Bioeconomy Development Opportunity Zone Risk Rating

'AA'

The Lewis County, WA BDO Zone for woody biomass is rated 'AA.' Quantities of wood fiber required for large-scale bio-projects are available at low risk due in part to the advanced quality and capacity of supply chain equipment and personnel.

Rating Parameters:

Category	Rated Quantity	Delivered Price	BDO Zone Size
Pulpwood	200,000 bdt/yr	$70-$90/bdt	75-mile drive distance from Centralia, WA
Forest Residue	100,000 bdt/yr	$80-$100/bdt	
Sawmill Residuals	300,000 bdt/yr	$25-$100/bdt	

BDO Zone Assets

- **600,000 bdt/yr available at low risk**
- **At least ten companies with dedicated pulpwood chipping capacity**
- **A leading regional forest industry in North America, with sustainability guarantees and stable lumber markets**
- **Considerable forest residue supply chain experience and capability**
- **Industrial infrastructure compatable with large-scale bio-projects**

BDO Zone Liabilities

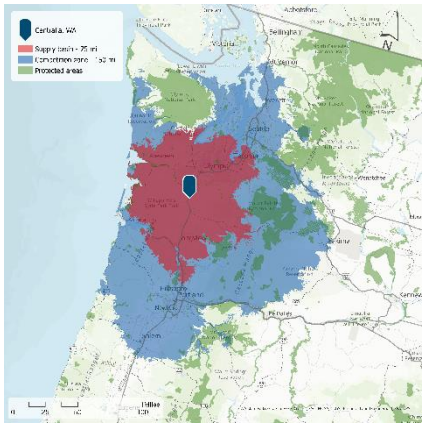
- **Transportation costs on the US west coast are the highest in the country and can impose limitations on feedstock availability**
- **Despite historical decline in the pulp and paper industry, five pulp mills remain operational within the competition zone**

BDO Zone Risk Rating

The Lewis County, WA, Bioeconomy Development Opportunity Zone is rated 'AA,' or very high quality.

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

Lewis County, WA, BDO Zone



Scoring & Rating Methodology

In assessing the biomass supply chain risk for the Bioeconomy Development Opportunity (BDO) Zone, 72 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 (USD) dollars. Maximum transport distance is based on a 75-mile driving distance from the center point (Centralia, WA).

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).

Next, 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.

Then, the **Gross Risk Indicator (GRI)** score is calculated as the product of the RRL and the RRI

scores. For example, if the 'Competitor Price and Price Sensitivity' is scored at a RRL of 2 and a RRI of 9, then the GRI for this risk indicator is $2 \times 9 = 18$.

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

Finally, the **Loaded RI** score for each Risk Indicator is calculated as the product of the Total Notch and the GRI score, which is the final score for that indicator.

Loaded RI scores of 20 or less are deemed *very low risk*; scores between 21 and 40 are deemed *low risk*; scores between 41 and 60 are deemed *medium risk*; scores between 61 and 80 are deemed *high risk*; and scores of 81 and greater are deemed *very high risk*.

The total risk rating for the BDO Zone is the average of all Loaded RI scores. The BDO Zone score for Lewis County, WA, is ***12.06 out of 100, resulting in an 'AA' designation***.

All scoring and rationale for each Risk Indicator are provided in Appendix B.

Analyst Notes

The Lewis County, WA BDO Zone encompasses an 8,177 square mile area in western Washington State, defined by a 75-mile drive distance from Centralia. The regional wood products industry is one of the largest in the country, producing over 1 billion board feet/year (8 million tons/year) and providing direct employment to over 10,000 and indirect employment to over 20,000.

The regional industry is supplied primarily by privately owned timberlands, approximately 2 million acres of which are located within the BDO Zone. Forests are comprised mainly of Douglas fir. Stands of spruce and hemlock are present in the coastal area in the western portion of the BDO Zone. Douglas fir forests transition into mixed softwood forests further east towards the Cascade Range.

The forests in the region are some of the most intensively managed in North America. As sawmills have become increasingly efficient (e.g., reductions in minimum acceptable log diameter) and tree planting has become more common, harvesting frequency has increased. On industrial forestlands – which account for approx. 50% of annual wood supply in the region – the typical rotation age (i.e., time elapsed between harvests) is 35 to 45 years. Rotation ages are more variable on smaller private woodlots (e.g., up to 100 years).

Although the majority of harvesting activity involves clearcutting, regulations specify maximum clearcut sizes, large buffer zones around ecologically sensitive areas, and strict reforestation requirements. Regulatory development is on-going, providing a balance between ecological and economic objectives.

We estimate that new projects seeking to utilize woody biomass for the production of energy, fuels, chemicals, or other bio-products would have access to 600,000 bdt/yr (1.2 million tons/yr) of wood fiber in the form of pulpwood, forest residue, and sawmill residuals. Pulpwood is currently underutilized in the region owing to the continued decline of the North American pulp and paper industry. There are presently five pulp and paper mills operating within the zone, but many run at partial capacity.

Current practice in many logging operations is to process recovered tree-lengths to a 4-inch top diameter, discarding material <4 inches in diameter that was previously utilized by the pulp and paper industry. Defective larger diameter roundwood that was previously utilized is also left at roadside. A total of 200,000 bdt/yr is forecast to be available for new projects over the next 20-30 years at low risk.

Slash that remains at roadside following product separation is also expected to be available to new projects with minimal additional investments in personnel and equipment. At least 15 mobile comminution units are already present in the BDO Zone, and operators in the region are familiar with the unique logistical issues associated with residue recovery. The presence of a new

bio-project in the area capable of paying $80-$100/bdt would have access to at least 100,000 bdt/yr of forest residue annually. Note that procuring this quantity would not require any additional harvesting and collection expenses.

Additional wood fiber is available from the 17 sawmills in the BDO Zone, which generate a combined ~2 million bdt/yr of chips, bark, sawdust, and shavings annually. Although sawdust is unlikely to be available due to expected wood pellet capacity expansion, outreach has determined that wood fiber (chips and shavings) and bark are available. A new project would be able to secure a fraction of this supply (300,000 bdt/yr, <15% of total production) for the rated price range of $25-$50/bdt for sawdust and bark, and $90-$100/bdt for wood chips.

BDO Zone Assets

The BDO Zone is located within one of the largest regional forest industries in the country. Seventeen sawmills with a combined capacity of 2.8 billion board feet per year and an estimated 100-150 logging sides (crews) operate within the BDO Zone. Over the past five years, average annual production of roundwood within the Zone has been approx. 1.1 billion board feet/yr (8 million tons/yr). Capital, product, and feedstock markets are highly responsive to changes in demand, providing scale-up assurances to prospective developers.

The regional forestry work force is trained and experienced in the production of the rated quantities of feedstock, including forest residue. Consolidation has occurred in most segments of the supply chain, including logging and transportation. Many of the businesses positioned to contribute to new bio-projects are large and profitable. Smaller companies also make important contributions to regional wood supply.

Pulpwood and forest residue accumulate at roadside/on landings during conventional forestry operations. Trees are felled, yarded to roadside/landing with most branches and tops intact, and subsequently processed and piled during sawlog production. While supply chains for pulp logs are standard to all regional forest industries, the historic scale of pulpwood production in western Washington State is matched only in a few other North American jurisdictions. Forest residue supply chain experience in the region is also a unique comparative advantage.

Workforce experience and skill is complemented by the existing regional supply chain equipment capacity. With few exceptions, operations are fully mechanized and involve a wide variety of equipment types depending on slope, yarding distance, and other factors. A significant proportion of the available equipment is owned by large, consolidated companies, including logging contractors with more than ten sides and multinational forest product companies. There are also over 15 comminution units (mobile chippers and grinders) available in the region for processing forest residue.

BDO Zone Liabilities

The most significant risks to new bio-projects are related to feedstock transportation. Inflation-adjusted diesel fuel prices on the west coast of the United States have been trending upwards since the early 2000s. In recent years, prices have reached as high as $6.00/gallon in Washington State (surpassed only by the State of California). Further risk to the transportation phase of the supply chain is imposed by the increasing cost of capital, occasional driver shortages, and the distances over which biomass will likely have to be transported to support new bio-projects in the Centralia area. The risk to new projects is moderated by the fact that all businesses – including competitors – must operate in similar conditions.

Sawmills in the region have continuously improved utilization standards, decreasing minimum acceptable small-end log diameters from 8 inches in the 1990s to 4-5 inches presently. There is at least one sawmill located in Oregon capable of milling logs with small-end diameters as small as 3 inches. Due to the potential further reduction of minimum diameter limit standards among the region's sawmills, there is risk that the rated

quantity of pulpwood will not be available at the price range of $70 to $90/bdt.

It is also possible that the total amount of timberland available for harvesting will decline over the next 10 to 20 years. Although harvesting levels have been stable since 2013 (2.4-3.2 billion board feet/yr), discussions around increased conservation and stricter regulations continue under the 1999 Forest & Fish Law, developed to ensure compliance with the federal Endangered Species Act and Clean Water Act while maintaining the economic viability of the Washington timber industry. While this is unlikely to affect the rated quantities and provides sustainability assurances for producers and consumers (particularly under SFI-certification, which is common in the state), these developments are noteworthy.

Infrastructure Profile

Infrastructure risk was assessed with reference to a 400-acre project site owned by the Industrial Park at TransAlta (IPAT). The site has zoning for industrial, manufacturing, and commercial use. Location advantages include proximity to major highways, railways, ports, airports, and markets. Although direct access to many essential utilities is not currently available, nearby industrial connections are present. Access to these connections is expected to be eased with the assistance of IPAT, Lewis County, and other local and state organizations. Moderate risks associated with housing and general labor availability are not significant barriers to bio-project development and success.

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Figure 1: Risk Indicators (Sorted by Risk Level)

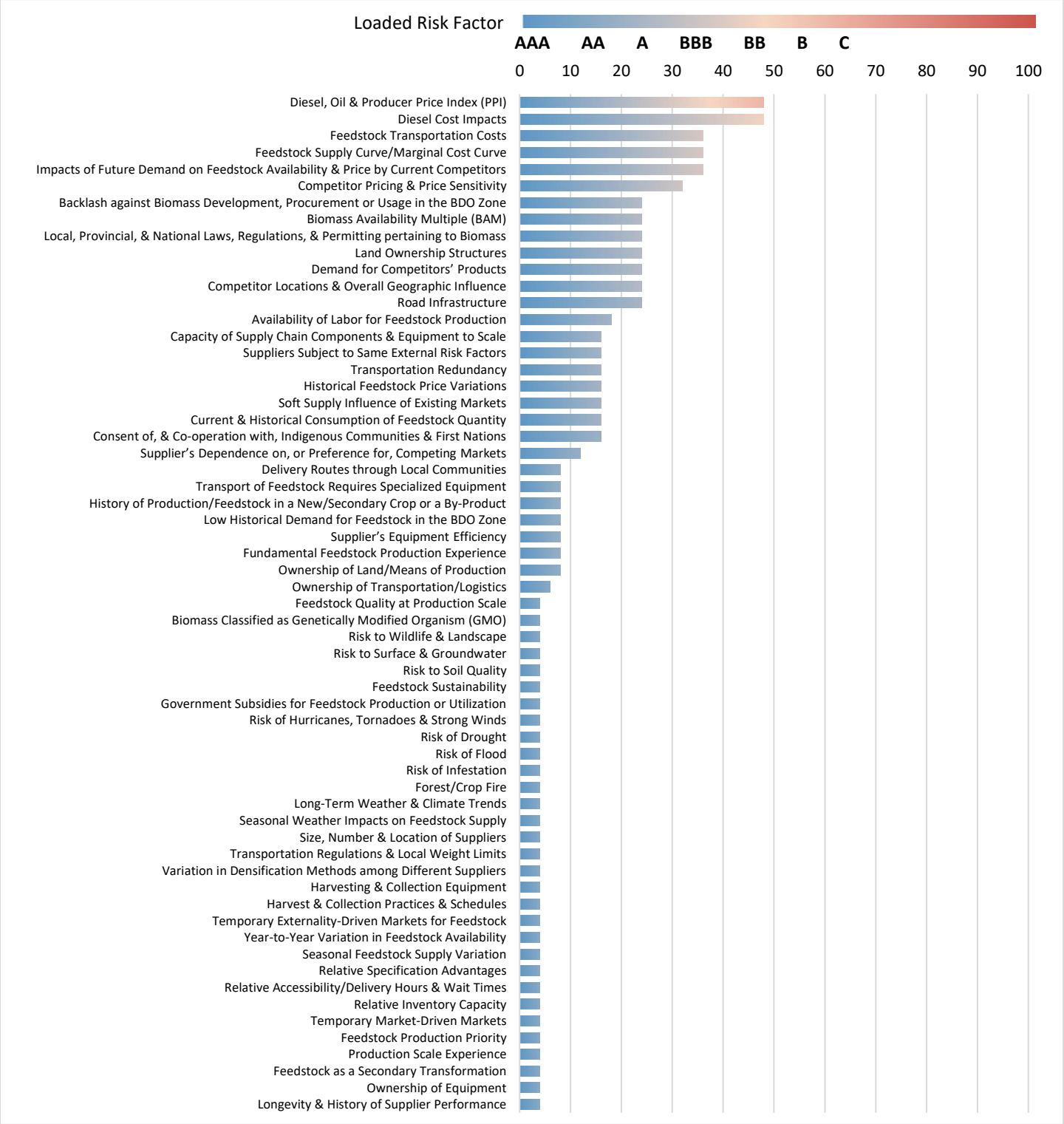


Table 1: Risk Indicators and Associated Scores

	Feedstock Supply Chain Risk Indicators	Raw Risk Likelihood	Raw Risk Impact	Gross Risk Indicator	Mitigation /Notching	Loaded RI Score
	Category 1.0: Supplier Risk					
1.1.1	Longevity & History of Supplier Performance	2	2	4	N/A	4
1.2.1	Supplier's Dependence on, or Preference for, Competing Markets	2	6	12	N/A	12
1.3.1	Ownership of Land / Means of Production	4	2	8	N/A	8
1.3.2	Ownership of Equipment	2	2	4	N/A	4
1.3.3	Ownership of Transportation/Logistics	4	2	8	25%	6
1.3.4	Feedstock as a Secondary Transformation	2	2	4	N/A	4
1.4.1	Fundamental Feedstock Production Experience	2	4	8	N/A	8
1.4.2	Production Scale Experience	2	2	4	N/A	4
1.5.1	Supplier's Equipment Efficiency	2	4	8	N/A	8
1.6.1	Feedstock Production Priority	2	2	4	N/A	4
	Category 2.0: Competitor Risk					
2.1.1	Competitor Locations and Overall Geographic Influence	4	6	24	N/A	24
2.1.2	Current and Historical Consumption of Feedstock Quantity	4	4	16	N/A	16
2.1.3	Competitor Pricing and Price Sensitivity	4	8	32	N/A	32
2.1.4	Impacts of Future Demand on Feedstock Availability and Price by Current Competitors	6	8	48	25%	36
2.1.5	Soft Supply Influence of Existing Markets	4	4	16	N/A	16
2.1.6	Temporary Market-Driven Markets	2	2	4	N/A	4
2.2.1	Relative Inventory Capacity	2	2	4	N/A	4
2.2.2	Relative Accessibility / Delivery Hours and Wait Times	2	2	4	N/A	4
2.2.3	Relative Specification Advantages	2	2	4	N/A	4
2.2.4	Demand for Competitors' Products	4	8	32	25%	24
	Category 3.0: Supply Chain Risk					
3.1.1	Biomass Availability Multiple (BAM)	4	6	24	N/A	24
3.1.2	Feedstock Supply Curve / Marginal Cost Curve	6	6	36	N/A	36
3.1.3	Seasonal Feedstock Supply Variation	2	2	4	N/A	4
3.1.4	Year-to-Year Variation in Feedstock Availability	2	2	4	N/A	4
3.2.1	Historical Feedstock Price Variations	4	4	16	N/A	16
3.2.2	Low Historical Demand for Feedstock in the BDO Zone	4	2	8	N/A	8
3.2.3	History of Production/Feedstock in a New/Secondary Crop or a By-Product	2	4	8	N/A	8
3.3.1	Diesel, Oil and Producer Price Index (PPI)	6	8	48	N/A	48
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	N/A	4
3.4.1	Harvest and Collection Practices and Schedules	2	2	4	N/A	4
3.4.2	Harvesting and Collection Equipment	2	2	4	N/A	4
3.4.3	Variation in Densification Methods among Different Suppliers	2	2	4	N/A	4
3.4.4	Availability of Labor for Feedstock Production	4	6	24	25%	18
3.5.1	Feedstock Transportation Costs	6	6	36	N/A	36
3.5.2	Diesel Cost Impacts	8	8	48	N/A	48
3.5.3	Transport of Feedstock Requires Specialized Equipment	2	4	8	N/A	8
3.5.4	Delivery Routes through Local Communities	2	4	8	N/A	8
3.5.5	Transportation Regulations and Local Weight Limits	2	2	4	N/A	4
3.5.6	Road Infrastructure	4	6	24	N/A	24
3.5.7	Transportation Redundancy	4	4	16	N/A	16
3.6.1	Size, Number and Location of Suppliers	2	2	4	N/A	4
3.6.2	Suppliers Subject to Same External Risk Factors	4	4	16	N/A	16
3.6.3	Land Ownership Structures	6	4	24	N/A	24
3.7.1	Seasonal Weather Impacts on Feedstock Supply	2	2	4	N/A	4
3.7.2	Long-Term Weather and Climate Trends	2	2	4	N/A	4
3.7.3	Forest / Crop Fire	2	2	4	N/A	4
3.7.4	Risk of Infestation	2	2	4	N/A	4
3.7.5	Risk of Hail	NR	NR	NR	NR	NR
3.7.6	Risk of Flood	2	2	4	N/A	4
3.7.7	Risk of Drought	2	2	4	N/A	4
3.7.8	Risk of Hurricanes, Tornadoes and Strong Winds	2	2	4	N/A	4
3.7.9	Risk of Low Temperatures	2	2	4	N/A	4
3.8.1	Government Subsidies for Feedstock Production or Utilization	2	2	4	N/A	4
3.8.2	Local, Provincial, and National Laws, Regulations, and Permitting pertaining to Biomass	6	4	24	N/A	24
3.8.3	Backlash against Biomass Development, Procurement or Usage in the BDO Zone	6	4	24	N/A	24
3.8.4	Consent of, and Co-operation with, Indigenous Communities and First Nations	4	4	16	N/A	16

3.8.5	Food Security Concerns	NR	NR	NR	NR	NR
3.9.1	Feedstock Sustainability	2	2	4	N/A	4
3.9.2	Risk to Soil Quality	2	2	4	N/A	4
3.9.3	Risk to Surface and Groundwater	2	2	4	N/A	4
3.9.4	Water Use	NR	NR	NR	NR	NR
3.9.5	Pesticide Risk to Human and Ecosystem Health	NR	NR	NR	N/A	NR
3.9.6	Risk to Wildlife and Landscape	2	2	4	N/A	4
3.9.7	Biomass Classified as Genetically Modified Organism (GMO)	2	2	4	N/A	4
	Category 4.0: Feedstock Scale-up Risk					
4.1.1	Feedstock Quality at Production Scale	2	2	4	N/A	4
4.1.2	Capacity of Supply Chain Components and Equipment to Scale	4	4	16	N/A	16
	Category 5.0: Infrastructure					
5.1	Physical Infrastructure	3.8	3.6	17.2	N/A	17.2
5.2	Logistics	3.5	3	13	N/A	13.0
5.3	Social Infrastructure	4.0	3.4	14.9	N/A	14.9
5.4	Workforce and Permitting	4.0	3.5	15.0	N/A	15.0
					Average	**12.06**



