PRINCE OF WALES ISLAND, AK

Bioeconomy Development Opportunity Zone

RATING GRADE: 'BB'

Date of Issue: January 6, 2025

BB
Speculative

Rating Parameters:

Category	Rated Quantity	Delivered Price	BDO Zone Size
Sawmill residue	6,500 bdt/yr	$20-$60/bdt	75-mi drive distance from Thorne Bay, AK
Pulpwood	3,000 bdt/yr	$65-$120/bdt	
Forest residue	2,000 bdt/yr	$100-$120/bdt	

BDO ZONE ASSETS

- Quantities sufficient to support a quadrupling of the regional biomass heating market.
- Forestry workforce and equipment scale up requirements likely to be achieved over short time frame.
- Availability of wood fiber from secondary forests will increase significantly over the next 15-20 years.

BDO ZONE LIABILITIES

- Ban on old-growth harvesting has significantly limited wood supply, leading to sawmill curtailments and business closures.
- Most available wood supply and equipment are tied to a larger sawmill and exporter in the region, and there are no guarantees of collaboration with new developers.
- Securing the rated quantities will likely require a doubling of woodland and milling operations by smaller sawmills in the BDO Zone.
- Remoteness of the BDO Zone presents market-, infrastructure-, and workforce-related challenges.

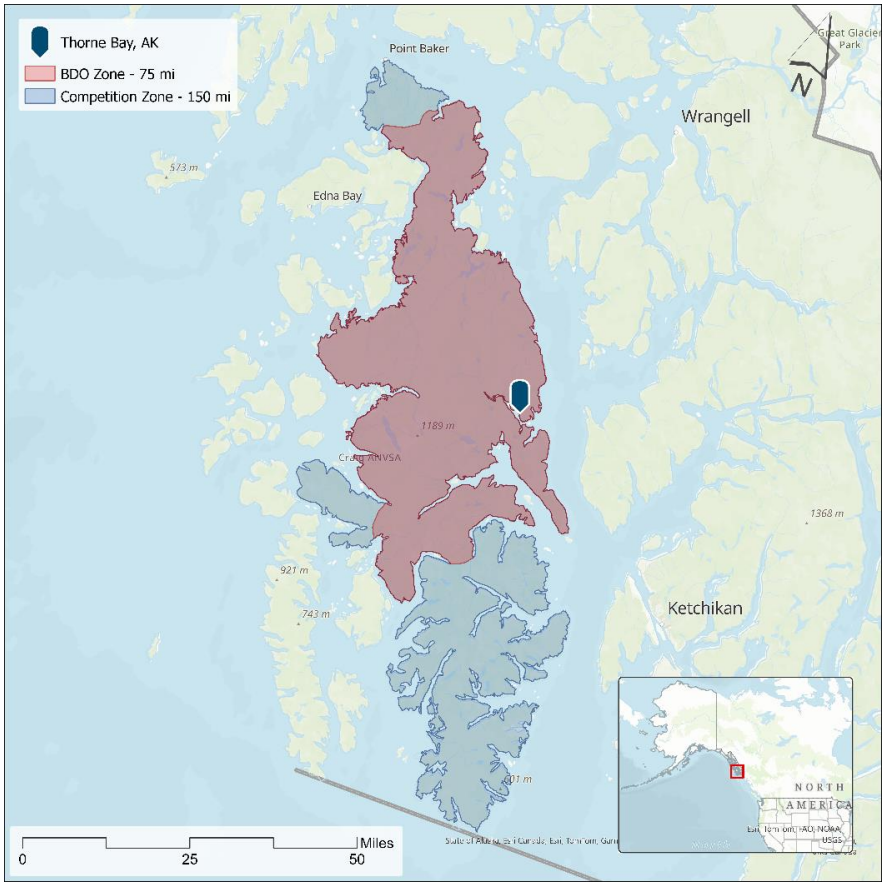
RATING GRADE

The Prince of Wales Island, AK, Bioeconomy Development Opportunity Zone, is rated 'BB', or 'moderate' risk.

Risk Rating Grades are defined as follows: AAA (extremely low), AA (very low), A (low), BBB (low-moderate), BB (moderate), B (moderate-high), and C (high).

'BB' ratings indicate moderate prospects for Feedstock Supply and Infrastructure (FS&I) with an elevated vulnerability to risk over time, particularly in the event of adverse business or economic conditions. Accessing the full rated quantity of wood fiber is contingent upon a doubling of lumber production by the network of small sawmills in the region. This will, in turn, likely require funding increases from existing and/or new capital sources.

PRINCE OF WALES ISLAND, AK BDO ZONE



BD OZ | BIOECONOMY DEVELOPMENT OPPORTUNITY ZONE INITIATIVE

ANALYST NOTES

The Prince of Wales Island, AK BDO Zone encompasses a 1,500-square mile area defined by a 75-mile drive distance from the City of Thorne Bay. Over 85% of the forested land base in the BDO Zone is part of the Tongass National Forest, owned and managed by the United States Forest Service. The majority of the remaining productive timberlands are owned and managed by the Alaska Division of Forestry. Terrain is mountainous and rugged.

The BDO Zone is assessed to contain approximately 11,500 bdt/yr of woody biomass available for new biomass-based projects over a scale-up period of three to five years. This includes 6,500 bdt/yr of sawmill residue, 3,000 bdt/yr of pulpwood, and 2,000 bdt/yr of forest residue. Sawmill residue could be delivered to a facility near Thorne Bay at a price of between $40 and $60/bdt for wood chips and $20 to $40/bdt for bark, offcuts, and other residuals. The rated quantity of pulpwood – including undersized or low-grade roundwood that cannot be utilized in lumber production – could be delivered at a price between $65 and $120/bdt, Forest residue could be delivered at a price of between $100 and $120/bdt after accounting for the cost of mobile chipping. A description of the methods used to estimate the rated quantities and prices is presented in Section B.

Risks relevant to the rated quantities and prices were assessed using 88 Risk Indicators from the US Standards for Biomass Supply Chain Risk (BSCR). Details of the risk assessment are presented in Section D. The following is a summary of the most significant assets and liabilities of the BDO Zone, as inferred from the risk assessment.

BDO ZONE ASSETS

Over the past decade, demand for forestry byproducts on Prince of Wales (POW) Island has been restricted to the residential and commercial/institutional heating market. An estimated 3,500 bdt/yr of low-grade roundwood and sawmill residue are utilized for heating. Export prospects are limited due to distance from the market and low supply. Competition risks for new bio-projects located on POW Island are, therefore, very low.

Other aspects of the BDO Zone associated with low risk include harvesting and collection practices and schedules, which are conventional and lead to the generation of pulpwood and sawmill residue as byproducts, and regional climate conditions, which are mild and enable supply chain operations for up to ten months per year.

The quantities rated as available for new projects are expected to be generated as a result of a scale-up in the operations of the six small-to-medium-sized sawmills located near Thorne Bay and Craig. Programs like the Alaska Division of Forestry's (DOF) Lumber Scaling Program, the United States Forest Service (USFS) Wood Innovations Program, and various initiatives led by Southeast Conference are designed to support the growth of regional sawmill capacity. Organizations like the DOF, USFS, the Alaska Forest Association (AFA), and the Mule Deer Foundation are committed to increasing wood supply within constraints.

Note that regulations and objectives related to forest management in the Tongass National Forest (NF) may change in the future. Various organizations advocate for increased harvesting activity in the region, either through transferring Tongass NF land to the State of Alaska or by modifying regulations on road construction and U.S. Forest Service (USFS) timber sales. While such regulatory changes could substantially increase future wood supply, they were not considered in the current evaluation.

BDO ZONE LIABILITIES

Regional wood supply has been limited by the 2016 decision to ban old-growth harvesting in the Tongass National Forest (NF), where the majority of timberlands in the BDO Zone are located. New timber sales from the Tongass NF are restricted to secondary forests with smaller average tree sizes. Most sawmills are optimized for larger-diameter roundwood that can only be sourced from old-growth forests. Continued investment in sawmill equipment upgrades that enable milling of smaller diameter roundwood is therefore required to expand commercial harvesting activity within the Tongass NF.

The level of sawtimber production needed to generate the required feedstock supply relies heavily on ongoing government support for sawmill equipment upgrades through the USFS Wood Innovations Program and Alaska's lumber grading legislation and program. If these regulations or subsidies are reduced or discontinued, the chances of continued growth for smaller sawmills in the

BDO Zone would decrease. Overall, Alaska's forest industry is more reliant on regulations and subsidies compared to the rest of North America. This is largely due to its remote location, low population density, and the emphasis on conservation in the Tongass National Forest.

The decline in wood supply and milling activity has led to workforce and equipment shortages. Many businesses involved in logging and milling have curtailed or permanently closed operations in recent years. New project developers will likely be required to make workforce and equipment investments to ensure supply chain reliability. Note, however, that these investments would be modest due to the relatively low-rated quantities.

Public opposition to forestry is relatively high in Southeast Alaska. Litigation of USFS timber sales and harvesting plans is common, often leading to wood supply delays or reductions. Continued public opposition to forestry is expected.

INFRASTRUCTURE PROFILE

Infrastructure risks were assessed with reference to a 50-acre waterfront parcel located one mile west of the City of Thorne Bay. The site has access to water and basic utilities, including power. However, telecommunications services are limited, and energy costs are elevated compared to state and national averages. Transportation-related risks are moderated by the established air and marine transportation networks servicing Prince of Wales Island, but most infrastructure risks remain elevated compared to other locations in North America.

SCORING & RATING METHODOLOGY

In assessing the biomass supply chain risk for the Bioeconomy Development Opportunity (BDO) Zone, 88 Risk Indicators from the US Standards for Biomass Supply Chain Risk (BSCR) were applied. These BDO Zone Risk Indicators are the subset of BSCR Risk Indicators applicable to evaluating feedstock risk within a BDO Zone.

Feedstock quantities are expressed in bone dry tons per year (bdt/yr), while feedstock costs are expressed in United States dollars (USD). The rated price range is based on an average 50-mile driving distance from the center point (Thorne Bay, AK).

The 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 Risk Likelihood (RRL)** score, which denotes the likelihood of a risk to future BDO Zone projects due to the Risk Indicator. RRL Scores are scaled as either very low (2), low (4), medium (6), high (8), or very high (10).

Each BDO Zone Risk Indicator is given a **Raw Risk Impact (RRI)** score, which denotes the impact on a future BDO Zone project due to the Risk Indicator. RRI scores are scaled as either very low (2), low (4), medium (6), high (8), or very high (10). Impact level scores are based on the impact level of a risk on the successful development and deployment of a BDO Zone project with no mitigation measures.

The **Gross Risk Indicator (GRI)** score is then calculated as the product of the RRL and the RRI scores. For example, if the 'Competitor Price and Price Sensitivity' is scored at an RRL of 2 and an RRI of 8, then the GRI for this risk indicator is 2 X 8 = 16.

If the analyst deems that a typical bio-based project could implement economically reasonable measures or best practices that mitigate the likelihood (RRL), the impact (RRI), or both, then the GRI will be notched accordingly.

The **Loaded RI** score for each Risk Indicator is the product of the GRI score and any notched scores. Loaded RIs are the final score for a Risk Indicator.

Loaded RI scores of 4 or less are deemed very low risk; scores between 5 and 16 are deemed low risk; scores between 17 and 36 are deemed medium risk; scores between 37 and 64 are deemed high risk; and scores of 65 and greater are deemed very high risk.

The total risk rating for the BDO Zone is the average of all Loaded RI scores and Infrastructure Indicators. The BDO Zone score for Thorne Bay, AK, is ***30.73 out of 100, resulting in a 'BB' designation.***

All scoring and rationale for each Risk Indicator are provided in Section D.

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SECTION A: RISK INDICATOR SUMMARY

