BARRY COUNTY, MI

Biofuel Development Opportunity Zone Rating

RATING GRADE: 'A'

Date of Issue: June 4, 2024

A
High Quality

Rating Parameters:

Category	Rated Quantity	Delivered Price	BDO Zone Size
Pulpwood	250,000 bdt/yr	$92-$96/bdt	75-mi drive
Forest Residues	57,000 bdt/yr	$96-$102/bdt	distance from
Sawmill Residues	17,000 bdt/yr	$78-$96/bdt	Hastings, MI

BDO ZONE ASSETS

- Over 320,000 bdt of low-risk biomass available within the BDO Zone.
- Well-developed timber and forest products industry. Many are generational operations providing stability to wood supply in the area.
- Rural character of Barry County is a positive attribute for new industries to attract workers.
- Pro-business attitude exists within local County to attract new biofuel operations.

BDO ZONE LIABILITIES

- Scale-up of forestry operations to support new industries could be hampered by truck driver shortages and specific industry insurance requirements focused on driver tenure and commercial equipment.
- Housing availability may be a concern if a large percentage of workers are sourced from outside the BDO Zone. Housing units (rent/purchase) are limited in the area.
- Rail service is 12 miles from Hastings, MI.

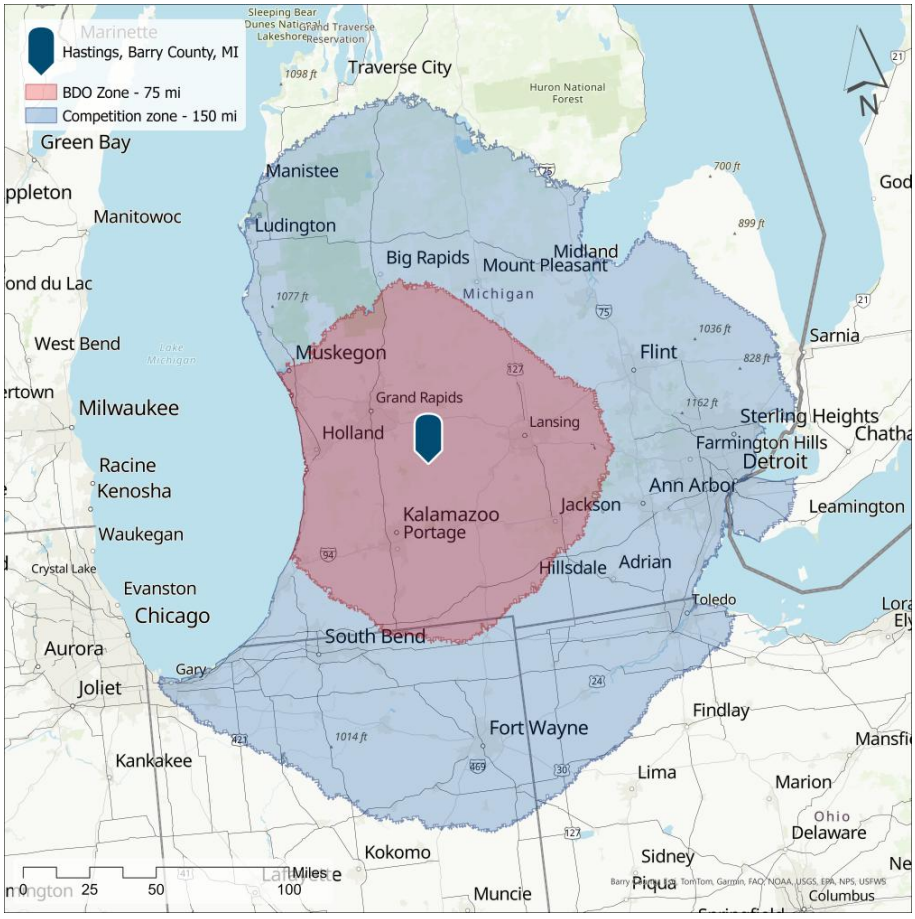
RATING GRADE

The Barry County, MI, Biofuel Development Opportunity Zone, is rated 'A', or 'low' risk.

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

'A' ratings denote high prospective viability of Feedstock Supply and Infrastructure and low expectations of default risk in the Zone. Capacity to support new biobased plant operations is considered strong. This capacity may, nevertheless, be more vulnerable to adverse weather, supply chain, economic, or infrastructure conditions than is the case for higher ratings.

BARRY COUNTY, MICHIGAN BDO ZONE



BD|THE BIOFUEL DEVELOPMENT
OZ|OPPORTUNITY ZONE INITIATIVE

ANALYST NOTES

In this risk rating assessment, the availability and pricing of three types of woody biomass, including pulpwood, forest residues, and sawmill residues, were determined. The estimated rated quantity for future biomass projects is the low-risk quantity after considering current competition, supply chain constraints (e.g., operational, accessibility, and market dynamics), and data/model uncertainty. The rated pricing is the expected price that future biomass projects are likely to pay to secure the rated quantity.

According to our analysis, a potential of 250,000 bdt/yr of pulpwood (about 65% of the total available unutilized pulpwood in the BDO Zone), along with approximately 25% of the produced forestry residues amounting to 57,000 bdt/yr could be feasibly sourced for a new project at low risk. Furthermore, considering the existing consumption rates in the Competition Zone, it is projected that 50% of the produced sawmill residues, equivalent to 17,000 bdt/yr, sourced from the 5 identified sawmills within the BDO Zone, can be procured at low risk for utilization in a new project. We expect that the rated quantity of pulpwood and forest residues would be available at a price range of $92-$102/bdt, while the sawmill residues could be secured at $78-$96/bdt.

In addition to the rated quantity and pricing, the BDO Zone's suitability to accommodate future biomass projects was assessed against 10 supplier risks, 10 competition risks, 46 supply chain risks, 2 feedstock scale-up risks, and 20 infrastructure risks. We did not find any high-risk indicators, but 18 medium-risk indicators mainly related to the infrastructure and supply chain scale-up, particularly biomass harvesting and transportation. The other risk indicators (70) are low/very low risks that can be considered BDO Zone assets. Most low-risk indicators are associated with the stable forest industry and supply and not a very competitive market for woody biomass in the BDO Zone. A summary of main assets (very low/low risks and liability (medium/high risks) are discussed in the following sections.

BDO ZONE ASSETS

The timber industry is well established in this area of Michigan, with a strong base of pulp/paper and pellet mills within the BDO Zone. These facilities have maintained their operations for generations, promoting a level of feedstock sustainability and indicating a strong asset for new industries to consider.

Barry County represents a very livable rural community. Its population of 65,000 is diverse and educated and has shown a positive growth trend in the past 20 years. The County is rated as "one of the safest in Michigan"[1] from a crime perspective. This environment is attractive to new industries as they seek staff for operations.

The city and county governments within the BDO Zone have streamlined permitting and building approvals, making it easier to start new industries. Business incentives are available to companies wanting to take advantage of tax preferences.

BDO ZONE LIABILITIES

The timber industry is experiencing a shortage of truck drivers, and Michigan is no exception. High insurance rates for loggers across the county have caused many to look to other industries. As a new industry to the BDO Zone, it is critical to look at the scale-up required to meet targeted feedstock volumes.

New employees face limited home and rental unit availability. Less than 1% of all housing in the area is available, while the statewide average is 4-6%.

The nearest loading facility to Hastings is just over 12 miles away for an industry requiring rail transport.

INFRASTRUCTURE PROFILE

The Hasting Industrial Park contains a 9-acre parcel that would be available for a new biofuel project. All major utilities are present, along with industrial zoning and permitting.

The area surrounding the Hastings Industrial Park is suitable for supporting small to medium-large commercial and industrial facilities. Primary roads and a commercial

[1] Crimegarde.org 2023

airport less than 25 miles away (Grand Rapids) give the area convenient access to private and commercial traffic.

SCORING & RATING METHODOLOGY

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

Feedstock quantities are expressed in bone dry tons per year (bdt/yr), while feedstock costs are expressed in United States dollars (USD). Maximum transport distance is based on a 75-mile driving distance from the center point (Hastings, MI).

The BDO Zone rating is based on an aggregation of the scores assigned to each BDO Zone Risk Indicator (RI) assessed in this report. First, each BDO Zone Risk Indicator is given a **Raw Risk Likelihood (RRL)** score, which denotes the likelihood of a risk to future BDO Zone projects due to the Risk Indicator. RRL Scores are scaled as either very low (2), low (4), medium (6), high (8), or very high (10).

