikely to prioritize the production of these crops, at the expense of higher-value commodities. For new crop types, inexperience in planting, harvest, collection, and yield data may pose higher levels of risk. If the feedstock is a secondary crop, then production can be subject to variables beyond suppliers' control (e.g., changing primary crop prices).	**Score**
Raw RI Score: There is no history of producing Flax Straw on a large scale in the BDO Zone. Feedstock is a by-product of Flax production.	**9**

Flax Straw production is proportional to Flax production. The potential availability of Flax Straw is determined by the number of Flax acres planted, the weather, and the type of Flax. The number of Flax acres planted each year is influenced in part by crop prices. Growers will plant less Flax and more of other crops if they believe Flax prices will be low and other crop prices will be high. These decisions are often made by growers a few months before seeding.
Raw RI Score is deemed *high*.

Notched Salience: RI 3.8 can be mitigated by sourcing Flax Straw from outside the BDO Zone. Due to low marginal cost to transport Flax Straw additional distance, we consider this as a feasible mitigator. As a result, Raw RI Score is notched down by 75%: Notched Salience is 2.25.	**Score 2.25**
Impact Level: Because Flax Straw is a nuisance to growers and we are confident new markets would be welcomed, despite the lack of historical Flax Straw production (baling), we deem RI Impact Level *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 7.49 out of 100.	**Score 7.49**

3.9. Diesel, Oil and Producer Price Index (PPI)

Rationale: Diesel, oil, and Producer Price Index (PPI) can impact costs affiliated with harvesting feedstock and its collection over time. Sensitivities to worst case scenarios should be run.	**Score**
Raw RI Score: The delivered cost of Flax Straw is affected by the price of diesel and oil as well as the PPI. The cost of baling and transportation is directly affected by the price of diesel. The PPI has an indirect impact on baling and transportation costs via labour costs. Figure 5 in Appendix B depicts historical diesel prices in Coronach, SK, over the last ten years. The price of diesel is volatile. Moreover, the federal carbon tax is expected to decrease the use of fossil fuels or increase costs annually. The industrial product price index (IPPI), on the other hand, shows little year-to-year volatility and continues to rise (we consider data for the past two years an anomaly due to variabilities introduced by the pandemic) (Figure 6 in Appendix B). Raw RI Score is deemed *moderate*.	**5**
Notched Salience: No adjustments. The prices of fuels are dictated by regional and international supply and demand.	**Score 5.0**
Impact Level: Even with high diesel prices, the cost to travel additional 10 km to acquire larger quantities of Flax Straw is $0.25/km. On the other hand, the past two years of increased PPI may not have been an anomaly and the trend may continue (projections are uncertain). RI Impact Level is deemed *medium*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 33.30 out of 100.	**Score 33.30**

3.10. Currency Risk

Rationale: If the Proponent's supply basin does not have a history of developed, large-scale feedstock procurement, suppliers may not have sufficient expertise in feedstock production to ensure reliable supply, especially early on. This can be particularity true for forest residues where typically the infrastructure for collection, processing and delivery is immature. Where supply chains are not well-established, risk can be mitigated when a Proponent controls a higher degree of feedstock processing. For example, if a Proponent requires clean wood chips and the historical demand in the woodshed is exclusively for pulpwood, then supply chain risk will be decreased by Proponent's intake of pulpwood and internal log debarking and chipping, rather than requiring inexperienced suppliers to deliver debarked wood chips.	**Score**
Raw RI Score: Approximately 16% of the 55,000 ODMT/yr Flax Straw estimated in this assessment is located on the US side of the border. Therefore, Raw RI Score is deemed *low-medium*.	**3**
Notched Salience: Currency exchange rate increases can be mitigated by acquiring Flax Straw from larger distances on the Canadian side of the border. As a result, Raw RI is notched down by 50%; Notched Salience is 1.5.	**Score 1.5**
Impact Level: We are fairly confident with our assessment that the US part of the BDO Zone has limited impact on the entire supply basin. RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 19.98 out of 100.	**Score 4.99**

3.11. Border Risk

Rationale: Where feedstock is transported to another country, there is risk exposure to border closures and crossing delays. The availability of trucks willing to do cross-border runs is limited, often decreasing supply chain flexibility and resilience. Plants near the US-Canada border which intake feedstock from both countries are exposed to these risks.	**Score**
Raw RI Score: There is no significant border risk as flax straw bales can be transported between US and Canada and Raw RI Score is deemed *low*.	**2**
Notched Salience: Border risk can be mitigated by acquiring Flax Straw from larger distances on the Canadian side of the border. Thus, Raw RI is notched by 50%: Notched Salience is 1.0.	**Score 1.0**
Impact Level: We are fairly confident with our assessment that the US part of the BDO Zone has limited impact on the entire supply basin. RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score 3.33**

3.12. Temporary Externality-Driven Markets for Feedstock

Rationale: Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances. For example, a Proponent using corn stover as a feedstock would not typically compete with the higher-end animal feed market. However, in times of significant hay shortage (e.g., during drought), farmers may use corn stover	**Score**

as hay replacement, driving the price of stover feedstock and decreasing its availability for bio-projects (Bergtold 2018).

1

Raw RI Score: No non-traditional and externality-driven markets for feedstock were identified. Raw RI Score is deemed *low*.

Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score 1.0**
Impact Level: Although we did not identify non-traditional and externality-driven markets for feedstock, existence of such markets would be significant. RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 3.33 out of 100.	**Score 6.66**

3.13. Harvest and Collection Practices and Schedules

Rationale: Differences in harvest timing and practices can create risk to both the quantity and quality of feedstock. For example, feedstock harvested by different suppliers in different windows can undergo different levels of exposure to sun, wind, and moisture, leading to variations in delivered feedstock quality.

Score

For example, agricultural feedstocks and energy crops have optimal harvesting windows to ensure minimal moisture content. In certain regions these harvesting windows may coincide with heightened weather risk, such as frost or rain.

Raw RI Score: Flax harvesting season lasts from late August to early October. Harvesting time varies by four weeks between the supply basin's southern and northern regions. Because of the weather, the harvesting window may be reduced.

7

Using the service of multiple custom harvest groups can negatively impact the quality and quantity of feedstock as they likely use different equipment and operators with different levels of experience.

Raw RI Score is deemed *high*.