Figure A-1. All Risk Indicators Sorted by Risk Level

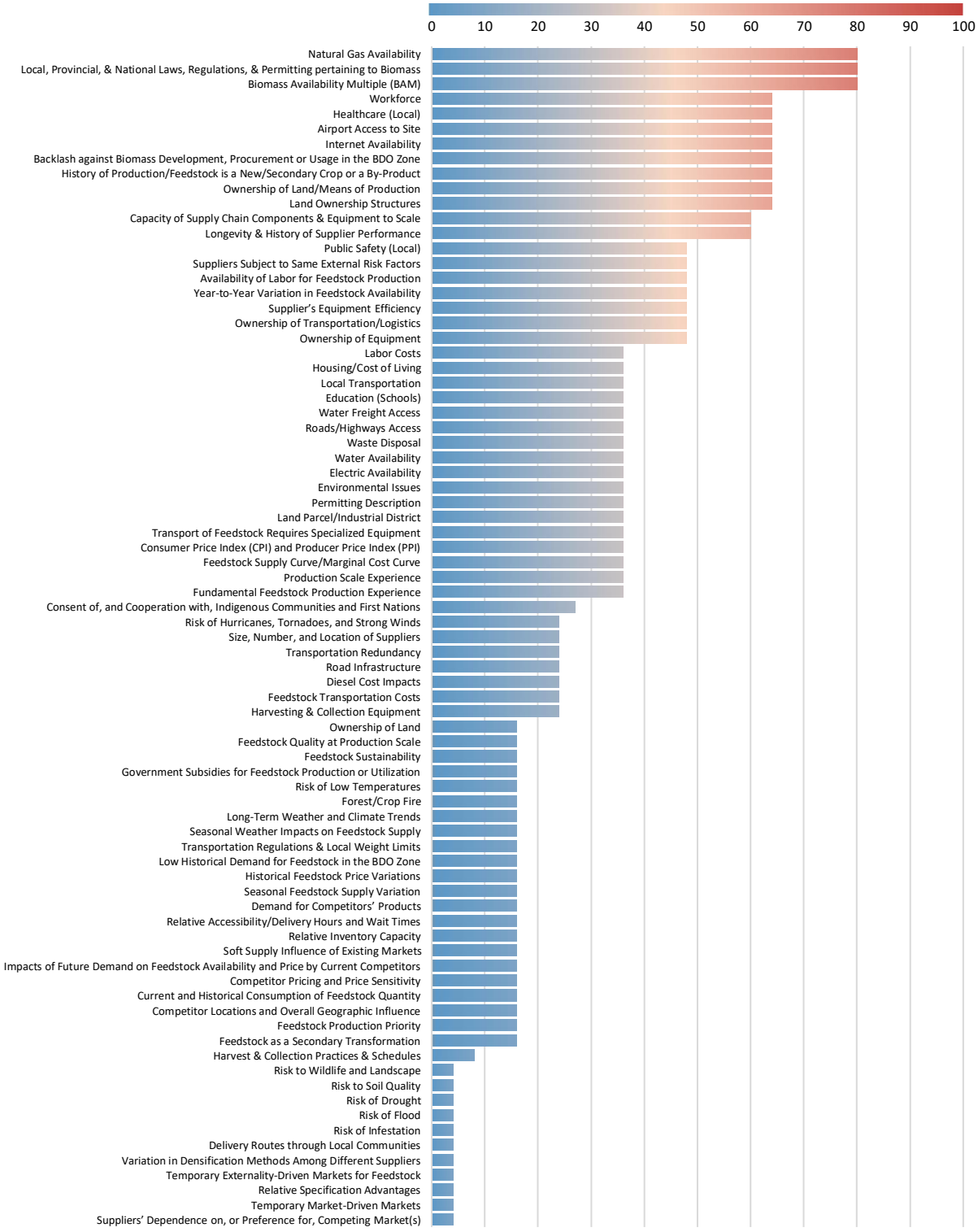


Table A-1. Risk Indicators and Associated Scores

Feedstock Supply Chain Risk Indicators	Raw Risk Likelihood	Raw Risk Impact	Gross Risk Indicator	Mitigation /Notching	Loaded RI Score
Category 1.0: Supplier Risk					
1.1 Risk Factor: Credit-Worthiness/Future Solvency of Suppliers					
1.1.1 Longevity & History of Supplier Performance	8	10	80	25%	60
1.2 Risk Factor: Conflicts of Interest/Vested Interest with Competing Market(s)					
1.2.1 Suppliers' Dependence on, or Preference for, Competing Market(s)	2	2	4	NN	4
1.3 Risk Factor: Supplier Control Over Production and Transportation					
1.3.1 Ownership of Land/Means of Production	8	8	64	NN	64
1.3.2 Ownership of Equipment	8	6	48	NN	48
1.3.3 Ownership of Transportation/Logistics	8	6	48	NN	48
1.3.4 Feedstock as a Secondary Transformation	4	4	16	NN	16
1.4 Risk Factor: Supplier Experience					
1.4.1 Fundamental Feedstock Production Experience	6	6	36	NN	36
1.4.2 Production Scale Experience	6	6	36	NN	36
1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity					
1.5.1 Supplier's Equipment Efficiency	8	6	48	NN	48
1.6 Risk Factor: Supplier Motivation					
1.6.1 Feedstock Production Priority	4	4	16	NN	16
Category 2.0: Competitor Risk					
2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets					
2.1.1 Competitor Locations and Overall Geographic Influence	4	4	16	NN	16
2.1.2 Current and Historical Consumption of Feedstock Quantity	4	4	16	NN	16
2.1.3 Competitor Pricing and Price Sensitivity	4	4	16	NN	16
2.1.4 Impacts of Future Demand on Feedstock Availability and Price by Current Competitors	4	4	16	NN	16
2.1.5 Soft Supply Influence of Existing Markets	2	8	16	NN	16
2.1.6 Temporary Market-Driven Markets	2	2	4	NN	4
2.2 Risk Factor: Specific Competitors' Competitive Advantage					
2.2.1 Relative Inventory Capacity	2	8	16	NN	16
2.2.2 Relative Accessibility/Delivery Hours and Wait Times	4	4	16	NN	16
2.2.3 Relative Specification Advantages	2	2	4	NN	4
2.2.4 Demand for Competitors' Products	4	4	16	NN	16
Category 3.0: Supply Chain Risk					
3.1 Risk Factor: Feedstock Availability					
3.1.1 Biomass Availability Multiple (BAM)	8	10	80	NN	80
3.1.2 Feedstock Supply Curve/Marginal Cost Curve	6	6	36	NN	36
3.1.3 Seasonal Feedstock Supply Variation	4	4	16	NN	16
3.1.4 Year-to-Year Variation in Feedstock Availability	8	6	48	NN	48
3.2 Risk Factor: Historical Issues					
3.2.1 Historical Feedstock Price Variations	4	4	16	NN	16
3.2.2 Low Historical Demand for Feedstock in the BDO Zone	4	4	16	NN	16
3.2.3 History of Production/Feedstock is a New/Secondary Crop or a By-Product	8	8	64	NN	64
3.3 Risk Factor: Non-Weather Based Externalities					
3.3.1 Consumer Price Index (CPI) and Producer Price Index (PPI)	6	6	36	NN	36
3.3.2 Currency Risk	NR	NR	NR	NR	NR
3.3.3 Border Risk	NR	NR	NR	NR	NR
3.3.4 Temporary Externality-Driven Markets for Feedstock	2	2	4	NN	4
3.4 Risk Factor: Risks Related to Feedstock Production, Harvest, and Collection					
3.4.1 Harvest & Collection Practices & Schedules	4	2	8	NN	8
3.4.2 Harvesting & Collection Equipment	6	4	24	NN	24
3.4.3 Variation in Densification Methods Among Different Suppliers	2	2	4	NN	4
3.4.4 Availability of Labor for Feedstock Production	8	8	64	25%	48
3.5 Risk Factor: Transportation					
3.5.1 Feedstock Transportation Costs	6	4	24	NN	24
3.5.2 Diesel Cost Impacts	6	4	24	NN	24
3.5.3 Transport of Feedstock Requires Specialized Equipment	6	6	36	NN	36
3.5.4 Delivery Routes through Local Communities	2	2	4	NN	4
3.5.5 Transportation Regulations & Local Weight Limits	4	4	16	NN	16
3.5.6 Road Infrastructure	6	4	24	NN	24
3.5.7 Transportation Redundancy	6	4	24	NN	24
3.6 Risk Factor: Supply Chain Resiliency					

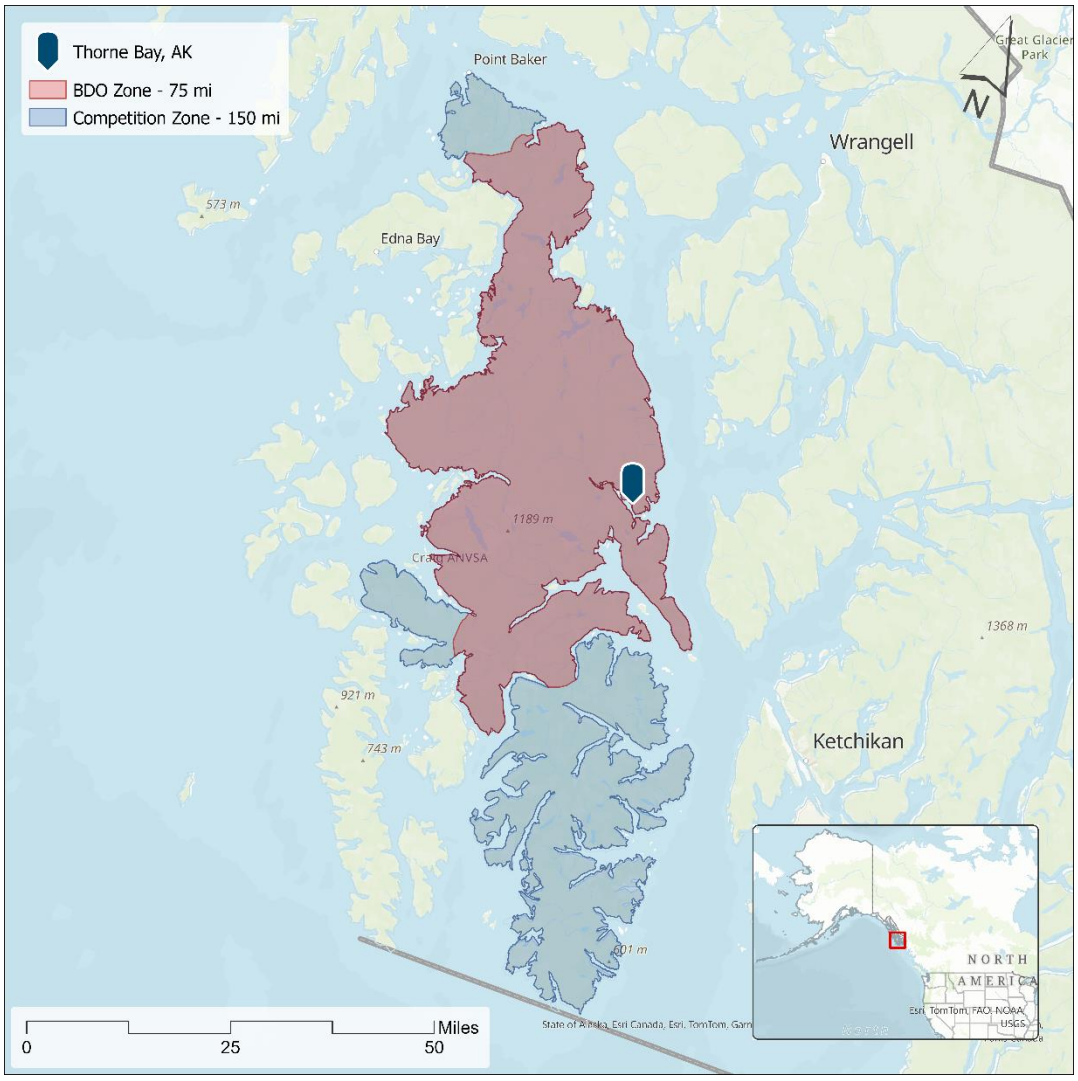
3.6.1 Size, Number, and Location of Suppliers	6	4	24	NN	24
3.6.2 Suppliers Subject to Same External Risk Factors	8	6	48	NN	48
3.6.3 Land Ownership Structures	8	8	64	NN	64
3.7 Risk Factor: Climate and Natural Risks					
3.7.1 Seasonal Weather Impacts on Feedstock Supply	4	4	16	NN	16
3.7.2 Long-Term Weather and Climate Trends	4	4	16	NN	16
3.7.3 Forest/Crop Fire	4	4	16	NN	16
3.7.4 Risk of Infestation	2	2	4	NN	4
3.7.5 Risk of Hail	NR	NR	NR	NR	NR
3.7.6 Risk of Flood	2	2	4	NN	4
3.7.7 Risk of Drought	2	2	4	NN	4
3.7.8 Risk of Hurricanes, Tornadoes, and Strong Winds	6	4	24	NN	24
3.7.9 Risk of Low Temperatures	4	4	16	NN	16
3.8 Risk Factor: Political and Social					
3.8.1 Government Subsidies for Feedstock Production or Utilization	4	4	16	NN	16
3.8.2 Local, Provincial, & National Laws, Regulations, & Permitting pertaining to Biomass	8	10	80	NN	80
3.8.3 Backlash against Biomass Development, Procurement or Usage in the BDO Zone	8	8	64	NN	64
3.8.4 Consent of, and Cooperation with, Indigenous Communities and First Nations	6	6	36	25%	27
3.8.5 Food Security Concerns	NR	NR	NR	NR	NR
3.9 Risk Factor: Sustainability and Environmental Concern					
3.9.1 Feedstock Sustainability	4	4	16	NN	16
3.9.2 Risk to Soil Quality	2	2	4	NN	4
3.9.3 Risk to Surface and Groundwater	NR	NR	NR	NR	NR
3.9.4 Water Use	NR	NR	NR	NR	NR
3.9.5 Pesticide Risk to Human and Ecosystem Health	NR	NR	NR	NR	NR
3.9.6 Risk to Wildlife and Landscape	2	2	4	NN	4
3.9.7 Biomass Classified as Genetically Modified Organism (GMO)	NR	NR	NR	NR	NR
Category 4.0: Feedstock Scale-up Risk					
4.1 Risk Factor: Feedstock Scale-Up					
4.1.1 Feedstock Quality at Production Scale	4	4	16	NN	16
4.1.2 Capacity of Supply Chain Components & Equipment to Scale	8	10	80	25%	60
Category 5.0: Infrastructure					
5.1 Risk Factor: Physical Infrastructure					
5.1.1 Land Parcel/Industrial District	6	6	36	NN	36
5.1.2 Ownership of Land	4	4	16	NN	16
5.1.3 Permitting Description	6	6	36	NN	36
5.1.4 Environmental Issues	6	6	36	NN	36
5.2 Risk Factor: Utilities					
5.2.1 Natural Gas Availability	8	10	80	NN	80
5.2.2 Electric Availability	6	6	36	NN	36
5.2.3 Water Availability	6	6	36	NN	36
5.2.4 Waste Disposal	6	6	36	NN	36
5.2.5 Internet Availability	8	8	64	NN	64
5.3 Risk Factor: Transportation/Logistics					
5.3.1 Roads/Highways Access	6	6	36	NN	36
5.3.2 Rail Access to Site	NR	NR	NR	NR	NR
5.3.3 Airport Access to Site	8	8	64	NN	64
5.3.4 Water Freight Access	6	6	36	NN	36
5.4 Risk Factor: Social Infrastructure					
5.4.1 Healthcare (Local)	8	8	64	NN	64
5.4.2 Education (Schools)	6	6	36	NN	36
5.4.3 Local Transportation	6	6	36	NN	36
5.4.4 Public Safety (Local)	8	6	48	NN	48
5.4.5 Housing/Cost of Living	6	6	36	NN	36
5.5 Risk Factor: Labor					
5.5.1 Workforce	8	8	64	NN	64
5.5.2 Labor Costs	6	6	36	NN	36
				Average	**30.73**

SECTION B: BIOMASS AVAILABILITY AND PRICING

OVERVIEW

BDO Zone Risk Indicators are scored with reference to specific feedstock quantities and prices. The rated quantities are determined by estimating the potential amount of biomass feedstock that can be produced within the BDO Zone, defined by a 75-mile drive distance from Thorne Bay, AK (Map B-1). To estimate biomass availability for new bio-projects, current demand for the rated feedstock types in in the Competition Zone (150-mile drive distance from Thorne Bay, AK) is subtracted from the estimate of total potential production. The rated quantity is determined by dividing the availability estimate by a Biomass Availability Multiple (BAM) of between 1.5 and 4.0. The BAM is applied to account for uncertainty in underlying data, models, assumptions, and future operating conditions. The resulting rated feedstock quantities are conservative estimates of availability for new projects. The price range associated with each rated quantity is determined through outreach and market analysis in the Competition Zone and reflects the anticipated price that a new bio-project would have to pay to secure the rated quantity of biomass.

Map B-1. Map of BDO Zone and Competition Zone



EVALUATED FEEDSTOCKS

Pulpwood: Roundwood that cannot be milled into solid wood products due to small diameter, irregular form, or other defect. Also referred to as low grade roundwood.

Forest residues: Branches, the top section of stems, and other trees and tree components that are recovered during forest operations but that cannot be sectioned into roundwood. Recovery of forest residue typically requires the use of mobile chippers or grinders capable of comminuting the material into smaller, homogenous particle sizes. Chip trucks are subsequently used to transport the material to the destination.

Sawmill residues: Byproducts of sawmill operations produced from the conversion of sawlogs into lumber and finished wood products. A typical lumber mill converts about 40-60% of sawlogs into finished wood products. The remaining portion of sawn timber is transformed during milling into sawmill residue, including wood chips, sawdust, planer shavings, and bark.

SUPPLY ANALYSIS

The Prince of Wales Island, AK BDO Zone is located in Southeast Alaska. The BDO Zone, defined by a 75-mile drive distance from Thorne Bay, covers the majority of Prince of Wales (POW) Island, the largest of the over 1,000 islands in the region that make up the Alexander Archipelago. The terrain is mountainous, and forests are comprised mainly of western hemlock, western redcedar, Sitka spruce, and lodgepole pine.[1]

Over 85% of forestland within the BDO Zone is part of the Tongass National Forest (NF),[2] managed by the USDA Forest Service. Most of the remaining forestland is owned by the State of Alaska and Indigenous organizations. State-owned forestlands are managed by the Alaska Division of Forestry (DOF) and Alaska Mental Health Trust.[3]

Between 2000 and 2021, sawtimber harvesting within the Tongass NF decreased from approximately 120 to 15 million board feet per year (MMBF/yr), a decline of 90%. The historical decline in sawtimber harvesting can be attributed to the legacy of intensive harvesting up until the 1990s, slow tree growth rates owing to regional climate, active opposition to forestry by environmental groups, and the USFS decision in 2016 to ban old-growth harvesting within the Tongass NF.[4] New USFS timber sales are now restricted to forests in earlier stages of development (referred to as young growth or secondary forest).

In recent years, harvesting in Southeast Alaska has ranged from 15 to 25 MMBF/yr. Approximately three-quarters of this wood supply has been sourced from the Tongass NF, with the remaining quarter sourced from the State of Alaska forestlands. While Alaska DOF timber sales have largely kept pace with annual harvesting from DOF timberlands (average of 9 MMBF/yr), USFS timber sales over the past five years have averaged only 3 MMBF/yr. Therefore, the volume of sawtimber under contract in the Tongass NF is declining rapidly. This is due in part to a sawmill preference for larger diameter trees typical for old-growth forests, the harvesting of which is being phased out in the Tongass NF.