Lewis County, WA, BDO Zone Independent Review Committee (IRC)

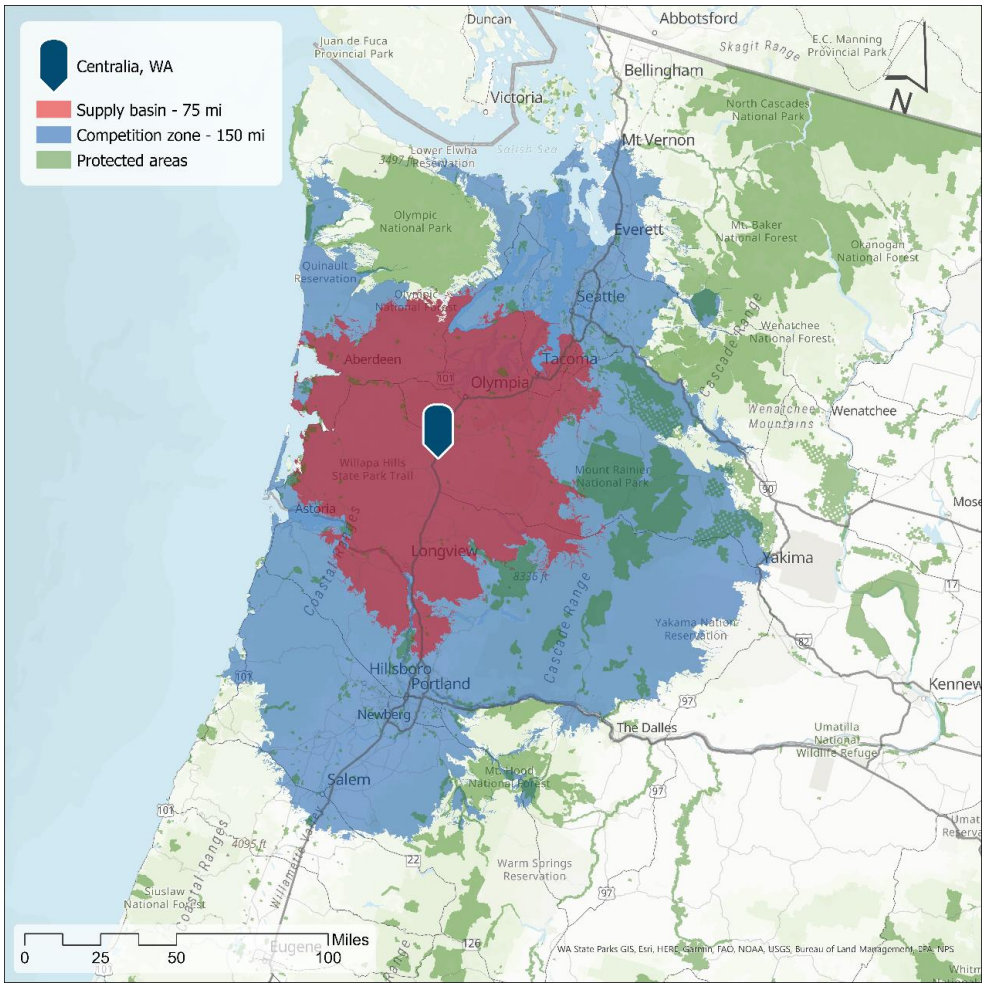
Larry McGee – Executive (retired), Renewables Task Force
Scott Brummer – Commissioner, Lewis County Commissioner District 3
Jason Spadaro – Executive Director, Washington Forest Protection Association
Court Stanley – Owner, Heartwood Consulting
Luke Moerke – President, The Alliance of Lewis County
Dick Hopkins – Partner and Forester, Hopkins Forestry
Jake Fay – SW WA Regional Director, Northwest Agriculture Business Center
Ed Orcutt – 20th District, Washington State Representative
Luke Rogers – Research Scientist, University of Washington
Elaine Oneil – Executive Director, Washington Farm Forestry Association
Steve Barnowe-Meyer – Forester (retired), Lewis County
Matt Comisky – Washington State Manager, American Forest Resource Council
Buddy Rose – Forester (retired), Devaul Publishing
Doug Cooper – Vice President of Resources, Hampton Lumber

APPENDIX A: BIOMASS AVAILABILITY AND PRICING

OVERVIEW

BDO Zone Risk Indicators are scored with reference to specific feedstock quantities and prices. The rated feedstock quantities are determined by estimating the total potential amount of woody biomass that can be produced within the BDO Zone (75-mile drive distance from Centralia). This estimate of total potential is then reduced based on expected demand for woody biomass and by applying the Biomass Availability Multiple (BAM), which reduces the amount available based on informed assumptions of supply chain constraints (e.g., operational, accessibility, and market constraints). The final rated feedstock quantities are conservative, low risk estimates of availability for new projects. The price range associated with each rated quantity is determined through outreach and market analysis in the wider competition zone (150-mile drive distance from Centralia) and reflects the anticipated price that a new bio-project would have to pay to secure the rated quantity of biomass. The BDO Zone/supply basin and competition zone are shown on Map A-1.

Map A-1: Lewis County BDO Zone and competition zone with Centralia as center point



Note on units: all quantity units are standardized to bone dry tons per year (bdt/yr) and can be converted to green tons using a moisture content assumption of 50%. All price units are standardized to 2023 USD per bdt ($/bdt) and can be

expressed either as freight-on-board (FOB) at the location of feedstock production (not including the costs of transporting the feedstock to a new bio-project) or as delivered (including the costs of transporting the feedstock to a new bio-project).

Note on terminology: The BDO Zone is also referred to as the supply basin.

Woody Biomass Types in the Supply Basin

The Lewis County BDO Zone was evaluated with reference to specific quantities and prices of three woody biomass feedstock types: pulpwood, forest residue, and sawmill residuals.

Most sawmills in the BDO Zone are capable of milling roundwood with a small-end diameter as low as 5 inches.[1] To avoid competition with the value-added lumber industry, proponents seeking to procure roundwood (i.e., logs) will therefore be restricted to logs with a large-end diameter less than 5 inches, as well as larger diameter roundwood that is of a species or form incapable of being utilized by sawmills (i.e., with less than 12 recoverable board feet per log).[2] In the report, this material is referred to as "pulpwood" or "chipwood." There is sufficient pulpwood/chipwood availability in the area for new projects, despite the continued demands of the declining pulp and paper industry and a few sawmills in the region capable of utilizing roundwood with small-end diameters as low as 3 inches. Importantly, pulpwood as defined above is capable of being produced without any additional investment in terms of manpower or equipment. Pulp logs can be produced at roadside during sawlog production and loaded onto trucks. This provides cost advantages relative to forest residue, which generally must be comminuted (i.e., chipped or ground) before transport.

Forest residues are defined as components of trees that cannot be sectioned into logs (i.e., sawlogs or pulp logs), including material with a large-end diameter <1 inch as well as material that is too short or crooked to be efficiently loaded onto logging trucks. Examples include branches, stem tops, stem bottoms, and portions of merchantable stems that break during forest operations. To recover forest residue to market, mobile chippers/grinders must be used to comminute before transportation. Alternatively, bin trucks can be used to transport loose residue to satellite yards or final destination for comminution. Note that the rated quantity of forest residue represents material that accumulates on landings as a by-product of conventional forest operations; no additional harvest and collection costs would need to be incurred.

Sawmill residuals are the byproducts of sawmill operations, produced from conversion of sawlogs into finished wood products such as lumber and engineered wood. In Washington State, a typical softwood lumber mill converts about 60% of sawlogs into finished wood products. The remaining portion (40%) of sawn timber is transformed during milling into sawmill residuals, including wood chips, sawdust, shavings, and bark (also known as hog fuel).

Woody Biomass Availability in the Supply Basin

Pulpwood

The total potential amount of pulpwood that could be produced annually within the BDO Zone was estimated using county-level sawlog harvesting statistics, a pulpwood-to-sawlog production ratio of 1-to-5, and through outreach to local experts. Department of Revenue harvesting data for individual counties over the period 2018-2022 was adjusted for overlap with the BDO Zone to estimate the total annual sawlog production in the BDO Zone (approx. 1.1 billion board

[1] Approximately 60% of all lumber produced within Washington State in 2016 was milled from logs with diameters between 5 and 10 inches (https://www.dnr.wa.gov/publications/em_obe_2016_mill_survey_final.pdf, Table 12, p.39).

[2] The pulp and paper industry focuses procurement efforts on roundwood with a small-end diameter <5 inches, as well as larger roundwood for which there is no demand or that cannot be milled due to defect. The latest Washington State mill survey reports that 79% of all roundwood utilized by the pulp and paper industry in the state has a small-end diameter <5 inches (https://www.dnr.wa.gov/publications/em_obe_2016_mill_survey_final.pdf, Table 12, p.39).

feet/yr, or 4 million bdt/yr). The pulpwood-to-sawlog ratio of 1-to-5 was then applied to estimate total annual pulpwood production. The total annual production of pulpwood in the BDO Zone was estimated to be **800,000 bdt/yr**.

Although there are no reliable official statistics on pulpwood availability,[3] local forestry professionals contacted by Ecostrat consistently reported underutilization of pulpwood due to lack of markets. The recent closure of the WestRock – Tacoma pulp mill has resulted in a pulpwood demand decline of ~450,000 bdt/yr regionally, which is estimated to represent a ~50,000-100,000 bdt/yr decline in pulpwood consumption from operations within the BDO Zone.[4] The estimate of total pulpwood availability is therefore deemed conservative. Results were validated through comparison with mill survey data from 2016 (Table C-1, Appendix C).

Forest Residue

To determine the potential supply of forest residue in the BDO Zone, the University of Washington's online Biomass Calculator was used. The potential supply of forest biomass was estimated for a conservative state-wide harvest scenario of 2.4 billion board feet for the period 2025-2030 (state-wide harvesting over the period 2018-2022 averaged 2.5 billion board feet).[5] The Biomass Calculator and supporting report provide county-level estimates of the amount of forest biomass given operational constraints and losses during yarding, processing, and loading. These estimates are representative of quantities of unmerchantable biomass that accumulate on landings as a by-product of business-as-usual forest operations in the region: no additional harvesting and collection costs need to be incurred to recover this material to roadside.

Forest biomass is defined in the report to include branches, tops, small-diameter trees, and other unmerchantable material, as well as merchantable roundwood that is lost due to breakage and contamination during operations. The results for each county were adjusted for overlap with the BDO Zone boundaries. Final residue availability was estimated by adjusting the UW forest biomass estimates to separate the proportion of the total that could be processed into pulp logs with a reduction in top diameter (25%). The proportion that could not be processed into pulp logs with a reduction in top diameter (75%) was classified as forest residue (Table A-1).[6] The total amount of forest residue produced within the BDO Zone annually was estimated as **300,000 bdt/yr**. Results were validated through comparison with an alternative method of estimating residue availability (Table C-1, Appendix C).

[3] The WS DNR does not estimate pulpwood availability in official statistics and querying the USFS FIA dataset for pulpwood removals within the BDO Zone results in an estimate of <10,000 tons of pulpwood harvested annually and is therefore inaccurate.
[4] Calculated by estimating the percent overlap of the BDO Zone with a theoretical 75-mile procurement radius around the former Tacoma pulp mill, and assuming that 40% of feedstock procurement by the former mill was chipped pulpwood.
[5] The Biomass Calculator (https://wabiomass.cfr.washington.edu/) uses data and assumptions from the UW (2012) Washington Forest Biomass Supply Assessment report (https://wabiomass.sefs.uw.edu/docs/WashingtonForestBiomassSupplyAssessment.pdf).
[6] The methods used to estimate forest biomass in the UW (2012) report included the assumption of a top diameter of 4 inches. When markets for pulpwood are present, top diameters are typically reduced to 1-2 inches. We assumed that 25% of the total amount of forest biomass estimated using the UW Biomass Calculator could be sectioned into pulpwood.

Table A-1: Estimates of forest biomass availability in the BDO Zone by county with overlap values shown

County	Overlap value (% of county included within BDO Zone)	Forest biomass availability in BDO Zone (bdt/yr), as estimated using the UW Biomass Calculator	Forest residue availability in BDO Zone (bdt/yr), assuming 75% of UW forest biomass estimate cannot be sectioned into roundwood
Clark	0.19	2,836	2,127
Cowlitz	0.75	45,265	33,949
Grays Harbor	0.55	80,037	60,028
King	0.11	3,521	2,641
Kitsap	0.27	1,937	1,453
Lewis	0.74	90,409	67,807
Mason	0.70	29,623	22,217
Pacific	0.82	78,731	59,048
Pierce	0.47	29,190	21,893
Skamania	0.01	79	59
Thurston	1.00	28,494	21,371
Wahkiakum	0.90	21,747	16,310
Total		**411,867**	**308,900**

Sawmill Residuals

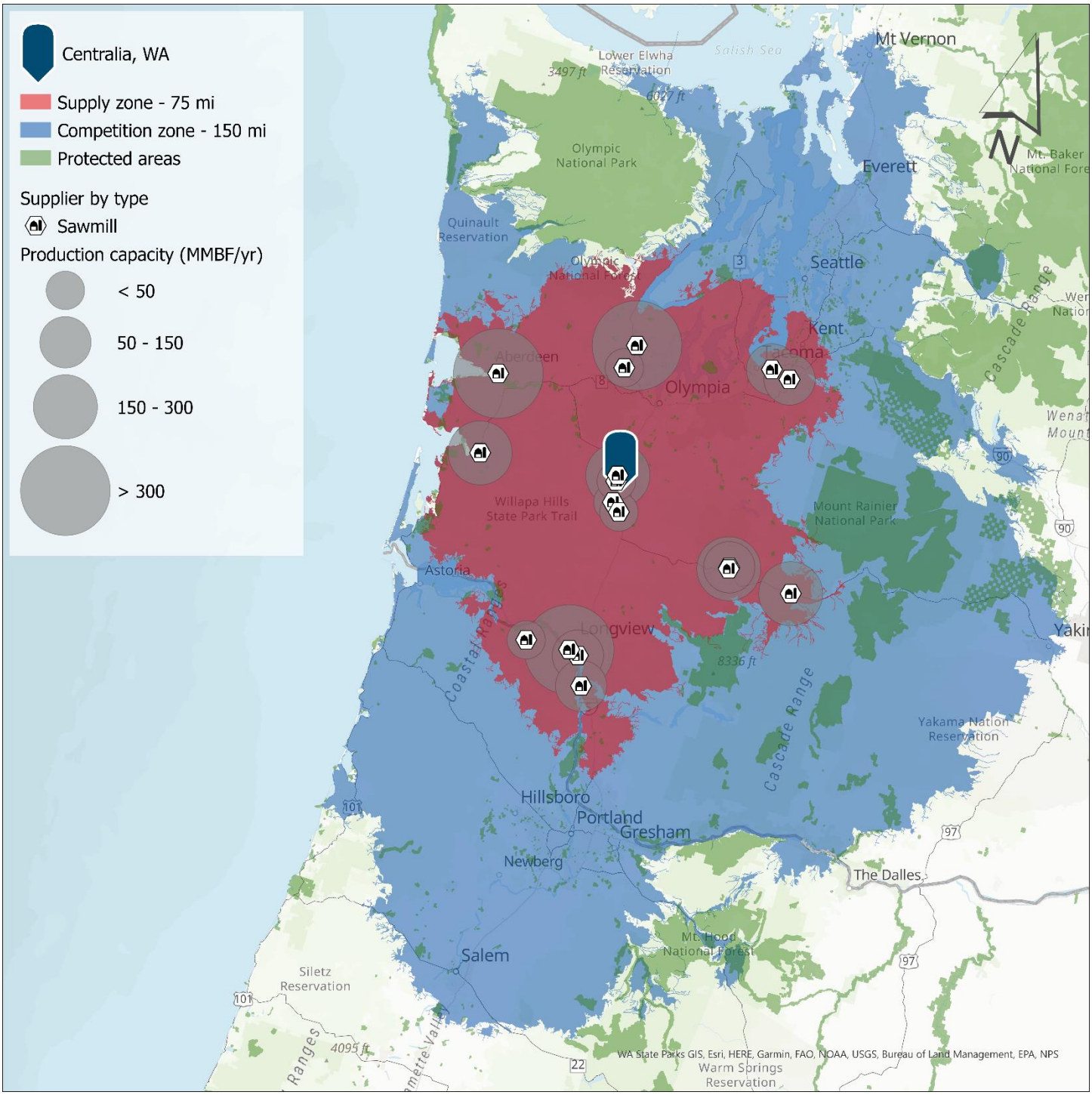
Total sawmill residuals production within the BDO Zone was calculated using estimates of recent sawlog intake and sawlog-to-residuals conversion factors for each of the residual types (chips, sawdust, shavings, bark). The annual sawlog intake for each of the BDO Zone's 17 sawmills was determined through literature review and outreach. Residuals conversion factors were estimated using a sawlog-to-lumber conversion efficiency of 60% and sawlog-to-residuals conversion factors determined through literature review and outreach (Table A-2).[7] Total sawmill residuals production in the BDO Zone was estimated to be **2.0 million bdt/yr**. Sawmills currently operating in the region are shown in Map A-2.

Table A-2: Estimates of sawmill residuals production in the BDO Zone

	Sawlog-to-product conversion efficiency	Total amount generated in BDO Zone (bdt/yr)
Lumber	60%	
Wood chips	24%	1,209,000
Sawdust	8%	403,000
Shavings	2%	201,500
Bark	2%	201,500
Total	100%	2,015,000

[7] https://corrim.org/wp-content/uploads/2020/06/CORRIM-AWC-PNW-Lumber.pdf (p.15)

Map A-2: Sawmills located within 75-mile drive distance of Centralia.