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

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

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

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

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

The total risk rating for the BDO Zone is the average of all Loaded RI scores and Infrastructure Indicators. The BDO Zone score for Barry County, MI, is ***19.46 out of 100, resulting in an 'A' designation.***

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

PROJECT TEAM

PROJECT DIRECTOR

Bob Buckingham
Ecostrat Inc.
bob@ecostrat.com

TECHNICAL ADVISOR AND REVIEWER

Mahmood Ebadian
Director of Advisory Services
Ecostrat Inc.
mahmood@ecostrat.com

TECHNICAL CONTACT

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

BUSINESS CONTACT

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



Barry County, MI, BDO Zone Independent Review Committee (IRC)

Jennifer Heinzman – President and CEO, Barry County Chamber and Economic Dev Alliance
Greg Moore – Community Affairs Manager, Consumers Energy
Carole Davis – Director, Fehsenfeld Center, Kellogg Community College
Amy Graham – Business Solutions Representative, West Michigan Works
Michelle Skedgell – Executive Director, Pierce Cedar Creek Institute
Ben Stoline – Board Member, Barry County Conservation Easement Board
Tom Wiswell – Owner & CEO, Barry County Lumber
Jim McManus – Planning & Zoning Administrator, Barry County Planning & Zoning
Dan King – Community Development Director, City of Hastings
Dan Patton – Director, Barry County Parks & Recreation