In future years, the Alaska DOF expects that an average of 9 MMBF/yr (~40,000 green tons/yr, or 20,000 bdt/yr) of sawtimber will be offered for sale annually from DOF lands in Southeast Alaska. Approximately 6 MMBF/yr of this amount (65%) will likely be offered on POW Island. Alaska Mental Health Trust forestlands are not managed under a sustained yield program, and therefore, amounts available in future years cannot be known with any certainty. For the Tongass NF, annual timber sales on POW Island in recent years have averaged approximately 2.25 MMBF/yr. The scale of future USFS timber sales from the Tongass NF is uncertain and will depend in part on federal executive policy and regional demand for

[1] https://www.fs.usda.gov/pnw/pubs/pnw_rb103.pdf
[2] The Tongass NF comprises 17 million acres in Southeast Alaska and is the largest National Forest in the United States.
[3] The Alaska DOF owns 80,000 acres of land designated for forestry.
[4] Old-growth forests in the region are defined as forests that are dominated by trees older than 150 years.

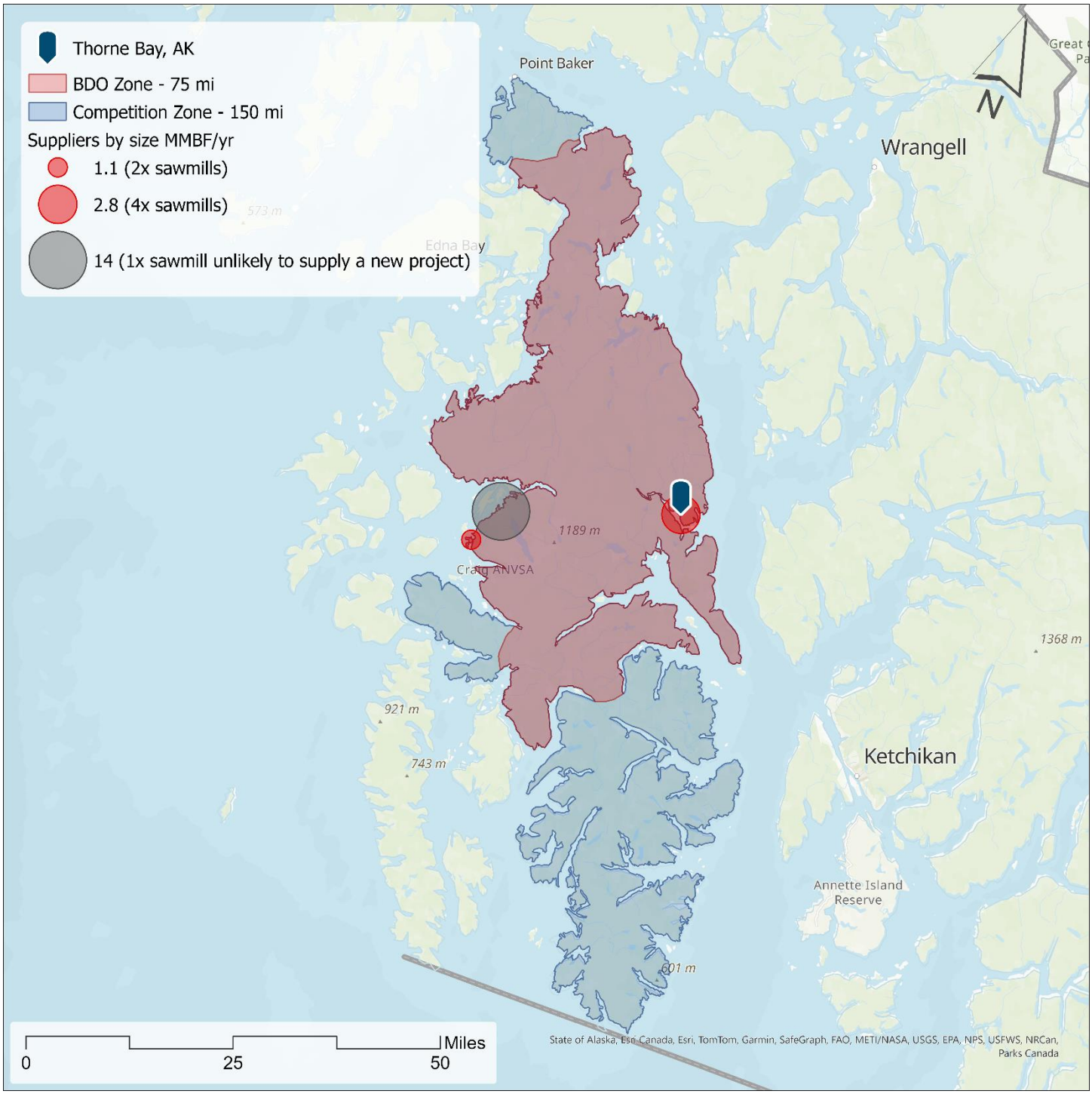
small-diameter sawtimber. Future wood supply from forestlands owned by indigenous organizations on POW Island will be insignificant due to participation in carbon trading and offset programs.

The largest sawmill in the BDO Zone, responsible for the majority of timber harvesting, solid wood product manufacturing, and sawmill byproduct generation, is no longer participating in the USFS annual sawmill survey and did not provide information for this rating.[5] Continuation of operations at the mill over the next ten years is uncertain due to the USFS decision to ban old-growth harvesting, the status of property ownership at the sawmill, and other factors. Continued business operations of the largest timber export company in the region are also uncertain.

Given the historical trends and uncertainties, the rated quantities of feedstock that could be available for new projects were determined under the assumption that no feedstock will be available from the forestry and milling operations of the large sawmill and exporter. The remaining sawmills in the BDO Zone have been operating below capacity in recent years, with an aggregate estimated sawtimber demand of only 4 to 6 MMBF/yr, which is equivalent to ~10% of sawtimber demand at installed lumber production capacity.[6] Therefore, for purposes of estimating feedstock availability for new bio-projects in future years, we assume that the smaller sawmills double production over a scale-up period of three to five years, generating a sawtimber demand of 8-12 MMBF/yr. The probability of scale-up is increased by the USFS Wood Innovations Program, which has provided grants supporting the purchase and installation of equipment capable of milling small-diameter logs. The two locations where smaller sawmills are clustered in the BDO Zone are shown in Figure B-1.

[5] Representatives at the sawmill were not interested in discussing wood supply possibilities for new projects.
[6] Installed lumber production capacity of the sawmills was estimated to be 24 MMBF/yr in the 2022 USFS sawmill survey, equivalent to 40-60 MMBF/yr of sawtimber demand.

Figure B-1. Locations of Sawmill Clusters on Prince of Wales Island that Could Support New Bio-Projects



Under these assumptions, it is estimated that a total of approximately 21,000 bdt/yr of woody biomass will be produced in future years as a result of forestry and milling operations carried out by, or in support of, the smaller sawmills. Of this total, an estimated 6,500 bdt/yr of pulpwood could be recovered during conventional and unconventional forest operations in the BDO Zone. This assumes that pulpwood is produced as a byproduct of sawtimber harvesting and ecological restoration activities at an aggregate ratio of 0.25 units of pulpwood for every unit of sawtimber. An additional 3,000 bdt/yr of forest residue generated during ground-based operations and 11,500 bdt/yr of sawmill residue generated by sawmills in the BDO Zone (not including the larger sawmill) could also be produced over a scale-up period of three to five years.[7]

Note that the larger sawmill was not interested in being involved in the BDO Zone Rating process, but this does not necessarily preclude collaboration in the future with a new bio-project. The opportunities for wood supply for new projects could be greatly improved if a project proponent was able to develop a business relationship with the large sawmill. The mill is the leading manufacturer of value-added solid wood products in Southeast Alaska and has been directly and indirectly responsible for the development and stability of the regional forestry workforce. The USFS Wood Innovations Program could conceivably be used to support investments in upgraded milling infrastructure at the larger sawmill, enabling increased use of secondary forests.

COMPETITION ANALYSIS

Potential competitors to new forest biomass-based projects in the BDO Zone are restricted to a few small sawmills that recover low-grade sawlogs from slash piles, the large sawmill with a biomass briquette production line,[8] and biomass-fueled combustion units of various scales and fuel specifications. Combustion units include two >1 MW wood chip boilers, 12 cordwood boilers (50-200 kW),[9] and an unknown number of wood stoves/fireplaces that utilize cordwood (firewood). In aggregate, we estimate the total near-term demand by these units for low-grade roundwood and sawmill residue to be 3,500 bdt/yr. There are currently no markets for the majority of sawmill residue generated on the island by smaller sawmills and this material must therefore be disposed of through burning without energy recovery.

Potential future competition for feedstock on the island is limited. A new school building was recently constructed on POW Island in the town of Hollis and local authorities plan on installing a bioheat unit with a larger capacity than the 50-kW cordwood boiler currently installed at the existing school. To account for this, the existing feedstock demand of the current boiler was doubled (50 bdt/yr to 100 bdt/yr).

Southeast Conference plans to establish a demonstration pellet mill on Gravina Island, north of the Ketchikan International Airport. The mill is expected to produce 2,000 tons of pellets for the regional residential heating market annually, with a capacity of up to 6,000 tons per year. Annual feedstock demand is estimated to be 2,000 bdt/yr of sawmill residuals sourced from suppliers near Ketchikan, AK. The pellet mill is unlikely to compete for biomass resources available for new projects on POW Island due to the costs and logistics of barging.

RATED QUANTITIES AND PRICING

The rated quantity available for new projects at low-to-moderate risk is estimated to be 11,500 bdt/yr. This estimate was derived by deducting expected competition from expected production[10] and by applying a Biomass Availability Multiple (BAM) of 1.5x to feedstock availability estimates. The BAM of 1.5x effectively decreases the amount estimated to be available to new developers by one-third, accounting for uncertainty in underlying data and assumptions (see Risk

[7] It is assumed that 75% of future conventional and unconventional forest operations will be ground-based, enabling recovery of forest residue. Cable logging generally does not enable efficient collection of forest residue and is therefore not considered in the analysis.
[8] If the large sawmill closes, it is assumed that current biomass briquette demand on Prince of Wales Island will be met by a new producer, and therefore we account for this demand in our assessment of rated quantity available for new projects.
[9] Two of these units are installed at a sawmill on the island
[10] As described in the "Supply Analysis" and "Competition Analysis" subsections above.

Indicator 3.1.1). Delivered prices for each feedstock type were estimated on the basis of costs and a 20% markup for profit and risk. Available quantities (after deducting near-term competition from supply potential), rated quantities, and rated pricing for the evaluated feedstock types are summarized in Table B-1.

Table B-1. Available and Rated Quantities and Corresponding Rated Price Range for the Evaluated Feedstocks

Feedstock type	Available quantity (bdt/yr)11	Rated quantity (bdt/yr)	Rated price range ($/bdt delivered)[12]
Sawmill residues	10,000	6,500	$20-$60
Pulpwood	4,500	3,000	$65-$120
Forest residues	3,000	2,000	$100-$120

[11] Calculated by subtracting current demand (as derived in Competition Analysis subsection) from total supply potential (as derived in Supply Analysis subsection).
[12] Prices based on outreach to local forestry professionals.

SECTION C: INFRASTRUCTURE



PROPERTY OVERVIEW

City:	Thorne Bay, Alaska
County:	Prince of Wales-Hyder Census Area
Acres:	+/- 50 acres
Pricing Note:	Open
Topography:	Flat
Zoning:	Open zoning for new industries

SITE CONTACT

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INFRASTRUCTURE SITE CONTACT

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PROPERTY PROFILE

Thorne Bay is located on the eastern shore of Prince of Wales Island in Southeast Alaska. The Island is accessible by ferry and float plane. Within Thorne Bay, there is a former log yard site directly on the Bay that is less than one mile from the city center.

The evaluated parcel is approximately 50 acres with utility connections for water and power. As a former log yard, the site is relatively flat with good truck access. There are no buildings or other infrastructure items on the parcel. No current port or dock facilities are in place.

Transportation

Nearest Highway: S. Thorne Bay Rd (paved) **Rail Served:** No
Nearest Seaplane Airport: Thorne Bay (1 mi) **Ferry Service:** Yes, multiple operators
Nearest Commercial Airport: Ketchikan International (45 minutes by floatplane)

Electric

Supplier: Alaska Power and Telephone **Website:** www.aptalaska.com
Ownership: Employee Owned / Non-Profit **Utility Extends to Site:** Yes
Phone: 800-478-7531 **Nearest Substation:** 1 mile
Capability: All power is either hydro or oil-based generation, with diesel backup. There is an "island" grid system managed by AP&T that serves Thorne Bay. Three-phase power is available to the Site, with limited capacity available.

Water

Supplier: City of Thorne Bay **Website:** www.thornebay-ak.gov/water
Ownership: Municipal **Size of Main:** 6"
Phone: 907-204-8481
Capability: Water Lake, north of Thorne Bay, supplies water, which is treated and stored in a tank before piped distribution. There is a water supply pipe system to the Site.

Wastewater

Supplier: City of Thorne Bay **Website:** www.thornebay-ak.gov/water
Ownership: Municipal **Size of Main:** 12"
Phone: 907-204-8481
Capability: The gravity sewage system includes secondary treatment before discharge into the Bay. There are sewage facilities at the Site.

Telecommunications

Supplier: Hughesnet **Website:** www.hughesnet.com
Ownership: Investor Owned **Platforms:** Wireless
Phone: 866-482-1777
Capability: Primary wireless. Limited coverage away from Thorne Bay.

SECTION D: RISK INDICATOR SCORING METRICS

CATEGORY 1.0: SUPPLIER RISK

1.1 Risk Factor: Credit-Worthiness/Future Solvency of Suppliers

1.1.1 Longevity & History of Supplier Performance

Rationale: Number of years in business is a positive indicator of future solvency. Historical performance is an indicator of future performance.

Risk Information: The regional forest industry has significantly declined in capacity and output over the past twenty years. Between 2000 and 2024, there was an approximate 60% decline in the number of operational sawmills in Southeast Alaska with capacities >1 MMBF/yr.[13] The most recent USDA survey of sawmills located within the Tongass NF estimates an annual production of 17 MMBF/yr in 2022, down from 87 MMBF/yr in 2000 (Figure E-1). A large sawmill located in Klawock on POW Island accounted for approximately 80% of total production in 2022. Continued operation of the sawmill over the next decade is uncertain due to constrained wood supply and land lease arrangements.[14] Smaller sawmills in the BDO Zone are also operating far below capacity, and a number of logging companies have curtailed operations or permanently closed in recent years.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very high, therefore the RRI is 10 out of 10.	**10**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 80 out of 100.	**80**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) There are a number of organizations and programs designed to support the growth of the Alaskan forest industry. The Alaska Division of Forestry and Fire Protection (DOF) offers favorable timber pricing and recently introduced the Alaska Lumber Grading Program, which aims to increase the use of lumber produced by Alaskan sawmills in new construction. Sawmills, logging companies, and other supply chain specialists in Southeast Alaska are organized under the Alaska Forest Association (AFA), which actively lobbies on behalf of its members at state and federal levels. The USDA Forest Service provides funding for sawmill upgrades, biomass heating installations, and other investments through its Wood Innovation and Community Wood Grant programs. Finally, Southeast Conference is a state and federally-designated regional development organization for Southeast Alaska that supports the development of the regional bioeconomy through demonstration projects, annual conferences, and workshops. The maintenance or expansion of the resources available to any of these organizations would reduce the risk of further curtailments and closures. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 60 out of 100.	**60**

[13] USDA Forest Service. September 2023. Tongass National Forest: 2022 Sawmill Capacity and Production Report. Prepared by Daniels, J., Morris, P., and O'Leary, D. USDA Forest Service, Alaska Region (Region 10). 14 pp.

[14] The owner of the mill did not respond to outreach and was not willing to provide information to the USDA Forest Service in support of the 2022 sawmill survey.

1.2 Risk Factor: Conflicts of Interest/Vested Interest with Competing Market(s)

1.2.1 Suppliers' Dependence on, or Preference for, Competing Markets

Rationale: Suppliers may have a vested interest or preference in supplying specific competitors with 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 suppliers' dependence on competing markets to accept or purchase other products/by-products. During periods of feedstock shortage, such suppliers may be more likely to allocate the scarce supply to competitors, resulting in supply disruptions for the Issuer.