Woody Biomass Demand in the Competition Zone

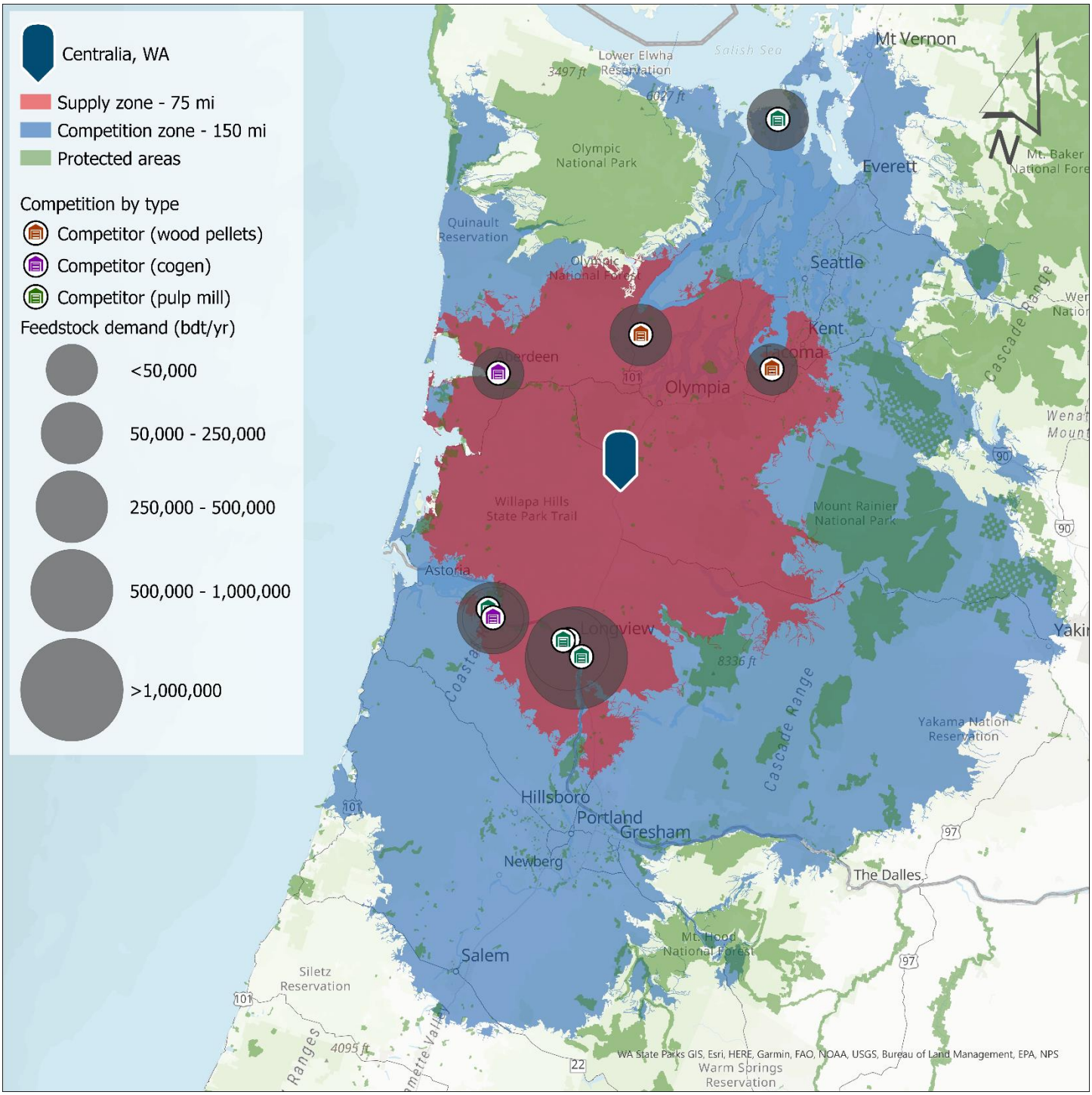
Total current consumption of pulpwood and sawmill residuals from the BDO Zone likely amounts to 1 – 1.5 million bdt/yr (60% sawmill residuals, 30% pulpwood). Over 90% of this quantity is estimated to be consumed by the five pulp mills located within a 150-mile drive distance of Centralia. Forest residue recovery and utilization has occurred intermittently since the 1980s and no current residue supply chains were identified. Current demand by competitor category is presented in Table A-3.

Table A-3: Woody biomass demand by competitor category

Competitor category	Total feedstock demand (bdt/yr)	Feedstock demand from the BDO Zone (bdt/yr)	Feedstock type
Pulp and paper	3,250,000	1,119,000	Sawmill chips, Pulpwood
Wood pellet	120,000	48,105	Sawdust
Cogeneration	115,000	26,170	Bark, shavings
Total	**3,485,000**	**1,193,275**	--

Pulpwood prices in recent years (<$40/ton, or $80/bdt) have been insufficient to sustain many of the pulpwood chipping facilities in the region, which supply the regional pulp mills with wood chips. In most operating areas, material <5 inches in large-end diameter that could be sectioned into logs as well as larger defective wood remains in slash piles following product separation. Other competitors for non-sawlog wood fiber in the BDO Zone are limited to two pellet mills and two cogeneration facilities (Map A-3).

Map A-3: Competitors located within 150-mile drive distance of Centralia.



Final Rated Quantities and Pricing

The final rated quantities and delivered price ranges were determined through literature review and outreach. The pulpwood rated quantity (**200,000 bdt/yr** of a potential 800,000 bdt/yr) is considered to be conservative if recent harvesting levels are sustained (>2.4 billion board feet per year) and pulp and paper market trends remain. Current demand for pulpwood by the five pulp mills in the competition zone is estimated to be ~500,000 bdt/yr but this is expected to decline in future years. For a delivered price range of $70-$90/bdt, we expect that logging contractors will be capable of bringing pulpwood to market over a transport distance of up to 75 miles.

The final rated quantity of forest residue is equivalent to 1/3 of the total potential supply of forest residue (**100,000 bdt/yr** of a potential 300,000 bdt/yr). This is expected to represent a low risk because (1) residue accumulates at roadside/landings during conventional logging operations, (2) over ten mobile comminution units are already present in the region, and (3) contractors have previous experience with residue recovery. To determine the rated price range for forest residue ($80-$100/bdt), price was made equal to the cost of comminution, loading, and transportation to a distance of 75 miles. Comminution and loading costs were taken from a recent forest residue cost-supply study for the western WA and western OR regions (~$40/bdt).[8] A payment of $1-$2/ton will sometimes be made to the landowner for access to the slash piles. Transportation costs @75 miles were estimated using a transportation cost formula commonly used in the region as of October 2023 ($0.35/ton/loaded mile).

With respect to sawmill residuals, the final rated quantity is equivalent to <15% of the total production in the supply basin (**300,000 bdt/yr** of a potential 2,015,000 bdt/yr). Sawdust is excluded from the estimate because regional pellet production capacity is expected to increase. Current and historic residuals pricing and price volatility was determined through outreach. For the rated price ranges, securing the rated quantities over the long term is considered a low-risk proposition at the rated price ranges ($25-$50/bdt for shavings and bark, and $90-$100/bdt for wood chips). Information relevant to the determination of rated quantities and pricing is presented in Table A-4 and Table A-5.

Table A-4: Potential and rated quantities for evaluated biomass types

	Potential quantity (bdt/yr)	Rated quantity (bdt/yr)
Pulpwood	800,000	200,000
Forest residue	300,000	100,000
Wood chips	1,200,000	200,000
Sawdust	400,000	--
Shavings	200,000	50,000
Bark	200,000	50,000

Table A-5: Recent historic pricing and rated price range for evaluated biomass types

	Pricing over the last five years ($/bdt)	Rated price range ($/bdt)*delivered @50-75 miles
Pulpwood	$40-$120	$70-$90
Forest residue	--	$80-$100
Wood chips	$75-$110 (FOB)	$90-$100
Sawdust	$5-$20 (FOB)	--
Shavings	$5-$20 (FOB)	$25-$50
Bark	$30-$45 (FOB)	$25-$50

[8] Adams et al., 2019. The importance of incorporating intertemporal and spatial log market dynamics in projections of residue-based biomass supply for liquid biofuel production in western Oregon and Washington, USA. Forest Policy and Economics 106: 101957.

APPENDIX B: 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: Washington is a leading producer of lumber in the country. Over the past ten years, harvesting levels have remained steady (2.4-3.2 billion board feet/yr) and lumber production and sales have increased.[9] Long-term declines in annual harvest volume and the number of sawmills (~100 in 1990, ~75 in 2002) have been compensated for by increases in mill capacity and efficiency.[10] The continued decline in pulp and paper production has negatively impacted pulpwood (chipwood) producers in western Washington, although this impact has been moderated by improved sawmill efficiencies, enabling the utilization of smaller diameter roundwood that was previously utilized for pulp and paper.

Within the BDO Zone, there are currently at least 17 operational sawmills (potential suppliers of sawmill residuals) and at least 100 logging sides (i.e., crews) and 40 logging contractors (potential suppliers of roundwood and forest residue) regularly operating. At least five logging contractors have over 50 employees and >10 sides. Over 1 billion board feet of lumber is produced annually by sawmills located within the BDO Zone. Logging contractors harvest at least 1 billion board feet of roundwood annually from the working forests of the BDO Zone, mainly from large industrial private forests and to a lesser extent small private woodlots. At least 15 businesses within the BDO Zone own and operate mobile comminution equipment. Most suppliers have been in business for multiple decades.

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. There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

[9] https://www.wfpa.org/wp-content/uploads/2017/11/forestfacts-and-figures10.pdf (p.2)
[10] https://www.dnr.wa.gov/publications/em_fwfeconomiclow1.pdf (Fig.13, p.25)

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 to supply to specific competitors for biomass feedstock. Preferences may be due to historical, long-term, or personal relationships, less stringent feedstock quality requirements, more flexible operating hours by competing markets, or supplier's dependences 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 a competitor resulting in supply disruptions for the Issuer.

Risk Information: Sawlog and pulpwood sales in western Washington State involve competitive bidding. Landowners and forestry contractors tend to sell to the highest bidder. Some proportion of the available wood supply is locked up in long-term supply contracts or through vertical integration (e.g., sawmill ownership and use of timberlands), but this is not expected to affect the availability of the rated quantity of pulpwood for new projects. Therefore, the rated quantities of pulpwood are expected to be available for new projects for the rated price range of $70-$90/bdt, which is above the historical average.

Sawmill owner-operators can be expected to maintain relations with existing buyers of residuals. The loyalty of sawmills to existing customers has been accounted for when specifying the rated quantity of 300,000 bdt/yr. Some risk can be expected for higher value wood chips due to higher current and expected demand under continued pellet capacity growth in the region. Competing markets for forest residue are restricted to boilers at pulp and paper mills; demand for residue has been inconsistent over time and priced relatively low (<$40/bdt). Preference for competitors is not considered to be a risk given the rated price range of $80-$100/bdt.

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 ***medium***, therefore the RRI is **6 out of 10.** Although unlikely, the presence of suppliers with preference for existing competitors could impact wood fiber availability for new projects.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) 12 is out of 100.	**Score** **12**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 12 out of 100.	**Score** **12**

1.3 Risk Factor: Supplier Control Over Production and Transportation

1.3.1 Ownership of Land/Means of Production

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

Risk Information: Within the BDO Zone, privately owned timberlands constitute 70% of total available timberlands and contribute to 80% of the annual wood supply. Within the private ownership category, industrial timberlands have a similar land base to small private woodlots (<2 MMBf/yr) but make a significantly larger contribution to regional wood supply. Industrial timberlands in the area are owned by a mix of lumber companies (e.g., Weyerhaeuser, SPI, Port

Blakely), institutional investors (e.g., timber management investment organizations (TIMOs), real estate investment trusts (REITs)), and private land management companies (e.g., Green Diamond Resource Company). The concentration of industrial timberland under TIMOs and REITs has generally been favorable to purchasers of sawlogs and pulp logs. Access to wood supply has increased and economies of scale in production ensure better wood pricing compared to a situation with smaller land parcels and a more mixed ownership. The remaining 30% of timberland in the BDO Zone is under federal (20%) and state, Native American, or municipal ownership (10%).[11]

A new project would likely source the majority of its pulpwood supply from the over 2 million acres of industrial forestland via competitive bidding for timber sales, as offered by landowners or intermediaries. There is low risk that pulpwood would not be available from industrial lands, as current and forecast pulpwood demand is low and there is only one large industrial timberland owner in the region that does not offer timber sales. Pulpwood supply from small forest landowners ("SFLOs", <2 MMBF/yr) would also be required to meet the rated quantity. Although wood supply from SFLOs is less certain owing to variation in harvesting frequency and small parcel size, there is sufficient SFLO acreage in the supply basin to support a significant fraction of the rated pulpwood quantity (e.g., 75,000 bdt/yr).

Since the 1980s, regulations have steadily reduced the amount of forestland available for harvesting on both private and public lands. Wood supply declines have disproportionately occurred on public lands, including the state-owned lands administered by the Washington State Department of Natural Resources (DNR) and the federal Washington National Forest system. The relatively large percentage of federal ownership (20%) is a slight risk to new bio-projects in the unlikely event that the rated quantity of pulpwood cannot be acquired from private lands. Overall, however, public ownership of lands constitutes a low risk given the availability of pulpwood from private lands (at least 280,000 bdt/yr). Note that most logging contractors have 2-3 sides (crews), enabling operation in multiple ownership types to hedge against procurement and contract uncertainty.

The supply of forest residue does not carry significant land ownership risks. All landowners in the region (private and public) are interested in the prospect of having slash piles removed free of charge or for a modest payment. Without markets for forest residue, that fraction of slash piles that are not salvaged for firewood is either left to decompose at roadside, burned, or hauled for disposal. The rated price range for forest residue ($80-$100/bdt) accounts for potential demands for stumpage by landowners (e.g., up to $5/bdt). Land ownership risk does not apply to the supply of sawmill residuals.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing. There is a sufficient mix of land ownership types and inventory capacity to avoid impacts associated with land ownership.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**8**

[11] https://nrsig.org/apps/forestland2019/

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100.	**8**

1.3.2 Ownership of Equipment

Rationale: In most cases, suppliers which own or lease equipment for harvest, collection and processing feedstock are lower risk than those who 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 harvest times that are convenient 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, the use of a third-party company with standard equipment specializing in harvesting, collection and transportation may decrease quality variations (e.g., ash content) of final feedstock.

Risk Information: Harvesting and processing equipment tends to be owned by forestry contractors, including logging and silviculture contractors. Large companies that own wood processing facilities tend not to own equipment directly. Weyerhaeuser is an exception, employing a number of harvesting crews and equipment. Equipment necessary for logging residue comminution in the two-pass operations typical of the region tends to be owned by businesses that specialize in roundwood chipping for the pulp and paper industry ("chipwood" producers, which own chippers) and companies that are involved in construction waste recovery (which own grinders).

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

1.3.3 Ownership of Transportation/Logistics

Rationale: In most cases, suppliers that own or lease transportation equipment necessary to transport biomass from forest or field are lower risk than those who do not. However, in some circumstances, reliance on third parties to transport biomass is common practice and does not contribute to risk.

Risk Information: Logging truck ownership in the region is divided among forest product companies, logging contractors, and independent trucking companies. Chip trucks are owned by a mix of forest product companies, chipwood producers, and independents. Intermittent logging truck capacity shortages in some areas can be attributed to the decline of small trucking companies and single-truck owner-operators (independents). Chip truck capacity shortages (particularly walking floor trailer types) have occurred recently in some areas of the BDO Zone, leading to longer-than-usual wait times and the concentration of residual piles in sawmill yards. This is generally not affected by ownership type.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** Likelihood is assessed as low rather than very low because there have been recent temporary shortages of trucking capacity and these shortages are plausibly linked to transportation ownership structures.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**8**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) Grays Harbor College offered a log truck driver training program in 2019/20. A number of forestry professionals contacted by Ecostrat indicated that they were interested in supporting logging truck operator training programs. We expect that programs of this kind will be initiated again within the network of community colleges and technical schools in the region (e.g., Grays Harbor College, Centralia Community College) if truck operator recruitment remains a problem. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 6 out of 100.	**6**

1.3.4 Feedstock as a Secondary Transformation

Rationale: A secondary transformation dependent upon the production of primary products, e.g., forest residues, corn stover, bark, or sawmill chips (unless from a dedicated chip mill) are all secondary transformations of a primary product.

Risks are higher if feedstock is a secondary transformation of a primary, more valuable product. It may not be economical for suppliers to produce biomass on its own, in the absence of markets for the primary product. 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 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 production of the primary crop requires resources to be taken away from the production of secondary crop (e.g., in case of shorter harvesting windows due to weather), the secondary feedstock supply will suffer. In times of stretched resources, suppliers may also perceive harvesting and collection of the feedstock as a nuisance, potentially decreasing production levels.

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

Risk Information: Significant quantities of pulpwood and forest residue accumulate in piles at roadside and on landings as a result of processing and sawlog production. Operational efficiency is not affected by this practice. Recovering pulp logs would require minor increases in processing and loading time inconsequential to the efficiency of sawlog production. Forest residue recovery is most likely to occur once logging operations have been completed and once all sawlogs and pulp logs have been transported off site. There is therefore no risk that pulpwood and residue production will reduce the productivity of sawlog operations. Sawmill residuals are by-products of lumber production and therefore do not constitute a risk to the production of lumber.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

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 forest industry produces over 2 million bdt/yr of sawmill residuals and is capable of producing >500,000 bdt/yr of pulpwood with minor changes in operating procedures when markets are available.[12] Logistics associated with handling, storage, loading, and transport of pulpwood and residuals can be optimized with an adequate supply of skilled operators and managers. Experience associated with forest residue production and utilization is less well-developed but significant compared to other regional forest sectors in North America. Logging residues accumulate on landings and at roadside as a consequence of whole-tree logging practices in the region, which usually do not involve delimbing before yarding. Product separation at roadside/landings results in the creation of logging residue piles ("slash" piles) that can be accessed by comminution and transportation equipment.

In most cases, logging residue piles are burned. Markets for logging residues have been temporary and largely restricted to boilers and cogeneration units at pulp and paper mills. The residue is either chipped/ground and loaded into chip

[12] To recover pulpwood, top diameters are reduced from 4-5 inches to 1-2 inches and felling/yarding and roadside product sorting is slightly altered to ensure recovery of unmerchantable roundwood.

vans or loaded directly into bin trucks without comminution and sent for terminal chipping. Prices for logging residue have not been sufficiently high or stable to encourage investment in equipment capable of recovering forest residues that remain dispersed within the operating area following yarding. There have been attempts to recover leftover residues using balers but economic returns were offset by the high cost of equipment ownership (purchase price ~$1.5 million for balers). The rated quantity is based on the assumption that a new project would procure residue using subcontracted grinding or chipping units, of which there are over 15 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 ***low***, therefore the RRI is **4 out of 10.** RRI is assessed as low instead of very low because regional experience recovering forest residue has been inconsistent over time.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**8**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100.	**8**

1.4.2 Production Scale Experience

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

Risk Information: Pulpwood and sawmill residuals production is conventional for the industry and occurs at scale. Sawmills and logging contractors operating in the BDO Zone have collectively processed over 8 million bdt of roundwood annually over the last decade.[13] The rated quantity of pulpwood and sawmill residuals (500,000 bdt/yr) represents <10% of the amount of roundwood and residuals that has been processed consistently by the industry over this period.

Although forest residue supply chains are uncommon, many operators and forest product companies have relevant experience. There are over 15 comminution units that regularly operate in the BDO Zone, mainly for purposes of comminution of pulpwood and construction and demolition waste. There have been a number of instances since the 1980s when mobile chippers and grinders were used to process forest residue. Although this experience has been infrequent, experience and equipment capacity relevant to residue recovery in the region is comparably high. There have also been instances when forest residues have been recovered using bin trucks, with terminal comminution at holding yards or pulp mills. Other supply chain actors have also demonstrated an ability to ramp up biomass procurement in response to market demand. For instance, there are previous examples of dedicated biomass harvesting in Christmas tree plantations and hardwood stands in response to increases in hog fuel demand. There is no risk associated with sawmill residuals.

Raw Risk Likelihood (RRL)	**Score**

[13] Estimated using total roundwood demand by sawmills in the BDO Zone (~5 million bdt/yr) and total roundwood production by county in the BDO Zone (~4 million bdt/yr).

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity

1.5.1 Supplier's Equipment Efficiency

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

Risk Information: Most logging and thinning operations are fully mechanized. Ground-based operations (slope <40%) typically include 1 x feller-buncher, 1 x log loader (AKA shovel), and 1 x processor, and are completed in two passes. In the first pass, the feller-buncher cuts and piles trees. In the second pass, a log loader moves the piled trees to roadside or to a landing (grapple yarding). The use of grapple skidders for yarding is uncommon due to the density of roads in most operating areas; the cost and performance advantages of grapple skidders relative to log loaders require greater skidding distances (maximum yarding distance is ~600 feet in most areas). Cable operations (slope >40%) involve manual chainsaw felling and tower-based cable yarding. Tethered logging – which involves the use of cable winch units mounted on specialized and conventional forestry equipment – is becoming more common on steep terrain (slope >40%) owing in part to more favorable insurance rates.[14]

A typical forest operation in the BDO Zone involves mechanized ground operations (slope <40%) in 35- to 45-year-old Douglas fir stands. In these conditions, logging sides (crews) have a typical productivity of 3 acres per day and a productivity per acre of 15,000 – 30,000 board feet/acre of sawlogs and 20-50 tons/acre of pulpwood (5 – 7 truckloads of pulpwood per day).[15] For a five-day work week and a 48-week work year, total pulpwood production for a single side, amounts to between 30,000 and 40,000 tons per year (15,000-20,000 bdt/yr). For these assumptions, recovering the rated quantity of pulpwood (200,000 bdt/yr) would require only 20 to 30 sides. Making the rated quantity of pulpwood available to new projects by reducing top diameters and bucking defective tree-lengths into logs is not expected to result in operational delays.