SECTION A: RISK INDICATOR SUMMARY

Figure A-1. Average Loaded RI Scores for Each Risk Factor

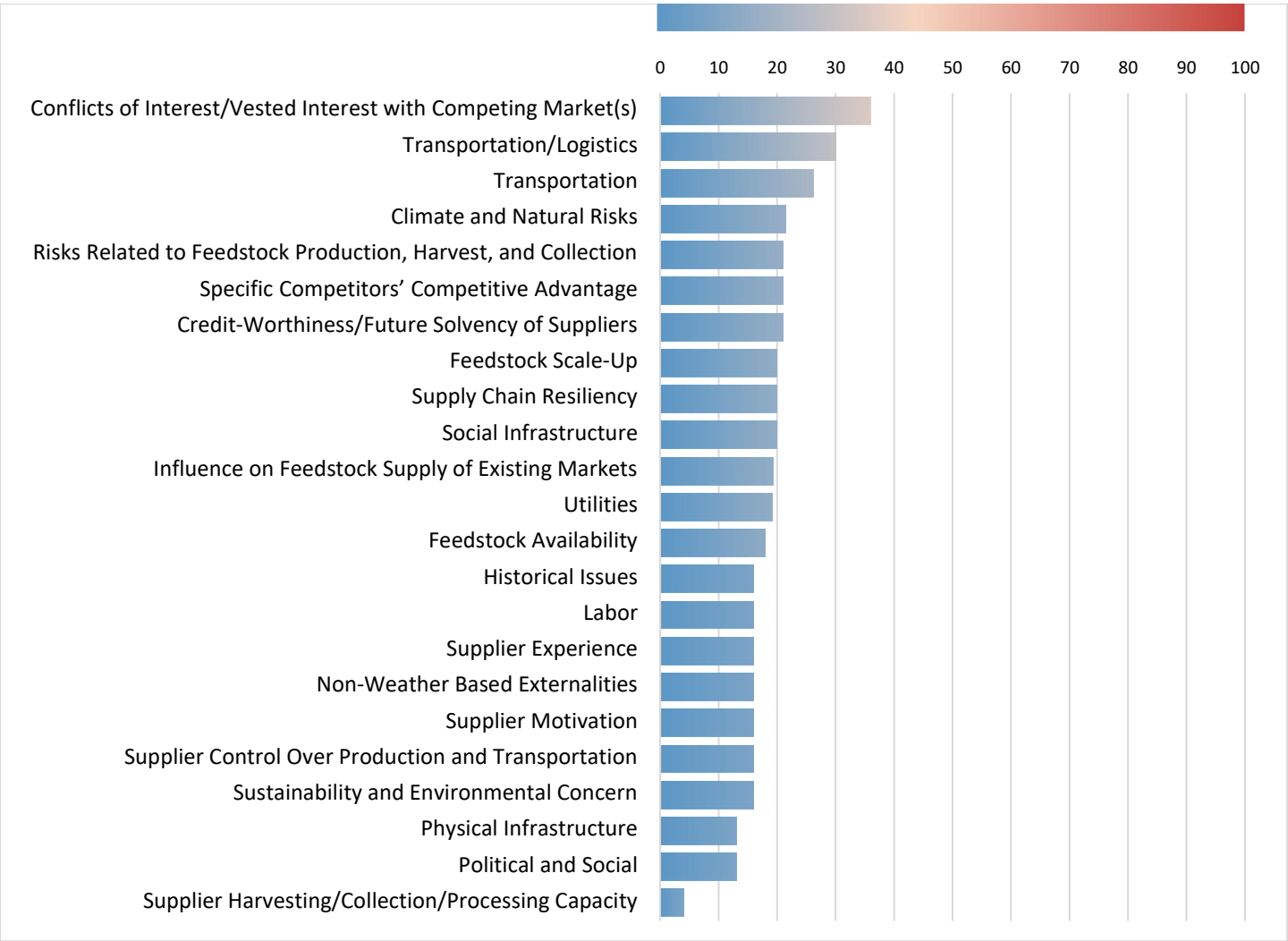


Figure A-2. Highest Risk Indicators

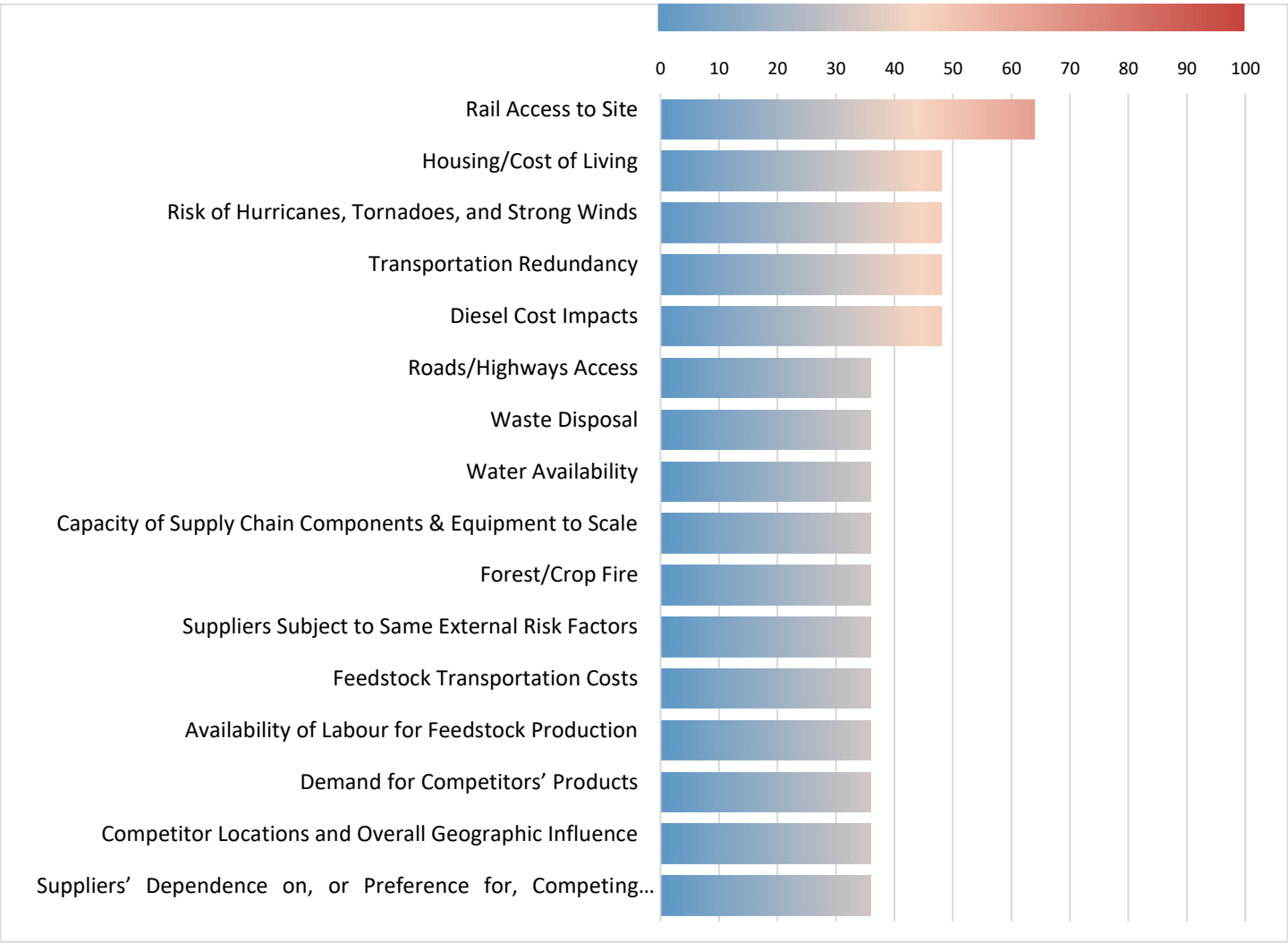


Table A-1. Risk Indicators and Associated Scores

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

3.6.1 Size, Number, and Location of Suppliers	4	2	8	NN	8
3.6.2 Suppliers Subject to Same External Risk Factors	6	6	36	NN	36
3.6.3 Land Ownership Structures	4	4	16	NN	16
3.7 Risk Factor: Climate and Natural Risks					
3.7.1 Seasonal Weather Impacts on Feedstock Supply	4	4	16	NN	16
3.7.2 Long-Term Weather and Climate Trends	4	6	24	NN	24
3.7.3 Forest/Crop Fire	6	6	36	NN	36
3.7.4 Risk of Infestation	4	4	16	NN	16
3.7.5 Risk of Hail	NR	NR	NR	NR	NR
3.7.6 Risk of Flood	2	4	8	NN	8
3.7.7 Risk of Drought	2	4	8	NN	8
3.7.8 Risk of Hurricanes, Tornadoes, and Strong Winds	6	8	48	NN	48
3.7.9 Risk of Low Temperatures	4	4	16	NN	16
3.8 Risk Factor: Political and Social					
3.8.1 Government Subsidies for Feedstock Production or Utilization	4	4	16	NN	16
3.8.2 Local, Provincial, & National Laws, Regulations, & Permitting pertaining to Biomass	4	4	16	NN	16
3.8.3 Backlash against Biomass Development, Procurement or Usage in the BDO Zone	2	2	4	NN	4
3.8.4 Consent of, and Cooperation with, Indigenous Communities and First Nations	4	4	16	NN	16
3.8.5 Food Security Concerns	NR	NR	NR	NR	NR
3.9 Risk Factor: Sustainability and Environmental Concern					
3.9.1 Feedstock Sustainability	4	4	16	NN	16
3.9.2 Risk to Soil Quality	4	4	16	NN	16
3.9.3 Risk to Surface and Groundwater	4	4	16	NN	16
3.9.4 Water Use	NR	NR	NR	NR	NR
3.9.5 Pesticide Risk to Human and Ecosystem Health	NR	NR	NR	NR	NR
3.9.6 Risk to Wildlife and Landscape	4	4	16	NN	16
3.9.7 Biomass Classified as Genetically Modified Organism (GMO)	NR	NR	NR	NR	NR
Category 4.0: Feedstock Scale-up Risk					
4.1 Risk Factor: Feedstock Scale-Up					
4.1.1 Feedstock Quality at Production Scale	2	2	4	NN	4
4.1.2 Capacity of Supply Chain Components & Equipment to Scale	6	6	36	NN	36
Category 5.0: Infrastructure					
5.1 Risk Factor: Physical Infrastructure					
5.1.1 Land Parcel/Industrial District	4	4	16	NN	16
5.1.2 Ownership of Land	2	2	4	NN	4
5.1.3 Permitting Description	4	4	16	NN	16
5.1.4 Environmental Issues	4	4	16	NN	16
5.2 Risk Factor: Utilities					
5.2.1 Natural Gas Availability	2	2	4	NN	4
5.2.2 Electric Availability	2	2	4	NN	4
5.2.3 Water Availability	6	6	36	NN	36
5.2.4 Waste Disposal	6	6	36	NN	36
5.2.5 Internet Availability	4	4	16	NN	16
5.3 Risk Factor: Transportation/Logistics					
5.3.1 Roads/Highways Access	6	6	36	NN	36
5.3.2 Rail Access to Site	8	8	64	NN	64
5.3.3 Airport Access to Site	2	2	4	NN	4
5.3.4 Water Freight Access	4	4	16	NN	16
5.4 Risk Factor: Social Infrastructure					
5.4.1 Healthcare (Local)	4	4	16	NN	16
5.4.2 Education (Schools)	4	4	16	NN	16
5.4.3 Local Transportation	4	4	16	NN	16
5.4.4 Public Safety (Local)	2	2	4	NN	4
5.4.5 Housing/Cost of Living	6	8	48	NN	48
5.5 Risk Factor: Labor					
5.5.1 Workforce	4	4	16	NN	16
5.5.2 Labor Costs	4	4	16	NN	16
				Average	**19.46**

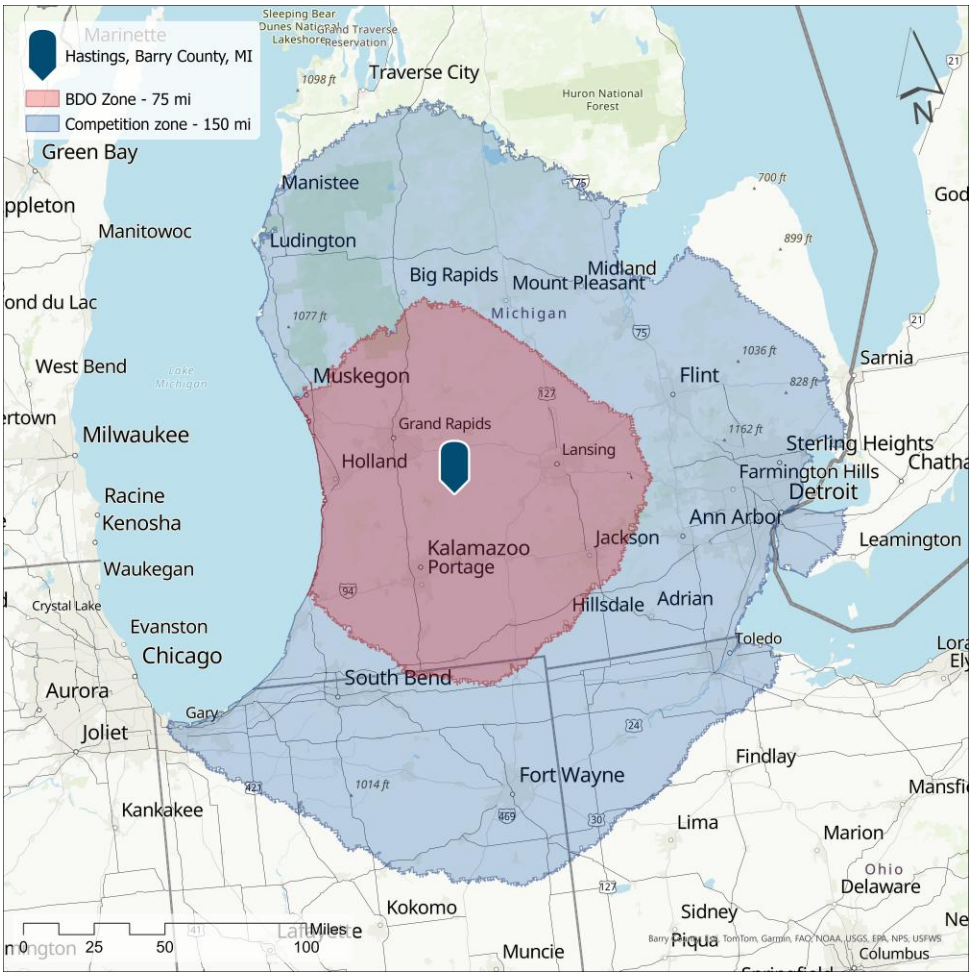
SECTION B: BIOMASS AVAILABILITY AND PRICING

This section assesses the availability and pricing of woody biomass as feedstock for bioenergy, biofuels, and other potential bio-based products in the Barry County, Michigan, BDO Zone. The center point for the woody biomass availability assessment is Hastings, Michigan.