Risk Information: Current end uses for non-sawtimber biomass are restricted to heating markets. Larger sawmills in the BDO Zone supply wood chips and briquettes to residential and institutional heating markets. Logging companies, Indigenous organizations, and smaller sawmills sell low grade logs as firewood for residential heating. It is estimated that total biomass demand from the heating market does not exceed 3,000 bdt/yr. There are currently no markets for forest residue in the BDO Zone. The limited demand for non-sawtimber biomass in the region precludes risk of suppliers' dependence on, or preference for, competing markets.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**4**

1.3 Risk Factor: Supplier Control Over Production and Transportation

1.3.1 Ownership of Land/Means of Production

Rationale: Suppliers that own land or a production facility where feedstock is produced tend to have better control of supply chains and present lower degrees of supply risk.

Risk Information: Over 85% of the forested land base in the BDO Zone is part of the federally owned Tongass National Forest. The remaining forestland is owned by the State of Alaska (DOF, Mental Health Trust), First Nations, municipalities, and private landowners. Although forestland is disproportionately under federal ownership, wood supply since 2017 has been sourced equally from federal and state forestlands. This reflects the imposition of a ban on old-growth harvesting within the Tongass NF and the prevalence of secondary forests that are insufficiently developed to enable economical harvesting. The decision by the USDA to ban old-growth harvesting within the Tongass NF has presented existing sawmills with significant wood supply challenges that are likely to continue without sawmill upgrades or the transfer of some portion of federal land to the Alaska DOF, which allows old-growth harvesting under certain conditions. Other management categories are not expected to contribute significantly to wood supply due to lack of land area and participation in carbon markets.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**

Raw Risk Impact (RRI) The risk impact is deemed high, therefore the RRI is 8 out of 10.	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**Score** **64**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	**Score** **64**

1.3.2 Ownership of Equipment

Rationale: In most cases, suppliers that own or lease equipment for harvest, collection, and processing feedstock are at lower risk than those that are not. For example, third-party harvesting equipment may not be available when required. Short harvest windows may be missed if a farmer and contractor cannot schedule convenient harvest times, and quantity shortages can result. However, in some circumstances, reliance on third-party equipment to harvest or produce feedstock can decrease supply chain risk. For example, when harvesting agricultural residues such as corn stover, using a third-party company with standard equipment specializing in harvesting, collection, and transportation may decrease quality variations (e.g., ash content) of the final feedstock.

Risk Information: Logging equipment is owned by local logging contractors. Ground-based operations typically include an excavator with processing head ("shovel"), whereas operations on slopes >35% use cable yarding equipment. Three-to-four feller bunchers are also present on POW Island to efficiently fell and pile small diameter trees typical of young growth forests.

It was determined during outreach that the forestry workforce and equipment complement is often inadequate for wood supply demands. The larger logging companies in the region have curtailed operations in recent years and tend to work exclusively for the larger sawmill and export company. A new project developer will likely need to invest in equipment or encourage suppliers to make the required investments. Risk impact is moderated by the relatively low rated quantity and corresponding low scale up requirement.

Although no mobile chipping units are currently available, Southeast Conference has secured financing to purchase a mobile chipping unit. The chipper is expected to be delivered to Prince of Wales Island in 2025 and will be available for lease by third parties.

Raw Risk Likelihood (RRL) The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 48 out of 100.	**Score** **48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment.	**Notch** **NN**

RRI Mitigation (Notch) No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100. **48**

1.3.3 Ownership of Transportation/Logistics

Rationale: In most cases, suppliers that own or lease transportation equipment necessary to transport biomass from forests or fields are at lower risk than those that do not. However, in some circumstances, reliance on third parties to transport biomass is common practice and does not contribute to risk.
Risk Information: The majority of logging trucks in the BDO Zone are owned by small businesses with one-to-five employees and fleets of one-to-three trucks. The current number of logging trucks in the BDO Zone is inadequate for existing demand. The two chip trucks that operate in the BDO Zone are owned by the large sawmill and are not expected to be available to new entrants. A new proponent will therefore have to make or encourage investments in additional logging and chip trucks. Risk impact is moderated by the relatively low rated quantity and corresponding low scale up requirement.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed high, therefore the RRL is 8 out of 10. **8**
Raw Risk Impact (RRI) **Score** The risk impact is deemed medium, therefore the RRI is 6 out of 10. **6**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL X RRI) is 48 out of 100. **48**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100. **48**

1.3.4 Feedstock as a Secondary Transformation

Rationale: Secondary transformation is dependent upon the production of primary products. Forest residues, corn stover, bark, and sawmill chips (unless from a dedicated chip mill) are all secondary transformations of a primary product.

Risks are higher if the feedstock is a secondary transformation of a primary, more valuable product. In the absence of markets for the primary product, it may not be economical for suppliers to produce biomass on their own. For example, a supplier may produce dimensional lumber as its primary product and wood chips as a by-product, therefore relying on the health of the housing market for production levels. If the demand for dimensional lumber drops, so can the availability of sawmill residues.

In the case of agricultural feedstocks, such as corn stover, the feedstock is a by-product of a primary crop. Since the primary crop is significantly more lucrative than the residue, it will be a priority for the producer. If the production of

the primary crop requires resources to be taken away from the production of the secondary crop (e.g., shorter harvesting windows due to weather), the secondary feedstock supply will suffer. In times of stretched resources, suppliers may also perceive the harvest and collection of the feedstock as a nuisance, potentially decreasing production levels.

Understanding the economic drivers for suppliers' primary products can help gauge risk levels for secondary transformation biomass products.

Risk Information: The rated quantities of feedstock are generated as a byproduct of harvesting and milling operations. Sawtimber harvesting in the BDO Zone has been in a state of historical decline, leading to revenue loss and business closures. We expect that sawmills and logging companies will support increased utilization of byproducts, as this provides an important alternative revenue stream. There is very low risk that forest residue recovery operations will interfere with conventional logging due to the low level of harvesting activity and low rated quantity.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

1.4 Risk Factor: Supplier Experience

1.4.1 Fundamental Feedstock Production Experience

Rationale: Risk is higher when suppliers have limited experience with planting, growing, harvesting, processing, and/or collecting biomass. Limited experience may be common for stover or forest residue supply chains where farmers or forestry producers may have no previous experience.

Risk Information: The regional industry was one of the largest in North America up until the late 1990s, supporting a large pulp mill, several large sawmills, and generating a roundwood demand of over 100 MMBF/yr (up to 400 MMBF/yr in the late 1980s).[15] Wood supply decreased to less than 50 MMBF/yr between the late 1990s and early 2000s following the USDA decision to stop honoring the timber supply agreement with the regional pulp mill. A decision in 2016/17 to eliminate old-growth harvesting within the Tongass NF further reduced timber supply. The gradual constriction of wood supply has had a significant impact on the milling and logging workforce, which has declined by ~85% since the early 2000s. Roundwood production experience is therefore currently limited. Lack of feedstock production experience is also significant for forest residue, as supply chains have never been established in the region. Overall, risk is moderated by the low rated quantity.

Raw Risk Likelihood (RRL)	**Score**

[15] "Cut History 1908-Present" (https://www.fs.usda.gov/detail/r10/landmanagement/resourcemanagement/?cid=fsbdev2_038785)

The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

1.4.2 Production Scale Experience

Rationale: Scale-up entails risk. Risk is higher when suppliers have limited experience producing the required quantity of feedstock.

Risk Information: The rated quantities of pulpwood and sawmill residue were estimated under the assumption that lumber production by the six smaller sawmills in the BDO Zone doubles over a scale up period of three-to-five years. While the sawmills have sufficient capacity to accommodate a 10x expansion of lumber output, there is often an incompatibility between the dimensions of sawtimber available for harvest and milling equipment specifications. Therefore, production scale experience risk for pulpwood and sawmill residue is assessed as moderate. In-woods chipping operations have never occurred in the BDO Zone and therefore the rated quantity of forest residue is associated with high production scale experience risk. Risk is moderated by the low scale up requirements to secure the rated quantities.

Raw Risk Likelihood (RRL) The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity

1.5.1 Supplier's Equipment Efficiency

Rationale: Equipment efficiency significantly influences the supplier's feedstock production capacity. Understanding the supplier's equipment capability enables understanding of their ability to produce feedstock of suitable quality.

Risk Information: Although excavators and cable yarding systems are standard equipment for logging operations in the Pacific Northwest, suppliers' equipment efficiency could be negatively affected by lack of experienced operators, aging equipment, and geography. Maintaining current harvesting levels is not guaranteed due to business closures and workforce attrition. Cutblocks often require road and bridge building for access and mountainous terrain can slowdown transportation of feedstock and equipment to and from work sites. There is no regional experience in mobile comminution, and chip truck access to forest operations will be difficult due to mountainous terrain.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 48 out of 100.	**48**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**48**

1.6 Risk Factor: Supplier Motivation

1.6.1 Feedstock Production Priority

Rationale: When biomass feedstock is a secondary or non-core line of business, a by-product, or a residual from a more valuable product, suppliers may not put in sufficient effort for consistent production. The risk of breach increases when feedstock production and/or delivery compromise a supplier's ability to make a primary product.

When biomass feedstock is a by-product of another main higher margin or main product such as corn stover (e.g., corn) or forest residues (e.g., pulpwood), supply may not be a top priority for a supplier.

Risk Information: There is no feedstock production priority risk associated with pulpwood and sawmill residue, which can be produced during conventional operations without compromising sawtimber and wood product production. In-woods chipping or grinding of slash piles is associated with some risk, however. Mountainous terrain and narrow, winding roads could lead to delays in chipping/grinding and chip transport operations. Aggregate risk for this indicator is reduced by the low contribution of forest residue to the total rated quantity (2,000 bdt/yr of 11,500 bdt/yr).

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**16**

Mitigation/Notching	Notch
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

CATEGORY 2.0: COMPETITOR RISK

2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets

2.1.1 Competitors' Locations and Overall Geographical Influence

Rationale: Competitors' locations relative to siting locations within a BDO Zone can affect the viability of procuring feedstock and the cost of that feedstock. Accurate and detailed competitor mapping provides an understanding of a competitor's geographical influence on new plants within a BDO Zone, including competitive advantages such as short hauling.

Risk Information: The total intake capacity of existing and potential competitors in the BDO Zone does not exceed 3,500 bdt/yr. Larger competitors are concentrated in Craig and have a combined demand of only 1,000 bdt/yr, mostly for wood chips.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

2.1.2 Current and Historical Consumption of Feedstock Quantity

Rationale: Clear understanding of feedstock consumption by key competitors for each rated feedstock type in the BDO Zone is essential to quantifying competitor risk.

Understanding current consumption and 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. It can enable more accurate estimates of the sensitivity of feedstock availability to potential future consumption levels or the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change).

Risk Information: Demand for low grade roundwood has been insignificant on POW Island since the closure of the Ketchikan pulp mill in the late 1990s. The majority of sawmill residues generated by the six smaller sawmills included in the supply analysis have been burned without energy recovery over the past two decades.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

2.1.3 Competitor Pricing and Price Sensitivity

Rationale: Understanding how much competitors pay (or receive) for different feedstock types is essential in determining the Issuer's competitiveness and accurately assessing the delivered cost range in the BDO Zone rating.

Current and historical prices paid/received by competitors provide insight into their procurement behaviors and exert pressure on suppliers in the BDO Zone, such as the ability/willingness to pay premiums for feedstock during times of feedstock shortage or reduce prices (or cut-off deliveries) during gluts. Competitors that have the ability to offer higher prices for feedstock during feedstock shortages can pose a significant risk to the Issuer.

Knowledge of competitor pricing and price sensitivity is also 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).

Risk Information: Low grade roundwood of preferable quality and species type can be sold as firewood at a premium of up to $250/ton ($500/bdt) during certain times of the year. However, it can also be sourced at prices as low as $30/ton ($60/bdt). Generally, there are low risks associated with competitor pricing for low grade roundwood due to the limited scale of the firewood market on POW Island (<2,000 bdt/yr). Demand for sawmill residue is restricted to the wood chip and sawdust generated by the largest sawmill. Wood chips are sold to the Craig City School District at prices of $30/ton and sawdust is used to produce bio-briquettes which are sold on the residential heating market for prices of ~$300/ton. Up to 10,000 tons of sawmill byproducts are generated by smaller sawmills, the majority of which are burned without energy recovery. Competitor pricing risk for sawmill residue is deemed low due to the limited extent of the market.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score**

The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

2.1.4 Impacts of Future Demand on Feedstock Availability and Price by Current Competitors

Rationale: Feedstock utilization in a BDO Zone can change over time. Expansion of feedstock demand by current competitors can put additional pressure on feedstock and lead to higher prices, feedstock disruptions, shortages, supplier breaches, or other types of supply chain disruption.

If current markets for feedstock have been publicly signaling the potential for increased demand for feedstock (in the case of a sawmill adding a shift or pulp mill potentially expanding into the production of renewable chemicals, for example), high interest in a supply zone 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 Issuer. If and when it occurs, increased demand on feedstock may decrease availability and increase cost for new plants within the BDO Zone.

Risk Information: There are no significant planned capacity increases by current buyers of low grade roundwood and sawmill residue. The Craig City School District plans to expand biomass district heating at one of its locations, potentially doubling biomass demand at the facility from 500 to 1,000 bdt/yr. There are no significant trends in competitor intake capacity.

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

2.1.5 Soft Supply Influence of Existing Markets

Rationale: In some cases, existing markets for feedstock may be able to exert high degrees of pressure over local suppliers, effectively enabling control of feedstock, especially during times of shortage. This control can derive from

qualitative or "soft" factors, such as long previous relationships between local suppliers and existing markets for feedstock.

Risk Information: The business relationship between the large sawmill in the region and the USFS constitutes a moderate risk to new projects. The sawmill is able to outbid most other parties for timber sales. If the mill makes investments in equipment capable of handling smaller diameter roundwood, and if the mill refuses to allow a new developer access to pulpwood, forest residue, and a portion of the sawmill residue it generates, the rated quantities may not be available. However, this scenario is unlikely. There are no other long-term business relationships that could impact feedstock availability for new projects. Firewood merchants sell <2,000 bdt/yr of low grade roundwood on the residential heating market. The large sawmill supplies <1,500 bdt/yr of chips and bio-briquettes to the heating market.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

2.1.6 Temporary Market-Driven Markets

Rationale: Alternative, non-traditional, market-driven competitors for feedstock can drive feedstock demand in unusual circumstances. A BDO Zone Rating Issuer based on 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 the price of feedstock and decreasing availability for bio-projects.[16]

Risk Information: No significant temporary, non-traditional markets for wood fiber were identified in the BDO Zone.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)*	**NN**

[16] Bergtold, 2018.

No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100. **4**

2.2 Risk Factor: Specific Competitors' Competitive Advantage

2.2.1 Relative Inventory Capacity

Rationale: The more inventory a competing biomass facility is able to store, the more competitive pressure it can exert on supply. Ability to store large inventories allows competitors to purchase inventory when the prices are low, potentially giving it an economic advantage. Additionally, the ability to store inventory during feedstock supply surpluses can enable competitors to continue to intake feedstock when the Issuer's plant (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity on the part of competing markets creates supplier loyalty and can make it more difficult for new projects to secure supply without paying a significant premium.
Risk Information: There is some risk that the larger sawmill in the BDO Zone makes use of its large inventory capacity to hoard pulpwood in the event that it controls future timber sales on the island. This is a very low probability but high impact scenario.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10. **2**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10. **8**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

2.2.2 Relative Accessibility/Delivery Hours and Wait Times

Rationale: The value attributed by suppliers to local competing markets for biomass is often directly related to the degree of flexibility the market provides in terms of delivery hours, and the more efficient discharge can occur.
Risk Information: There are no large-scale competitors for the rated quantities of feedstock and therefore low risk associated with favorable accessibility to suppliers.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch**

RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

2.2.3 Relative Specification Advantages

Rationale: When choosing a market for biomass feedstock, suppliers not only look at price, but also at relative quality requirements or specifications. It is important to understand feedstock quality specifications for competing markets within the BDO Zone, in order to accurately quantify the risk that competitors can exert on the Issuer's supply chain.