Notched Salience: The involvement of an experienced third-party baling company who uses square balers or vertical integration within the bio project could significantly reduce RI 3.13. As a result, Raw RI Score is notched down by 50%: Notched Salience is 3.5.	**Score 3.5**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 23.31 out of 100.	**Score 23.31**

3.14. Harvesting and Collection Equipment

Rationale: Different types of harvesting and collection equipment used by suppliers can have a significant impact on the quality and availability of feedstock. The use of different types and combinations of harvesting, collection, and processing equipment among suppliers can lead to non-homogeneous feedstock. Equipment that is not designed specifically for biomass cultivation, harvesting, and collection can increase feedstock quality risks. Relevant equipment should be specified for the sake of product consistency and risk reduction.	**Score**
Raw RI Score: In the past, most of flax growers used to 'bunch and burn' as the flax straw clogged up field equipment. Now, some growers use larger combines which cut the straw into smaller pieces, so leaving flax straw in the field is less problematic. Therefore, the end users of flax straw must communicate with growers to ensure flax straw are left in windrow in the field for efficient baling operation. Square balers can handle short straw lengths with ease, but they are uncommon in the BDO Zone. Since flax straw is not baled as frequently as other regional crop residues such as cereal straw, the commercial users of flax straw need to compete with users of other crop residues (e.g. wheat and canola straw) to secure the harvest equipment within the short harvest season. the raw RI Score is deemed *high*.	**8**
Notched Salience: Given the high capital investment and loss of primary crop yield, growers are unlikely to purchase conventional balers. For the same reasons, there is a low likelihood of large-scale investment in square balers by local growers to supply a bio-plant in the BDO Zone. RI 3.14 could be significantly reduced by outsourcing harvest and collection to a reputable third-party baling company capable of supplying square balers or because they do not need to use a shredder on their combine. This will also save on fuel consumption and leave flax straw in windrows in the field for efficient baling operations. As a result, Raw RI Score is notched down by 75%. Notched Salience is 2.0.	**Score 2.0**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 13.32 out of 100.	**Score 13.32**

3.15. Variation in Densification Methods among Different Suppliers

Rationale: The shape and density of the unit in which feedstock is supplied can impact feedstock cost and quality. Standard feedstock densification modes for biomass consist of round or square bales, pellets, cubes, chips, or grindings. As well, bales of different densities can absorb moisture at different rates. In certain cases, round bales have been viewed as problematic due to their uneven moisture content distribution (Huhnke 2018).	**Score**
Raw RI Score: The vast majority of balers available in the supply basin are round balers. If growers invest in square balers (unlikely due to capital costs), the resulting mix of round and	

square bales can result in a less homogeneous feedstock supply for a bio-project, including high variations in moisture content and problems with handling and processing equipment. Furthermore, round bales cost more to transport and store per tonne than square bales. Overall, for large-scale projects, using one type of bale **(**preferably large square bales), will be more viable both operationally and economically. Raw RI Score is deemed *moderate*.	**7**
Notched Salience: Outsourcing harvest and collection to a credible third-party baling company that can supply square balers and ensure homogeneous bale density and size or through a vertically integrated bio-project could significantly mitigate RI 3.15. As a result, Raw RI Score is notched down by 50%: Notched Salience is 3.5.	**Score 3.5**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 23.31 out of 100.	**Score 23.31**

3.16. Availability of Labour for Feedstock Production

Rationale: Skilled labour shortages can be difficult to remedy in the short term. Availability of suitable labour regionally can impact the ability to procure sufficient feedstock quantities on schedule. Labour risks are higher for greenfield facilities where supply chains are not yet active; or for Proponents for whom large feedstock requirements or development of new (or expanded) supply chains demand significant additions to the local labour force.	**Score**
Raw RI Score: Labour for Flax straw collection and transportation is only required for the 4–6 week harvest period. We believe that transport companies will be able to handle the temporary increase in demand because this is a common dynamic in agricultural markets. Additionally, trucks could be brought in from other provinces and states if necessary. We are concerned about the existing labour force's ability to meet the increased demand for baling. A more immediate risk is a shortage of trained baler operators. Due to a current lack of markets for Flax Straw and an underdeveloped supply chain, the number of trained baler operators is low. As a result, willing participants would need to be trained. The relatively short harvesting season means there is less time to train new baler operators. Raw RI Score is deemed *high*.	**7**
Notched Salience: RI 3.16 can be significantly mitigated by importing temporary labour and trucking equipment from other regions. In addition, all sub-risks in RI 3.16 could be significantly mitigated by outsourcing harvest and collection to a credible third-party baling company or by provision of similar services through a vertically integrated bio-project. As a result, Raw RI Score is notched down by 50%: Notched Salience is 3.5.	**Score 3.5**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 23.31 out of 100.	**Score 23.31**

3.17. Feedstock Transportation Costs

Rationale: Transportation is often one of the most significant cost components of biomass supply chains. The average transport cost and percentage of total feedstock cost attributable to transport should be known.	**Score**
Raw RI Score: We estimate that transportation costs account for about 15-20% of total feedstock delivered costs. Given that a minor increase in average transport distance results in a significant expansion of the feedstock supply basin (see supply curves in Appendix B), we consider the risk of rising transportation costs significantly impacting the delivered price of feedstock to be low. The raw RI Score is deemed *low-medium*.	**3**
Notched Salience: No adjustments.	**Score 3.0**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 29.97 out of 100.	**Score 29.97**

3.18. Number, Size, Mix and Locations of Suppliers

Rationale: Generally, a supply portfolio involving multiple suppliers of various sizes (and from multiple regions) is important for ensuring steady and uninterrupted feedstock supplies with minimal price fluctuations. If a small number of large suppliers provides a high proportion of total feedstock, a disruption or supplier breach will have a greater impact on the supply chain. In such cases the risk of disruption is lower, but the impact of those disruptions is higher. Conversely, a large number of small suppliers are less likely to have the capacity to withstand internal disruptions and thus may be more likely to breach. Here, risk of disruption is higher, but its likely impact is lower. The number of suppliers as well as the ratio of small to large suppliers should be optimized. There is no pre-determined number or optimal ratio of suppliers, although having too many or too few can both pose higher degrees of risk.	**Score**
Raw RI Score: Numerous viable potential feedstock suppliers exist in the area. Based on previous studies, a large-scale project would require between 150 and 250 growers. A large number of suppliers can reduce feedstock risk because isolated failures would not have a significant impact on the entire supply chain. Feedstock supply chains of this size, on the other hand, can be more difficult to coordinate. The raw RI Score is deemed *moderate*.	**5**
Notched Salience: The large number of potential suppliers can make coordinating the supply chain potentially more complicated and costly. Because the number of suppliers could impact the interest and effectiveness of a third-party baling company as a mitigant to other RIs, Raw RI Score notched down by 25%: Notched Salience is 3.75.	**Score 3.75**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 24.98 out of 100.	**Score 24.98**

3.19. Suppliers Subject to Same External Risk Factors (Non-Weather and Equipment Based)

Rationale: When a single risk event can impact the feedstock production ability of all (or most) suppliers, then feedstock risk is higher and supply chain resiliency is lower. Resilience is maximized when biomass supply chains exhibit diversity in spatial location (i.e., geography), production practices, and other elements of supply chain structure such that the impact of single high-risk events has varying impacts on suppliers.	**Score**
Raw RI Score: Flax Straw suppliers face risks related to falling Flax prices and increasing price of other oilseed crops such as canola, which may force growers to switch to other crops. The raw RI Score is deemed *high*.	**9**
Notched Salience: The radius of the supply basin could be significantly expanded to reduce RI 3.19, including into the United States. Supply curves show widespread availability at marginally higher costs. On-site bale inventories of more than 12 months can help to smooth out typical moderate fluctuations in straw supply. Farmers who enter into supply contracts with a bio-project would consider their profit from straw in addition to primary Flax generation. This additional income may keep Flax planting competitive (in terms of farmer profit), even if other crops become marginally more valuable in certain years. In addition, finding a solution to remove the tough Flax Straw from the field can encourage growers to keep growing flax. As a result, Raw RI Score is notched down by 50%: Notched Salience is 4.5	**Score 4.5**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 14.99 out of 100.	**Score 29.97**