OVERVIEW

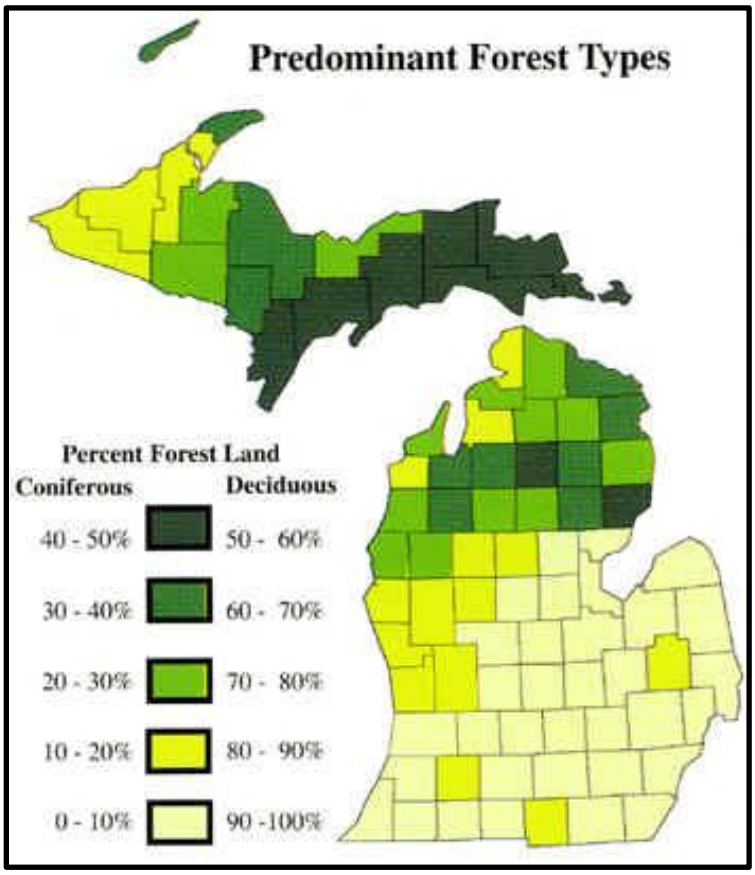
The BDO Zone and the Competition Zone define the areas of interest for this BDO Zone rating (Figure B-1). The BDO Zone defines a driving distance of 75 miles from the center point (Hastings, MI), where biomass will most likely be sourced for a new project. The Competition Zone is defined as a driving distance of 150 miles from the BDO Zone center point. This is the area where users may be located that could compete for available material, impacting the availability of woody biomass feedstock for future biofuel projects located in the BDO Zone. The BDO Zone is almost completely contained in Michigan, encompassing all or part of its 28 counties. The Competition Zone expands to a total of 56 Michigan counties, 14 Indiana counties, and 7 Ohio counties. The detailed list of counties in the BDO Zone is shown in Section E, Table E-1.

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



The BDO Zone consists primarily of deciduous trees and only 10-20% coniferous trees. Figure B-2 shows the various species present in the BDO Zone.

Figure B-2. Tree Species Composition in the BDO Zone



Most of the forest land in the BDO Zone is privately owned (71%);[2] State and Federal ownership accounts for 21%, and the forest industry owns the remaining 8%. The high level of private ownership brings stability to the supply by reducing the number of harvesting regulations. The trend for sawmill and pulp mill companies to maintain ownership of timberland has been falling for approximately 25 years. Only two mill operators still own land in Michigan; one has operations in the BDO Zone.

Michigan Forestry Best Management Practices (BMP)[3] are organized and executed by the Michigan SFI (Sustainable Forest Initiative) Implementation Committee in collaboration with the Environmental Quality. The forests in the BDO Zone are well-managed and subject to regular audits for BMP (Best Management Practices) compliance. BMPs are guidelines for maintaining forest health, focusing on soil and water during forest management and harvesting.

EVALUATED FEEDSTOCKS

Three types of woody biomass are produced and available in the BDO Zone: pulpwood, forest residues, and sawmill residues.

[2] State of Michigan, Land Tenure 2012
[3] www.michigan.gov/dnr

Pulpwood is defined as standing small-diameter trees between 5 and 11 inches in diameter at breast height.[4] Pulpwood is traditionally used to make paper, paperboard, oriented strand board (OSB), and medium-density fiberboard (MDF). Pulpwood is also used to produce wood pellets.

Forest residues refer to the by-products or leftover materials resulting from forestry operations, such as timber harvesting and thinning. These residues typically consist of branches, tops, and other woody debris that remain on-site after the sawtimber has been harvested. Forest residues differ from whole tree chips as the roundwood or log portion of the tree is not included.

Sawmill residues are the by-products of sawmill operations, produced from the conversion of sawlogs into finished wood products such as lumber and engineered wood. About half of the sawlog volume is converted to finished wood products and the remainder consists of sawmill residues such as: wood chips, sawdust, shavings, and bark (also known as hog fuel).

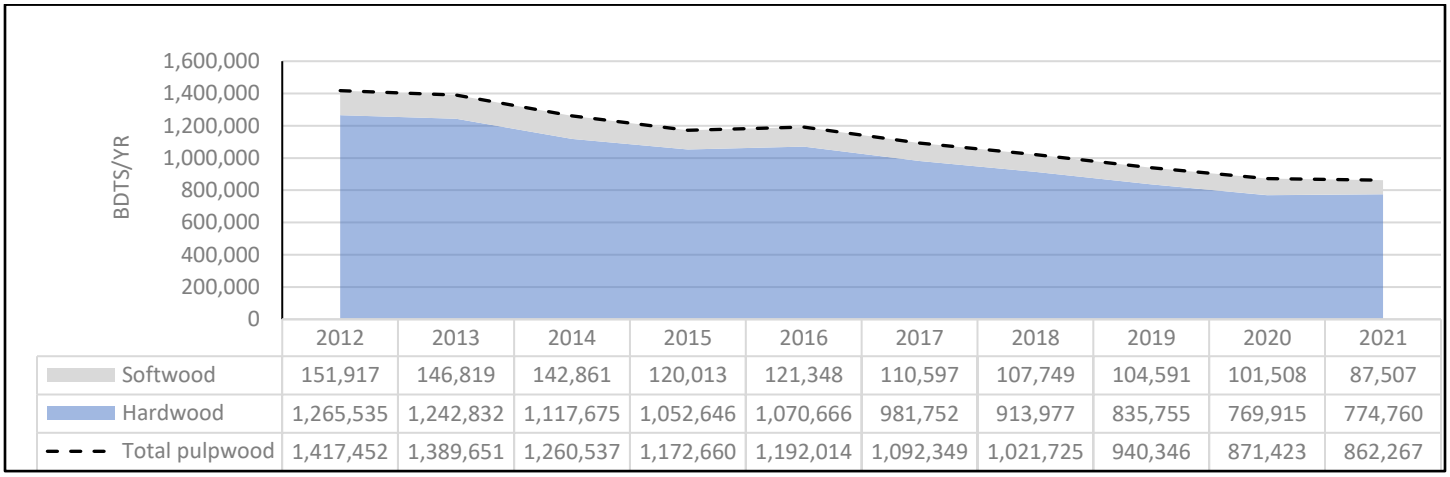
SUPPLY ANALYSIS

Pulpwood and Forest Residues Availability in the BDO Zone

The high-level estimates of pulpwood and forest residue availability in the BDO Zone were sourced from the US Department of Agriculture Forest Inventory and Analysis (FIA). These estimates represent the total potential availability to new projects in the BDO Zone, considering the excess biomass after accounting for current and projected biomass use. Note that this quantity is typically less than the total estimated availability due to various factors, such as private landowner reluctance, inadequate infrastructure, labor accessibility, and adverse weather conditions during the harvest season.