Experience with logging residue recovery operations and associated equipment is more limited. All logging contractors in the region are positioned to ensure a sufficient supply of residue to roadside, as this occurs as a by-product of conventional logging operations. Contractors with chippers and grinders capable of recovering forest residue from slash piles are present in the region and include the chipwood companies (wheeled chippers that can be brought to landings)

[14] https://www.fs.usda.gov/forestmanagement/equipment-catalog/tethered.shtml
[15] Assuming 7.5 tons per 30 MBF and a pulpwood-to-sawlog production ratio of 1-to-5.

and companies involved in construction waste recovery (mobile grinders). We identified 15 companies that own and operate chippers and grinders in the region. Chip trucks (required for transport of comminuted residue) are generally available. Given past examples of slash pile comminution and recovery, and given the number of companies that own and operate comminution equipment and chip vans in the region, we expect that the efficiency of slash pile comminution and transport will be adequate for the rated quantity of residue.

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 ***low***, therefore the RRI is **4 out of 10.** Successfully recovering the rated quantity of forest residue may result in logistical challenges as operators become familiar with the pace and scale of comminution, loading, and hauling operations. .	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**Score** **8**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100.	**Score** **8**

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, or when it is a by-product or a residual from a more valuable primary product, then suppliers may not put in sufficient effort for consistent production. Risk of breach increases when production and/or delivery of feedstock compromises a supplier's ability to make a primary product.

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

Risk Information: No risk associated with feedstock production priority is foreseen. Given the conventional nature of pulpwood production, processing at roadside is not expected to lead to declines in the production of sawlogs. Grinding/chipping of forest residue piles is expected to occur after completion of roundwood recovery operations and therefore will not impact the production of higher value roundwood. Sawmill residuals are produced as a by-product of mill operations.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing..	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

CATEGORY 2.0: COMPETITOR RISK

2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets

2.1.1 Competitor 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 the geographical influence a competitor may have on new plants within a BDO Zone, including competitive advantages such as short hauling.

Risk Information: Our analysis indicates that there are nine identified competitors for woody biomass feedstock within a 150-mile drive from Centralia WA, which we refer to as the "competition zone." Eight of the nine identified competitors are located within a 75-mile drive distance of Centralia. Competitors include five pulp mills, two wood pellet mills, and two cogeneration facilities. Based on our estimates, the combined consumption of woody biomass by these competitors is approx. 4 million bdt/yr, with approx. 1.5 million bdt/yr of this amount coming from the BDO Zone itself. Sawmill residuals constitute ~60% of this amount, and pulpwood ~40%.

Pulpwood: The pulp and paper industry is the primary consumer of pulpwood and pulp chips (also referred to as chipwood) in the region. Current demand for pulpwood by the five pulp mills within the competition zone is approx. 1.5 million bdt/yr, of which 500,000 bdt/yr is sourced from the BDO Zone. A small log sawmill in Oregon capable of utilizing material with a small-end diameter as low as 3 inches is known to procure a small amount of wood fiber from the region, but there are no indications that the mill is positioned to increase procurement. Given the estimated total annual production of pulpwood in the BDO Zone (~800,000 bdt/yr) and given the continued projected decline of the regional pulp and paper industry, we conclude that the relatively close position of pulpwood competitors to the potential infrastructure site constitutes a low-to-moderate risk to the rated quantity.

Forest residue: Approximately 300,000 bdt/yr of forest residue accumulates at roadside and on landings as a result of conventional forest operations in the BDO Zone annually. Current practice is to pile the residues (creating "slash" piles) and to burn the piles with or without salvaging of firewood. Since the 1980s, markets for forest residue have been common but temporary. There are currently no markets for forest residue and therefore there is no risk associated with the rated quantity.

Sawmill residuals: Pulp mills are the main competitors for sawmill residuals, procuring an estimated ~700,000 bdt/yr of wood chips from the BDO Zone annually (total annual production of wood chips in the BDO Zone is ~1.2 million bdt/yr). Pulp mills also source a modest amount of bark and shavings from sawmills to satisfy on-site biomass boiler fuel demand. At least two sawmills within the BDO Zone utilize bark and shavings as fuel for on-site biomass boilers, but total annual demand is likely <50,000 bdt/yr. Sawdust is consumed primarily by two wood pellet facilities located within 60 miles of Centralia. The facilities consume a combined ~120,000 bdt/yr, 50,000 – 100,000 bdt/yr of which is likely procured from the BDO Zone. Overall, the risk presented by proximal competitors for sawmill residuals is assessed as low.

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 ***medium***, therefore the RRI is **6 out of 10.** Although the regional pulp and paper industry is declining, competing facilities are located within the BDO Zone and many have large annual feedstock demands.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 24 out of 100.	**Score** **24**

2.1.2 Current and Historical Consumption of Feedstock Quantity

Rationale: Clear understanding of feedstock consumption by key competitors for each rated type of feedstock 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 to the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change).

Risk Information:

Pulpwood: As in other areas of North America, the pulp and paper industry in Washington State has been in decline since the 1990s. Within the BDO Zone, the number of pulp and paper mills declined from 12 in 1983, to 5 in 2023.[16] Demand for wood chips produced by the network of whole log chippers and sawmills in the region has subsequently decreased. The recent shutdown of the WestRock – Tacoma pulp mill has resulted in a local feedstock demand decrease of ~450,000 bdt/yr, including ~270,000 bdt/yr of residuals and 180,000 bdt/yr of pulpwood chips sourced from whole log chipping operations. Many chipping plants have curtailed production or closed permanently. Currently, most logging contractors that operate within the BDO Zone are leaving pulpwood at roadside. Within the boundaries of the BDO Zone, total potential availability of pulpwood is 800,000 bdt/yr, and current demand for pulpwood is ~500,000 bdt/yr and declining. The rated amount of 200,000 bdt/yr is expected to be available at low risk given current demand and the continued decline of the pulp and paper industry.

Forest residue: Markets for forest residue have been temporary and largely restricted to boilers and cogeneration units at pulp and paper mills. Prices for residue have not been sufficiently high to encourage continuous, year-to-year operations of residue supply chains, including mobile comminution and chip truck transport.

Sawmill residuals: Within the BDO Zone, there are currently at least 17 operational sawmills generating over 2 million bdt/yr of residuals annually. The pulp and paper industry consumes approx. 700,000 bdt/yr of the estimated 1.2 million bdt/yr of wood chips that are generated by these sawmills. With respect to consumers of lower value sawdust, shavings,

[16] https://www.dnr.wa.gov/publications/em_fwfeconomiclow1.pdf, Figs.12 and 13, p.25

and bark, Georgia Pacific and Sierra Pacific Industries have cogeneration units that utilize a combined ~115,000 bdt/yr of bark and shavings, whereas wood pellet plants in Shelton and Tacoma together consume another 120,000 bdt/yr of sawdust. Sawdust was not rated, as there are expectations for near-term pellet capacity growth in the region. The rated quantities of chips, shavings, and bark represent ~15%, 25%, and 25% of the total quantities generated in the BDO Zone annually.

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 × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

2.1.3 Competitor Pricing and Price Sensitivity

Rationale: Understanding how much competitors pay (or receive) for different feedstock types is an essential step to determining competitiveness of Issuer and to accurate assessment of 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 ability/willingness to pay premiums for feedstock during times of feedstock shortage or reduce prices (or cut off deliveries) during gluts. Competitors that have an ability to offer higher prices for feedstock during feedstock shortages can pose significant risk to 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:

Pulpwood: The market for sawlogs and pulpwood in western Washington State is driven by competitive bidding. Landowners and forestry contractors engage in the practice of selling their wood products to the highest bidder, while a certain amount of the wood supply is tied up in long-term supply contracts or through vertical integration. Stumpage pricing for lumber has been relatively stable over the past decade, reflecting the health of the lumber industry (Figure C-1, Appendix C). Stumpage pricing for pulpwood, on the other hand, has been relatively volatile. While it is difficult to explain the causes of this volatility it can be viewed as an indicator of the declining pulp and paper industry.[17] In recent

[17] One explanation for the volatile pulpwood stumpage pricing over the past three years relates to the concurrence of rising lumber prices, labor shortages, and rising fuel prices during the early stages of the COVID-19 pandemic and subsequent lockdowns. The decline in the housing market and subsequent reduction in regional lumber mill production significantly decreased the accessibility of sawmill residuals. A trend that emerged as a result was the heightened consumption of whole log chips by pulp mills.

months, many whole log chippers (the principal suppliers of pulpwood chips to pulp mills) have paused operations or shut down permanently.

Forest residue: Markets for forest residue in the BDO Zone are limited to the pulp and paper mills, which utilize low-quality wood fiber to satisfy a fraction of on-site energy requirements. Demand has been inconsistent over time and pricing has generally been insufficient to cover the costs of slash pile comminution and transportation (e.g., at least $80/bdt for a transportation distance of 50 miles). The potential risk associated with favouring competitors is not deemed significant, given the price range of $80-$100/bdt.

Sawmill residuals: The historical pricing range for residual chips, as seen from 2007 to 2022, has been approximately $80 to $85 per bdt (FOB).[18] The residual chip market demonstrates a tendency to remain unaffected by output losses, as pulp mills compensate for residual chip deficiencies by utilizing primary pulpwood chips. It is anticipated that sawmill owner-operators will uphold relationships with current purchasers of residuals. The historical pricing of sawdust and shavings has fluctuated between $10/bdt and $20/bdt FOB, whereas pricing for bark has historically been less than $40/bdt FOB. Currently, prices for sawdust and shavings are ~$5/bdt FOB and prices for bark remain in the range of $30-$45/bdt FOB. Regional pellet production capacity is expected to increase significantly within the next five years and therefore sawdust was assumed not available for new projects.

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 ***high***, therefore the RRI is **8 out of 10.** Although the risk likelihood of competitor pricing is low, the rated quantities of pulpwood and sawmill residuals would be impacted significantly by a temporary or enduring ability for existing competitors to pay premiums for feedstock. The pulp and paper industry has paid as high as $120/bdt for pulpwood and up to $110/bdt for wood chips in recent years, although this has been on a temporary basis.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 32 out of 100.	**32**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 32 out of 100.	**32**

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 can lead to higher prices, feedstock disruptions, shortages or supplier breach 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 production of renewable chemicals, for example),

[18] Data gathered through outreach in addition to https://www.forest2market.com/hubfs/2016_Website/Documents/20181130_Forest2Market_Residuals_Market_Assessment_Final.pdf

high interest in a supply basin can make suppliers overconfident, leading to a supplier-controlled market where short-term contracting becomes the norm and supply chain reliability is compromised for the 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:

Pulpwood: The rated quantity of pulpwood (200,000 bdt/yr) represents ~20% of the total amount of pulpwood that could be generated annually given harvesting levels in recent history (800,000 bdt/yr). The rated quantity represents ~65% of pulpwood potentially available for new projects after accounting for current pulp mill demands (500,000 bdt/yr). Given that continued declines in the pulp and paper industry are expected, there is sufficient room in the market for new projects without risking oversaturation or upward pressure on prices. Although the regional pellet market is expected to expand in the near term, there are large supplies of low-cost sawdust and wood chips available from local sawmills.

Forest residue: There are no current markets for forest residue. Historically, utilization has been limited to the boiler systems used in pulp and paper mills. Residue is typically piled and subject to open burning. Prices generally do not incentivise comminution, loading, and transportation of forest residue, and there are no indications that regional demand for residue will increase.

Sawmill residuals: Some risk can be expected for sawmill residuals due to higher current and expected demand under continued pellet capacity growth in the region. The new Drax facility in Longview expected to come online in 2025 will rely almost exclusively on sawmill residuals, particularly sawdust. Sawdust was not rated for new projects, whereas wood chips – a likely secondary source of wood fiber for future pellet mills – was rated conservatively (200,000 bdt/yr, or ~15% of annual wood chip production by sawmills in the BDO Zone.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.** The rated quantities of feedstock were selected conservatively to minimize the risk of competition. However, a risk remains given planned capacity expansions in the BDO Zone.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***high***, therefore the RRI is **8 out of 10.** Pulpwood and sawmill residuals supplies could be impacted significantly by increased competitor demand and pricing.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**48**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) Long-term supply agreements and maintaining a large feedstock inventory would reduce the likelihood of increased competitor demand and pricing constraining access to the rated quantities. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 36 out of 100.	**36**

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 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:

Pulpwood: Landowners and forestry contractors commonly engage in the practice of selling their products or services to the bidder offering the highest price. A small proportion of the wood supply is currently allocated to long-term supply contracts or vertical integration arrangements (e.g., sawmill ownership and timberland use). This is not expected to affect the rated pulpwood quantity for new projects. Therefore, the rated amount of pulpwood is not likely to become unavailable for new projects for reasons related to contracting or previous relationships.

Forest residue: Current markets for forest residue are limited and historical markets have been temporary. Markets have generally been constrained to utilization in boilers of pulp and paper mills, characterized by uncertain demand patterns and relatively low prices (less than $40/bdt). Considering the price range of $80-$100/bdt, the preference for rivals is not deemed to pose a significant risk.

Sawmill residuals: It is anticipated that owners and operators of sawmills will endeavour to sustain relationships with current purchasers of sawmill residuals. The rated quantity of 300,000 bdt/yr was determined by taking into account the sawmill's commitment to maintaining customer loyalty. Anticipated risks for higher-value wood chips are expected due to the expected increase in regional pellet 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 × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **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.[19]

Risk Information: There is no risk from temporary non-traditional markets. Firewood markets in the region are relatively weak (~$200/cord delivered) owing to the prevalence of softwood.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**Score** **2**

[19] Bergtold, 2018.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **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 competitively 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 Issuers plant (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity on the part of competing markets thereby creates supplier loyalty and can make it more difficult for new projects to secure supply without paying a significant premium.

Risk Information: While data regarding the inventory capacities of the five pulp mills, two cogeneration facilities, and two pellet mills was not fully accessible, it is reasonable to assume that the competitors' inventory capacities are substantial. Inventory capacity estimates were derived for some of the larger competitors using mapping software. With one exception, all of the pulp and paper mills were found to have inventory capacities in excess of 40 acres. Woodyards usually have dedicated areas for wood chip piles as well as a staging area for trucks to drop off inbound feedstock should maximum inflow capacity be reached. On-site feedstock inventory is usually maintained to ensure one week of continuous operation.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

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 efficiently discharge can occur.

Risk Information: It was determined through outreach to local experts that delivery hours and wait times at the five pulp mills are not an issue. The high relative accessibility of the regional pulp and paper mills is not assessed as a significant risk to the rated quantities of feedstock. The ease of delivery to the mills frees up pulpwood and residual/residue trucking capacity for new projects.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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: In this assessment we assume that a new bio-project would be able to intake woody biomass that is available in the market. From this perspective, competitors do not have relative feedstock specification advantage.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**

Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

2.2.4 Demand for Competitors' Products

Rationale: Increased demand for 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: According to many industry analysts, pulp and paper prices are expected to grow over the long-term. Some project that the market will grow by 0.13% between the years 2023 and 2028.[20] A significant response by local producers to paper market growth in the form of improvements in efficiency and capacity is highly uncertain given the historic decline in North American pulp and paper competitiveness and output. Recent changes in ownership provide some indication that regional pulp mills could increase production in response to future demand, but this is regarded as a low risk.

Despite the strong growth in wood pellet production and sales within North America over the past two decades, Washington's pellet production capacity has remained unchanged. Since 2012, only two pellet mills have operated in the state (Pacific Coast Fiber Fuels and Manke Lumber Co.), with a combined pellet production capacity of ~100,000 tons/yr. There are no indications that the two pellet plants currently operating in the BDO Zone will increase production, although a new pellet mill is expected to come online in the next five years. Increased demand for sawdust and wood chips (potentially 450,000 bdt/yr) is possible, but the availability of pulpwood and forest residue for new bio-projects is not expected to be affected.

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 ***high***, therefore the RRI is **8 out of 10.** The presence of large current and potential future competitors presents a significant impact risk.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 32 out of 100.	**32**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) Long-term supply agreements and maintaining a large feedstock inventory to cope with short-term increases in demand would reduce the likelihood of increased competitor demand and pricing constraining access to the rated quantities. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 24 out of 100.	**24**

[20] https://www.fortunebusinessinsights.com/north-america-pulp-and-paper-market-106617

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:

Pulpwood: As noted in Appendix A, no official statistics on potential pulpwood supply in the region are available. The total annual generation of pulpwood in the BDO Zone (800,000 bdt/yr) was determined using harvesting data for individual counties over the period 2018-2022 (adjusted for overlap with the BDO Zone) and using the assumption of a 1-to-5 pulpwood-to-sawlog production ratio. Given the current pulpwood demand by pulp and paper mills within the BDO Zone (~500,000 bdt/yr), the BAM for the rated quantity of pulpwood (200,000 bdt/yr) is likely 1.5.

Forest residue: The rated quantity of forest residue (100,000 bdt/yr) constitutes less than one-third of the overall potential forest residue supply (BAM >3.0). Recovering this material to market is mainly a question of pricing, as residues accumulate at roadside and landings during conventional operations and mobile comminution equipment and residue recovery operation experience is already present in the region. Outreach has confirmed that for the rated price range of $80 to $100/bdt, contractors willing to incur the expenses of comminution, loading, and hauling up to a distance of 75 miles would likely earn a profit. There is uncertainty regarding the proportion of operating areas that would present challenges to residue recovery due to narrow roadways, landings, and other factors. The BAM of >3.0 is expected to account for these operability constraints.

Sawmill residuals: Approximately 2 million bdt/yr of sawmill residuals are generated annually within the BDO Zone. It is expected that ~15% of this amount in the form of chips, shavings, and bark could be acquired at low-to-moderate risk by a new bio-project for the rated price range. Pellet production in the region could double over the next 5-10 years, and this would result in competition for residuals, primarily sawdust and secondarily wood chips. To avoid potential competition, sawdust was not rated. However, wood chips available from sawmills were rated because it is uncertain what the regional pellet industry will be capable of paying for 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 ***medium***, therefore the RRI is **6 out of 10.** Although we assess the risk likelihood as low, there is uncertainty associated with estimates of feedstock availability for new projects. The use of different methods to estimate feedstock availability would lead to different rated quantities, but we do not expect that the overall risk rating would be altered. .	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**

Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 24 out of 100.	**Score** **24**

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 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 core supplier.

Risk Information: We estimate that the majority of available woody biomass is located over 50 miles from Centralia (Figure C-2, Appendix C). Although significant milling capacity is present in Centralia-Chehalis (~350 MMBF/yr), the largest sawmills are located over 45 miles away in Longview, Shelton, and Aberdeen. Pulpwood and forest residue resources available within the supply basin are concentrated within, and to the west of, Lewis County (Map C-2, Appendix C). To procure half the rated quantity of pulpwood and forest residue would likely require delivered prices of greater than $70/bdt. The low-to-moderate risk of feedstock transportation distance is compounded by high diesel prices.

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 × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 36 out of 100.	**Score** **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[21] and can manifest in shortages and higher costs for Issuers.