3.20. Seasonal Weather Impacts on Feedstock Supply

Rationale: Seasonal weather impacts are defined as deriving from natural weather variations (i.e., spring thaws, rainy seasons or dry seasons) as opposed to singular weather events (like fires, droughts or hurricanes). Seasonal weather changes can be a significant risk factor affecting feedstock availability, quality, and price. Given the major influence weather has on multiple aspects of growing, harvesting, and transporting biomass, it is difficult to predict the availability of biomass at a given location with a high degree of certainty. However, it is possible, to generate reasonable upper/lower bound estimates of biomass production in any given year in a wider supply basin, using past data and statistical models. Such estimates are important in assessing feedstock risk and enable accurate assessment of the efficacy of Proponent's mitigation methods.	**Score**
Raw RI Score: Weather massive impacts on feedstock supply. Flax production, and thus Flax Straw availability, varies from year to year. Weather events may cause significant variations in yield, but the range of variance has been well tracked and is represented by the 1-in-10-year low statistic. The statistic indicates that every ten years the Coronach BDO Zone can expect a low of 11,000 ODMT/yr of Flax Straw.	**7**

Flax Straw can be too dry for baling when the weather is dry, resulting in lower Flax Straw yields. Early winters can shorten the harvesting season, leaving less time for Flax Straw collection (growers prioritize grain over collection of Flax Straw). Dry weather reduces the potential availability of Flax Straw because it reduces Flax yields and because drier straw is more difficult to bale. Raw RI Score is deemed *medium-high*.	
Notched Salience: Marginal cost increases due to longer transport distances; on-site bale inventories of more than 12 months; option agreements with redundant growers; and engagement of a credible third-party (or equivalent vertical integration of such service within a bio-project) to harvest/bale Flax Straw from redundant growers could help mitigate RI 3.20. As a result, Raw RI Score is notched down by 50%: Notched Salience is 3.5.	**Score 3.5**
Impact Level: In case where seasonal weather impacts cannot be effectively mitigated, the RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 34.97 out of 100.	**Score 34.97**

3.21. Long-Term Weather and Climate Trends

Rationale: In certain regions, climatic trends and significant potential changes to future weather patterns can create feedstock risk.	**Score**
Raw RI Score: Although precise forecasting is impossible, regional temperatures are expected to rise as a result of climate change. The same risks would exist in drier weather as in 3.20. Raw RI Score is deemed *moderate*.	**7**
Notched Salience: Access to the flax straw outside the supply area in case of drought years could mitigate. As a result, Raw RI Score is notched down by 50%: Notched Salience is 3.5.	**Score 3.5**
Impact Level: In case where long-term weather and climate trends cannot be effectively mitigated, RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 34.97 out of 100.	**Score 34.97**

3.22. Risk of Infestation

Rationale: Risk of future infestation, including its estimated consequences on feedstock supply, should be calculated into the overall risk profile. Since insect populations are influenced by environmental conditions, future changes in climate can be expected to significantly alter the outbreak dynamics of certain insect species. In some cases, larger and more frequent insect outbreaks may occur, but in other cases recurring outbreaks may be disrupted or diminished.	**Score**
Raw RI Score: The main diseases pertaining to flax are Fusarium Wilt, pasmo and powdery mildew[1]. These diseases pose real risk to flax crops, and to the supply of Flax Straw. Risks can be higher with	**4**

[1]https://www.saskflax.com/growing/diseasecontrol.php#:~:text=Flax%20wilt%20or%20Fusarium%20wilt,weather%20therefore%20aggravates%20the%20disease

higher temperatures, potentially driven by changing climate. On the other hand, historically the diseases have not affected the region in a significant way, suggesting that the risk is moderate. Raw RI Score is deemed *moderate*.	
Notched Salience: The radius of the supply basin could be expanded to significantly to reduce RI 3.22, including into the United States. Supply curves show widespread availability at a marginally higher cost. On-site bale inventories of more than 12 months can help to smooth out typical moderate fluctuations in straw supply. However, a disease outbreak can affect an extended area, limited these mitigation strategies. As a result, Raw RI Score is notched down by 25%: Notched Salience is 3.0.	**Score 3.0**
Impact Level: Disease outbreak can have a significant impact on the availability of Flax Straw due to flax crop failure. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 29.97out of 100.	**Score 29.97**

3.23. Risk of Extreme Weather Events—Hail, Flood, Drought, Hurricanes, Tornadoes, Strong Winds, and Extreme Low Temperature

Rationale: See BSCRS Standards RI 3.7.5 Risk of Hail; 3.7.6 Risk of Flood; 3.7.7 Risk of Drought; 3.7.8 Risk of Hurricanes, Tornadoes, Strong Winds; 3.9.7 Risk of Low Temperatures.	**Score**
Raw RI Score: Extreme weather events such has hail, flooding, and strong winds pose a limited risk to Flax straw availability in the Coronach BDO Zone. Raw RI Score is deemed *low*.	**3**
Notched Salience: No adjustments.	**Score 3.0**
Impact Level: An extreme weather even can cause flax crop to fail. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 29.97 out of 100.	**Score 29.97**

3.24. Government Subsidies for Feedstock Production or Utilization

Rationale: Feedstock directly subsidized though government programs can pose greater long-term risk than feedstock that is not. Subsidies may be subject to amendment or repeal, sometimes with minimal notice. NOTE: This risk indicator refers to direct feedstock subsides only; it does not apply to government subsidies that pertain indirectly to the operations of the Proponent, such as Loan Guarantees, or to the markets for products produced by the Proponent.	**Score**
Raw RI Score: No government subsidies for feedstock exist at this time, including Flax. The raw RI Score is deemed *low*.	**1**
Notched Salience: No adjustments.	**Score 1.0**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.25. Local, Provincial, and National Laws, Regulations and Permitting Pertaining to Biomass

Rationale: Feedstock whose production is directly dependent on local, provincial/state, or national laws and government regulations can pose greater long-term risk than feedstock that is not, since laws and regulations may be subject to amendment or repeal. If biomass utilization requires specific permits (i.e., percentage removal of forest residues or corn stover, allowable cut limits, air emission, storage permits, rights-of-way, overweight permits for trucks, cross-border permitting for shipment of biomass, chain of custody, or certification of sustainability) then likelihood of obtaining such permits and/or complying with permitting requirements should be examined.	**Score**
Raw RI Score: Flax Straw supply is not governed by any laws, regulations, or permits issued by the government. The raw RI Score is deemed *low*.	**1**

Notched Salience: No adjustments.	**Score 1.0**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.26. Backlash Against Biomass Development, Procurement or Usage in the Region

Rationale: Public backlash against biomass development in the Proponent region can directly impact Proponent's ability to procure, transport, trans-load, store, or utilize feedstock by affecting local policies, regulations, and the Proponent's ability to obtain necessary permitting.	**Score**
Raw RI Score: No backlash against biomass development is expected. The raw RI Score is deemed *low*.	**1**