Figure B-3 shows the annual net growth of the pulpwood-sized trees in the BDO Zone. The data reflects a gradual decline (38%) over the past ten years. This could be due to weather effects like drought and heat. Some insect infestation due to the weather has also occurred during this period. The trend is expected to continue

Figure B-3. Average Annual Net Growth of Pulpwood in the BDO Zone

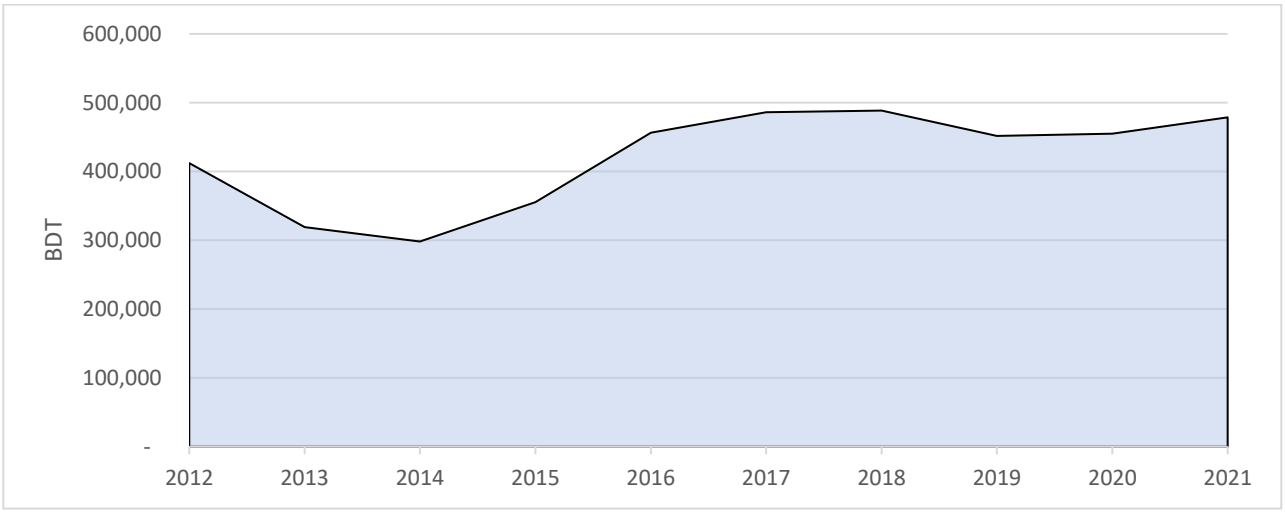


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Softwood	151,917	146,819	142,861	120,013	121,348	110,597	107,749	104,591	101,508	87,507
Hardwood	1,265,535	1,242,832	1,117,675	1,052,646	1,070,666	981,752	913,977	835,755	769,915	774,760
Total pulpwood	1,417,452	1,389,651	1,260,537	1,172,660	1,192,014	1,092,349	1,021,725	940,346	871,423	862,267

Figure B-4 represents the historical amount of pulpwood harvested by year. This shows a 24% increase in harvest operations since 2012. This is a healthy trend for the local forestry industry.

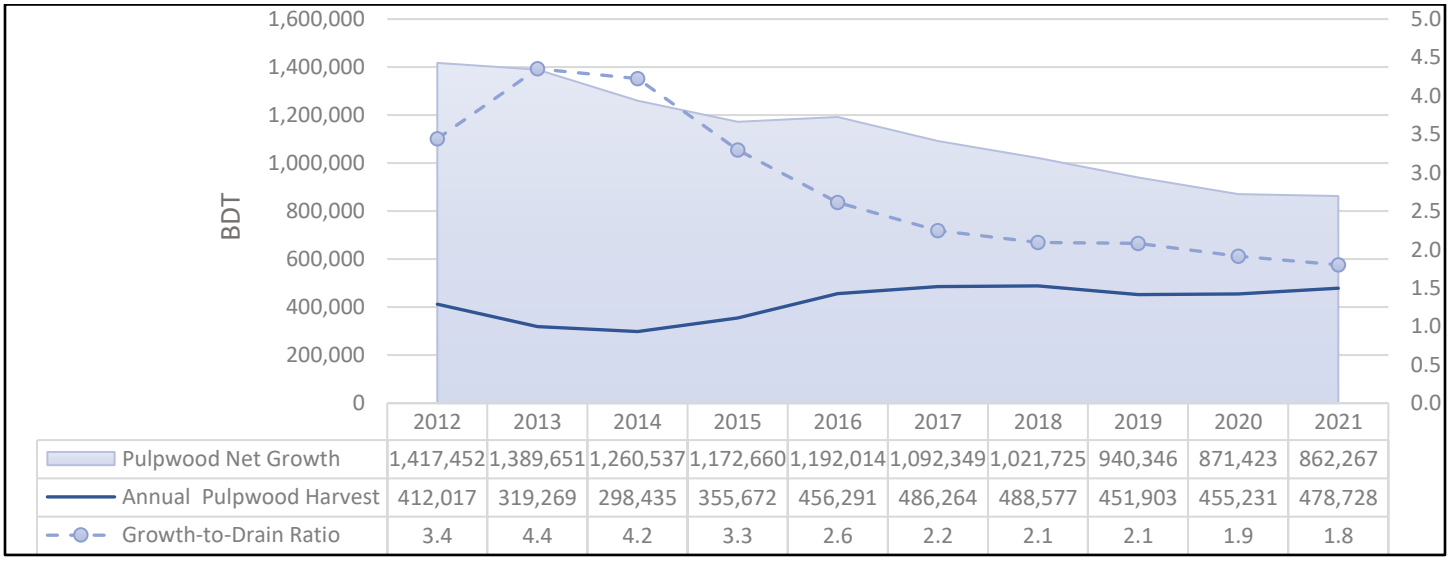
[4] Diameter outside the bark of the tree's stem measured at a point 4½ feet above the ground.

Figure B-4. Annual Pulpwood Harvesting Totals in BDO Zone



A growth-to-drain ratio is obtained by incorporating the estimated pulpwood growth with the historical pulpwood harvest removals. The growth-to-drain ratio should be at least 1.2 or higher to maintain a healthy forest, meaning growth exceeds harvest volumes. Figure B-5 shows a growth-to-drain ratio for pulpwood of 1.8 in 2021 within the BDO Zone.

Figure B-5. Annual Growth-To-Drain Ratio of Pulpwood in the BDO Zone



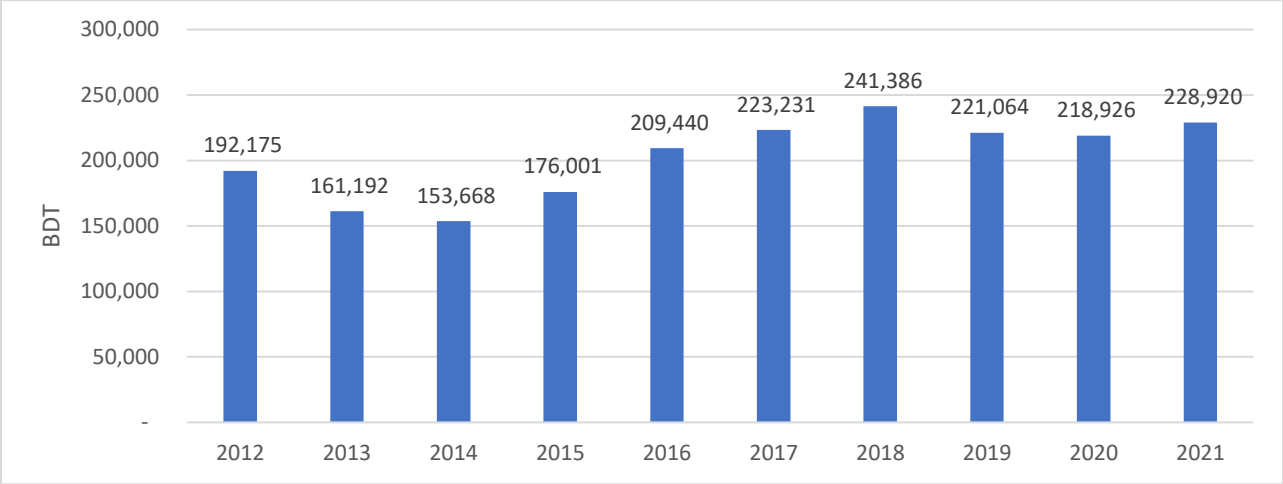
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Pulpwood Net Growth	1,417,452	1,389,651	1,260,537	1,172,660	1,192,014	1,092,349	1,021,725	940,346	871,423	862,267
Annual Pulpwood Harvest	412,017	319,269	298,435	355,672	456,291	486,264	488,577	451,903	455,231	478,728
Growth-to-Drain Ratio	3.4	4.4	4.2	3.3	2.6	2.2	2.1	2.1	1.9	1.8

Figure B-5 shows that the amount of available pulpwood (i.e., growth minus harvest) was 383,500 bdt in 2021, which will be assumed to be available in 2024. Only a sustainable harvest quantity should be used from that quantity.

Forest Residues

Figure B-6 below suggests that fiber recovery (forest residues) has been fairly consistent in the past decade. This shows stability in the local industry. USDA Timber Products indicates that generated forest residues average 22% of the total volume of roundwood harvested each year in Michigan. Most forest residues are not being removed and made available based on local feedback. The numbers below show what potentially could be available based on total harvest volumes.

Figure B-6. Historical Forest Residue Quantities produced in the Barry County, MI BDO Zone[5]



From Figure B-6, the forest residue availability in the BDO Zone in 2021 was approximately 229,000 bdt. This value is assumed to be consistent with projections for 2023/24.