Risk Information: There are no significant seasonal variations in woody biomass availability in western Washington. Winters are mild and rainfall generally does not curtail operations unless extreme. Temporary operational shutdown can also occur during periods of heavy snowfall, but this is limited to a couple weeks a year. As long as buffer zone regulations are abided, equipment operators can work throughout the year with no risk of shutdown.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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: Washington State forests have the highest average per-acre yield of any state in the country.[22] Up to half of the annual wood supply is sourced from intensively managed monotypic Douglas fir stands that have been planted with genetically improved cultivars. Stands with substantial infiltration by other tree species are pre-commercially or commercially treated. Rotation ages are typically 35-45 years on industrial private lands. The remaining half of annual wood supply is sourced from forests with a greater tree species diversity and using a rotation age of up to 100 years. The shift on industrial private land towards shorter harvest return intervals over the past two decades (e.g., ~60 years to 30 years) has likely reduced year-to-year variation in wood supply. Wood supply variation is highest within the small forest landowner (SFLOs) category**.**

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.** . There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**

[21] Golecha & Gan 2016.
[22] https://www.dnr.wa.gov/publications/em_fwfeconomiclow1.pdf, p.27

The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

3.2 Risk Factor: Historical Issues

3.2.1 Historical Feedstock Price Variations

Rationale: If volatility is shown in the historical feedstock price, 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:

Pulpwood: Pulpwood/chipwood pricing in western Washington is relatively volatile. The delivered price of pulpwood chips in western Washington has been volatile in recent years, swinging from a five-year high of $60/ton to a five-year low of $20/ton within a 12-month period. Average pulpwood pricing over the past five years was determined through outreach to be $20-$35/ton, which is near or below the costs that logging contractors must incur to bring pulpwood to market over a ~50-mile transportation distance. Pulpwood (3–4-inch small end diameter) stumpage values reached a recent historic high of $20/ton over the period Jul.1 to Dec.31, 2023, reflecting high prices over the previous year. Stumpage prices for pulpwood are expected to return to levels experienced over the 2021-2022 period (<$10/ton).

Forest residue: Markets for forest residue in the region have generally involved shorter transport distances (<35 miles), indicating that costs have likely been in the range of $20/ton ($40/bdt). Any volatility in historical pricing can be tied to the temporary nature of forest residue demand and therefore is not regarded as a noteworthy risk.

Sawmill residuals: With the exception of wood chips, sawmill residuals pricing has been volatile in recent years. Prices for wood chips (15-30% lower than pulpwood chips) remained within the range of $40-$60/ton FOB over the 2019-2022 period. Prices for sawdust and shavings, on the other hand, dropped from $10/ton in 2019 to <$3/ton in 2023, reflecting a lack of consistent demand. Bark has sold at a price of $15-$25/ton over the past five years. To avoid the risk associated with increased sawdust prices that are likely to follow from planned pellet production capacity increases in the region, sawdust was not rated.

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.** The rated quantities are sufficiently high to mitigate against continued price volatility.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**16**

3.2.2 Low Historical Demand for Feedstock in the BDO Zone

Rationale: If Issuer BDO Zone does not have history of developed, large-scale feedstock procurement, suppliers may not have sufficient expertise in feedstock production to ensure reliable supply, especially in 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 of pulpwood and manage log debarking and chipping internally. Rather than requiring inexperienced suppliers to deliver debarked wood chips.

Risk Information: There are no risks associated with the large-scale procurement of pulpwood and sawmill residuals in the BDO Zone. Compared to other regions in North America, supply chains for conventional feedstocks are advanced. Over the past 30 years, a network of whole log chippers has developed in the region in support of the pulp and paper industry. As the industry continues to decline, new bio-projects will be able to leverage this network of facilities.

There is already considerable experience with forest residue recovery in the region. Supply chains have included roadside comminution as well as loose residue transport using bin trucks. Although markets for forest residues have been local (<35-mile transportation distance) and temporary, experience is comparatively high and there is adequate comminution and chip truck capacity for supply chain initiation in the near term.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**8**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100.	**8**

3.2.3 History of Production/Feedstock is a New/Secondary Crop or a Byproduct

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: Pulpwood, forest residue, and sawmill residuals are produced as a consequence of supply chains for primary forest products (e.g., lumber, veneer, finished wood products). Pulpwood and forest residue are produced during conventional forest operations, which involve whole-tree yarding, roadside processing, and product assortment (including piling of forest residues). Although forest residue recovery to markets is less common, there is adequate experience and capacity for this purpose in the region. Sawmill residuals are produced as a by-product of milling operations. There is therefore no risk associated with lack of experience with feedstock production for any of the evaluated feedstock types.

Since all feedstock types are dependent on the health of primary forest product markets, there is some risk associated with suppliers' lack of control over external factors. This risk is deemed to be low, however, because demand for sawlogs and veneer in western Washington has been relatively stable over the past decade. The western Washington forest industry holds a leading national position in the conventional bioeconomy, providing assurances of continued success.

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 ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**8**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100.	**8**

3.3 Risk Factor: Non-Weather Based Externalities

3.3.1 Diesel, Oil and Producer Price Index (PPI)

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

Risk Information: In the western United States, diesel fuel costs consistently surpass those in the central and eastern regions. As of October 2023, the price of diesel fuel in the western coast region (PADD 5) was $5.69 per gallon, while it remained below $4.80 per gallon in all other parts of the country, except for California, where it reached $6.27 per gallon. Over the long term, the volatility in diesel prices on the west coast parallels the national trend but at a higher

price level. Unlike other regions in the United States, real diesel prices have shown a continuous upward trend over the past three decades (Figure C-3, Appendix C). Variation in the Consumer Price Index (CPI) for the West region (inclusive of Washington State) is comparable to those of the Mountain and South regions (Figure C-4, Appendix C). Risk associated with regional price levels is therefore deemed to be low. Overall, this indicator presents a medium risk likelihood and high risk impact due to diesel price levels and volatility.

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 ***high***, therefore the RRI is **8 out of 10.**	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**Score** **48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 48 out of 100.	**Score** **48**

3.3.2 Currency Risk

Rationale: Where feedstock is purchased in a currency different than that which a new bio-based plant with 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: Irrelevant to this rating.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is not rated.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch × RRI Notch) is not rated.	**Notch** **NR**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is not rated.	**Score** **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: Irrelevant to this rating.

Raw Risk Likelihood (RRL)	**Score**

The risk likelihood is deemed ***not relevant***, therefore the RRL is not rated.	**NR**
Raw Risk Impact (RRI) The risk impact is deemed ***not relevant***, therefore the RRI is not rated.	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is not rated.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch × RRI Notch) is not rated.	**Notch** **NR**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is not rated.	**Score** **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.[23]

Risk Information: There is no risk from temporary externality-driven markets. Firewood markets in the region are relatively weak owing to the prevalence of softwood. No effect is expected on pricing or demand for pulpwood**.**

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

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.

[23] Bergtold, 2018.

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 risk 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: Harvesting occurs year-round with few slowdowns or shutdowns. Harvesting systems include ground-based, cable yarding, and tethered yarding. In all harvesting systems, non-sawlog-quality roundwood and forest residue concentrate at roadside or on landings as a result of whole-tree/tree-length harvesting practices, which are commonplace in the region. Due to the sawmill standards in the region, most of the roundwood available for use by new bio-projects will be of a small diameter (<5 inches large-end diameter). Small-diameter material is more prone to splitting if left exposed to the elements for a prolonged period of time, particularly during hotter times of the year. This is not expected to elevate risk associated with harvest and collection practices and schedules, but it is noteworthy.

The quality of forest residue can be affected by piling and recovery practices, but this is not expected to exhibit significant variation across operations. Optimal management and recovery of forest residue entails on-site retention of material near the bottom of piles that is contaminated by rock and soil, careful scheduling of comminution and transportation equipment, and screening of chipped or ground material at destination (among other measures). Risk is low due to the experience of forestry contractors in the region with comminution and trucking best practices.

Cable yarding and tethered harvesting systems – which account for 20-30% of forest operations in the BDO Zone – do not significantly affect residue availability assumptions.[24] Most logging contractors have 2-3 sides (crews), enabling operation in multiple ownership types to hedge against procurement and contract uncertainty. There are at least six contractors in the region with over ten sides.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**

Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**

Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

[24] University of Washington (UW). 2012. p.34-37

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. Use of different types and combinations of harvesting, collection and processing equipment among suppliers can lead to non-homogeneous feedstock. Equipment that is not designed specifically for biomass cultivation, harvesting and collection, can increase feedstock quality risks.

Relevant equipment should be specified for the sake of product consistency and risk reduction.

Risk Information: There are three main harvesting equipment configurations in the region. Ground-based configurations typically include feller-bunchers, excavators with grapple heads (shovel/log loader), and dangle-head processors. Grapple skidders are used in some cases but productivity gains do not offset the additional capital costs associated with this machinery. Cable logging configurations occur on excessive slopes (>40%) and involve the use of overhead cables ("skylines") to yard manually felled trees. Skylines are suspended by vehicle-mounted towers or booms. Tethered logging configurations are also used on steeper terrain and involve the use of specialized equipment mounted with cables, winches, and controls as well as conventional ground-based equipment mounted with cable-winch kits. The cables stabilize the equipment on slopes. All configurations involve whole-tree yarding and functionally similar roadside processing equipment (e.g., dangle-head processors, stroke delimbers). There is therefore no risk associated with this indicator.

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.** There are no plausible circumstances where this indicator would affect feedstock supply or pricing.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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.[25]

Risk Information: The majority of comminution activity within the region has involved terminal chipping by dedicated chipwood businesses. Logs are debarked, chipped, and sent to pulp and paper facilities. Grinders have been used in instances when demand for hog fuel by pulp mills was sufficient to pay for the costs of forest residue recovery from slash

[25] Huhnke, 2018.

piles. Slash recovery can result in contamination with soil and rock. We expect that new projects sensitive to feedstock quality will focus procurement on 200,000 bdt/yr of debarked and chipped pulpwood and 200,000 bdt/yr sawmill chip by-products available at low risk within the region. Projects capable of utilizing lower quality material with high bark content and minimal rock/soil contamination are expected to utilize 100,000 bdt/yr of ground residues and 50,000 bdt/yr of sawmill bark by-products. There is a sufficient variety and capacity of densification equipment to accommodate the range of feedstock dimensional, cost, and quality preferences of new bio-projects.

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 × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × 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. 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 Issuer's for whom large feedstock requirements, or development of new (or expanded) supply chains, demand significant additions to the local labor force.

Risk Information: Most informants agreed that the availability of labor for transportation represents the most significant constraint to wood supply in the region. A logging truck operator training program was offered at Grays Harbor College in Aberdeen in 2019/20 but the program has been put on hold since 2020. There are numerous CDL programs offered in the region but no other examples of logging truck driver training programs could be identified. Although there can be difficulties finding trucks, most respondents noted that the labor force follows the market closely. While there has been a shortage in recent years, that shortage can be tied to changes in forest product markets, particularly for pulpwood/chipwood.

Other workforce elements, including skilled logging equipment operators, millwrights, and sawmill workers are generally available, although it is sometimes difficult to find harvesting contractors when lumber market prices spike.[26] Although the logging workforce in the region is aging, most forestry professionals contacted during outreach did not view the availability of equipment operators as a significant risk to new projects. Logging workforce recruitment and training by the larger forest product companies, the Master Logger Program of the Washington Contract Loggers Association (WCLA), and by individual logging contractors is considered adequate to ensure future supply of the rated quantities. An estimated 100-150 crews ("sides") regularly operate in the supply basin.

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

[26] Workforce shortages are most common on small private woodlots

Being a leading regional forest industry in North America with a sawmill capacity of over 2.5 billion board feet of lumber per year, the Lewis County BDO Zone is expected to have a market-responsive workforce. Any temporary shortages of truck operators and other labor categories have a high likelihood of being resolved via increased hiring/recruitment. .	
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.** In the event that there is a significant lag in the supply response of labor to increased demand, shortages of the rated quantities of feedstock would likely result.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* Grays Harbor College offered a log truck driver training program in 2019/20. A number of forestry professionals contacted by Ecostrat indicated that they were interested in supporting logging truck operator training programs. We expect that programs of this kind will be initiated again within the network of community colleges and technical schools in the region (e.g., Grays Harbor College, Centralia Community College) if truck operator recruitment remains a problem. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is 25%.	**Notch** **25%**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 18 out of 100.	**Score** **18**

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 average transport distance from suppliers to Issuer is high, the supply chain is subject to greater sensitivities to risks, such as increases in diesel cost, weather impacts, mechanical breakdown, and by 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: Diesel fuel prices on the west coast of the United States are consistently higher than prices in the central and eastern regions. As of October, 2023, diesel prices on the west coast (PADD 5) were $5.69/gallon, compared to <$4.80/gallon in all other regions in the United States with the exception of California ($6.27/gallon). Long-term diesel price volatility on the west coast tracks diesel price volatility nationally, but at a higher price point. In contrast to other regions in the United States, real diesel prices have been trending upwards over the past three decades (Figure C-3, Appendix C).

Throughout North America, the costs of owning and operating transportation equipment have increased significantly in recent years. Forestry professionals contacted by Ecostrat who regularly operate within the supply basin noted a 30% increase in prices for tires and occasional diesel prices in excess of $6/gallon over the past three years. The purchase

price of trucks was also observed to have increased in excess of inflation. The exit of independents from the trucking business is partly attributed to the excessive costs of ownership and maintenance.

Comparatively high capital, O&M, and fuel costs on the west coast result in final costs of biomass transportation that are up to 25% higher than costs on the east coast (e.g., $0.35/ton/mile vs. $0.25/ton/mile). Within the BDO Zone, high capital, O&M, and fuel costs are compounded by the distances that will likely need to be travelled to bring the full rated quantities to market. As reported in Risk Indicator 3.1.2, to access over 50% of the available biomass in the BDO Zone will likely require transportation distances in excess of 50 miles (Figure C-2, Appendix C).

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 × RRI) is 36 out of 100.	**36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 36 out of 100.	**36**

3.5.2 Diesel Cost Impacts

Rationale: Changes in diesel cost impact transport cost over time. Sensitivities to worst case scenarios should be run.

Risk Information: As discussed in Risk Indicator 3.5.1, diesel prices are excessive in the western region compared to other areas of the United States and, in contrast to other regions, have trended upwards in real terms since the 1990s (Figure C-3, Appendix C). As of January 2023, Washington State had the third highest diesel prices in the USA.[27] Continued increases in diesel prices may limit access to the rated quantities. For example, if diesel prices increased to $7.00/gallon, hourly rates for trucking could increase by up to 30% (e.g., from $120-$150/hour to $155-$195/hour).[28] For an FOB-at-roadside or FOB-at-mill price of $20-$30/ton, this represents up to a 10% increase in the price of delivered feedstock. It is recognized that pricing formulae and rates can vary significantly by region, company, and year, and therefore this uncertainty is reflected in the final rating.

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 ***high***, therefore the RRI is **8 out of 10.**	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**48**

[27] https://gasprices.aaa.com/state-gas-price-averages/
[28] Determined through outreach. Note that an equivalent fuel surcharge could be imposed instead.

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 48 out of 100.	**48**

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 in required transportation equipment, equipment owners have increased leverage over transportation prices and supply chain resiliency can be lower.

Risk Information: Transportation capacity is sufficient for the existing throughput of roundwood and residuals. Logging trucks, bin trucks, possum belly trailers, walking-floor trailers, and self-unloading trailers are generally available. Many logging truck companies have multiple trailer types and are able to switch trailers relatively easily in response to demand. Given the size and scale of the forest industry in western Washington, the supply of capital and labor generally shifts to match demand within a relatively short time frame. Most local experts contacted by Ecostrat believed that trucking businesses in the region had the financial capacity to respond to increases in demand equivalent to the rated quantities.

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 ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**8**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100.	**8**

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 power to force regulations regarding truck transport, impeding the ability BDO Zone suppliers to transport feedstock.

Risk Information: Forestry is a major industry in the region. Most rural communities are familiar with, and accepting of, logging and logging truck traffic. For example, over 70% of those surveyed in the counties included in the BDO Zone

support logging.[29] Opposition to the forest industry is significant at the state and national levels but not in rural communities.
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 ***low***, therefore the RRI is **4 out of 10.** **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 8 out of 100. **8**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **N/A** No adjustment. *RRI Mitigation (Notch)* No adjustment.
Loaded RI Score **Score** The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100. **8**

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: In many counties, logging truck drivers must obtain a permit to operate on logging roads. None of the local forestry professionals contacted by Ecostrat identified transportation regulations as a barrier to wood supply. Truck owner-operators are able to satisfy weight regulations by adding axles if necessary. The maximum allowable gross vehicle weight (GVW) before special permit requirements is 105,000 pounds. This is significantly higher than most states in the central and eastern regions of the USA (~80,000 pounds). Generally, special permits are not applied for because this can result in excessive wait times and costs (e.g., pilot car requirements).
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 × RRI) is 4 out of 100. **4**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **N/A** No adjustment. *RRI Mitigation (Notch)* No adjustment.
Loaded RI Score **Score**

[29] https://data.workingforests.org/#Lewis

The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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: Primary and secondary roads in western Washington State are generally in good quality due to the mild climate. The Interstate 5 (I-5), which runs north-south, is within a less than 20-minute travel time from the majority of wood processing facilities in the BDO Zone. Road density is generally not a problem. A history of intensive forest management in the region has resulted in a high density of logging roads. Chip truck access can be limited on many sites due to narrow roads, particularly on smaller private woodlots. We assume that the majority of forest roads on industrial timberlands and larger woodlots will be capable of accommodating the chip van traffic required to procure the rated quantity of forest residue, which represents less than one-third of the available supply.

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 ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 24 out of 100.	**Score** **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: A few local forestry professionals contacted by Ecostrat noted that the availability of trucks was the main constraint to reliable, timely wood supply in the region. Others were less concerned over the availability of transportation capacity, noting that capacity has shifted with demand in the past in western Washington. Logging truck availability has been limited in some areas of the BDO Zone in recent years, likely because of the drastic decline in price of, and demand for, pulpwood/chipwood. Chip trucks (a mixture of possum belly, walking floor, and self-unloading trailers) are not as much of a concern, as most of the companies that run dedicated pulpwood chipping operations own a sufficient number of chip trucks to ensure timely delivery. Further, many owners of trucks (particularly the sawmills) have both logging and chip trailers, enabling for changeover of trailer type in response to demand. Bin trucks are also available in the region to transport uncomminuted residue.

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 × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

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: As one of the leading U.S. regional forest industries in terms of annual production, employment, and value-added, western Washington includes a significant number of large, aggregated suppliers that have leveraged economies of scale. There is no sawmill in the BDO Zone with a capacity of less than 50 MMBF/yr and there are seven sawmills with capacities >150 MMBF/yr. This contrasts with central and eastern states, where sawmills with capacities <30 MMBF/yr are more common. Consolidation has also occurred in the logging business: there are at least five logging contractors operating in the BDO Zone with >50 employees. A population of over 25 smaller logging contractors with 1-5 sides also operates 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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**

The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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: The availability and pricing of each of the rated feedstocks is dependent on the health of value-added forest product markets, namely dimensional lumber and finished wood products. A collapse in demand for these conventional forest products would lead to increases in delivered cost and reductions in availability of pulpwood, forest residue, and sawmill residuals. This is unlikely in the near term given lumber production trends over the past decade, which have remained stable between 2.3 and 2.6 billion board feet per year. However, there are indications that wood supply could become reduced over the long term as a result of stricter regulations pertaining to buffer zones and sustainable harvesting targets on state and federal land. This presents a moderate risk to the rated quantities of pulpwood and forest residue, as determined with reference to a lumber production forecast of 2.4 billion board feet per year over the next 20-30 years. Generally, the diversity of harvesting configurations in the BDO Zone (ground, cable, tethered) provides resilience against other potential wood supply disruptions (e.g., climate-related, market-related).