Notched Salience: No adjustments.	**Score 1.0**
Impact Level: RI Impact Level is deemed *low*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.27. Consent of, and Co-Operation With, Indigenous Communities and First Nations

Rationale: Where new project development is on or near Indigenous or First Nation land, or when Indigenous or First Nations exert influence over feedstock producing areas, consent of, and co-operation with, Indigenous communities and First Nations decreases the Proponent's risk.	**Score**
Raw RI Score: No Indigenous communities that would be impacted by Flax straw production or procurement were identified in the supply basin. The raw RI Score is deemed *low*.	**1**

Notched Salience: No adjustments.	**Score 1.0**

Impact Level: RI Impact Level is deemed *low*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.28. Feedstock Sustainability, Including Risks to Soil Quality and Surface and Ground Waters

Rationale: Understanding a project's overall emissions and carbon intensity throughout the feedstock supply chain is essential to reducing risks related to carbon pricing mechanisms and related regulations. GHG emissions from production, harvest, and transportation can pose significant challenges to Proponent claims of carbon neutrality for biomass projects. Carbon emissions from harvested soils, as well as emissions from harvesting machinery or delivery trucks, can make the achievement of net-zero difficult. If a Proponent's financial model relies on carbon neutrality/GHG regulatory pricing frameworks, then an investigation into the feedstock's carbon emission status is essential.	**Score**
Raw RI Score: The vast majority of Flax Straw is currently burned in the field as there is no established demand for the straw. Therefore, an alternative use of Flax Straw would be positive from GHG emissions perspective. The perceived impact of Flax Straw removal on soil quality may influence participation: not all suppliers will agree to Flax Straw removal. That said, we still estimate that 80% of growers would be interested in supplying Flax Straw. Therefore, the raw RI Score is deemed *moderate*.	**2**
Notched Salience: No adjustments.	**Score 2.0**
Impact Level: RI Impact Level is deemed *low*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 6.66 out of 100.	**Score 6.66**

3.29. Geographic Location Influence on Feedstock Variability

Rationale Feedstock from different regions may differ in quality due to variations in soil quality, topography, harvest practices, weather, fertilizer applied, etc.	**Score**
Raw RI Score: There should be no significant variation in feedstock quality from feedstock harvested within the BDO Zone. Raw RI Score is deemed *low*.	**1**
Notched Salience: No adjustments.	**Score 1.0**
Impact Level: Feedstock quality will likely be important to a new Flax Straw processing project. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 9.99 out of 100.	**Score 9.99**

3.30. Capacity of Supply Chain Components and Equipment to Scale

Rationale: Scale-up risk increases if supply chain components or underlying feedstock infrastructure necessary for these components cannot scale to handle Proponent feedstock requirements and throughput capacity. Capacity to scale should be demonstrated**.**	**Score**
Raw RI Score: The supply basin's baling equipment is presently insufficient to support a large-scale, especially s farmers mainly own round balers which are less capital intensive compared to square balers but less efficient to store and transport round bales in commercial quantities. Individual growers are unlikely to invest in more efficient baling equipment. There is a high risk that baling equipment would not scale, especially in the short term. Labour availability may be an issue as well, as discussed above. Raw RI Score is deemed *high*.	**8**
Notched Salience: RI 3.30 could be moderately mitigated by outsourcing harvest and collection to a credible third-party baling company or by vertically integrating in the bio-project. As a result, Raw RI Score is notched down by 50%: Notched Salience is 4.0.	**Score 4.0**
Impact Level: Baling is necessary to collect and transport Flax Straw. RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Score × Impact Level) is 39.96 out of 100.	**Score 39.96**

APPENDIX B : BACKGROUND RESEARCH

This appendix serves as a Flax Straw availability background study to the BDO Zone Risk Rating for the Town of Coronach, SK.

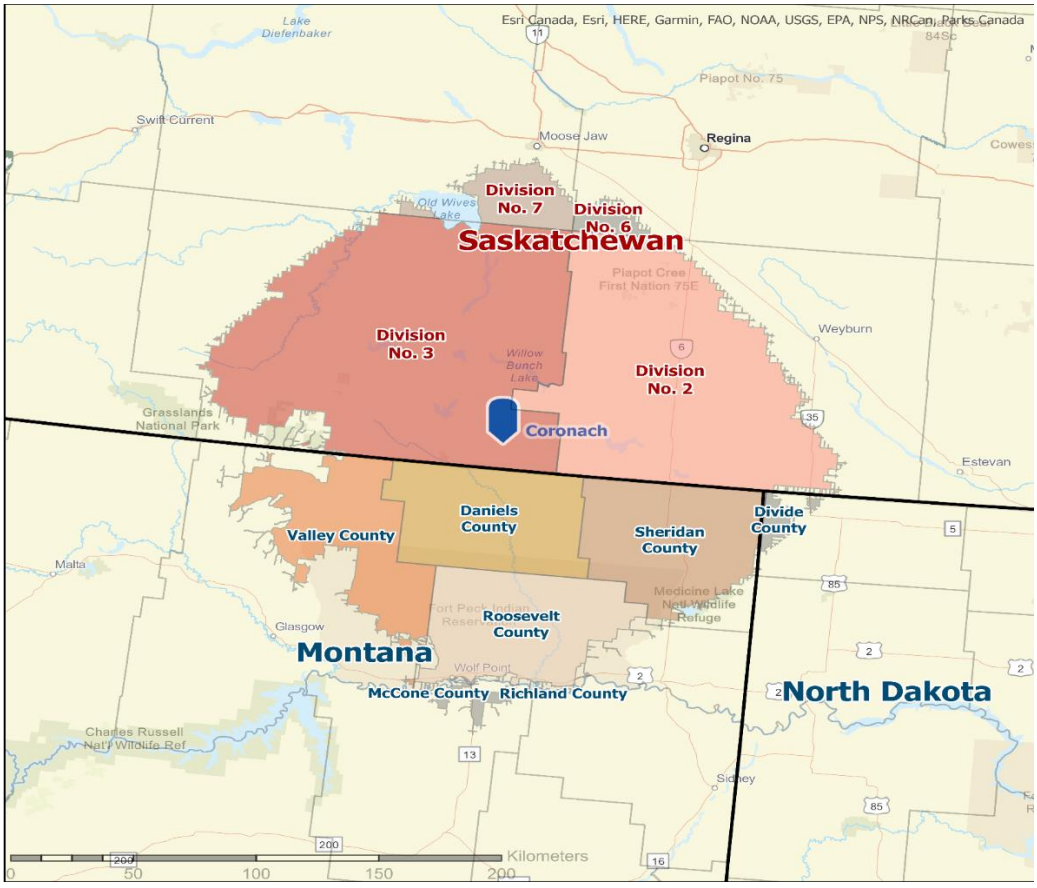
BACKGROUND RESEARCH AND ASSUMPTIONS

Study Region

The BDO Zone is defined as a 140-km drive distance from Coronach, SK (Map 1). We have considered Flax straw availability from both the Canada and USA side in our estimates as currently the phytosanitary and inspection requirement for Flax straw are not that significant for the straw sourced and transported to Canada from the United States and so do not appear to be significant barriers at present.