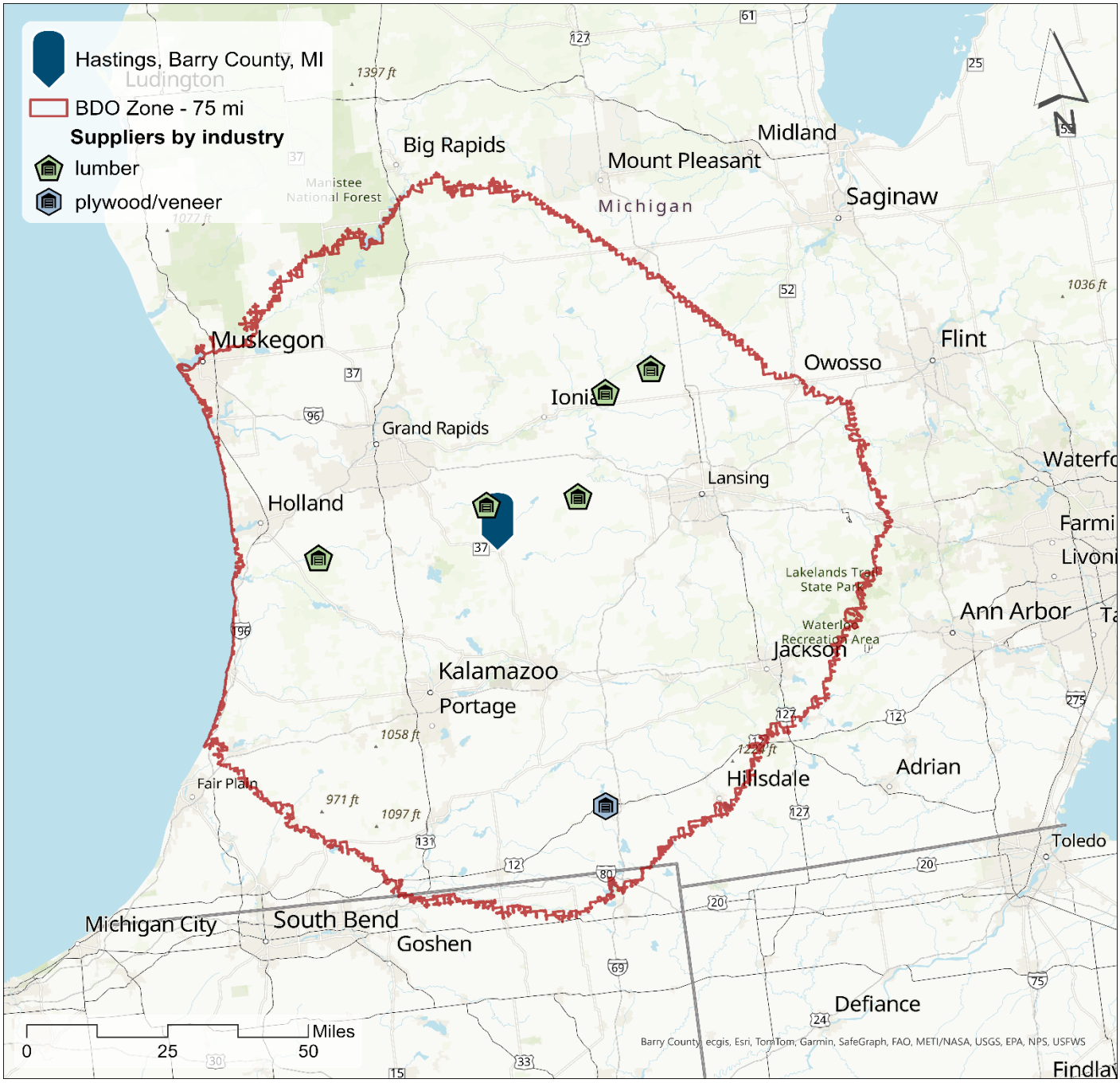
Sawmill Residues Availability in the BDO Zone

Based on outreach to sawmills, it was determined that almost all the sawmill residues produced are currently being used internally or bought by other facilities. However, there is no high degree of vertical integration between sawmills and pulp & paper or pellet mills that could limit sawmill residue availability.

According to Forisk[6] industry database, five sawmills, and one plywood/veneer facility are located within the BDO Zone. Figure B-7 shows the locations of the sawmill and plywood/veneer mill within the BDO Zone.

[5] www.fs.usda.gov/research/products/dataandtool/tools/timber-products-tpo-interactive-reporting-tool
[6] Forisk Consultants, North American Forest Industry Capacity Database, 2024.

Figure B-7. Feedstock Suppliers in the BDO Zone

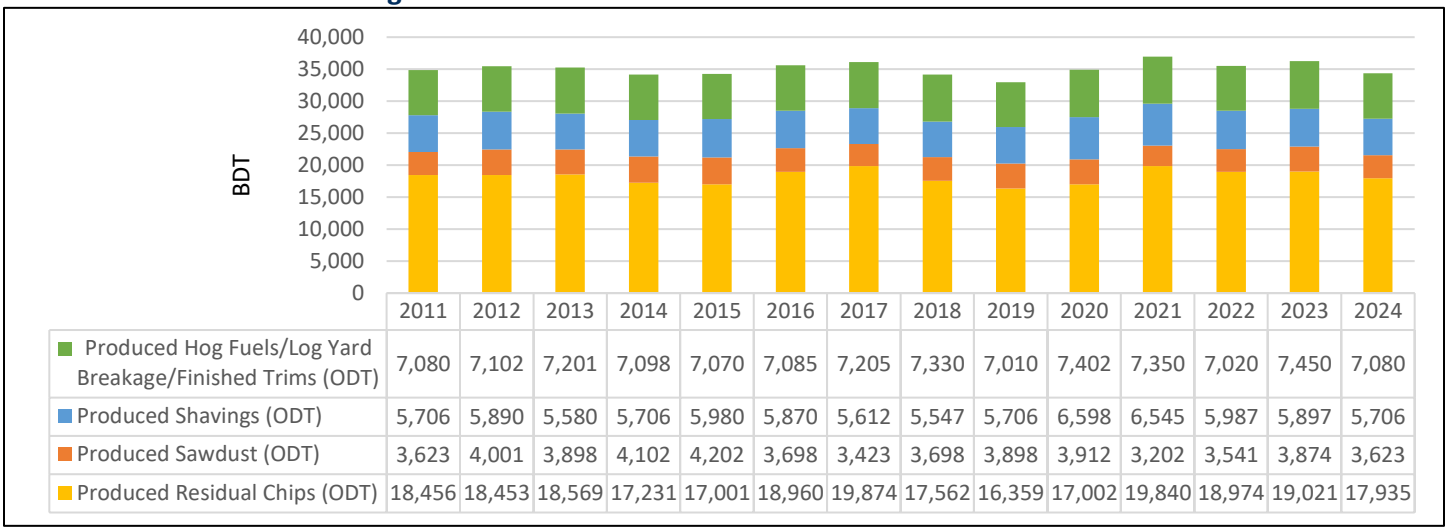


In addition to the five sawmills shown above, the Amish community owns approximately 20 additional sawmill facilities operating within the BDO Zone. Very little data is available on their source of logs, lumber production, and sawmill residue volume. These entities do not generally provide information to government reporting agencies.

A new bio-industry entering the BDO Zone could possibly obtain residues from these sources, but potential volumes are not included here as they cannot be substantiated.

The volume of sawmill residues produced annually is shown in Figure B-8. There has been very consistent production over this period, indicating sustainability within the sawmill sector.

Figure B-8. Sawmill Residues Produced in the BDO Zone[7]



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Produced Hog Fuels/Log Yard Breakage/Finished Trims (ODT)	7,080	7,102	7,201	7,098	7,070	7,085	7,205	7,330	7,010	7,402	7,350	7,020	7,450	7,080
Produced Shavings (ODT)	5,706	5,890	5,580	5,706	5,980	5,870	5,612	5,547	5,706	6,598	6,545	5,987	5,897	5,706
Produced Sawdust (ODT)	3,623	4,001	3,898	4,102	4,202	3,698	3,423	3,698	3,898	3,912	3,202	3,541	3,874	3,623
Produced Residual Chips (ODT)	18,456	18,453	18,569	17,231	17,001	18,960	19,874	17,562	16,359	17,002	19,840	18,974	19,021	17,935

Table B-1 below shows the volumes of sawmill residues for 2024, which will be used as available quantities. As indicated above, local pellet producers utilize all sawmill residues. These are high-risk feedstock sources for new industries to consider.