Risk Information: The firewood market prefers higher quality roundwood and markets for sawmill and forest residue are limited or non-existent.

Raw Risk Likelihood (RRL) The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **4**

2.2.4 Demand for Competitors' Products

Rationale: Increased demand for the competitor's final product can cause an increased demand for feedstock by the competitor. For example, an increased demand for wood pellets due to high energy prices in Europe or for biofuels due to a favorable clean fuels policy can cause increased pellet/biofuel production by competing markets. Thereby driving demand for feedstock within a BDO Zone.

Risk Information: Markets for the rated feedstock types are restricted to Prince of Wales Island, are relatively small, and exhibit no significant growth trend.

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching	**Notch**

RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

CATEGORY 3.0: SUPPLY CHAIN RISK

3.1 Risk Factor: Feedstock Availability

3.1.1 Biomass Availability Multiple (BAM)

Rationale: Biomass Availability Multiple (BAM) indicates the degree of redundancy in an Issuer's supply chain in relation to the rated quantity in the BDO Zone. BAM is the mean ratio of biomass feedstock available to a project in relation to delivered cost, divided by the Issuer's mean rated quantity. BAM is a strong indicator of supply chain resilience when stressed by supply shortage and/or supplier breach. BAMs of 1.5 or higher are generally signals of lower feedstock risk for new projects in BDO Zones.

Risk Information: A BAM of 1.5x was applied to the rated quantities of feedstock. This provides some assurances that the 11,500 bdt/yr of wood fiber is available to new developers at low-to-moderate risk. However, while possible, the assumption that smaller sawmills in the BDO Zone make investments in newer equipment capable of milling small diameter logs is associated with significant uncertainty. The USFS Wood Innovations Program has been used to support investments of this sort previously. Other assumptions used in the study are also associated with some level of uncertainty, including the MBF-to-ton conversion factor,[17] pulpwood production as a percentage of sawtimber production, and sawmill conversion efficiencies.

Raw Risk Likelihood (RRL) The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed very high, therefore the RRI is 10 out of 10.	**Score** **10**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 80 out of 100.	**Score** **80**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 80 out of 100.	**Score** **80**

3.1.2 Feedstock Supply Curve/Marginal Cost Curve

Rationale: The greater the feasible transport distance, the more feedstock is accessible to the Issuer, but at a higher delivered cost. The feedstock supply curve, sometimes referred to as the marginal cost curve, is a function of feedstock

[17] A conversion factor of 5 tons per MBF was selected. Typical conversion factors in the region range from 4.5 to 6 tons per MBF.

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; suppliers can become insolvent, or weather events can temporarily disrupt feedstock availability. When a disturbance occurs, the Issuer 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 further away than the core supplier.

Risk Information: There is insufficient data to construct a feedstock supply curve for wood supply from USFS timberlands at this time. Over 80% of the BDO Zone land area is occupied by the Tongass NF; USFS timber sales from conventional and unconventional forestry on POW Island could, therefore, occur anywhere within a 75-mile drive distance of Thorne Bay over the next 10 to 20 years. Alaska DOF timberland holdings on POW Island are concentrated in the central and southern parts of the island near Thorne Bay and, therefore, future timber sales are expected to be sourced within a 50-mile drive distance of Thorne Bay.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**36**

3.1.3 Seasonal Feedstock Supply Variation

Rationale: Biomass supply can present significant seasonal supply variations. Seasonal supply variations combined with limitations associated with longer-distance transportation and storage can lead to BDO Zone biomass supply imbalances[18] and can manifest in shortages and higher costs for Issuers.

Risk Information: Forest and transportation operations are often delayed during the winter months (December-March) due to freezing conditions. Mild weather conditions and freeze-thaw cycles lead to icy roads and slippery operating areas. Wood supply challenges encountered during this period are avoided by concentrating harvesting and stockpiling in the spring, summer, and fall.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**

[18] Golecha & Gan, 2016.

The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.1.4 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.

Risk Information: Timber sales from federal and state lands in recent years have varied considerably. A state forester contacted by Ecostrat noted that, while 9 MMBF/yr is a reliable average level of timber sales from DOF-managed state lands in Southeast Alaska, actual timber sales in any given year can vary between 3-12 MMBF/yr. This could lead to significant problems in maintaining a steady flow of feedstock to new bio-projects. Stockpiling of biomass feedstock during years of relatively high harvesting activity could mitigate this impact to some extent.

Raw Risk Likelihood (RRL) The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 48 out of 100.	**Score** **48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**Score** **48**

3.2 Risk Factor: Historical Issues

3.2.1 Historical Feedstock Price Variations

Rationale: If the historical feedstock price shows volatility, then the risk of future price fluctuation is elevated. If feedstock prices have historically exceeded the price at which the Issuer would have to cease operations or breach a financial covenant (i.e., the "red line" feedstock cost), then mitigation measures should be put in place.

Risk Information: Regional demand for pulpwood collapsed following the closure of the Ketchikan pulp mill in the late 1990s. A portion of the low grade roundwood produced in the region are occasionally exported to Canada and the western USA, although this practice is declining. In recent years, export markets have paid on average ~$75/ton for

pulpwood.[19] Many timber sales do not involve valorization of low grade roundwood due to inadequate quantities for marine transportation and other factors. The majority of byproducts produced by smaller sawmills on POW Island have been disposed of by way of open burning for over a decade.

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.2.2 Low Historical Demand for Feedstock in the BDO Zone

Rationale: If Issuer BDO Zone 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 in the early years. This can be particularly 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 new bio-based plants control a higher degree of feedstock processing. For example, if a BDO Zone rating is issued for clean wood chips and the historical demand in the Zone has been exclusively for pulpwood, then supply chain risk will be decreased for new bio-based plants that intake pulpwood and manage log debarking and chipping internally. Rather than requiring inexperienced suppliers to deliver debarked wood chips.

Risk Information: The Ketchikan Pulp Corporation pulp mill consumed approximately 100 MMBF of roundwood annually over its 50-year operating history. This quantity was sourced mainly from the secondary and primary forests of Prince of Wales Island. Following the closure of the pulp mill in 1997 and the eventual closure of sawmills owned by the company, demand for roundwood declined considerably. Overall, the lack of large demands for roundwood and sawmill residue over the past decades is not considered to be a significant risk to new projects due to the relatively low rated quantities.

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching	**Notch**

[19] Based on outreach.

RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.2.3 History of Production/Feedstock is a New/Secondary Crop or 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 such risk. Secondary crop or by-product producers may be less likely to prioritize production.

For new crop types, inexperience in planting, harvest, collection, and yield data may pose higher levels of risk.

If feedstock is a secondary transformation (i.e., wheat straw, corn stover, or forest residue), then production can be subject to variables beyond suppliers' control (e.g., changing demand for sawtimber, or primary crop prices).

Risk Information: The availability of the rated feedstocks is subject to continued demand for sawtimber in the BDO Zone. Our methods for estimating the rated quantity of feedstock account for the possibility that the larger sawmill in the region closes, thereby reducing sawtimber demand and subsequent generation of pulpwood, forest residue, and sawmill residue. However, uncertainties remain regarding whether an adequate level of harvesting will be maintained over time, and whether smaller sawmills make the required investments in milling equipment capable of handling small diameter roundwood. Risks are moderately increased by the inclusion of forest residue in the analysis: forest residue supply chains are undemonstrated in the region and will require considerable learning-by-doing before road- and landing-building, mobile chipping, and chip truck efficiencies are optimized.

Raw Risk Likelihood (RRL) The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed high, therefore the RRI is 8 out of 10.	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**Score** **64**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	**Score** **64**

3.3 Risk Factor: Non-Weather Based Externalities

3.3.1 Consumer Price Index (CPI) and Producer Price Index (PPI)

Rationale: CPI and PPI can impact feedstock cost of harvest and collection over time. Sensitivities to worst-case scenarios should be run.

Risk Information: During the 2021-2022 period, the Alaskan Consumer Price Index (CPI) and the national Producer Price Index (PPI) experienced significant spikes due to the COVID-19 pandemic, lockdowns, and global supply chain disruptions. However, since 2023, these inflationary trends have begun to stabilize, partly as a result of the Federal Reserve's interest rate hikes. Despite recent improvements in CPI and PPI figures, the future economic outlook remains more uncertain compared to the period before the hyperinflation of 2021-2022. Alaska is particularly vulnerable to inflation due to higher-than-average prices for food, energy, and transportation, for example, and distance from markets.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**36**

3.3.2 Currency Risk

Rationale: Where feedstock is purchased in a currency different than that which a new bio-based plant will locate in a BDO Zone, currency exchange rates and volatility can constitute risk exposure. BDO Zones that cross the US-Canada border, for example, which intake feedstock from both countries, are exposed to such currency risk.

Risk Information: Not relevant.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**NR**

3.3.3 Border Risk

Rationale: Where feedstock is transported cross-border to another country, risk exposure to border closures and crossing delays becomes present. The availability of trucks willing to do cross-border runs is limited, which can decrease supply chain flexibility and resilience. Plants near the US-Canada border, which intake feedstock from both countries, are exposed to these risks.

Risk Information: Not relevant.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**NR**

3.3.4 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, an Issuer 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 as hay replacement, driving the price of stover feedstock and decreasing its availability for bio-projects.[20]

Risk Information: No alternative, non-traditional, externality-driven competition risks were identified.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**4**

[20] Bergtold, 2018.

3.4 Risk Factor: Risks Related to Feedstock Production, Harvest, and Collection

3.4.1 Harvest & Collection Practices & Schedules

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

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

For forestry biomass, unsightly clear-cuts and slash piles (even on plantation forests and especially when located near communities) can provoke unwanted public backlash even when suitable and sustainable replanting regimes are followed.

Risk Information: Timber harvesting in the region involves a mix of ground-based shovel logging in flatter areas and cable logging in steeper terrain. Neither of these practices is likely to lead to variation in feedstock quality, and neither are differences among operators in operating tendencies. Forest residue recovery during cable logging would likely interfere with the efficiency of roundwood recovery operations and therefore was assumed to be zero in the supply analysis. In shovel logging operations, forest residue accumulates at roadside as a by-product of harvesting operations. Follow-on mobile chipping or grinding operations will produce feedstock of varying specifications depending on equipment parameters, weather conditions, and time since harvesting. No significant impacts on feedstock quantity and quality are expected due to the relatively small scale of operations.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 8 out of 100.	**8**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 8 out of 100.	**8**

3.4.2 Harvesting & Collection Equipment

Rationale: Different types of harvesting and collection equipment used by suppliers in a BDO Zone can have a significant impact on the quality and availability of feedstock. Using 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.

Risk Information: All equipment required for harvesting and collection of the rated quantities of feedstock are conventional and unlikely to lead to significant variation in feedstock quality or availability when managed and operated properly. However, it was noted during outreach that much of the equipment currently available is old and requires additional maintenance, potentially reducing the availability of feedstock during specific periods if stockpiling is inadequate. This problem is compounded by the geography of the region, which leads to long wait times for replacement of equipment and components.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100.	**24**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100.	**24**

3.4.3 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. The size of wood fiber processed in a grinder is less homogenous than if a chipper is used.

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.[21]

Risk Information: Feedstock variation is unlikely to impact new projects as long as procurement managers specify feedstock quality expectations and manage the supply chain accordingly.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**NN**

[21] Huhnke, 2018.

The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**4**

3.4.4 Availability of Labor for Feedstock Production

Rationale: Skilled labor shortages can be difficult to remedy in the short term. The availability of suitable labor in an area can impact the ability to procure sufficient feedstock quantities on required schedules. Labor risks are higher where supply chains are not yet active or for Issuers for whom large feedstock requirements or the development of new (or expanded) supply chains demand significant additions to the local labor force.

Risk Information: In 2020, the population of the Prince of Wales-Hyder Census Area was 5,753. The largest city on Prince of Wales Island is Craig, with a population of approximately 1,000. Thorne Bay has a population of approximately 500. During outreach to local experts, it was determined that it is often difficult to source logging and trucking services in the BDO Zone. The larger logging companies that currently operate on the island were not interested in sharing information during outreach and are known to operate exclusively for the larger sawmill and wood exporter in the region. Logging and log scaling professionals from out of state (e.g., Washington State) are often brought into Alaska, increasing the costs of forest operations (e.g., housing, transportation, food). There are also approximately 50 forestry workers from South America who assist in logging and silvicultural activities.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**64**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* The Alaska Forest Association offers sawmill employees, loggers, and other forestry professionals group health and pension benefits to retain and recruit workers. The Total Notch (RRL Notch) X (RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**48**

3.5 Risk Factor: Transportation

3.5.1 Feedstock Transportation Costs

Rationale: Transportation can be 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.

Transport distances of 80-120 km for biomass feedstocks are typical, but larger distances can be common. Where the average transport distance from suppliers to Issuers is high, the supply chain is subject to greater sensitivities to risks, such as increases in diesel cost, weather impacts, mechanical breakdown, and the demand for scarce feedstock from competitors closer to the source.

Understanding average transport distance can help flag higher-risk BDO Zones where transport distance materially exceeds the average.
Risk Information: As reviewed in Risk Indicator 3.1.2, there is insufficient information to infer expected average transportation distances associated with USFS timber sales over the next ten years. Transportation distances associated with the Alaska DOF timber sales are expected to average 50 miles in future years because DOF timberlands are concentrated in central and southern POW Island. Attributes of the BDO Zone that could increase feedstock transportation costs include diesel prices that are higher-than-average for the United States, road building costs,[22] and the requirement to purchase or lease an additional logging and chip truck. Given the low rated quantity, these requirements are deemed to be easily surmountable and, therefore, risk is assessed as low-to-moderate.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. — **6**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100. — **24**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100. — **24**

3.5.2 Diesel Cost Impacts

Rationale: Changes in diesel costs impact transport costs over time. Sensitivities to worst-case scenarios should be run.
Risk Information: As of September 2024, Alaska had the 18th most expensive retail diesel prices, despite the state's low population and distance to refineries.[23] Diesel prices in Alaska are lower than in many of the leading regional forest industries in the USA, including Washington, Maine, Oregon, and Pennsylvania. This can be attributed in part to Alaska's state diesel taxes, which are the lowest in the United States.[24]
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. — **6**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100. — **24**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN**

[22] One informant noted that road building can cost up to $200,000 per mile in some areas due to the need for rock blasting and related activities in steep terrain.
[23] Note that there are many more remote towns and villages in Alaska (outside the BDO Zone) where diesel prices are as much as twice the national average.
[24] State of Alaska diesel taxes are less than 15 cents per gallon, compared to an average state tax of over 30 cents per gallon (https://www.api.org/oil-and-natural-gas/consumer-information/motor-fuel-taxes).

No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100. — **24**

3.5.3 Transportation of Feedstock Requires Specialized Equipment

Rationale: Requirements for specialized transport equipment (e.g., walking-floor trailers) can increase supply chain risk. Where there is low availability of required transportation equipment, equipment owners have increased leverage over transportation prices and supply chain resiliency can be lower.

Risk Information: The rated quantity of pulpwood would require no more than two logging trucks making two trips per day and operating 175 days per year.[25] There are at least three independent logging truck operators on the island that are likely to allocate capacity for new projects. A new project developer might require direct or indirect investment in one additional logging truck to ensure timely deliveries. The rated quantity of sawmill residue and forest residue would require one or two dedicated chip trucks.[26] These would have to be purchased or leased by a new developer or associated supplier, as the current chip truck capacity on the island is unavailable for new projects. This represents a medium scale-up risk.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**36**

3.5.4 Delivery Routes through Local Communities

Rationale: Transportation of biomass can become a nuisance to local communities, especially if a large number of trucks pass through residential and school areas. Local communities often have the power to force regulations regarding truck transport, impeding the ability of BDO Zone suppliers to transport feedstock.