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 × RRI) is **16** out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

3.6.3 Land Ownership Structures

Rationale: The ownership (or control) of the land base on which feedstock is produced can have significant impact on 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 are 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: Within the BDO Zone, approximately 70% of timberlands are privately owned (35% small private, 35% industrial/TIMOs-REITs), 20% are federally owned, and 10% are owned by either the state, Native American tribes, and municipal governments.[30] Annual wood supply is disproportionately sourced from private timberland (>80%). There has

[30] https://nrsig.org/apps/forestland2019/

been no recent trend in small private timberland owners being less willing to prioritize timber production; if market prices for wood are sufficient, WA state private landowners will harvest. Stumpage prices for lumber have been steady over the past decade, whereas prices for pulpwood/chipwood have exhibited volatility in response to pulp mill shutdowns (temporary and permanent). Some risk is presented by the presence of TIMOs and REITs, which manage timberland for shareholders. The continued growth of carbon markets could lead to reductions in timber harvesting.
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 × RRI) is 24 out of 100. **24**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **N/A** No adjustment. *RRI Mitigation (Notch)* No adjustment.
Loaded RI Score **Score** The Loaded RI Score (Total Notch × GRI Score) is 24 out of 100. **24**

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 basin. Such estimates are important in assessing feedstock risk and enable accurate assessment of the efficacy of Issuer's mitigation methods.

Risk Information: Western Washington experiences minimal seasonal variations in woody biomass availability. Mild winters with rainfall pose no significant obstacle to operations, except in extreme cases. Temporary operational pauses may occur during periods of heavy snowfall, but these interruptions are typically limited to a few weeks per year. As long as operators adhere to buffer zone regulations, they can carry out their work year-round without the risk of shutdown.
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 × RRI) is 4 out of 100. **4**

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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: There are no long-term weather and climate trends that are likely to impact the rated quantities of feedstock. For example, there are no trends in extreme precipitation or drought.[31]

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 × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

3.7.3 Forest/Crop Fire

Rationale: Forest/crop fires, especially when occurring at 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 at investigating adaptation strategies and options to deal with future fire occurrence. There is growing consensus that as wildfire activity increases, fire agency suppression efforts will be increasingly strained. However, analyses of fire history suggest that it is the effect of climate variability on precipitation regimes that is the primary reason for the decreasing fire activity in the southern BDO Zone of Canada.

[31] https://statesummaries.ncics.org/chapter/wa/

Risk Information: In Western Washington State, forest fires are uncommon due to persistent year-round precipitation. Fire return intervals are infrequent (>125 years).[32]	
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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

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 are no notable pest outbreaks in recent history in western Washington. Mountain pine beetle outbreaks have increased significantly since the late 1990s but their effects are restricted to the ponderosa and lodgepole pine forests of eastern Washington.[33]	
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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**

[32] https://esajournals.onlinelibrary.wiley.com/doi/10.1002/ecs2.4070
[33] https://www.dnr.wa.gov/publications/em_fwfeconomiclow1.pdf, Fig,.21, p.35

Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

3.7.5 Risk of Hail

Rationale: Hail has negligible impact of 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 increase.

Risk Information: Irrelevant to this rating.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is not rated.	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is not rated.	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is not rated.	**NR**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × 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: There are no trends in extreme precipitation events in Washington State.[34] Flooding events are rare and cannot be predicted with any certainty. Risk to wood supply over the long-term is minimal.

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 × RRI) is **4** out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**

[34] https://statesummaries.ncics.org/chapter/wa/

Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × 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: There is no significant risk of drought in western Washington State. If prolonged drought does occur, it is unlikely to effect wood supply.

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 × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × 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: Strong wind events are uncommon in the region and – if they occur in the future – are unlikely to impact the rated quantities.

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) 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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

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: Winters in western Washington State tend to be mild; freezing temperatures are uncommon.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

3.8 Risk Factor: Political and Social

3.8.1 Government Subsidies for Feedstock Production or Utilization

Rationale: Feedstock that is directly subsidized though government programs can pose greater long-term risk than feedstock that is not. Subsidies may be subject to amendment or repeal, sometimes with minimal notice.

NOTE: This risk indicator refers to direct feedstock subsides only; it does not apply to government subsidies that pertain indirectly to the operations of the Issuer such as Loan Guarantees or to the markets for products produced by the Issuer.

Risk Information: There have been no instances in recent history of feedstock subsidies in the region. The forest residue supply chains that have been temporarily established since the 1990s have been driven largely by subsidies for renewable electricity, not for feedstock.

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) 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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

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 utilization of biomass requires specific permits (i.e., percentage removal of forest residues or corn stover, allowable cut limits, air emission, storage permits, rights-of-way, overweight permits for trucks, cross-border permitting for shipment of biomass, chain of custody, or certification of sustainability) then likelihood of obtaining such permits and/or complying with permitting requirements should be examined.

Risk Information: The forest industry in Washington State is subject to a number of federal and state regulations relevant to forest harvesting activity. Federal regulatory developments – including the development of the Northwest Forest Plan (NWFP) and the listing of salmonid species as threatened/endangered under the Environmental Species Act (ESA) – led to significant declines in timber availability on federal and private lands from the mid-1990s through to the mid-2000s. Timber supply risk from private lands was reduced significantly following the federal approval of the WA state Forest Practices Habitat Conservation Plan in 2006, which enabled private landowners in the state (industrial and small private landowners) to harvest in areas previously off-limits under the NWFP and ESA. Discussions around increasing buffer zones and reducing sustainable harvesting levels on public land continue, presenting a low-to-moderate risk to future supplies of pulpwood and forest residue.

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 ***low***, therefore the RRI is **4 out of 10.** Amendment of regulations is expected to have a marginal impact on annual harvesting activity. .	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**

Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 24 out of 100.	**Score** **24**

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: Over 70% of those surveyed in the counties included in the BDO Zone support logging.[35] However there are a number of organizations that frequently advocate for stricter regulation of forestry practices (e.g., Center for Responsible Forestry, Conservation Northwest, Washington Environmental Council). Many informants contacted by Ecostrat believed that regulations were likely to become stricter in the near-term. Any declines in logging that result from continued regulatory development are expected to be marginal.

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 ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 24 out of 100.	**Score** **24**

3.8.4 Consent of, and Co-operation 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 co-operation with, Indigenous communities and First Nations decreases Issuer risk.

Risk Information: Tribal lands in the supply basin constitute <1% of the total working forest land base. The Muckleshoot Indian Tribe owns and manages approx. 100,000 acres in western Washington and are party to a number of agreements that ensure that their lands are not infringed upon without their consent. It is recommended that bio-project proponents consult with the Tribe before any development proceeds.

[35] https://data.workingforests.org/#Lewis

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 × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

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, 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: Irrelevant to this rating.

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

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

Rationale: Public concerns about 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: Public concerns over the sustainability of forest practices are largely addressed by the strict regulatory environment in Washington State. Federal and state laws including the Washington Forest Practices Act (1974) and the Forests and Fish Act (1999) require adherence to buffer zones around ecologically sensitive areas, monitoring of the impacts of forest operations, and reforestation. Regulations limit clearcutting on private and public lands to 120 acres

and require retention of up to 18% of every harvesting unit. Replanting must be completed before adjacent stands can be cut. The industry invests in site preparation, planting, and various stand management actions that are designed to ensure regrowth.[36] The growth-to-drain ratio for forests in the BDO Zone has exceed 1.2 over the past three years.[37] Regulations governing harvesting on federal and state lands continue to be developed. The sustainable harvest on state lands will likely drop over the next planning cycle and buffer zone requirements are being made more stringent. This does not affect the rated quantity of wood but provides further assurances to potential developers of the sustainability of future operations.

In addition to government policies and regulations, almost all forest product companies that operate in western Washington State are members of a third-party sustainability certification standard. Industrial forests tend to be SFI-certified (FSC certification is uncommon in Washington State), whereas many smaller private woodlots are certified under the American Tree Farm System (ATFS). Under both of these programs, certification requires adherence to standards of forest management designed to mitigate impacts on biodiversity, forest regeneration, water quality, and related attributes. Compliance is verified through auditing. SFI-certified mills can only source roundwood from logging contractors that are certified. Most logging contractors that operate in western Washington are Accredited Logging Professionals under the Washington Contract Loggers Association (WCLA) Master Logger Program (MLP).

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 × RRI) is 4 out of 100.	**4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

3.9.2 Risk to Soil Quality

Rationale: Soil sustainability can be defined as 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 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 which can degrade the soil and its nutrients.

[36] https://meridian.allenpress.com/fpj/article/67/5-6/316/136646/A-Life-Cycle-Assessment-of-Forest-Resources-of-the
[37] FIA data

Risk Information: The soils of western Washington State are some of the most productive in the country, owing to a temperate climate, abundant rainfall, and high organic matter content. A 2010 study of logging residue recovery in Washington State involving the University of Washington and TSS Consultants (contracted by WA DNR, funded by USDA-USFS), concluded that the amount of biomass retained on site as a result of operability constraints is sufficient to preserve ecological functions.[38] We did not consider the possibility of collecting loose residues from the stand following operations. Although this pool of forest residues is available in greater abundance (compared to processing residue on landings), it would lead to increased costs and would increase risk of soil quality depletion. There is no risk of soil nutrient or carbon depletion from pulpwood and processing residue recovery.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × 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: Regulations under the Forests and Fish Agreement (1999) require that forest operations on private land include riparian buffers around rivers and streams (fish-bearing and non-fish-bearing). Forestry on privately-owned lands is subject to a number of regulations designed to protect against river sedimentation and threatened species declines (e.g., salmon). SFI certification is common in the area. Due to the presence of strict regulations requiring buffer zones around riparian areas, risk is assessed as very low.

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 × RRI) is 4 out of 100.	**Score** **4**

[38] UW 2012 – state-wide forest biomass supply assessment, p.15

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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: Irrelevant to this rating.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is not rated.	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is not rated.	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is not rated.	**NR**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × 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: Irrelevant for this rating.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is not rated.	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is not rated.	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is not rated.	**NR**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × 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: Forestry in Washington State is subject to numerous policies and regulations that aim to ensure sustainability and wildlife protection. The federal Northwest Forest Plan (NWFP, est. 1994) aims to protect threatened and endangered wildlife by limiting the extent and intensity of forest operations in the federally managed forests of Washington, western Oregon, and northwestern California.[39] Private and state trust lands are subject to a Habitat Conservation Plan (est. 1997) that ensures compliance with the federal Endangered Species Act.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × 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: Many forest companies in the region use artificially selected Douglas fir seedlings when replanting. Artificial selection of tree species cultivars is achieved through grafting and interbreeding. There are no indications that genetically modified tree species will become a feature of forestry in western Washington State.

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 × RRI) is 4 out of 100.	**Score** **4**

[39] https://www.dnr.wa.gov/publications/em_fwfeconomiclow1.pdf; https://www.fs.usda.gov/r6/reo/overview.php

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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: The quality of pulpwood and sawmill residuals is ensured by best practices and familiarity on the part of sellers and buyers. Producing the rated quantity of forest residue at scale does not constitute a risk to feedstock quality as it is expected that grinders (not chippers) will be used to process slash piles. Slash pile management is commonplace in the region.

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 × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

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 of pulpwood (200,000 bdt/yr) and forest residue (100,000 bdt/yr) can be procured without requiring any additional investment in logging and thinning capacity. In many cases, pulpwood is being processed and left on landings until markets improve; slash piles are available at roadside and landings as a consequence

of normal operations. Additional trucks will likely be required but this is not considered a significant risk due to the demonstrated responsiveness of capital and labor in the region to changes in demand. Comminution capacity is also adequate for scale-up, as there are a number of mobile grinders and chippers capable of comminuting the rated quantity of forest residue. A network of approx. ten companies specialized in whole log chipping has developed over the past couple decades to supply the pulp and paper industry. The companies own and operate stationary and/or mobile chipping equipment installed at terminal yards where pulpwood is aggregated or brought to forest operations for on-site pulpwood comminution. There are a number of companies specialized in construction and demolition that own and operate grinders that can be readily employed for comminution of forest residue.

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 × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel

Risk Information: A 400-acre parcel located southeast of the Centralia Generating Station (913 Big Hanaford Rd, Centralia, WA 98531) was chosen as the project site with the most promise for bio-project development at this time. The site is owned by the Industrial Park at TransAlta ("IPAT") and is adjacent to land owned by TransAlta. Infrastructure risks were scored with reference to the project site and the industrial park of which it is a part, as well as to broader regional infrastructure resources when appropriate. Note that there are other sites that could be considered and developers are encouraged to speak with local economic development staff.

The 400-acre project site is located in the southeastern portion of a ~4,400-acre patchwork of brownfield, greenfield, and undevelopable sites zoned for industrial use (Map C-2, Appendix C). IPAT owns approx. 1,000 acres of non-contiguous land within the area for purposes of industrial development. This land was transferred from TransAlta to IPAT since 2014 under special legislation designed to encourage new industrial development following the announcement that the Centralia Generating Station will permanently close by 2025.

The 4,400-acre area is situated on the eastern boundary of Centralia on Interstate 5, equidistant between Seattle and Portland. Assets within the broader park include but are not limited to: 3M GPD of industrial water, potable water, sanitary sewer, rail access, rail loading infrastructure, a 48" main and 12" natural gas lines, 230kv power, and fiber optic access. The project site does not have direct access to water lines, sewer lines, 12" natural gas lines, and rail. New developers seeking access to this infrastructure would be assisted by IPAT, which has water rights and an on-going

relationship with TransAlta, which owns much of this infrastructure. Further support for industry at the industrial park is offered through the Economic Alliance of Lewis County who are committed to working with interested landowners to help facilitate processes on the front end (like zoning, environmental analysis, and permitting) that will expedite development.

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 × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 36 out of 100.	**Score** **36**

5.1.2 City Ownership

Risk Information: The project site is privately owned by IPAT and lands adjacent to the site are owned by TransAlta. The future of TransAlta-owned and managed lands is subject to the private property rights associated with the company and to the local, state, and federal regulations that govern those rights. IPAT is committed to supporting the supply of rail, water, and sewer access to new projects. IPAT has received about $4 million for use in developing the industrial park's infrastructure from state and federal sources. Support and commitment for attracting industry and development is highlighted by IPAT's partners on the project which include but are not limited to the following: City of Centralia, City of Chehalis, Lewis County, Impact Washington, The Industrial Commission, and the Washington Economic Development Association.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

5.1.3 Industrial Land Use Zone

Risk Information: The project site has industrial, manufacturing, and commercial zoning. All of the land surrounding the project site is owned by TransAlta and shares the same zoning designation.	
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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

5.1.4 Natural Gas Line

Risk Information: IPAT is traversed by a high pressure 48' distribution line. Natural gas supplies are provided by Northwest Pipeline Corporation via the Chehalis Gate Station. PSE reduces the pressure of natural gas from 345 pounds per square inch (psi) to 280 psi at the station. The capacity is approximately 560,000 cubic feet per hour (cfh). High pressure supply lines (with diameters of 16", 12", 8", 6", and 4") provide gas service to regions via pressure reducing stations known as district regulators. These district regulators reduce pressures to 25 to 60 psi, which are typical distribution operating pressures. In Centralia, there are two district regulators. Note that there are currently no natural gas lines available direct to the 400-acre site.

Industrial natural gas prices in Washington in June 2023 averaged $11.14 per thousand cubic feet, which was approximately 186% more than the national average rate of $3.9 per thousand cubic feet.[40] Year over year, the average industrial natural gas rate in Centralia increased 37%, from $8.35 per thousand cubic feet in June 2022 to $11.42 per thousand cubic feet in June 2023 (Based on WA data; U.S. Energy Information Administration). The higher prices in Washington are due in part to the fact that due to the natural mountainous terrain in the state, supply lines run north to south versus in the states east of the Rockies which have supply lines running in every direction.

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 × RRI) is 36 out of 100.	**Score** **36**

[40] Based on WA data; U.S. Energy Information Administration

Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 36 out of 100.	**Score** **36**

5.1.5 Electrical

Risk Information: By virtue of the IPAT property being adjacent to Bonneville Power Administration lines, the project site has easy access to 230 kV power nearby. Access to low-cost electricity is sustained in Centralia through its utility, Centralia City Light (CCL).[41] CCL receives most of its power from the federally based Bonneville Power Administration (BPA). Additional power is received through CCL's Yelm hydroelectric generation plant (12 MW max capacity). The City will be required to make improvements to the Yelm system in order to eliminate risks of failure and ensure power generation at the maximum allowable amount based on water availability. The City will also continue to support proposals for renewable projects which can generate and add capacity through the use of existing infrastructure at the to be decommissioned TransAlta facility.[42] Note that power to the TransAlta facility is provided by the Lewis County Public Utility District. The industrial electricity rate in Lewis County over the last five years has averaged $0.08/kwh, which was 32% higher than the state average of $0.0605/kwh but 22% lower than the U.S average rate of $0.0975.[43]

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

5.1.6 Fresh Water Supply

Risk Information: The project site has potential access to close to 7 million gallons of potable water and industrial water through the connection of lines into the TransAlta facilities' existing system. IPAT has water rights and is working with TransAlta to clarify water access logistics. A water treatment plant is located within the 4,400-acre area (owned by

[41] In Lewis County, the average industrial electricity rate over a 5-year period is $0.08/kwh which was 32.23% higher than the state average of $0.0605/kwh but 22% lower than the U.S average rate of $0.0975 (https://findenergy.com/wa/lewis-county-electricity/)
[42] https://www.utc.wa.gov/regulated-industries/utilities/energy/conservation-and-renewable-energy-overview/clean-energy-transformation-act
[43] https://findenergy.com/wa/lewis-county-electricity/

TransAlta). Intake water is drawn from the Skookumchuck River at a rate of 26 MGD. The facility pumps intake water to the surge pond, then treats it with filtration, deionization, and reverse osmosis and then uses it for all power plant and potable water demands. As TransAlta prepares for the slated 2025 facility shutdown, they have begun to make plans for its water rights, which represents more than 50 cubic-feet per second (that is 22,500 gallons per minute) and 28,000 acre-feet per year of out-of-stream uses. These plans include development of what would be the state's largest water bank to date. While it is still in the early planning stages, several new water uses have already been identified including making water available to the City of Centralia for the basin's expanding agricultural needs. The TransAlta water bank is situated near Centralia, Washington, along the Skookumchuck River—a major tributary of the Chehalis River.
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 × RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **N/A** No adjustment. *RRI Mitigation (Notch)* No adjustment.
Loaded RI Score **Score** The Loaded RI Score (Total Notch × GRI Score) is 36 out of 100. **36**

5.1.7 Sewage Disposal Trunk Line

Risk Information: IPAT has recently completed development of the utilities at their industrial park to include potential future access to sanitary sewer. However, sewage control issues remain within the area. Trunk lines are in need of replacement in some areas and the sewage treatment plant may require capacity upgrades to accommodate new projects. The project site at IPAT does not have direct access to sewage 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) **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 × RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **N/A** No adjustment. *RRI Mitigation (Notch)* No adjustment.
Loaded RI Score **Score** The Loaded RI Score (Total Notch × GRI Score) is 36 out of 100. **36**

5.1.8 Drainage and Stormwater Management

Risk Information:

Dewatering at the project site will involve discharge of water through a roadside ditch into the following creeks:

Outfall #	Outfall Description	Outfall Description	Surface Waterbody Name	Latitude	Longitude
1	Packwood Creek	Packwood Creek	Surface Water Body	46.751973	-122.82942
2	Big Hanaford Creek	Big Hanaford Creek	Surface Water Body	46.758534	-122.82942

The Washington State Department of Ecology provides and oversees drainage and stormwater management plans. Centralia's storm water infrastructure within the city consists of the following system elements: 34 miles of curbs and gutters, 14 miles of gravel shoulders, 22 known culverts, 153,300 linear feet of storm water conveyance pipe, and 1,533 catch basins,[44] 71 drywells, 511 manholes, 16 retention/detention storm water facilities, 31 outlets and ¼ to ½ mile of open ditch. Sufficient measures are being taken by the city to manage storm water and prevent/prepare for floods caused due to the increase in water level of the water bodies during heavy rainfall. The Comprehensive Plan of the City includes regulations for land use planning that prioritize stormwater management.[45]

The City of Centralia and its urban growth areas face poor stormwater drainage due to their floodplain location, elevation, and proximity to full rivers and streams. This is exacerbated by an old conveyance system, undersized systems, and lack of drainage provisions. Additionally, rivers and streams in Centralia have experienced water quality declines and loss of aquatic habitat due to stormwater runoff. Sufficient measures are being taken by the city to manage storm water and prevent/prepare for floods caused due to the increase in water level of the water bodies during heavy rainfall. The Comprehensive Plan of the City includes regulations for land use planning that prioritize stormwater management.[46]

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 ***very low***, therefore the RRI is **2 out of 10.**	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**Score** **8**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100.	**Score** **8**

[44] Based on the assumption that there are three catch basins and 300 linear feet of storm water conveyance pipe per manhole.
[45] https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?id=375953
[46] https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?id=375953

5.1.9 Available ICT (Information & Communication Technology) Services

Risk Information: Internet speeds in the project site and surrounding area are approximately 85 Mbps, while wired internet connections average a speed of 30 Mbps. Major carriers such as AT&T, Verizon, T-Mobile, and U.S. Cellular all offer good 4G coverage with some 5G availability and there are several options for fiber internet in both the Centralia and project site.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

5.1.10 Infrastructure – Landfill/Alternative Markets for Waste Disposal

Risk Information: The city owned Central Transfer Station for solid waste disposal is located in Centralia, 9 miles from the project site. The tipping fee is $100 per ton with a minimum fee is $15.00 for 280 pounds or less. Industry is responsible for solid waste management including hauling to waste disposal facilities. Other landfills in the area include the East Lewis County Transfer Station in Morton, WA (52 miles from the project site).