Table B-1. Generated Sawmill Residues Within the BDO Zone

Type of sawmill residue	Average total produced (bdt/yr)
Wood chips	18,000
Sawdust	3,600
Wood Shavings	5,700
Fuels/Bark	7,050
Total	**34,350**

COMPETITION ANALYSIS

There are currently 14 competitors for biomass in the Competition Zone for pulpwood, forest residues, and sawmill residues (Figure B-9).[8] This number has been steadily declining over the past decade due to consolidation and soft commodity market prices. These industries consist of mills that produce wood pellets, power, and pulp & paper.

[7] Forisk.com/product/north-American-forest-industry-database/
[8] FORISK Mill Database. North American Forest Industry Capacity. March 2016

Figure B-9. Competitors in the Competition Zone



Three large biomass power facilities of approximately 40 MW, each and one of 18 MW, are the dominant consumers of wood in the Competition Zone, accounting for 51% (1,150,000 bdt) of the pulpwood and forest residue demand. The largest of the three plants has an expiring power purchase agreement (PPA) in July of 2024. If this PPA is not picked up by another utility, pulpwood flow will increase by over 450,000 bdt and be available to new bio-economy industries.

Pulp and paper, and pellet facilities have seen some closures and production reductions in recent years. In 2023, a pellet mill in Northern Indiana (within the Competition Zone) shut its doors, succumbing to the softening of foreign pellet prices.

That same year, a pulp and paper facility in Kalamazoo reduced its production by over 35% to offset slacking market demand.

Table B-2 shows that the 14 competitors consume a total of 1.7 million bdt of woody feedstock annually and that 138,000 bdt, or 8% of that volume, are sourced by the BDO Zone.[9]

Table B-2. Summary of Competitors in the Competition Zone[10]

Category	Number of Companies	Total Wood Demand (bdt/yr)	Estimated Wood Demand Met from the BDO Zone (bdt/yr)
Wood Pellets	3	208,000	73,900
Pulp & Paper	2	334,000	-
Biomass Power	3	1,147,000	61,800
Biomass Heat (<10MW)	5	11,000	100
Biomass Combined Heat and Power	1	26,000	2,200
Total	**14**	**1,700,000**	**138,000**

RATED QUANTITIES AND PRICING

For various reasons, not all the pulpwood and residues in the BDO Zone will be available to future biomass projects. Key reasons include suppliers' unwillingness to participate in the supply system, uncertainties in the length of timber harvest seasons due to flood or drought, and competition from existing end users. Additionally, assumptions in biomass calculations also play a role.

To account for uncertainties in the woody biomass availability assessment, the Biomass Availability Multiple (BAM) is applied to the total potential biomass available. BAM serves as an indicator of supply chain resilience in the face of shortages or supplier breaches, with a higher BAM factor reflecting higher uncertainty in biomass availability for a project.

Given that the forest products industry is well established in the BDO Zone, a BAM of 1.5 reflects low-risk pulpwood availability while maintaining a sustainable growth-to-drain ratio above 1.2. Given that there is little active harvesting of forest residues in the area, a higher BAM of 4 is being applied to forest residues.

The operating facilities have consistently produced sawmill residues for many years, and that is expected to continue. A BAM of 2.0 shows strength yet provides that most of these residues are committed to the local market.

Table B-3 below summarizes the rated quantities of the three biomass types available in the BDO Zone.

[9] The estimated wood demand from the BDO Zone was calculated proportional to the distance between each competitor and the center of the BDO Zone.
[10] Forisk data 2024

Table B-3. Rated Quantities of Biomass in the BDO Zone

Biomass Type	Technical Available Quantity (bdt)	BAM	Rated Quantity (bdt)
Pulpwood	380,000	1.5	**250,000**
Forest Residues	229,000	4	**57,000**
Sawmill Residues	35,000	2.0	**17,000**
TOTAL	**644,000**		**324,000**

Sawmill residues within the BDO Zone represent a higher-risk feedstock source for prospective BDO Zone projects. The constrained availability of sawmill residues, as demonstrated by identifying only five relatively small sawmills in the area (Figure B-7), alongside entrenched long-term relationships within the local market, significantly impedes the feasibility of new projects seeking to secure this feedstock. In short, limited supply and the competitive landscape collectively heighten the risk profile of relying on sawmill residues as a primary feedstock source.

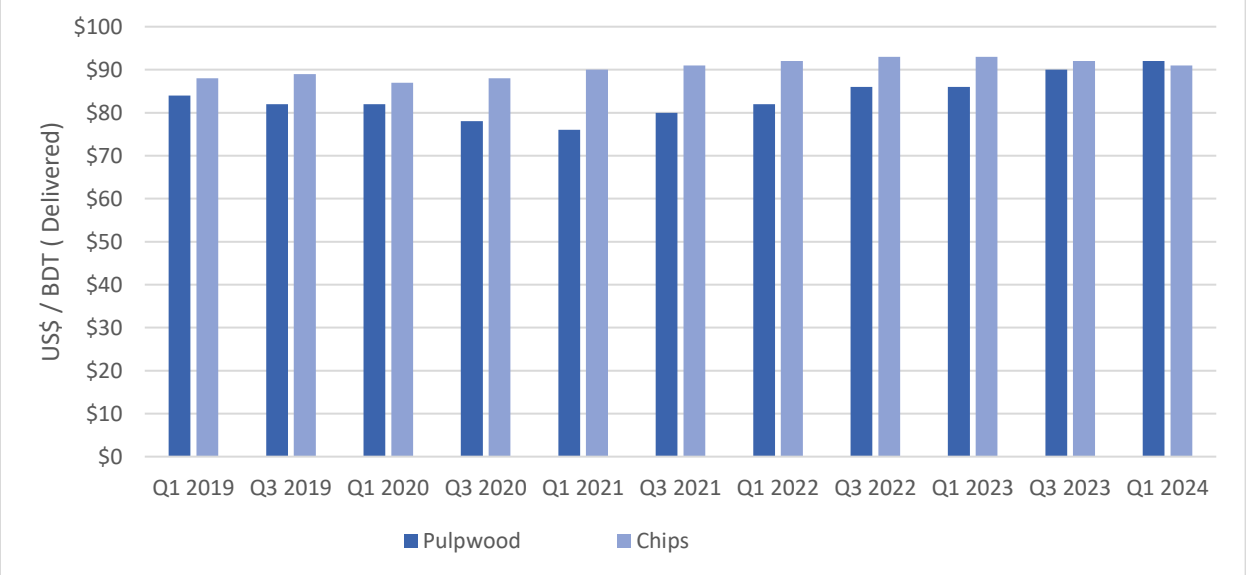
Table B-4 shows delivered prices in 2024 of the three types of biomass based on Forisk Wood Fiber Review. These prices are per delivered bdt.

Table B-4. Recent Delivered Price Ranges for the Types of Biomass in the BDO Zone[11]

Pulpwood	$92-$96	bdt
Forest Residues	$96-$102	bdt
Sawmill Residues	$78-$96	bdt

The figure below shows how the historical prices have remained stable within the BDO Zone since 2019.[12] These prices represent delivered quantities using the formula below.

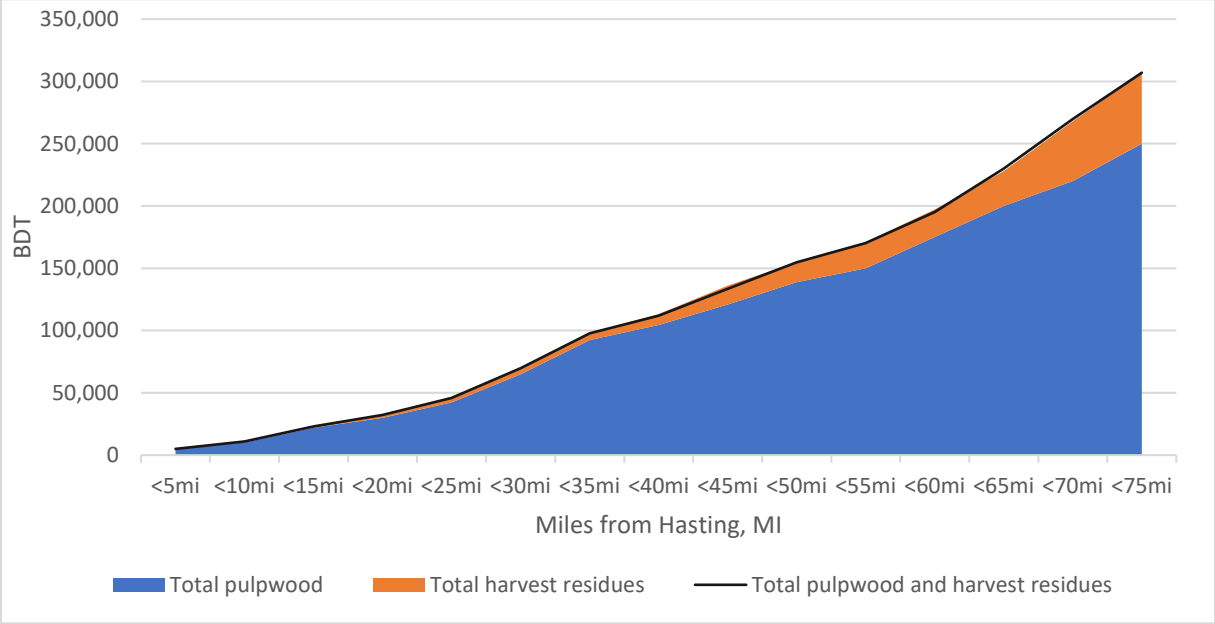
Figure B-10. Historical Pulpwood and Residual Chips Pricing 2019-2024