To investigate competing markets, we researched an area equal to 280-km drive distance from Coronach (double of the BDO Zone). We did not identify any large-scale users of Flax Straw within that area. Cattle feedlots are the only significant consumers of Flax Straw in the region, accounting for an estimated 5% of generated Flax Straw. The remainder is either left in the fields or burnt after the grain is harvested.

Map 1: Feedstock supply basin



Current Demand

Presently no large-scale facilities consuming Flax straw exist within the 280 km competition zone.

Cattle feedlots, which predominately use Flax straw for bedding are the only consumers in the region. Sokhansanj et al. (2006)[2] estimate that in the Prairies, 2.5% of generated Flax Straw goes to cattle feedlots *and we estimate up to 5% in all following calculations*.

Although at least 95% of Flax Straw is left in the field or burnt. To account for sporadic tillage, we assume that 5% of Flax Straw is tilled. Therefore, based on our assumptions, 90% of generated Flax Straw is currently unused and potentially available to new buyers.

Assumptions

Potential Flax Straw Availability

We utilized two approaches to determine the potential availability of Flax straw in the region. Potential (as opposed to actual) Flax straw availability is the amount of Flax straw that could be acquired from the supply basin. It does not consider the availability of equipment or other variables related to infrastructure that could affect actual availability. These variables are discussed later.

Approach 1: Theoretical Model

To estimate theoretical potential availability of Flax Straw, we first used Agriculture and Agri-Food Canada's Biomass Inventory Mapping and Analysis Tool (BIMAT)[3] to determine potential Flax Straw availability at each 10 km distance interval from Coronach from the Canada side and USDA tool has been used to attain acreage and hence calculate the straw from the USA side. Since BIMAT provides data up to 2016 (based on data collected between 1985 and 2016), we acquired additional data from Statistics Canada and extrapolated BIMAT assumptions onto data for 2017 through 2022.

A separate model was developed to verify BIMAT's assumptions. The following are assumptions in our model:

- The total Flax Straw that could be potentially acquired makes up between 60 and 80% of flaxseed yield (in pounds)
- Although rarely Flax Straw is tilled, to remain conservative, we assume a tillage rate of 5%
- As previously stated, Prairie-wide estimates indicate that 2.5% of generated Flax Straw is utilized as cattle bedding, and we estimate 5% in our calculations

Approach 2: Outreach to Growers and Transport Companies in Adjacent Area

To determine growers' willingness to supply Flax Straw and to confirm Flax Straw potential availability, assumptions based on previous studies in adjacent areas have been considered.

Growers tend to provide estimates based on the bale and acre unit. For example, the price of Flax straw paid for by cattle feedlots is calculated per bale.

[2] Sokhansanj, S., Mani, S., Stumborg, M., Samson, R., and Fenton, J. (2006). Production and distribution of cereal straw on the Canadian prairies. Canadian Biosystems Engineering, Vol. 48.
https://www.researchgate.net/publication/236999871_Production_and_distribution_of_cereal_straw_on_the_Canadian_prairies
[3] Accessible through: http://www.agr.gc.ca/atlas/bimat

To determine the quantity of Flax Straw per bale we assume a rough estimate of 1,500 pounds per square bale and 1,000 pounds per round bale. We recognize the number of bales per acre and also the tonnage per bale varies between Flax straw farmers and cattle farmers.

Limitations to our methodology:

There are two main assumptions exist within the methodology:

1) Given fair Flax Straw prices, growers will be willing to supply;
2) Once the biomass facility is commissioned and the price of the Flax Straw becomes attractive and the supply chain develops, participation levels will increase.

Since large-scale markets for Flax Straw do not exist, farmers may be underestimating potential problems (such as twine left in the fields) and the effort it takes to collect and bale flax straw. Faced with the realities of actual Flax Straw supply, some growers may decline to participate.

Alternatively, growers who indicated that they are currently not interested in supplying may change their minds and supply once the Project demonstrates that it is a serious buyer and that Flax straw can be a significant source of income for them. Additionally, growers with negative experience in supplying straw for the cattle bedding market (for example, uneven demand or problems with twine left in the fields) might be initially reluctant to supply. This may change once a project demonstrates it is a reliable and profitable Flax Straw buyer.

1-in-10-Year Low

Flax production, and therefore Flax Straw potential availability, varies from year to year. 1-in-10 low flax yield statistics are available from BIMAT.

Flax Straw Cost

With the exception of a relatively small cattle bedding market (estimated 5% of all potential Flax straw production), there is no market for Flax straw. Therefore, an understanding of the market price is limited. The bedding market is scattered and unreliable and often operates based on a “special deal” basis (for example, when neighbours sell to neighbours at a discounted price).

No index that tracks the price of Flax straw in the region exists, and for these reasons, we estimate price based on farmers’ verbal indications from adjacent regions.

Limitations: When interpreting prices verbally indicated by farmers, two limitations should be considered:

- Farmers provide ‘ask’ prices. In regular markets, ask prices tend to be higher than the market price as sellers attempt to raise prices. Therefore, reported ‘ask’ prices tend to overestimate the actual price.

- With high demand for feedstock, price can increase significantly. Farmers base their price indications on variables such as the cost of replacing fertilizer, the cost of baling, and the current market price for bedding straw. Once a large-scale facility significantly increases demand for straw, farmers may increase prices[4].

[4] One way to mitigate price increases due to increased demand is through fixed-price contracts. At this point, however, we do not know whether farmers would be open to such agreements.

Tables 3 and 4 show verbal price indications provided by farmers. Originally prices were provided with a bale as a unit. We converted these prices to ODMT for consistency.

Material cost: Material cost refers to the price of Flax Straw paid to the farmers. Since flax straw decays slowly and it is not a good biomass for fertilizer purposes and has been a problematic biomass to leave in the field, the material cost is estimated to be low, in a range of $2-5/ODMT.

Farm-gate cost: Farm gate cost includes material baling, collection, and stacking. In an interview with a few local farmers and a custom harvest group, the farm-gate cost ranges $40-60/ODMT.

Table 3: Verbal price indications provided by farmers. Prices per MDT

	Low	High	Average
Material Cost ($/ODMT)	$2	$5	$3
Farm-gate Cost ($/ODMT)	$40	$60	$50
Total Cost ($/ODMT)	$42	$65	$53

Transportation Cost

We acquired a few verbal transportation cost indications, which were provided in $/km (Table 4). These rates include one hour of loading and one hour of unloading rates. Any additional time ranged from $100 to $120 per hour. The average indicated cost of transporting Flax straw is $0.30 per loaded km and per ODMT.

Note on minimum hours: Many trucking companies in the region are located at a distance to Coronach, and if engaged, would need to bring trucks to the area. For this reason, a minimum number of hours is sometimes required, as companies would not bring trucks in just for one haul.

Table 4: Transportation cost indications

Rates based on km travel inclusive of loading and unloading fee		
	$/Loaded Km	
53 ft triple axle highboy trailer.	5.00	
Super b Step Deck.	5.50	Minimum of $550/load
48 ft trailer	4.55	Minimum of $285/load.
Average	**5.02**	

Indicated transportation rates provided above are expressed in $/loaded km for an entire load. For modelling purposes, we estimated cost per ODMT. First, we estimated the number of bales that can be fit on a trailer based on indications provided by companies (Table 5). Then we converted these estimates to MT per trailer (Table 6), arriving at a cost per km per ODMT.