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

5.2 Risk Factor: Logistics

5.2.1 Road and Highway Access and Intersection

Risk Information: The project site is strategically located just 9 miles west from Interstate 5 (runs north to Thurston County and south to Cowlitz County), 9 miles from Highway 12 (runs east from Interstate 5 through the Cowlitz River Valley in the Cascade Mountains to Yakima County), and 12.5 miles from Highway 6 (runs west from I5 through the coastal range to Pacific County). IPAT is developing additional road infrastructure capable of bearing heavy traffic. The North County Industrial Access project, which is currently under review, involves a direct industrial ingress/egress arterial two-lane, two-way truck route from Interstate 5 to the Industrial Park at TransAlta (IPAT). The North County Interchange had been included in the $55.5 million capital plan for 2025-2026. However, the timelines for the release of funds for the North County Industrial Access project are currently under discussion.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

5.2.2 Ocean/River Access

Risk Information: Deep Water Ports include the Port of Tacoma operated by the Northwest Seaport Alliance, 50 miles north of the project site. The Port provides both containerized and break-bulk shipping. The Port of Olympia, 16 miles north of Centralia, provides break-bulk shipping only. The Ports of Kalama and Longview provide marine access for export/import business. Wahkiakum Port #1 provides marine access including recreational and commercial use.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**

Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

5.2.3 Railway Service

Risk Information: Three railways run through Centralia including BNSN (North/South), Union Pacific (East/West), and Puget Sound & Pacific Railroad (PSAP). All three railway companies run within 6 miles west of TransAlta which has its own dedicated spur connecting directly to the BNSN. The TransAlta plant rail spur is located approx. 3 miles from the project site.

A connection between Centralia and Blakeslee Junction is provided by the Union Pacific Railroad. There is a transloading facility located in Chehalis approximately 14 miles from the facility which offers onsite warehousing, short-term staging space, and a transload yard with dual boxcar/center beam capabilities. The transloading facility can handle 15 railcars daily and provides access to BNSF and Union Pacific service. Note that access can sometimes be denied or delayed for small or modest demands.

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 × RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 36 out of 100.	**36**

5.2.4 Accessibility to Airport

Risk Information: Chehalis–Centralia Airport is a 438-acre city-owned public use airport located in Chehalis. The airport lies one mile west of the town and is 13 miles from the project site. The airport contains a single asphalt runway. In 2011 there was an average of 131 operations. Other airports within Lewis County include Ed Carlson Memorial Field (cargo and other non-passenger use) and Packwood (general aviation).

A summary of other local class airports in Lewis County is provided below:

Airport	Type	Aircraft	Annual Operations	Runway Length	Distance from Centralia, WA
Ed Carlson Memorial Field	Local General Aviation	18 based aircraft	8,300 Annual Operations	4,479' Runway Length	24 miles
Packwood	Local General Aviation	1 based aircraft	5,300 Annual Operations	2,356' Runway Length	74 miles

The nearest commercial airport to Centralia is Seattle (SEA) Airport which is 59.3 miles away. Other nearby airports include Portland (PDX) (80.2 miles), Everett (PAE) (89.4 miles) and Victoria Inner Harbor Apt (YWH) (120.3 miles).

There are six (6) private airports within ten miles of Centralia.

- Skyqueen Airport is located 2 miles east of Centralia at Seminary Hill.
- Hartly Airport is located 6.7 miles south of Centralia at Chehalis.
- Skatter Creek Airport is located 8.4 miles northwest of Centralia at Rochester.
- Wissler's Airport is located 8.7 miles northeast of Centralia at Tenino.
- Dwight Field Airport is located 9.1 miles southeast of Centralia at Chehalis.
- Sorrel Airport is located 9.3 miles northwest of Centralia at Tenino.

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 ***very low***, therefore the RRI is **2 out of 10.**	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**Score** **8**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 8 out of 100.	**Score** **8**

5.3 Risk Factor: Social Infrastructure

5.3.1 Healthcare Facilities

Risk Information: Lewis County has two hospitals servicing 76,012 people across 2,403 square miles (one hospital per 38,006 people), ranking 23rd of 39 Washington counties in hospitals per capita. The 2019 County Health Rankings study by the University of Wisconsin Population Health Institute ranks Lewis County 30th out of 39 Washington counties in terms of health outcomes, including lifespan and prevalence of poor physical or mental health. The County is a recognized Health Professional Shortage Area and Medically Underserved Population, ranking 29th out of 39 Washington counties for clinical care services. The population size and characteristics indicate that there are too few

health care professionals. One primary care physician serves 2,200 residents. In comparison, Washington State has one Primary Care Physician per 1,220 persons, twice that of this region.

The largest hospitals in the region include Morton General Hospital and Providence Centralia Hospital. Morton General Hospital is a Trauma Level 5 hospital located 50 miles from the project site. The hospital provides inpatient and outpatient care, emergency department, diagnostic imaging, medical laboratory, rehabilitation, and sleep medicine services to East Lewis County. The hospital has 19 physicians in 12 disciplines. Providence Centralia Hospital is a non-profit Trauma Level 4 hospital located 11 miles from the project site. Providence teams are trained in lymphedema, neurological, occupational, pediatric, speech, wound care, oncology, and chemotherapy. Diagnostic imaging services include breast-specific gamma imaging, bone density screenings, CT-Scans, X-Rays, digital mammograms, digital radiology, fluoroscopy, MRIs, nuclear medical exams, and ultrasound.

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 × RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**16**

5.3.2 Educational Facilities

Risk Information: There are 4 private schools in Lewis County that are K-12 whereas public schools consist of 17 elementary schools, 5 middle schools, 2 junior high schools, 12 high schools, and 1 K-12 school. Lewis County fares better than the state average in with its 84 percent high school graduation rate. Fewer than 80 percent of high school students in Washington state earn a diploma. The average student to teacher ratio in Lewis County between both public and private schools is 20:1. There is one two-year public college (Centralia College) which is a member of the 34 community and technical colleges in the state which offers a bachelors in applied sciences, CDL training, and transfer programs. There is also a university located in neighboring Thurston County (Saint Martin's University). Washington State University Lewis County Extension offers several programs that connect people in Lewis County to the research and knowledge bases of the state's land grant research university providing solutions to local problems and stimulating local economies.[47]

Other colleges and universities not far from Lewis County include:

- South Puget Sound Community College, Olympia, WA: Public, 2-4 years
- The Evergreen State College, Olympia, WA: Public, 4 years
- Washington State University, Seattle, WA: Public, 4 years
- Clover Park Technical College, Puyallup, WA: Public, 2 years

[47] https://extension.wsu.edu/lewis/

- Central Washington University, Ellensburg, WA: Public, 4 years
- Eastern Washington University, Cheney, WA: Public, 4 years.

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 × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

5.3.3 Transportation Facilities

Risk Information: In addition to the information provided above, Twin Transit operates a local bus service in the Centralia-Chehalis area, providing accessible fixed-route, deviated route, and paratransit services. The White Pass Community Services Coalition operates the LEWIS Mountain Highway Transit (MHT), which provides fixed-route transit service between Centralia/Chehalis and Packwood via Morton. Twin Transit and the Centralia Train Depot are co-located in eastern Centralia. The Greyhound Bus Station is on Twin Transit Centralia Route 21 and serves as a passenger loading and unloading point for three north-south routes. Amtrak Cascades serves the Centralia/Chehalis area with a depot in downtown Centralia, operating along the Burlington Northern Santa Fe rail lines. The Lewis County Convention & Visitors Bureau (CVB) provides free local trolley service between downtown and the Centralia Outlet Mall during designated seasonal events. Private transportation is available through multiple taxi services or on-demand ride sharing services. Designated bicycle paths and routes help travelers locate safe, direct connections to areas they want to access. Freight rail service is available to and from Centralia along the Burlington Northern Santa Fe (BNSF) Railroad, Union Pacific Railroad, and Tacoma Railroad. For Air Facilities, refer to Section 5.2.4.

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 × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

5.3.4 Recreational Facilities

Risk Information:

Community venues include Claquato Church and St. Urban Church. County Parks include the following:

County Parks	Acreage	Location	Facilities
Back Memorial Park 5.0 Dieckman Road in Adna	5	Dieckman Road in Adna (Just south of intersection with the Willapa Hills Trail)	Track, ball fields, playground, and picnic area
Rose Park	20.9	Penning Road (South of SR 6)	Covered picnic/kitchen area, picnic area, playground, volleyball area, horseshoe pit, trail with exercise stations
Schaefer Park	19	SR 507 and Big Hanaford Road	River swimming, fishing, group use, playground, picnic area
South County Regional Park	18.5	Ray Road (South of SR 505, just south of Toledo)	Swimming, fishing, boating, playground and picnic area
Packwood Cowlitz River Public Access Point	N/A	Alta Dr, Packwood, WA	Swimming, fishing, boating, hiking, playground and picnic area
Southwest Washington Fairgrounds	30.0	1909 S Gold St, Centralia, WA	largest indoor/outdoor event facility in the area. The fairgrounds offer over 100,000 square feet of multi-use buildings. Major amenities include historic grandstands, 2 outdoor stages, large parking and camping areas.

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**Score** **4**

5.3.5 Cultural Facilities

Risk Information: Lewis County has undertaken several efforts over the last five years to enhance quality of life in the area including the Chehalis Renaissance project and Centralia Station. Plans are underway to provide Lewis County with a permanent *Discover! Children's Museum* in Chehalis. Timberland Regional Library serves Lewis County and has six branch libraries, and two kiosks where library patrons can reserve/check out books.

There is a wide variety of cultural amenities in Lewis County including art galleries, museums, theatres/film, music, and festivals. Some of these include but are not limited to:

- ARTrails of Southwest Washington. The 2003-founded cooperative exhibits regional artists, art studios, and galleries and hosts an annual fall studio tour that includes events in Lewis County's smaller communities.
- The county honors the Oregon Trail travels of pioneer Ezra Meeker with numerous historical markers throughout the region. There are historical markers in Centralia, Chehalis, Claquato, and Toledo.
- The Lewis County Historic Bike Ride is an annual fundraiser that originated in the early 1990s as a county-sponsored historical celebration.
- The Evergreen Playhouse in Centralia, Washington is the longest-running community theatre in Lewis County.
- Lewis County, Washington contains 35 sites listed on the National Register of Historic Places, including seven sites of national significance and eight sites of state significance. Wesley Everest gravesite, Jackson, John R., House, La Wis Wis Guard Station No. 1165, North Fork Guard Station No. 1165, and Randle Ranger Station--Work Centre are notable locations**.**

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 × RRI) is 4 out of 100.	**4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

5.3.6 Public Safety Facilities

Risk Information: In 2022, per 1,000 residents, Lewis County had a crime rate of 29.4 which is less than half of the state rate of 67.5. Centralia had a rate 103.4 and Chehalis 124 which is 53.2% and 84% more than that of the state average respectfully.[48] The Lewis County Sheriff's Office (LCSO) is a full-service law enforcement agency organized into three bureaus: Operations, Corrections, and Services that are overseen by the Sheriff's Administrative Staff consisting of 42 Commissioned Deputies (110 employees agencywide). There are 55 fire departments in Lewis County, Washington, serving a population of 76,012 people in an area of 2,403 square miles. There is one fire department per 1,382 people, and one fire department per 43 square miles. In Washington, Lewis County is ranked 12th of 39 counties in fire departments per capita, and 17th of 39 counties in fire departments per square mile.[49]

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**

[48] https://www.waspc.org/assets/CJIS/Crime%20in%20Washington%202022-compressed.pdf
[49] https://www.countyoffice.org/wa-lewis-county-fire-departments/

The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

5.3.7 Housing

Risk Information: The median home value in Lewis County is $398,375[50] and the average rent for a two-bedroom apartment is $1,150/month. Homes on average are appreciating at 0.7% a year. In Lewis County, 70% of the housing stock is single family residential, and the average sale price has increased from roughly $150,000 in 2012 to over $350,000 in 2021 which reflects a 127% increase. During the same period, there was a 69% decrease in the supply of homes for sale. In June 2021, the county had only a 1-month supply of housing where typically, a region needs at least a 4-month supply to stabilize sale price.

Lewis county has over 4,400 cost-burdened renter households and over 2,200 severely cost-burdened renter households. While the county has close to 1,100 income restricted housing units for rent, this is insufficient to accommodate all the lower income households that qualify. In Lewis County, 48% of renters pay more than 30% where of their income on housing. Households spending at least 30% of their income on housing make up 29.4% of all households whereas, the national average for comparison is 22.8%. Rental unit vacancy is also low at 4.5%. Long-distance commuting is an indicator of lack of affordable or available housing closer to job locations. There are over 18,000 people who work in Lewis County 52% work between 25 – 50 miles from their workplace.

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 ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 32 out of 100.	**Score** **32**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 32 out of 100.	**Score** **32**

[50] https://www.rockethomes.com/real-estate-trends/wa/lewis-county

5.4 Risk Factor: Workforce and Permitting

5.4.1 Labor Availability

Risk Information: Between 2009 and 2023, Lewis County's average annual unemployment rate declined from 13.3% to 4.1%. The County's labor force has expanded by nearly 4,200 since 2014 which may suggest ongoing faith in the local economy and improved job environment. Close 26 % of workers commute from counties outside of Lewis County. The workforce in Lewis County is aging. In 2020, the age group of 55 and older was the largest in the County, accounting for 26.2% of employment across all industries. The next-highest proportion of workers were between the ages of 35 and 44 (21.5%). 28.1% of the residents have a high school diploma, and 31% of residents have a diploma/degree.

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 ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 24 out of 100.	**Score** **24**

5.4.2 Labor Cost

Risk Information: In 2020, the average annual wage in Lewis County was $48,214 less than the state average of $73,504 whereas the median hourly wage was $23.64, lower than the state's median hourly wage of $29.28 and the state's median hourly wage excluding King County of $25.01. In 2020, Lewis County's per capita personal income was $47,752, which lagged behind both the state and the nation. The national median was $59,510, while the state median was $67,126. 2019 saw a median household income of $58,912 in Lewis County. The county's median was less than the state's ($78,687) and the nation's ($65,712).

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 × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**

Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 4 out of 100.	**4**

5.4.3 Training Programs/Community College

Risk Information: In Lewis County there are programs and community/technical colleges that are helping meet the evolving needs of the clean energy industry and provide education and training opportunities in various energy-related fields. The Pacific Northwest Center of Excellence for Clean Energy at Centralia College coordinates with the other 34 community and technical colleges in the state to offer relevant classes and respond to industry needs. The center is involved in the program design for clean energy. Centralia College is considering the development of a two-year associate degree program focused on green hydrogen and intends to add a hydrogen elective to an existing curriculum at the college. The industrial trades program at Centralia College offers welding, diesel ERA (electronics, robotics, and automation), and energy conservation courses.

The community of technical institutions which Centralia College is part of, are adaptable and willing to add classeses or programs based on industry demand, focusing on local businesses and employment needs. Clover Park Technical College, a neighbouring college/university with biofuels equipment and a large laboratory, can link Centralia College or institutions in the system to the University of Washington thereby ensuring students have access to relevant programs. There is a strong emphasis on the importance of connecting students to universities for further education and degrees beyond the two-year curriculum through a focus on internships, pre-apprenticeships, and transfer options in environmental sciences and engineering for example. Centralia College offers a transfer program with Washington state University where they can take the prerequisites at Centralia College for two years before transferring to the larger institution. The Renewable Energy Vehicle and Infrastructure Technician Training (REVIT) vocational program is another noteworthy program in the region that introduces high school students to the renewable energy industry.

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 × RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score	**Score**
The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**16**

5.4.4 Permit Process

Risk Information: The permitting process is described on the Lewis County Community Development website.[51] Lewis County has a history of encouraging timely processing and embracing economic development. The issuance of a permit can be divided into three general phases:

[51] https://lewiscountywa.gov/departments/community-development/).

Step 1 – Complete Master Site Review. After approval of the Master Site Review, building plans may be submitted. Following submission, the permit center will forward the information to the building department for plan review. A minimum of four (4) weeks may be required for commercial or industrial building use permits, dependent on the project and scope of reviews involved.

Step 2 - Complete Site Evaluation: (1) Road Approach Application and Site Address Application. (2) State Environmental Policy Act (SEPA) – commences upon submission of a completed environmental checklist while the SEPA review is integrated throughout the agency's permit procedure. The lead agency and applicant can collaborate to reduce potential impacts by revising the proposal or designating mitigation measures to be included in the permit conditions. The draft checklist is forwarded for interagency and tribal government consultation, following which the approving agency will make a final determination. The decision-making agency will determine whether SEPA compliance is required. The majority of agencies make concerted efforts to process permit applications expeditiously while addressing regulatory and environmental concerns. Permits required, project complexity, whether information is already available, and whether additional studies are required all affect the duration of the process.

Step 3 - Development Permitting. Application for a Building Permit.

In general, the permit application process takes between two and six months.

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 × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **N/A**
Loaded RI Score The Loaded RI Score (Total Notch × GRI Score) is 16 out of 100.	**Score** **16**

APPENDIX C: TABLES, FIGURES AND MAPS

Table C-1. Comparison of BDO Zone biomass availability estimate with other estimation methods and sources

Feedstock type	Assumptions/methods	Estimate	Notes
Potential annual forest residue availability	Biomass recovery factor of 7 bdt/acre (average reported in UW, 2012, p.95) Total acres harvested per year in BDO Zone of 35,000 – 55,000 acres/yr, using estimate of county-level harvesting adjusted for overlap with BDO Zone (1.1 billion board feet/yr) and assuming 20,000 – 30,000 board feet/acre	245,000 – 385,000 bdt/yr of forest residue	Assumes implementation of forest biomass recovery in all annual operations Comparable to estimate of potential forest biomass availability derived using UW Biomass Calculator under a conservative state-wide harvest scenario (411,867 bdt/yr)
Potential annual pulpwood availability	County-level harvest statistics adjusted for overlap with BDO Zone (WS DoR, 2018-2022) Percentage of annual harvest in WS that is consumed by the pulp and paper industry (11%; WS DNR, 2017, p.39) Percentage of annual harvest that is of pulpwood quality but that is left unutilized owing to lack of markets (5-10%)	640,000 – 840,000 bdt/yr of pulpwood	The percentage of the annual harvest that was consumed by the pulp and paper industry is lower than what it was in 2016 due to market decline and the closure of WestRock – Tacoma. Demand for pulpwood by the pulp and paper industry is expected to continue to decline. Therefore, the estimate of potential pulpwood availability for new projects (~800,000 bdt/yr) is conservative.