Risk Information: The development of significant public opposition to truck traffic is unlikely due to the low population density on POW Island and the low rated quantity.

Raw Risk Likelihood (RRL) — **Score**

[25] Assumes a payload of 10 bdt.
[26] Assumes a payload of 15 bdt.

The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**
Raw Risk Impact (RRI) The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **4**

3.5.5 Transportation Regulations & Local Weight Limits

Rationale: In many BDO Zones, transportation is regulated based on seasonal road conditions. These regulations (e.g., "frost laws") often take the form of weight restrictions or limits on the number of trucks allowed on roads. Such regulations can impede the project's ability to source sufficient feedstock or increase the cost of doing so at certain times of the year.

Risk Information: No significant transportation regulations were identified. Alaska's road weight limits specify a maximum gross vehicle weight of 80,000 lbs, or 40 tons.

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.5.6 Road Infrastructure

Rationale: Feedstock cost and availability can be a function of road infrastructure, in particular the accessibility the infrastructure provides to feedstock. Issues with road networks will translate directly to risks to feedstock supply.

Risk Information: The 1997 Tongass NF Plan had the goal of building an average of 110 miles of roads annually (Chp.2).[27] The USDA's National Roadless Conservation Rule of 2001 significantly impacted this objective, greatly reducing the

[27] 1997 Tongass Land Management Plan, Chapter 2 (https://www.fs.usda.gov/detail/tongass/landmanagement/planning/?cid=stelprdb5445359).

extent of road construction within the National Forest. Overall, the logging road network on POW Island is extensive and well-developed but requires maintenance work in many areas. Landings are often small and accommodation of mobile chippers and chip trucks would require additional road building expenses. This constitutes a relatively low aggregate impact, as pulpwood and sawmill residues can be procured without added road infrastructure expenses
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. **6**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100. **24**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100. **24**

3.5.7 Transportation Redundancy

Rationale: Transport equipment redundancy is important for dealing with seasonally variable feedstock supplies as well as the risk of equipment breakdowns.
Risk Information: There is low transportation redundancy on POW Island. There are a few logging trucks that are likely available to new project developers. There are only two chip trucks, none of which are likely to be available to new project developers. Risk is moderated by the low rated quantity of feedstock, which will require modest investments in new transportation equipment.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. **6**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100. **24**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100. **24**

3.6 Risk Factor: Supply Chain Resiliency

3.6.1 Size, Number, and Location of Suppliers

Rationale: In general, a supply portfolio involving multiple suppliers of various sizes (and from multiple BDO Zones) is important for ensuring steady and uninterrupted feedstock supply 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 greater impact on the supply chain. In such cases the risk of disruption is lower, but the impact of those disruptions is higher. Conversely, many 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 their 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.

Risk Information: Potential suppliers of the rated quantities are of small size and low number. There are six sawmills that are likely to supply a new project, all of which have lumber production capacities of <3 MMBF/yr, with the exception of one sawmill that has a capacity of 11 MMBF/yr. Actual lumber production has averaged 0.3 MMBF/yr per sawmill in recent years. There is no locational risk associated with sawmill residue supply, as all sawmills are located within 40 miles of the center point (Thorne Bay, AK). There are also likely fewer than three logging contractors capable of supplying the rated quantities of pulpwood and forest residue. Overall, risk likelihood and impact are limited by the low rated quantity, which requires only modest investment in additional supplier capacity.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100.	**24**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100.	**24**

3.6.2 Suppliers Subject to Same External Risk Factors

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 structures such that the impact of single high-risk events have varying impacts on suppliers.

Risk Information: All suppliers are subject to timber sales activity in the BDO Zone, which has been in a state of historical decline. Rated quantities are contingent on a doubling of lumber production by six small sawmills, compounding risk.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**

The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 48 out of 100.	**Score** **48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**Score** **48**

3.6.3 Land Ownership Structures

Rationale: The ownership (or control) of the land base on which feedstock is produced can have a significant impact on the Issuer's feedstock risks. Risk of long-term variation in stumpage cost for wood fiber (i.e., the cost that one pays to a landowner for the right to cut and purchase their wood fiber), for example, is much higher in the US, where >90% of the land is private, and thus stumpage cost is determined on a competitive auction basis. Conversely, in Canada, >90% of the land is owned by the Crown, and stumpage is allocated by the government.

Risk Information: Wood supply from the USFS-managed Tongass NF has declined in recent years and timber sales in future years will be restricted to young growth forest. The USFS is dedicated to increasing sustainable harvesting within the Tongass NF subject to these constraints. The rated quantities will be available to new project developers if sawmills in the region make the necessary investments to handle small diameter logs. The Alaska DOF continues to support harvesting in old-growth stands when appropriate and therefore constitutes a low risk to new projects. The growth of carbon markets does not pose a significant risk because government-owned forestlands are not eligible to participate in carbon trading and offset schemes.

Raw Risk Likelihood (RRL) The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed high, therefore the RRI is 8 out of 10.	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**Score** **64**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	**Score** **64**

3.7 Risk Factor: Climate and Natural Risks

3.7.1 Seasonal Weather Impacts on Feedstock Supply

Rationale: Seasonal weather impacts are defined as those deriving from natural weather variations (i.e., spring thaws, rainy seasons, or dry seasons – as opposed to from 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 that weather has on multiple aspects of growing, harvesting, and transporting biomass, it is difficult to predict the availability of biomass at a specific location at different points in the future with a high degree of certainty. However, it is still possible, using past data and statistical models, to generate reasonable upper/lower bound estimates of biomass production in any given year in a wider supply zone. Such estimates are important in assessing feedstock risk and enable accurate assessment of the efficacy of Issuer's mitigation methods.

Risk Information: As described in Risk Indicator 3.1.3, seasonal disruption of wood supply is restricted to the winter months when road conditions become icy. This is a low risk to new projects because harvesting is by convention concentrated during the spring, summer, and fall.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

3.7.2 Long-Term Weather and Climate Trends

Rationale: In certain BDO Zones, climatic trends and significant potential changes to future weather patterns can create feedstock risk.

Risk Information: Southeast Alaska is characterized by a mild temperate climate. Wildfires and major flooding events are uncommon. Wildfires could become more common over time but this is unlikely to affect wood supply over the lifespan of a new project. Landslides are more common than elsewhere in the coterminous United States but there is no strong link between landslides and climate change.[28] Glacial melting caused by global warming does not impact forestry in the BDO Zone.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**

[28] IPCC. 2021. Climate Change 2021: The Physical Science Basis. Chp.12, 12-20/21.

The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.7.3 Forest/Crop Fire

Rationale: Forest/crop fires, especially when occurring on a large scale, destroy feedstock and create shortages.

Fire-prone conditions are predicted to increase across Canada. This could potentially result in a doubling of the amount of area burned by the end of this century compared with amounts burned in recent decades. Boreal forests, which have been historically greatly influenced by fire, will likely be especially affected by this change.

Other climate change impacts that could add damaged or dead-wood to the forest fuel load (e.g., as a result of insect outbreaks, ice storms, or high winds) may increase the risk of fire activity. New research is aimed at refining these climate change estimates of fire activity and investigating adaptation strategies and options to deal with future fire occurrences. There is growing consensus that as wildfire activity increases, fire agency suppression efforts will be increasingly strained. However, analyses of fire history suggest that the effect of climate variability on precipitation regimes is the primary reason for the decreasing fire activity in the southern BDO Zone of Canada.

Risk Information: Southeast Alaska is characterized by a cool, wet climate. Large, stand-replacing fires are rare.[29] Some climate models project that wildfires could become more common in the region due to increasing average global temperatures but this is unlikely to impact wood supply over the lifespan of a new project.

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

[29] https://www.fs.usda.gov/database/feis/fire_regimes/AK_Pacific_maritime/all.html

3.7.4 Risk of Infestation

Rationale: Risk of future infestation, including its estimated consequences on feedstock supply, should be calculated into the overall risk profile.

Since forest insect populations are influenced by environmental conditions, future changes in climate can be expected to significantly alter the outbreak dynamics of certain forest insect species. In some cases, larger and more frequent insect outbreaks may occur, but in other cases, recurring outbreaks may be disrupted or diminished. As climate continues to change, we can expect more situations, particularly at the margins of tree ranges, where sub-optimal conditions for tree growth and reduced tree vigor can lead to outbreaks of forest insects.

Risk Information: There have been no major forest pest outbreaks in the last 50 years.

Raw Risk Likelihood (RRL) The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **4**

3.7.5 Risk of Hail

Rationale: Hail has negligible impact on forestry biomass but is one of the principal destroyers of agricultural crops in North America.

There is much uncertainty about the effects of anthropogenic climate change on the frequency and severity of extreme weather events like hailstorms and their subsequent economic losses. Some studies indicate a strong positive relationship between hailstorm activity and hailstorm damage, as predicted by minimum temperatures using simple correlations. This relationship suggests that hailstorm damage may increase in the future if global warming leads to further temperature increases.

Risk Information: Not relevant.

Raw Risk Likelihood (RRL) The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is not rated.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**Notch** **NR**
Loaded RI Score	**Score**

The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	NR

3.7.6 Risk of Flood

Rationale: Floods can cause catastrophic disruption and delay in feedstock supply. Where there is high risk of flood and thus negative impact to feedstock supply, the BDO Zone rating should account for this risk.

Risk Information: Flooding events are uncommon due to topography and proximity to the ocean.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**4**

3.7.7 Risk of Drought

Rationale: Droughts can cause significant disruptions to feedstock supplies across entire BDO Zones for extended periods of time, especially in case of agricultural residues and energy crops. Parts of Western Canada are experiencing more frequent and severe droughts, and scientists expect drought to affect new areas across Canada going forward.

Tree species are adapted to specific moisture conditions. Having less water available through drought has a range of negative impacts on the health of forest ecosystems. Direct impacts include reduced growth, increased tree mortality, and failure to regenerate. Indirect impacts include reduced ability to defend against insects and disease and increased fire risk. These impacts can affect the availability of wood fiber for an Issuer.

Risk Information: Southeast Alaska has a temperate climate with high annual precipitation.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**

Loaded RI Score	Score
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	4

3.7.8 Risk of Hurricanes, Tornadoes, and Strong Winds

Rationale: Hurricanes, tornadoes, and strong winds can destroy timber stands, crops, and feedstock piles. They can also delay forestry and agricultural operations. Hurricanes and tornadoes can indirectly cause temporary shortages of available transportation as available trucking moves to handle higher-value disaster-related contracts. For example, Katrina cleanup limited availability of live-bottom trailers in the North and South-East of the US for several months as truckers shifted operations to handle more lucrative government contracts.

Although scientists are uncertain whether climate change will lead to an increase in the number of hurricanes, warmer ocean temperatures and higher sea levels are expected to intensify their impacts.

Recent analyses conclude that the strongest hurricanes occurring in some BDO Zones, including the North Atlantic, have increased in intensity over the past two to three decades.

Risk Information: Soils in the BDO Zone are shallow, precluding the development of large tap roots. Blow down events can affect the availability of sawtimber and derivative feedstocks, particularly in early-stage forests.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	6
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	4
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100.	24
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100.	24

3.7.9 Risk of Low Temperatures

Rationale: Low temperatures can cause crop failure, leading to shortages of biomass. Additionally, low temperatures can have adverse impacts on the operations of feedstock processing equipment in Northern BDO Zones.

Risk Information: Winter temperatures in the BDO Zone seldom drop to levels likely to impact forestry equipment. The prevalence of older equipment slightly elevates risk of low temperatures.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	4
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	4
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	16
Mitigation/Notching	**Notch**

RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.8 Risk Factor: Political and Social

3.8.1 Government Subsidies for Feedstock Production or Utilization

Rationale: Feedstock that is directly subsidized through 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 subsidies only; it does not apply to government subsidies that pertain indirectly to the Issuer's operations, such as Loan Guarantees, or to the markets for products produced by the Issuer.

Risk Information: A small fraction of the rated quantity of pulpwood and forest residue is likely to come from ecological restoration operations that are subsidized under the USFS Stewardship and integrated resource service contracts (IRSCs).

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.8.2 Local, Provincial, & National Laws, Regulations, & Permitting Pertaining to Biomass

Rationale: Feedstock whose production is directly dependent on local, provincial, or national laws or 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 (e.g., 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), the likelihood of obtaining such permits and/or complying with permitting requirements should be examined.

Risk Information: The level of sawtimber production required to ensure the rated quantity of feedstock is dependent on continued government support for sawmill equipment upgrades under the USFS Wood Innovations Program and the State of Alaska's lumber grading legislation and program.[30] Any curtailment or cessation of these regulations and subsidies would reduce the likelihood of continued growth of smaller sawmills in the BDO Zone. Generally, the Alaska forest industry has a greater dependence on regulations and subsidies than is typical in North America. This can be attributed to distance from market, low population density, and the prioritization of conservation objectives within the Tongass National Forest.

Note that regulations and objectives relevant to forest management in the Tongass NF could change in future years. There are a number of organizations that support increased harvesting activity in the region, through transfers of Tongass NF land to the State of Alaska and/or through changes to regulations governing road building and USFS timber sales within the Tongass NF. Changes in regulations and objectives could significantly increase future wood supply but were not evaluated in the present rating.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very high, therefore the RRI is 10 out of 10.	**10**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 80 out of 100.	**80**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 80 out of 100.	**80**

3.8.3 Backlash Against Biomass Development, Procurement, or Usage in the Region

Rationale: Public backlash against biomass development in the Issuer BDO Zone can directly impact Issuer's ability to procure, transport, trans-load, store, or utilize feedstock by affecting local policies, regulations, and Issuer's ability to obtain necessary permitting.

Risk Information: There are a number of organizations actively opposed to logging in southeast Alaska, including the Southeast Alaska Conservation Council, Natural Resources Defense Council, Earth Justice, Green Peace, and the Sierra Club. Litigation of timber sales and proposed harvesting operations is common. For example, a planned timber sale on over 40,000 acres of old-growth and secondary forests on Prince of Wales Island was stopped in 2020 through litigation.[31]

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10.	**8**

[30] https://www.uaf.edu/ces/sustainable-resources/lumber/index.php
[31] https://earthjustice.org/case/challenging-the-massive-timber-sale-on-prince-of-wales-island-in-the-tongass-national-forest

Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**64**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	**64**

3.8.4 Consent of, and Cooperation with, Indigenous Communities and First Nations

Rationale: Where new project development on or near Indigenous or First Nation land, or where near Indigenous or First Nations exert influence over feedstock producing areas, consent of, and cooperation with, Indigenous communities and First Nations decreases Issuer risk.

Risk Information: The majority of First Nations in the region, including the Tlingit, Haida, and Tsimshian people, are shareholders in the Sealaska Corporation, a for-profit Indigenous corporation created under the Alaska Native Claims Settlement Act of 1971. There are at least 10 community for-profit Indigenous corporations on POW Island that are members of the Sealaska Corporation. Wood supply from Indigenous corporations on the island is generally unavailable due to participation in carbon markets. Indigenous corporations and communities on the island are directly involved in USFS and State timber sales, including through planning, silvicultural operations,[32] and litigation. The extent to which First Nations organizations sanction and collaborate with timber sales contract holders in the future (and by association new project developers seeking to secure pulpwood and forest residue supplies from these timber sales) will depend on the parameters of specific timber sales, project proponents' willingness to engage in discussions, and other factors.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* By working closely with Indigenous corporations and communities, new project proponents are likely to reduce impacts of possible disagreements over the extent and intensity of forest operations in the BDO Zone. The Total Notch (RRL Notch) X (RRI Notch) is 25%.	**Notch** **25%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 27 out of 100.	**27**

[32] Shaan-Seet Inc. in Craig employs 12 forestry technicians that are engaged in surveys and silvicultural operations on the Tongass NF.

3.8.5 Food Security Concerns

Rationale: Despite the fact that any significant correlation between food prices and biofuel production is unclear, claims that biofuel production has driven up food prices, taken food from communities or had a negative impact on land use can fuel public backlash. For example, the removal of biomass may raise public concerns relating to food security if Issuer feedstock requires the use of land that would otherwise be used for growing food.