Table 5 shows three types of trailers fit to transport square bales: 48 ft trailer, 53ft and super-B flatbed trailers. Between 24 and 36 square bales fit on a 48 ft trailer, between 26 and 39 bales on a 53 ft trailer and between 44 and 66 bales on a super-B flatbed. The maximum payload is in the range of 23-27 ODMT. These estimates result in transportation costs of $0.19 - 0.22 ODMT/loaded km. However, in practice, bale density is usually lower than the numbers in Table 5 and the average actual payload are estimated to be 20 ODMT. Thus, we use the average $0.25/ODMT/loaded km cost estimate in modelling.

To calculate the average distance travelled within a particular supply basin, we assume that the supply basin is circular. With that assumption in mind, we multiple the distance to the edge of the supply basin by 2/3. So, for a 140-km supply radius, the average transportation cost is $23.33/ODMT.

Table 5: Number of bales per trailer indications (INL, 2016)

Truck Configurations[a]	Load Limits		Payload		Maximum Load Bulk Density (DM lb/ft³)
	Length (ft)	GVW (lb)	Max (lb)	Square Bale Count	
(1) 48-ft flatbed trailer	48[b]	80,000[b]	51,100	24 – 4×4×8-ft 36 – 3×4×8-ft	16.6 – 4×4×8-ft 14.8 – 3×4×8-ft
(2) 53-ft flatbed trailer	53[c]	80,000[b]	50,800	26 – 4×4×8-ft 39 – 3×4×8-ft	15.3 – 4×4×8-ft 13.6 – 3×4×8-ft
(3) 24-ft flatbed tractor pulling two 30-ft flatbed trailers	105[d,e]	105,500[d]	59,500	44 – 4×4×8-ft 66 – 3×4×8-ft	10.6 – 4×4×8-ft 9.4 – 3×4×8-ft

a. Impacts on transportation costs for these configurations are discussed in greater detail in Section 2.3.2.2.
b. Federal limits.
c. Common state maximum on National Network (NN) highways.
d. Allowable common limits in CO, ID, KS, ND, NE, OK, and SD for two trailing units on non-NN highways.
e. Overall truck length limit. Actual load length is 95 ft.

Charts and Tables

The following are charts and tables with results from research conducted for the purposes of this BDO Zone development.

Figure 2. Theoretical availability of Flax Straw at 80% participation rate and 1.2x redundancy

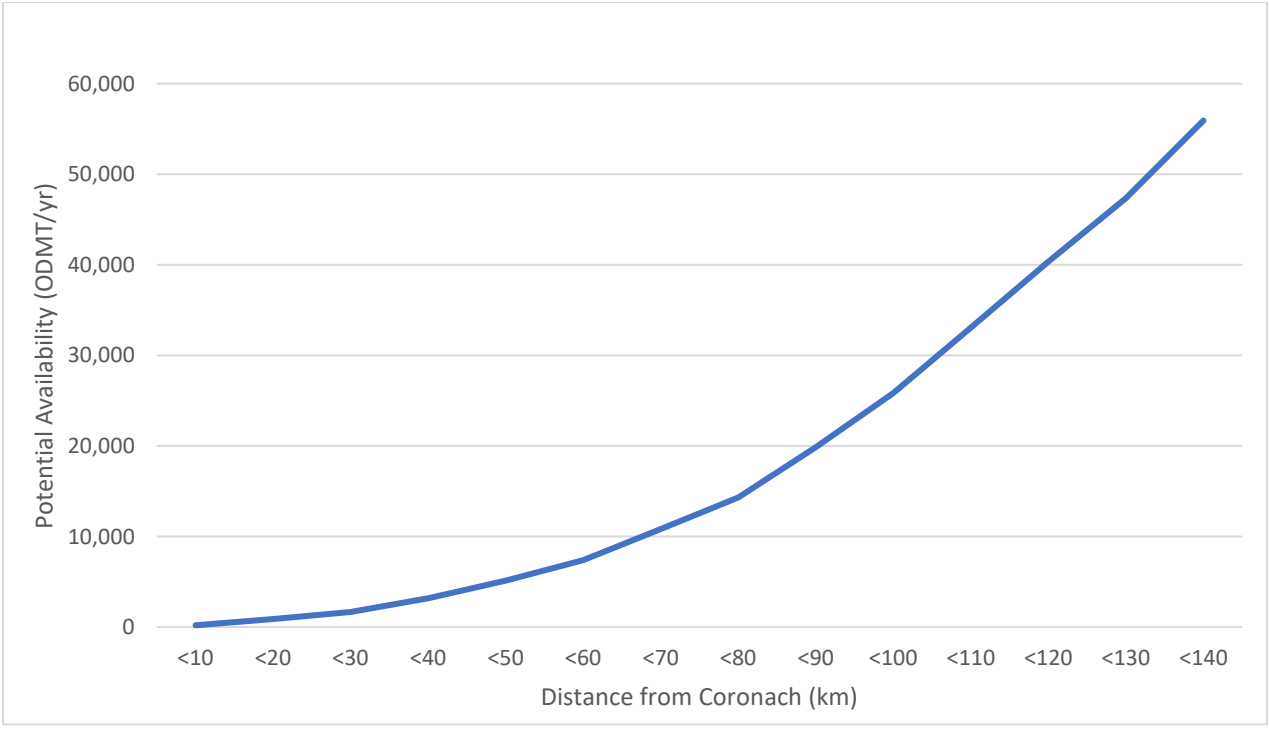


Figure 3. Marginal Flax Straw cost as a function of quantity potentially available