Map C-1. Concentration of available forest biomass (pulpwood and forest residue) within 75-mile drive distance of Centralia, by county.

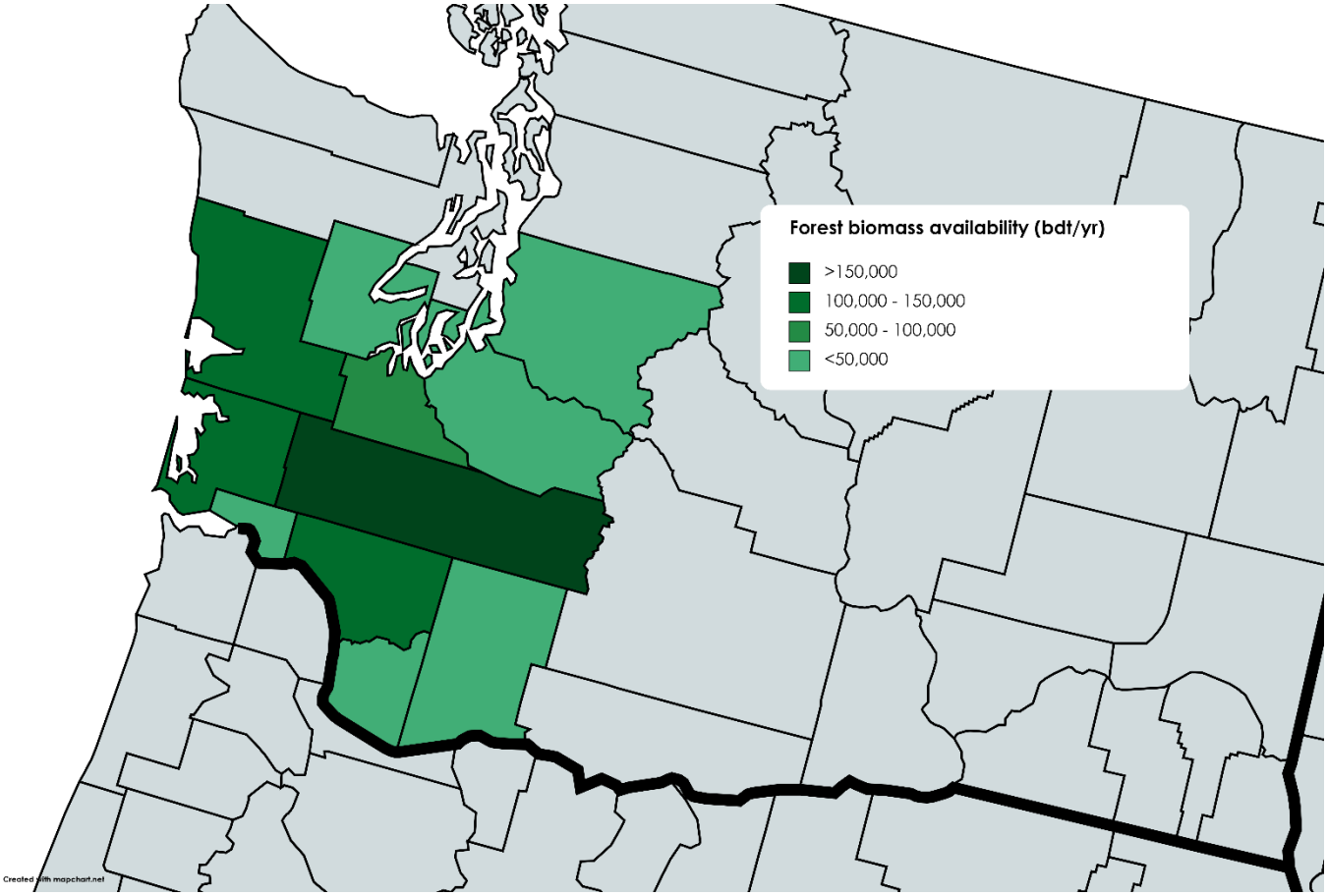
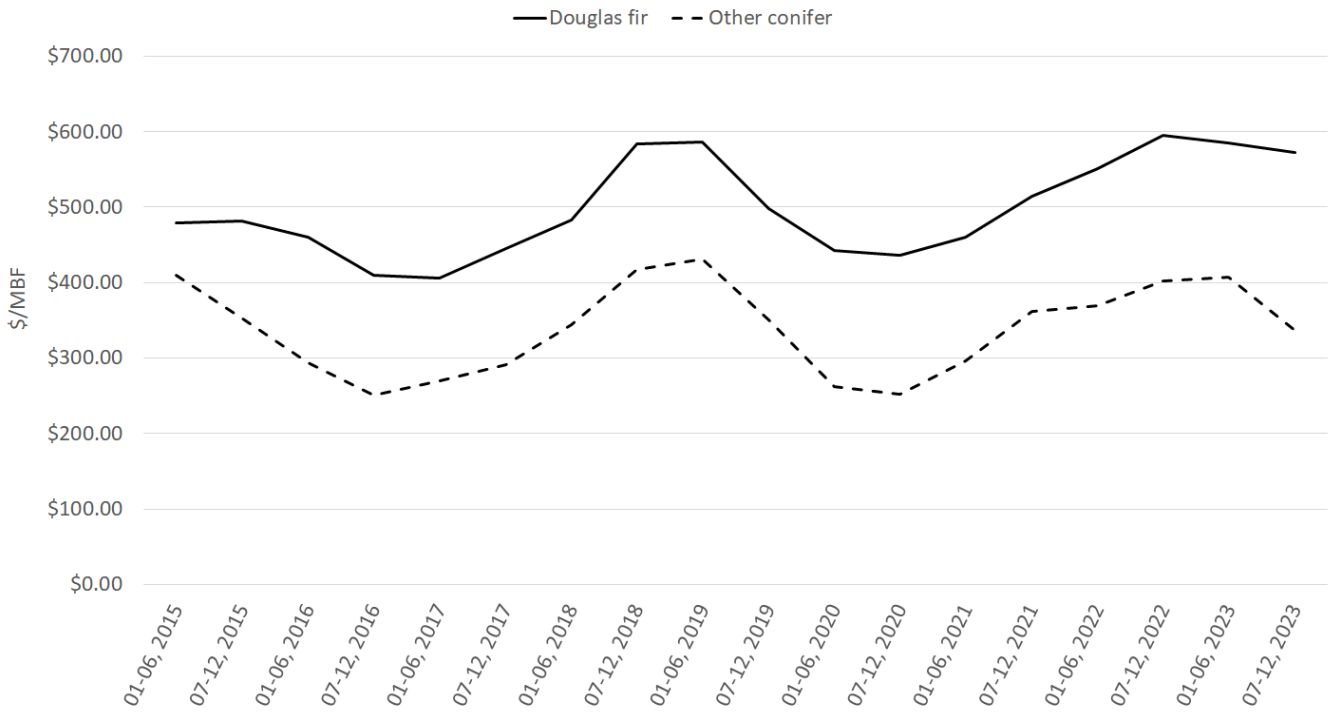


Figure C-1. Stumpage prices for douglas fir and mixed conifer species, 2015-2023



https://dor.wa.gov/taxes-rates/other-taxes/forest-tax/stumpage-value-determination-tables

Figure C-2. Potential availability of woody biomass as a function of distance from Centralia, WA (supply curve). Note: This represents potential availability, not low-risk availability for new projects.

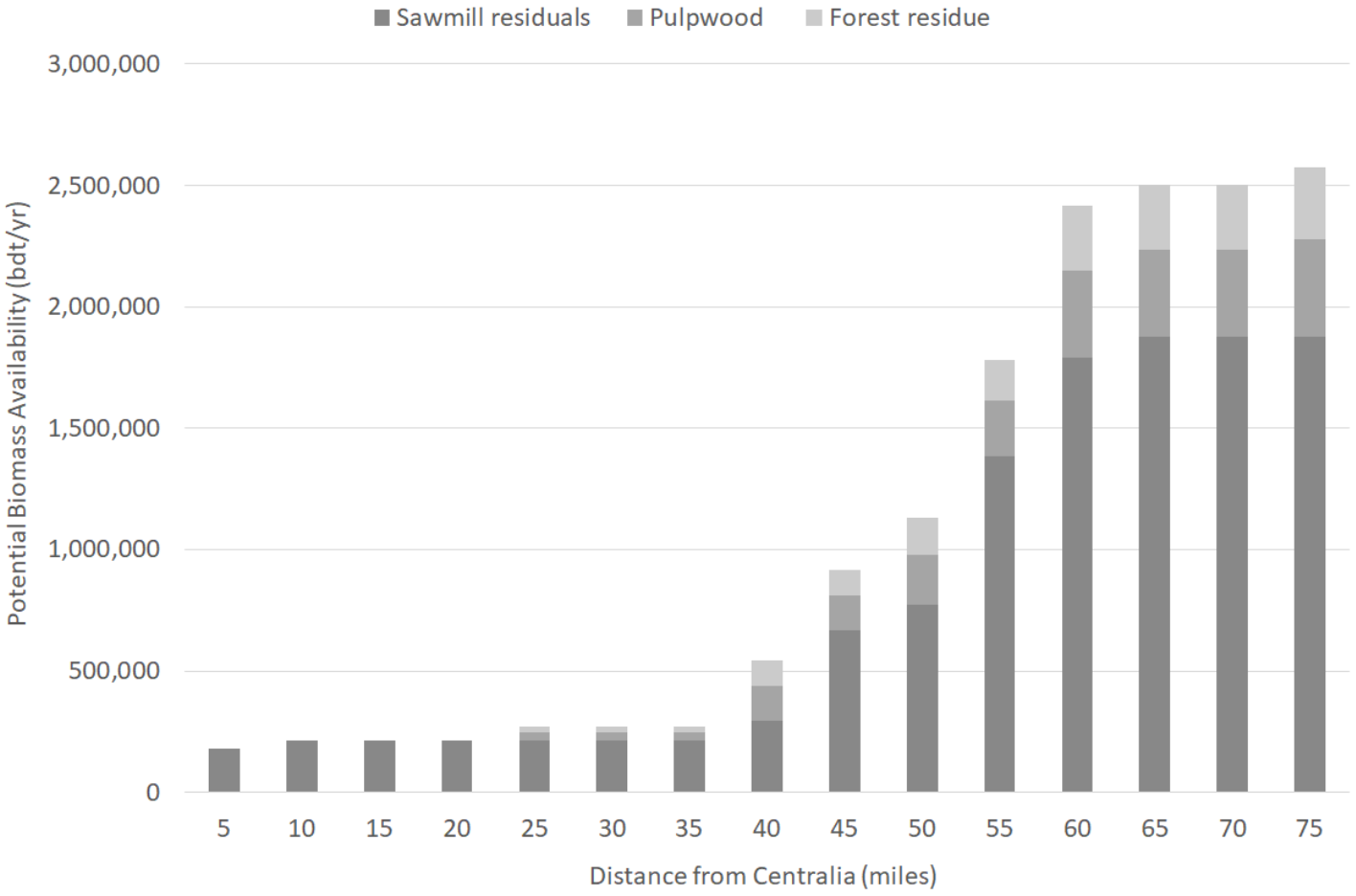
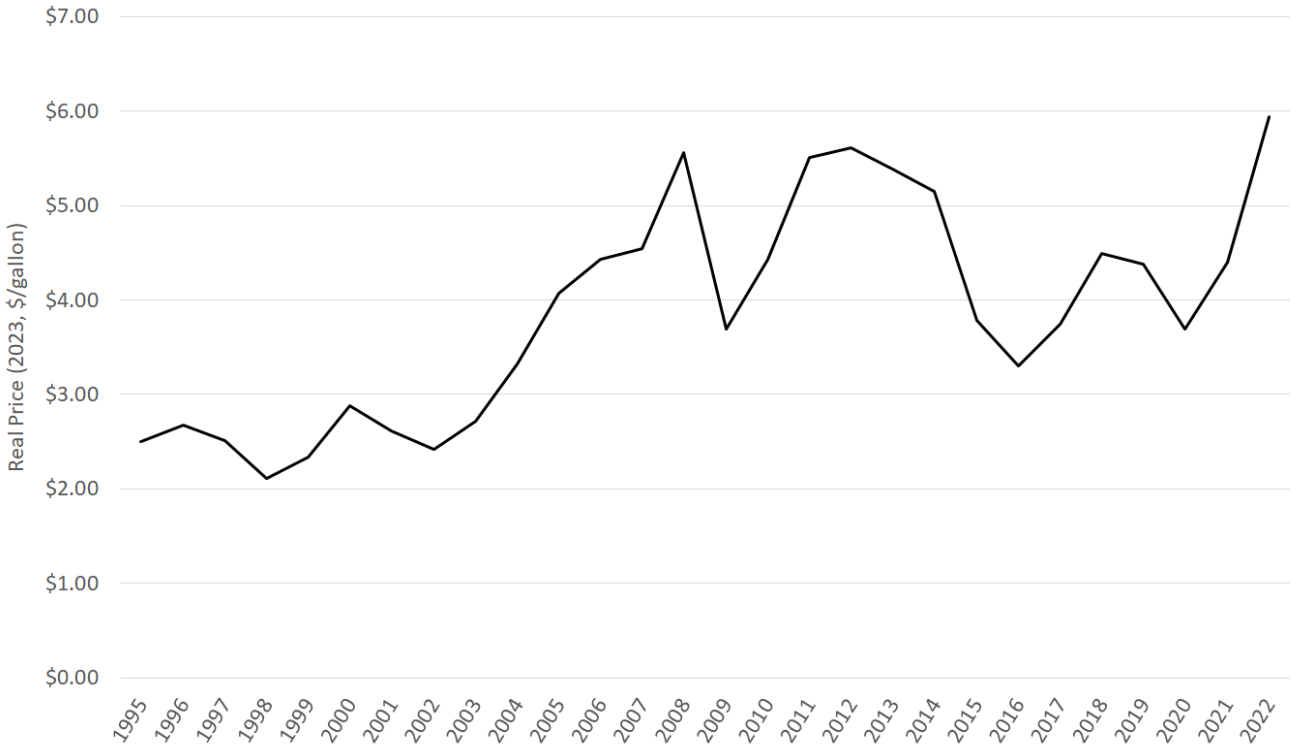
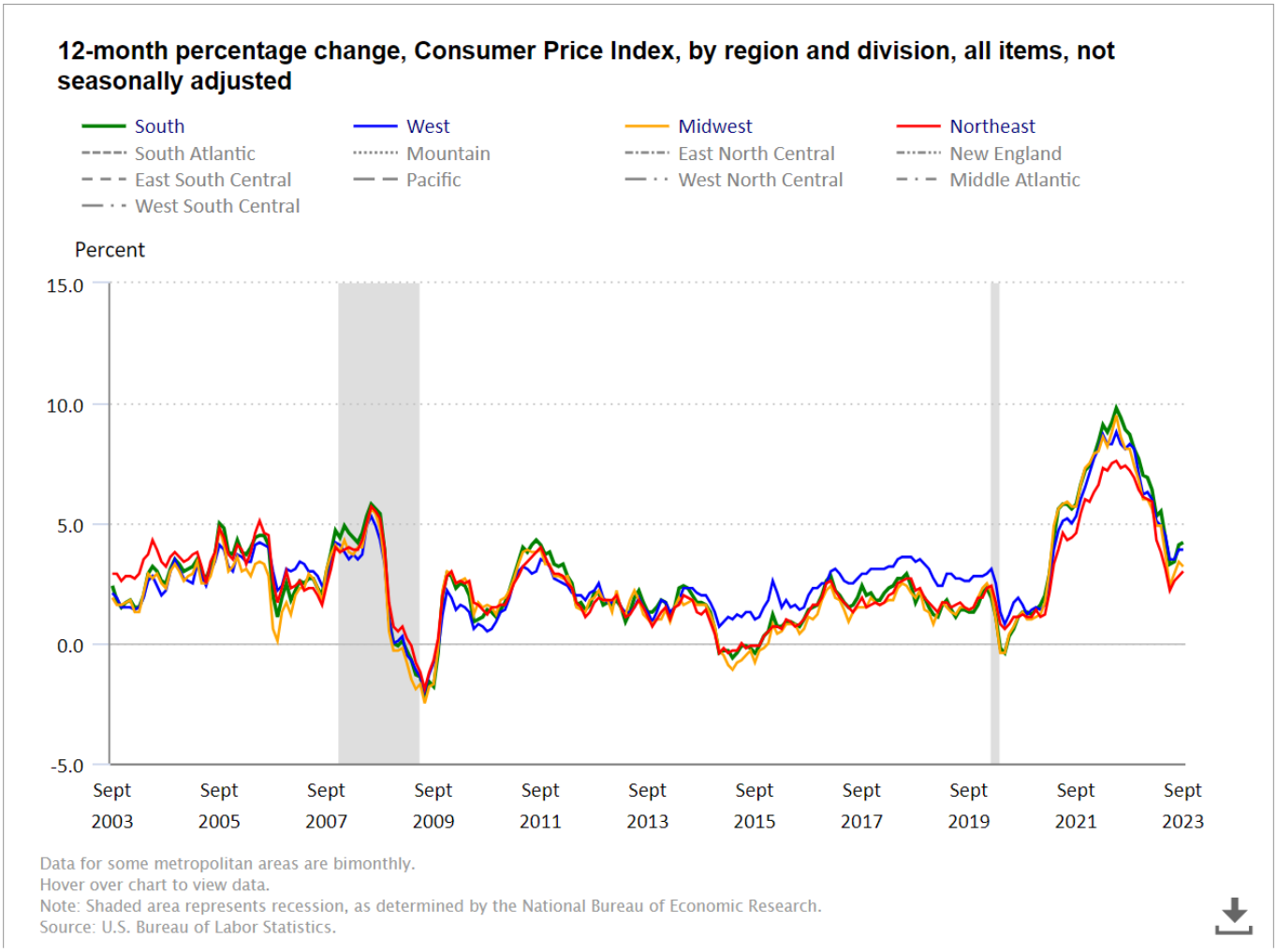


Figure C-3. PADD 5 West Coast diesel prices, 1995-2022



https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_R50_DPG&f=A

Figure C-4. CPI for the South, West (incl. Washington State), Midwest, and Northeast US regions, 2003-2023.



https://www.bls.gov/charts/consumer-price-index/consumer-price-index-by-region.htm

Map C-2. Location of project site (in red).



APPENDIX D: LEGAL DISCLAIMER

This BDO Zone Rating (the "Rating") is prepared for, and provided to, the Economic Alliance of Lewis County, and is intended to be read and used in its entirety and not in parts. Separation or alteration of any section or page from the main body of this Rating is expressly forbidden. In preparing this Rating, Ecostrat has used information obtained from third parties or otherwise publicly available. All such information has not been independently validated, verified, or confirmed by Ecostrat (except where otherwise specifically indicated) and Ecostrat makes no representation or warranty as to the accuracy or completeness of any information provided by third parties or otherwise publicly available.

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