Risk Information: Not relevant.

Raw Risk Likelihood (RRL) The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is not rated.	**Score** **NR**
Mitigation/Notching Click or tap here to enter text.The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**Score** **NR**

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

Rationale: Public concerns about the sustainability of feedstock production can jeopardize biomass feedstock operations. Sustainability certification schemes should be utilized where applicable to ensure that feedstock comes from sustainable sources.

Canada leads all countries with 166 million hectares of certified forests, a figure that is nearly four times more than second-place United States at 47 million hectares.

Risk Information: The rated quantities were estimated on the basis of wood supply from USFS- and Alaska DOF-managed timberlands. Both organizations practice sustained yield forestry, and the USFS banned old-growth timber sales in 2016. Under the National Environmental Protection Act (NEPA), rigorous environmental impact assessments with completion times of up to five years must be carried out before harvesting can commence in the Tongass NF.

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.9.2 Risk to Soil Quality

Rationale: Soil sustainability can be defined as the management of soil in a way that does not exert any negative or irreparable effects either on the soil itself or any other systems. There is a diversity of approaches to soil sustainability in jurisdictional guidelines for forest biomass harvesting and production. For different feedstock types, there are also different thresholds at which feedstock removal causes significant negative consequences on the soil.

Poor soil quality that negatively impacts the long-term sustainability of the feedstock can entail long-term feedstock risk. Sub-optimal soil management can leave exposed soil post residue-harvest, which can lead to soil wash-off and soil carbon loss from precipitation and wind. Over-harvesting of biomass also depletes the carbon stock in the soil and creates a negative feedback loop that can degrade the soil and its nutrients.

Risk Information: Southeast Alaska has relatively shallow soils that are prone to logging damage and natural disturbance events (e.g., landslides). However, procurement of the rated quantity of feedstock will not increase the extent of forest operations in the BDO Zone.

Raw Risk Likelihood (RRL) The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **4**

3.9.3 Risk to Surface and Groundwater

Rationale: Excessive nutrient runoff from biomass feedstock production can accumulate in surface waters and result in algal blooms and hypoxia, which can lead to habitat loss for aquatic species higher up the food chain and alter aquatic ecosystem food webs. Damage to aquatic ecosystems can cause social and regulatory backlash. Water intake issues can also increase risk.

Risk Information: Not relevant.

Raw Risk Likelihood (RRL) The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is not rated.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**Score** **NR**

3.9.4 Water Use

Rationale: Biomass feedstock operations can have significant impacts on the hydrological flux (infiltration, groundwater recharge, interception, and transpiration) of ecosystems. This can lead to water shortages, lower yields, and backlash from regulatory bodies if management plans are not properly instituted.

Risk Information: Not relevant.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**NR**

3.9.5 Pesticide Risk to Human and Ecosystem Health

Rationale: Application of pesticides (i.e., herbicides, fungicides, and insecticides) on agricultural and forest landscapes can result in adverse health effects for humans and ecosystems. If pesticide application is required in feedstock production, the impact must be considered in the BDO Zone rating.

Risk Information: Not relevant.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**NR**

3.9.6 Risk to Wildlife and Landscape

Rationale: Biomass production and supply chain operations with negative impacts on wildlife and landscape are at a greater long-term risk of encountering project setbacks and disruptions.

Risk Information: The rated quantities will not increase the extent and intensity of forest operations and therefore pose low risk to wildlife and landscape aesthetics.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**

RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **4**

3.9.7 Biomass Classified as Genetically Modified Organism (GMO)

Rationale: There are various risks associated with GMOs, such as migration or dispersion across the landscape, which can generate community backlash and create supply chain risk. GMOs can also be heavily regulated. If planning to grow or procure GMO feedstocks, especially purpose-grown energy crops, it is important to understand the risks.

Risk Information: Not relevant.

Raw Risk Likelihood (RRL) The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is not rated.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**Score** **NR**

CATEGORY 4.0: FEEDSTOCK SCALE-UP RISK

4.1 Risk Factor: Feedstock Scale-Up

4.1.1 Feedstock Quality at Production Scale

Rationale: The physical and chemical properties of feedstock used in lab, pilot and field testing can fail to be representative of feedstock generated by large-scale operations.

It is important to conduct tests on feedstock representative of that which will be produced by large-scale operations. Failure to adequately test the full range of parameter values can result in severe problems during scale-up.

Risk Information: Follow-on mobile chipping or grinding operations will produce feedstock of varying specifications depending on equipment parameters, weather conditions, and time since harvesting. Given the low rated quantity and the small number of operators likely to be involved in feedstock production, this represents a low risk.

Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)*	**Notch** **NN**

No adjustment.

RRI Mitigation (Notch)
No adjustment.

The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).

Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

4.1.2 Capacity of Supply Chain Components & Equipment to Scale

Rationale: Scale-up risk increases if supply chain components, or underlying feedstock infrastructure necessary for these components, cannot scale to handle Issuer feedstock requirements and throughput capacity. Capacity to scale should be demonstrated.

Risk Information: The rated quantities are premised on a scenario whereby smaller sawmills double lumber production over a scale up period of three-to-five years. Doubling production is a significant scale-up risk as this will require investments in milling equipment capable of handling small-diameter logs; the USFS timber sales program is expected to continue to prioritize harvesting of younger forests with lower average DBH.

Other scale-up requirements are more modest. Project proponents and/or associated suppliers will likely need to invest in at least one harvester and forwarder (for ecological restoration operations), one mobile chipping unit, one-to-two excavators equipped with grapples ("shovels"), and one-to-two chip trucks.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very high, therefore the RRI is 10 out of 10.	**10**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 80 out of 100.	**80**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) The USFS Wood Innovations Program has offered grants to sawmills in Southeast Alaska for mill equipment upgrades, and Southeast Conference plans to purchase a mobile chipping unit available for lease to third parties on POW Island. These initiatives could partially mitigate scale-up risks. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 60 out of 100.	**60**

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Industrial District

Risk Information: The 50-acre waterfront parcel is located one mile west of the City of Thorne Bay. Proximity to the city offers advantages such as access to local labor, services, and infrastructure. Open zoning provides flexibility for various industrial uses, allowing the parcel to be utilized for different types of industries without significant regulatory hurdles.

However, the remoteness of the island presents logistical challenges. Transportation of goods and materials to and from this site is more complicated and costly compared to mainland locations. In addition, water and waste management systems available on site might require upgrades to support industrial activities. For new industries, a thorough feasibility study is recommended to evaluate the specific requirements of the intended operations, the suitability of local infrastructure, and the cost implications. Addressing these factors will help determine if the site can be developed into a successful industrial location.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**36**

5.1.2 Ownership of Land

Risk Information: The 50-acre parcel is privately owned and available for immediate sale.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

5.1.3 Permitting Description

Risk Information: The island's local communities often prioritize environmental conservation, which could lead to opposition or slower permitting processes for industries seen as potentially harmful to the environment. Engaging with local stakeholders and ensuring that operations align with community values around sustainability and conservation will be critical for gaining local support.

Raw Risk Likelihood (RRL) The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

5.1.4 Environmental Issues

Risk Information: Environmental issues on Prince of Wales Island (POW) present significant challenges for new industries considering Southeast Alaska as a location. The island's history of logging within the Tongass National Forest has created strict environmental regulations. Companies in industries like bio-economy or manufacturing that require large tracts of land will need to navigate stringent guidelines aimed at protecting old-growth forests and wildlife habitats. These regulations could limit expansion opportunities and increase operational costs for industries needing land or timber resources.

Industries that rely on significant water usage may face challenges tied to the island's delicate water ecosystems. Contamination risks from runoff or industrial waste could lead to increased scrutiny and tighter environmental impact assessments, slowing down permitting processes and raising costs for wastewater treatment.

Industries will need to develop robust waste management systems to prevent pollution of the island's fragile ecosystems. This is especially important given the logistical difficulties of managing waste on a remote island. Poorly managed industrial waste or runoff could lead to fines and long-term environmental damage, further elevating operational risks.

Raw Risk Likelihood (RRL) The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**

Loaded RI Score	Score
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	36

5.2 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: The absence of natural gas pipelines on Prince of Wales Island means that both residential and commercial sectors rely on heating oil and propane for heating. For new industries considering establishing operations in Thorne Bay, this presents a significant cost barrier. Dependence on heating oil or propane will lead to higher-than-average energy costs and logistical challenges related to fuel supply and storage.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	8
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very high, therefore the RRI is 10 out of 10.	10
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 80 out of 100.	80
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 80 out of 100.	80

5.2.2 Electric Availability

Risk Information: Prince of Wales Island is not connected to a central transmission-distribution electrical grid but is instead powered by a microgrid owned by Alaska Power & Telephone Co. (AP&T). The microgrid is powered by three 2-5 MW hydroelectric stations owned by Haida Energy Inc. and Alaska Power & Telephone Co., and five 1-2.5 MW petroleum liquid power stations owned by Alaska Power & Telephone Co.[33] Small-scale geothermal and solar units also contribute to power supply.

Commercial electricity rates are significantly higher than both the state and national averages. While AP&T can negotiate a lower interruptible rate, industries considering the area should be aware of the current high cost of electricity—around 26.5 cents per kWh, with recent fluctuations possibly pushing it to 29 or 32 cents per kWh. This could impact operational costs, making energy efficiency a key consideration.

There is a single three-phase power line to the industrial site. The available capacity is unknown and could fluctuate based on hydro flow levels.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	6
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	6

[33] https://atlas.eia.gov/pages/energy-maps

Gross Risk Indicator (GRI)	Score
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	36
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	36

5.2.3 Water Availability

Risk Information: Thorne Bay's fresh water supply primarily comes from local sources, including springs and wells. The water is typically sourced from the nearby Thorne River and surrounding aquifers. The area has sufficient fresh water to meet the needs of its residents, but the supply can be subject to fluctuations, particularly during periods of drought or high demand. The water delivery system in Thorne Bay is managed by the Thorne Bay Water Utility. The system provides piped water to most residential and commercial properties within the city. However, due to the remote nature of the area, the infrastructure might not be as robust or modern as in more urban areas. Residents generally rely on the local utility for water delivery, and there are efforts to maintain and upgrade the system as needed.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	6
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	6
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	36
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	36

5.2.4 Waste Disposal

Risk Information: Given its remote location, waste management on POW poses logistical and environmental challenges. Managing waste streams and preventing pollution, particularly plastic and marine debris, is essential to protecting the island's natural landscapes and surrounding waters. The city provides refuse collection services, a regional baler, a recycling facility and landfill, and participates in annual hazardous waste disposal events.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	6
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	6

Gross Risk Indicator (GRI)	Score
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	36
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	36

5.2.5 Internet Availability

Risk Information: Internet availability is limited, with HughesNet providing satellite-based services. While satellite internet offers basic connectivity, it tends to suffer from slower speeds, higher latency, and data caps compared to fiber or cable options. Currently, no fiber is available in Thorne Bay, though a cable connection has been completed in the northern part of the island. However, this service is not yet extended to Thorne Bay. The limited internet infrastructure presents challenges for industries requiring reliable and high-speed internet, particularly in sectors like technology or logistics. Other internet service providers include AT&T, Alaska Communications Service, and Starlink.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	8
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10.	8
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	64
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	64

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: There are over 1,300 miles of paved or maintained gravel road that extend in all directions on Prince of Wales Island. There are also several hundred miles of logging roads that enable access to the managed forests of the Tongass NF. The road infrastructure allows access to the Inter-Island Ferry Authority terminal in Hollis, connecting Prince of Wales Island to Ketchikan, which is critical for moving goods and people between the island and the mainland. While Thorne Bay and the surrounding areas benefit from a functioning road network, the mix of paved and unpaved roads, coupled with harsh weather conditions, creates logistical challenges for industries. This adds some risk for industries requiring consistent, reliable transportation infrastructure.

Raw Risk Likelihood (RRL)	Score

The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

5.3.2 Rail Access

Risk Information: There is no rail transportation on Prince of Wales Island. This item is not rated.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is not rated.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**Score** **NR**

5.3.3 Airport Access

Risk Information: The reliance on floatplanes and the 45-minute commute to Ketchikan International Airport introduces additional logistical layers for industries in Thorne Bay. While the floatplane terminal in Thorne Bay is vital, the complexities of weather disruptions and limited cargo capacity remain challenges. Industries may need to explore partnerships with floatplane operators or invest in alternative transport solutions like integrating marine shipping with air transport, ensuring smoother operations for moving both people and products.

Floatplane operators like Island Air Express, Pacific Airways, and Taquan Air provide daily scheduled services between Ketchikan and Prince of Wales Island. Additionally, Island Air Express and Alaska Seaplanes connect the island to Juneau and other Panhandle cities. Thorne Bay itself hosts a passenger and freight terminal for floatplanes, which is essential for maintaining connectivity, though industries face logistical challenges due to reliance on these services.

Raw Risk Likelihood (RRL) The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed high, therefore the RRI is 8 out of 10.	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**Score** **64**

Mitigation/Notching	Notch
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	64

5.3.4 Water Freight Access

Risk Information: Marine transportation services in Southeast Alaska are well established. The Alaska Marine Highway System provide ferry services throughout the region. Nearby Ketchikan, AK is the major U.S. container port in the region, serviced by Alaska Marine Lines. Inter-Island Ferry Authority (IFA) operates daily ferry services between the island's main terminal in Hollis and Ketchikan on the mainland. Freight is typically moved via ferries, which can handle vehicles, goods, and equipment. Commercial barging services from Ketchikan to Thorne Bay are provided by Samson Tug & Barge.

Freight can also be flown in and out of Thorne Bay via floatplanes, which are essential for moving smaller or time-sensitive shipments. Services like Island Air Express and Taquan Air connect Thorne Bay to Ketchikan and other Southeast Alaska destinations. While floatplanes offer flexibility and quicker delivery times than ferries, they are not well-suited for large-scale freight. This limits the volume of goods that can be shipped, adding logistical complexity for industries that need to move heavy equipment or bulk materials.

Marine transportation capacity improvements in the form of new and improved vessels and shipping-receiving infrastructure are required. A major container terminal/port with rail access in Prince Rupert, BC previously served as an important destination for goods produced on the island. However, a faulty ramp at the port has functioned to cease shipments. An expected date for ramp repair has not been agreed upon by U.S. and Canadian authorities. It was also noted during outreach that there are often long wait times associated with barges due to high demand and long travel times.

In summary, while Thorne Bay's water freight access via ferries and floatplanes supports local and small-scale operations, it poses logistical challenges for larger or supply-chain-intensive industries. Companies must carefully consider the higher transportation costs, capacity limits, and potential disruptions when planning operations in this remote region.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	6
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	6
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	36
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)*	NN

No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100. — **36**

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: The limited healthcare availability in Thorne Bay, with the local health center only open on Fridays and emergency services relying on volunteer staffing, poses a significant risk for industries considering setting up operations there. With primary healthcare requiring a 45-minute floatplane ride to Ketchikan, this situation could deter potential employees, particularly those with ongoing medical needs or families requiring consistent access to healthcare services.

Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10. — **8**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10. — **8**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 64 out of 100. — **64**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100. — **64**

5.4.2 Education (Schools)

Risk Information: Thorne Bay School, with its small enrollment and favorable student-teacher ratio, offers a more personalized education experience. However, the lack of post-secondary education options on Prince of Wales Island means that families and individuals seeking higher education or vocational training will need to relocate to Ketchikan or Juneau, increasing the difficulty of attracting workers with such needs. This gap may be a concern for employees with school-age children or those looking to further their own education while working.

Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. — **6**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10. — **6**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100. — **36**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN** No adjustment. *RRI Mitigation (Notch)*

No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

5.4.3 Local Transportation

Risk Information: Thorne Bay offers a local on-call bus service that provides transportation to key locations, including the ferry terminal at Hollis. This service is useful for residents and employees who may not have personal vehicles, allowing them to access ferry connections to Ketchikan and other nearby towns.