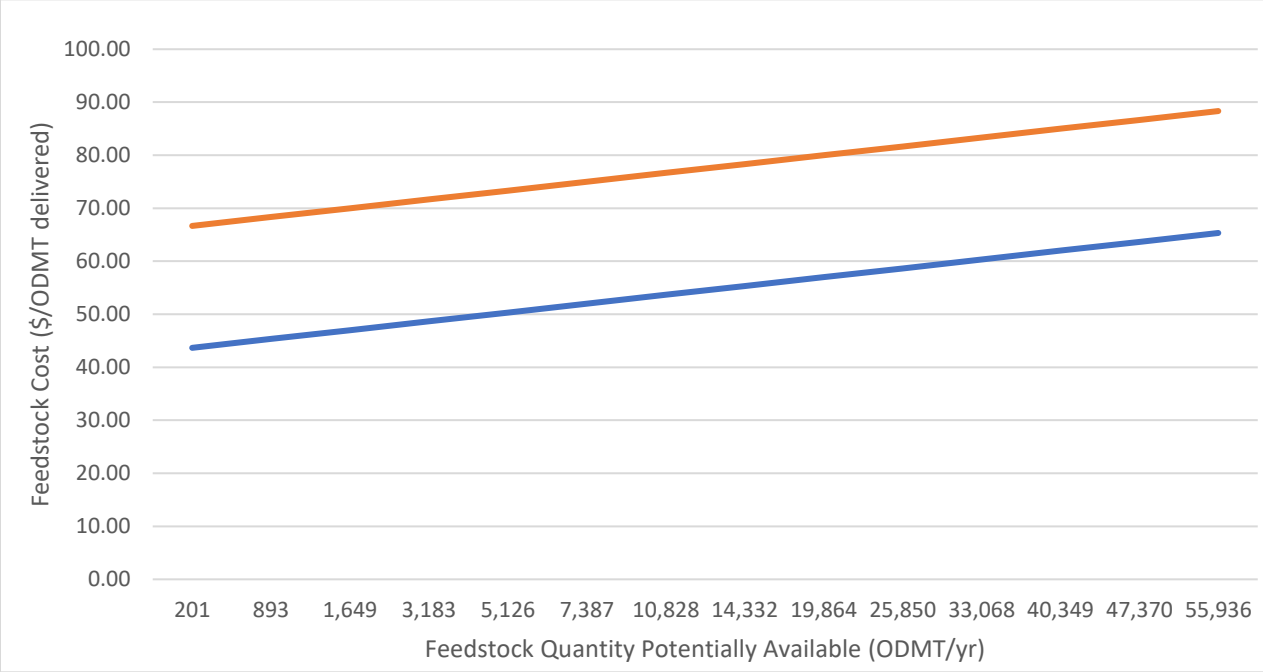


Figure 4. Historical flax production in the Coronach BDO Zone, 1976 - 2020

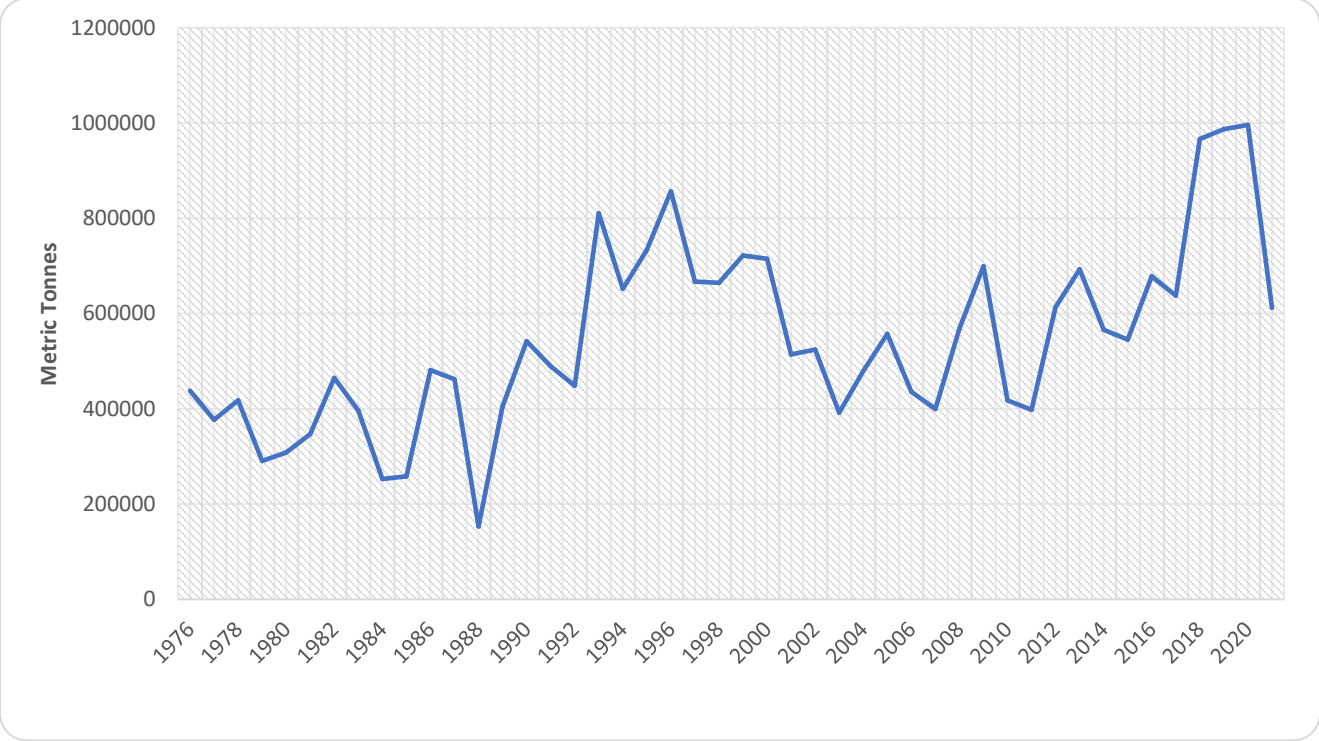
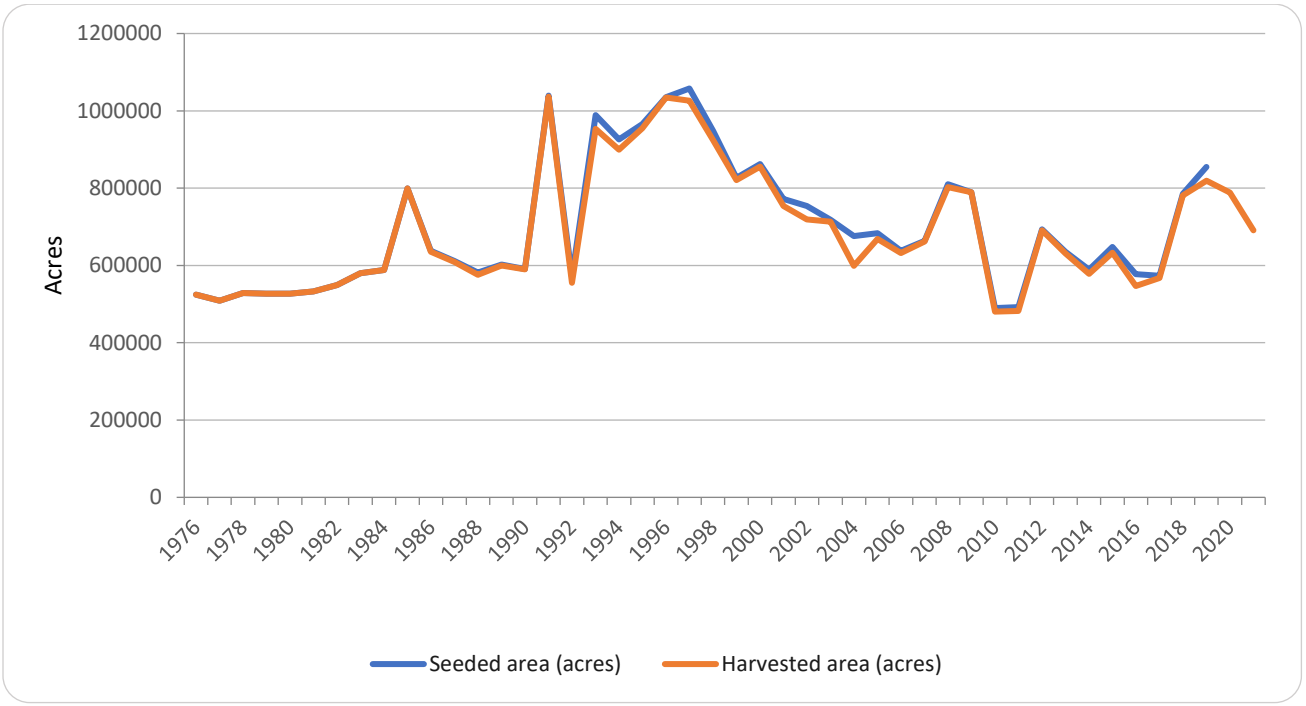


Figure 5. Historical area of flax seeded and harvested in the Coronach BDO Zone



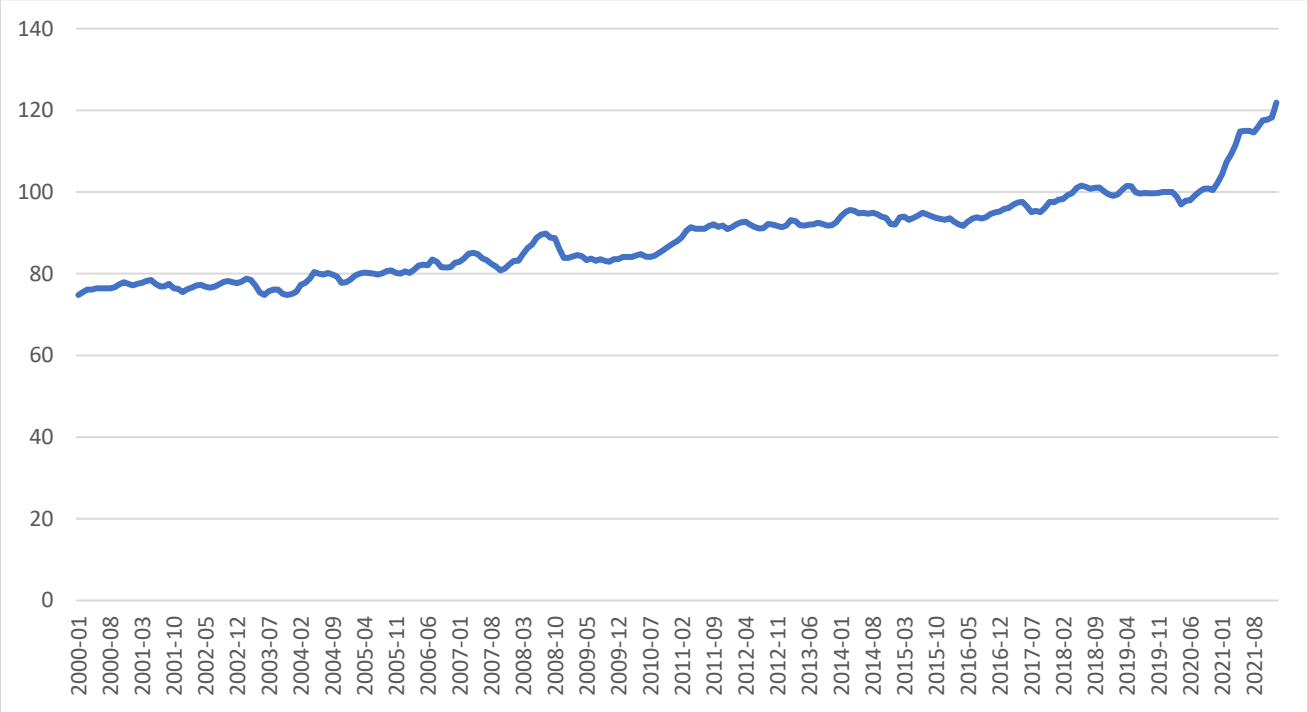
Source: Statistics Canada, 2023

Figure 6. Historical diesel price in the Coronach region



Source: Statistics Canada, 2023

Figure 7. Historical Industrial Product Price Index (IPPI), 2000 - 2021



APPENDIX C: INFRASTRUCTURE

Location

Coronach has a land area of 2.34 Km^2 (0.90 sq mi), and is located 10 Km north of the Canada-US border crossing at Port of Scobey in south central Saskatchewan. The town serves as the starting point for the Outlaw Trail between Canada and Mexico, and as a gateway to Saskatchewan's Big Muddy Badlands. The RM of Hart Butte is adjacent to the Town of Coronach and the US boundary, neighboring Daniels County in Montana, with a land area of 839.22 km2 (324.02 sq mi).

Population

In the 2021 Census conducted by Statistics Canada, Coronach had a population of 612, living in 272 of its 351 total private dwellings at a density of 261.5/Km2 (677.4/sq mi), a change of -4.8% from its 2016 population of 643. Whereas, RM of Hart Butte had a population of 263, living in 100 of its 110 total private dwellings at a density of 0.3/km2 (0.8/sq mi), a change of 4.4% from its 2016 population of 252. However, the population within Coronach's immediate trading area is 5000 people.

Infrastructure review

Currently, there is one Industrial area located in the Northern part of Coronach. There are also 3 other land parcels falling in FUD (Future Urban Development) close to the boundaries of the town. The Government is in the process of site selection and development of an Industrial Park in the RM of Hart Butte, with easy access to Infrastructure such as Rail and Transmission lines.

Infrastructure:

- **Water Supply Source** – 600,000 gallon wells
- **Sewage** – Lagoons
- **Broadband** – 450 MGB download speed
- **Highway** – located on secondary highway #18
- **Rail** – 606 Km short line owned by Great Western Railway
- **US Border** – Coronach is located 19 Km north west of the Ports of Coronach & Scobey Montana. The Port of Scobey is located 22 Km north of Scobey, MT which is approximately 150 Km north of US #2 highway. Coronach is 85 Km west of the Ports of Regway and Raymond Montana.
- **Poplar River Power Station** – operated by SaskPower and is located 10 Km southeast of Coronach. An integral part of the operation is the Morrison Dam, Cookson Reservoir and Poplar River Coal Mine. The power station incorporates two 300-megawatt steam turbine driven generators. The building has a ground floor of 72,658 square feet and is 246 ft high. The stack is 25 feet in diameter at the base and 400 feet in height.
- **Poplar River Mine** – owned and operated by Westmoreland Coal Company northeast of Coronach. Total coal production is used by the Poplar River Power Station for fuel. The lignite coal is exposed with two draglines. It is transported to the power station by a privately owned rail line.

Transportation Infrastructure

Roads:

- 158 Km from Moose Jaw
- 211 Km from Regina
- 240 Km from Williston

- 273 Km from Swift Current
- 286 Km from Minot
- 384 km from Saskatoon
- 611 Km from Winnipeg
- 647 Km from Calgary
- 745 Km from Edmonton

Rail:

- 34 Km from Rockglen station
- 78 Km from Assiniboia
- 58 Km from Bengough

Goods can be transported towards the north and west through the Great Western Railway, connecting the CP line. Goods transported to the east and south have to be trucked to Bengough station that connects the CP line to CN line and Stewart Southern Railway.

Ports:
384 Km from Port of Saskatoon

Air:

- 136 Km from Canadian Forces Base Moose Jaw
- 159 Km from Regina International airport
- 185 Km from Estevan Airport
- 393 Km from Minot International Airport

APPENDIX D: LEGAL DISCLAIMER

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