Local transportation options in Thorne Bay are functional but limited, impacting new employee mobility, especially for those without personal vehicles. The limited public transportation and reliance on personal vehicles, car rentals, or ATVs may pose challenges for employees without access to their own transportation, particularly if they are commuting from other parts of the island. Industries considering the area should consider the challenges posed by the limited public transport infrastructure and plan accordingly for employee commuting needs.

Raw Risk Likelihood (RRL) The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

5.4.4 Public Safety (Local)

Risk Information: Thorne Bay, AK, like many rural areas, has some unique challenges when it comes to law enforcement and public safety. While the crime rate may be higher compared to other areas in Alaska, the lack of a robust, local law enforcement presence adds complexity to the situation. Thorne Bay has a higher-than-average crime rate compared to other areas in Alaska. The rural, isolated nature of the community may contribute to this, as smaller communities often face challenges in managing crime, particularly with limited law enforcement resources.

Thorne Bay does not have a local, dedicated police department. Instead, law enforcement services are provided by the Alaska State Troopers, who are responsible for covering vast areas of rural Alaska. This means response times can be slow, especially in emergencies.

While Thorne Bay is not an inherently unsafe place, the higher-than-average crime rate and limited law enforcement coverage pose safety concerns that should be taken into account by those considering moving or starting businesses in the area.

Raw Risk Likelihood (RRL) The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 48 out of 100.	**Score** **48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**Score** **48**

5.4.5 Housing/Cost of Living

Risk Information: Housing costs in Thorne Bay are generally lower than in Alaska's larger cities. The cost of purchasing a home or renting a property is relatively affordable compared to other parts of Southeast Alaska, making it an attractive option for those looking for more budget-friendly living arrangements. Rental options in Thorne Bay are more limited, but when available, they tend to be relatively inexpensive. Monthly rents for homes or cabins typically range from $700 to $1,200, depending on the property size and amenities. Due to the small population and remote location, there are fewer homes on the market at any given time compared to more populated areas. This limited inventory can make it challenging for newcomers or employees of new industries to find housing quickly.

New industries may need to consider the availability of housing for incoming workers, as the limited housing market could pose challenges for employee relocation. Companies may need to assist with housing or offer incentives to attract workers to the area.

The cost of living in Thorne Bay, AK, involves a mix of lower housing costs but higher expenses for utilities, transportation and goods. This reflects its remote and rural setting, contributing to a generally higher cost of living compared to other areas in the State.

Raw Risk Likelihood (RRL) The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**

Loaded RI Score	Score
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	36

5.5 Risk Factor: Labor

5.5.1 Workforce

Risk Information: In 2020, the population of the Prince of Wales-Hyder Census Area was 5,753.[34] The largest city on Prince of Wales Island is Craig, with a population of approximately 1,000. Thorne Bay has a population of approximately 500. The local workforce in Thorne Bay, AK, primarily consists of residents who are engaged in various local industries such as logging, fishing, and small-scale services. For industries requiring specialized skills or advanced training, finding qualified local candidates can be challenging. The limited educational and training opportunities in the area contribute to this issue. Attracting skilled workers from outside the region can be difficult due to the remote location and limited amenities. Prospective employees may be deterred by the high cost of living and lack of access to advanced educational and healthcare facilities. Companies looking to operate in Thorne Bay may need to provide additional support and incentives to attract and retain qualified employees.

Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	8
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10.	8
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	64
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	64

5.5.2 Labor Costs

Risk Information: Labor costs can be significantly impacted by the remote location and relatively small population on Prince of Wales Island. As of 2024, the minimum wage in Alaska is $15.00 per hour. This rate is consistent across the state, including Thorne Bay. It is higher than the federal minimum wage of $7.25 per hour. Average salaries for construction and skilled trades range from $40,000 to $60,000.

Labor costs can be higher for specialized positions due to the need to attract workers from outside the area, which also impacts overall salary levels. Additionally, remote locations often face higher wages for roles due to the cost-of-living adjustments and the need to compensate for the isolation. The combination of higher minimum wages and potentially higher average salaries reflects the challenges of living and working in remote areas like Thorne Bay.

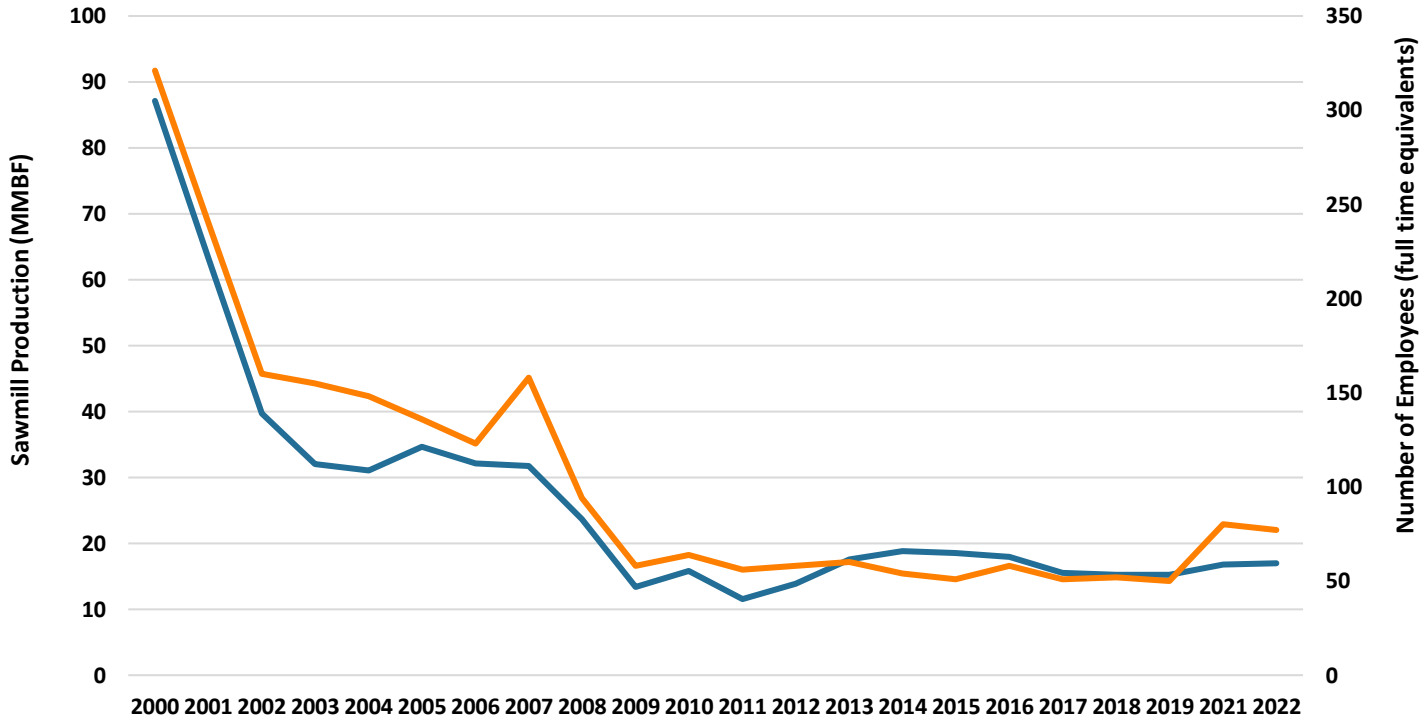
Raw Risk Likelihood (RRL)	Score
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	6
Raw Risk Impact (RRI)	**Score**

[34] https://live.laborstats.alaska.gov/cen/2020-census-data.html

The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

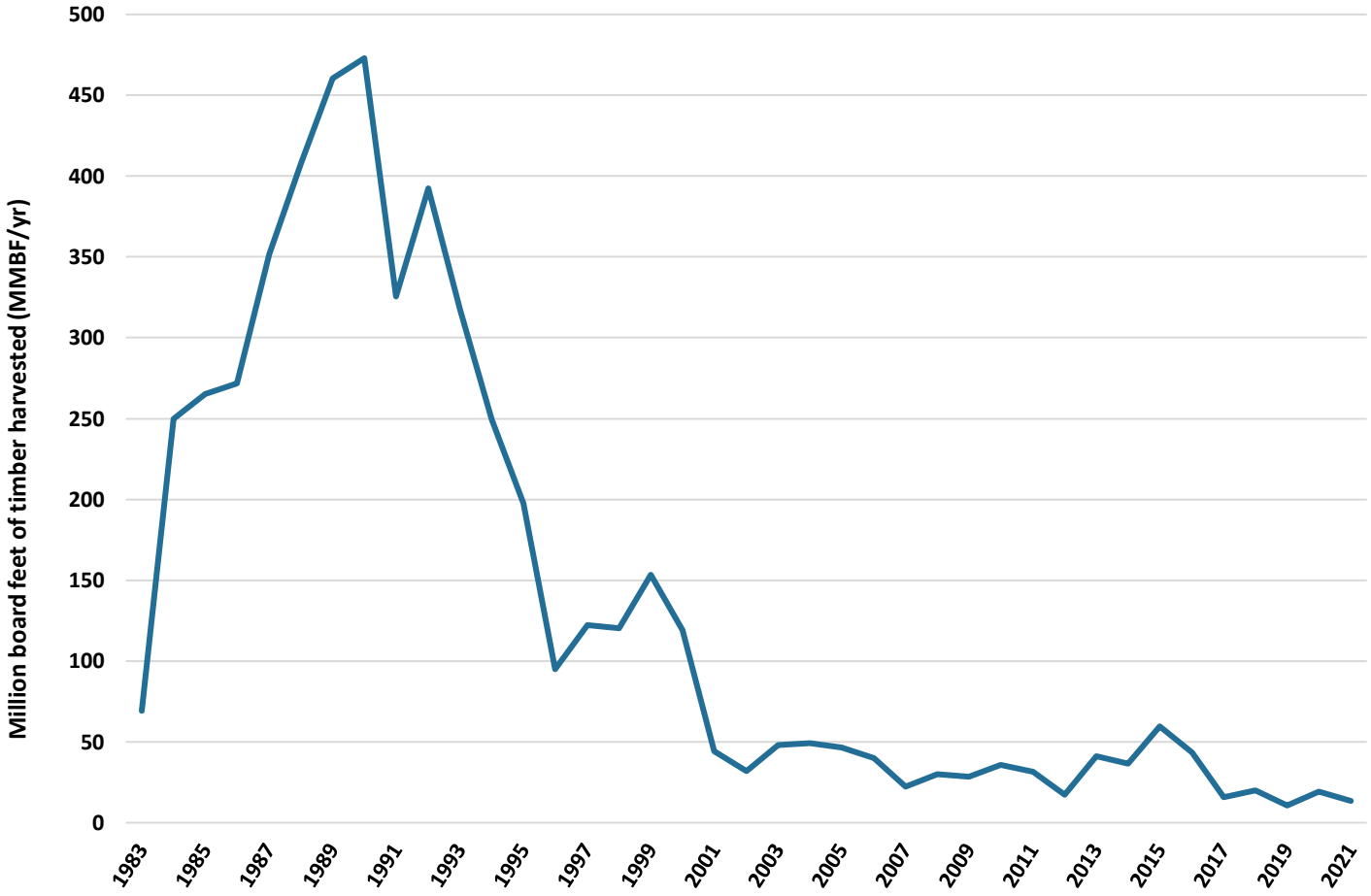
SECTION E: TABLES, FIGURES, AND MAPS

Figure E-1. Trend in Sawmill Production and Workforce, 2000-2022[35]



[35] USDA Forest Service. September 2023. Tongass National Forest: 2022 Sawmill Capacity and Production Report. Prepared by Daniels, J., Morris, P., and O'Leary, D. USDA Forest Service, Alaska Region (Region 10). 14 pp.

Figure E-2. Annual timber harvest in the Tongass National Forest, 1983-2021[36]



[36] "Cut History 1908-Present" (https://www.fs.usda.gov/detail/r10/landmanagement/resourcemanagement/?cid=fsbdev2_038785)

Map E-1. Prince of Wales Island in Southeast Alaska



Figure E-3. Primary transportation modes to and from Thorne Bay, AK



Map E-2. Primary road network on Prince of Wales Island

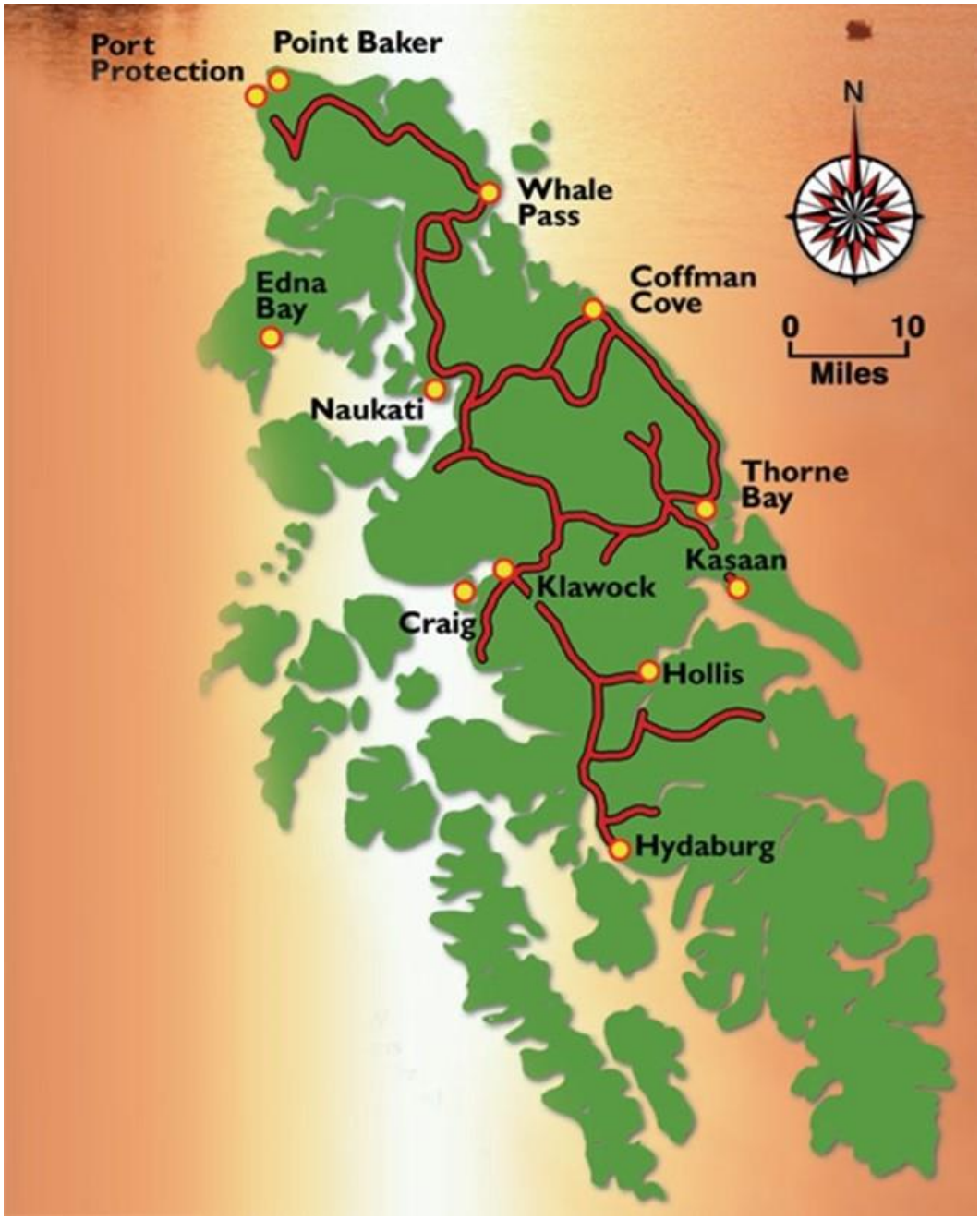


Figure E-4. Location of selected industrial site



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