[11] Forisk Wood Fiber Review – Lakes Region 2024
[12] Also, from Forisk Wood Fiber Review – Lakes Region 2024

The available quantities of pulpwood and forest residues increase as the distance from Hastings, MI increases. It is generally a linear progression, as might be expected up to the 75-mile BDO Zone limit. Delivered prices assume a transportation cost for an average transportation distance of 100 miles (round trip), or $22/bdt.[13]

Figure B-11. Rated Quantities of Pulpwood and Harvest Residues by Mileage from BDO Zone Center



The forestry industry within the BDO Zone is well established and thus capable of supplying the rated quantities presented above. Also, biomass prices have remained somewhat stable for the last 5 years. However, for a new project, some scale-up risks will still exist. For example, trucking costs and shortages of drivers could impact the ability to deliver increasing amounts of feedstock.

[13] Assumes a cost of $2.76/mile (www.method.me/pricing guides/trucking-rates-per-mile), a 25-ton load of biomass at 50% moisture content.

SECTION C: INFRASTRUCTURE



PROPERTY OVERVIEW

Address:	210 Industrial Park Drive
City:	Hastings
State:	Michigan
County:	Barry
Acres:	9.0
Pricing Note:	Open
Topography:	Flat
Zoning:	D2-Industrial

SITE CONTACTS

Economic Development Contact
Jennifer Heinzman
Barry County Econ Development
Jennifer@mibarry.com

ADDITIONAL NON-RATED SITES

Infrastructure Site Contact
Bob Buckingham
Bob@ecostrat.com

PROPERTY PROFILE

The parcel submitted is a 9-acre greenfield site located in the Hastings Industrial Park, southeast of town (Figures C-1, C-2, and C-3). No identified development impacts include wetlands/streams, floodplains, or easements. A rather flat site with no real impact from topography. The parcel is irregularly shaped, the key focus area. being roughly 6 acres. The current zoning in place is D2 – Industrial. Based on the existing zoning, the site would not require rezoning for bio-industry. The City of Hastings owns the site.

Transportation

Nearest Highway: Highway 37 (< 1-mile)
Nearest Interstate: I-96 (21 miles)
Nearest Airport: Grand Rapids, MI

Rail Served: CSX -12 miles
Rail Accessible: No
Air Infrastructure in Place: No

Electric Service

Supplier: Consumers Energy
Ownership: Public Utility
Phone: (800) 477-5050
Capability: 10-50 MWs

Website: www.consumersenergy.com
Utility Extends to Site: Yes
Nearest Substation: < 1mile

Natural Gas

Supplier: Consumers Energy
Ownership: Public Utility
Phone: (800) 477-5050
Capability: 2" 60 PSI at site

Website: www.consumersenergy.com
Size of Main: 12"
Pressure: *150 psi* (main)

Water

Supplier: City of Hastings
Ownership: Municipal
Phone: (269) 945-2468
Capability: Not available at site

Website: https://www.hastingsmi.gov
Size of Main: 12" - 1 mile away
Peak Capacity: 4MGD

Wastewater

Supplier: City of Hastings
Ownership: Municipal
Phone: (269) 945-2468
Capability: 2MGD

Website: https://www.hastingsmi.gov
Size of Main: 8" (.25 miles away)

Telecommunications

Supplier: HughesNet
Ownership: Private
Phone: (844) 406-1664
Capability: Satellite, Fiber

Website: https://www.hughesnet.com/
Platforms: 5G +

SECTION D: RISK INDICATOR SCORING METRICS

CATEGORY 1.0: SUPPLIER RISK

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

1.1.1 Longevity & History of Supplier Performance

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

Risk Information: The forest products industry is very well established in the BDO Zone. Many suppliers have been in operation for generations. This history is a good predictor of the future sustainability of operations. This is representative of low-risk supply sources for a new project.

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

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

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

Rationale: Suppliers may have a vested interest or preference in supplying specific competitors with biomass feedstock. Preferences may be due to historical, long-term, or personal relationships, less stringent feedstock quality requirements, more flexible operating hours by competing markets, or suppliers' dependence on competing markets to accept or purchase other products/by-products. During periods of feedstock shortage, such suppliers may be more likely to allocate the scarce supply to competitors, resulting in supply disruptions for the Issuer.

Risk Information: There are two pulp/paper facilities, three pellet mills, six heat/power combinations, and three biomass power facilities in the 150-mile Competition Zone. These facilities are the main consumers of pulpwood and sawmill residues and demand over 1,700,00 bdt of feedstock annually. Most suppliers have contracts with one or more of these facilities. This represents a medium risk to new incoming industries to secure sawmill residues.

Raw Risk Likelihood (RRL) The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)*	**Notch** **NN**

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

1.3 Risk Factor: Supplier Control Over Production and Transportation

1.3.1 Ownership of Land/Means of Production

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

Risk Information: Most of the forest land in the BDO Zone is privately owned (71%),[14] with state ownership accounting for 21% and the forest industry owning the remaining 8%. The high level of private ownership brings stability to the supply. The trend for sawmill and pulp mill companies to maintain ownership of timberland has been falling for approximately 25 years. Only two mill operators still own land in Michigan; one has operations in the BDO Zone. This represents a low risk to new incoming industries.

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

1.3.2 Ownership of Equipment

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

[14] State of Michigan, Land Tenure 2012

Risk Information: There are 35 independent logging/trucking companies within the BDO Zone.[15] Change in equipment ownership status is unlikely to occur across most of these companies. Logging is a major industry and is likely to continue regardless of equipment ownership status. Loggers in the BDO Zone are mostly independent contractors that own their own equipment, typically harvesters, skidders, and loaders. When loggers require additional equipment, they will hire other contractors to provide the equipment and labor on a temporary basis.

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

1.3.3 Ownership of Transportation/Logistics

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

Risk Information: Trucks and trailers used to transport biomass are generally owned by the logging and trucking companies. Biomass transport is a major employer in the BDO Zone.

Biomass transport is a well-established and integral part of the local economy. A change in ownership status of trucks is unlikely to cause a meaningful impact on the 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 X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**

[15] Michigan Timber Services, 2019

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

1.3.4 Feedstock as a Secondary Transformation

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

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

In the case of agricultural feedstocks, such as corn stover, the feedstock is a by-product of a primary crop. Since the primary crop is significantly more lucrative than the residue, it will be a priority for the producer. If the production of the primary crop requires resources to be taken away from the production of the secondary crop (e.g., shorter harvesting windows due to weather), the secondary feedstock supply will suffer. In times of stretched resources, suppliers may also perceive the harvest and collection of the feedstock as a nuisance, potentially decreasing production levels.

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

Risk Information: The main source of feedstock in the BDO Zone is pulpwood, which is not a byproduct of the forest industry. In contrast, the production of forest and sawmill residues mainly depends on the housing market, a leading indicator for the US economy. Forest residue recovery is most likely to occur once logging operations have been completed and all sawlogs and pulp logs have been transported off-site. Therefore, there is the 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)	Score
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	4
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10.	4
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	16
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	NN
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	16

1.4 Risk Factor: Supplier Experience

1.4.1 Fundamental Feedstock Production Experience

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

Risk Information: Forestry is a long-established industry in Michigan and in the BDO Zone, with over 100 years for sawmills and over 80 years for pulp and paper. The forest supply chains are well-established for pulpwood and sawmill residues. Modern forestry practices and methods for breeding, planting, growing, harvesting, and collecting biomass have been in place for decades within the BDO Zone. This history represents a low risk of production experience for operations within the BDO Zone.

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

1.4.2 Production Scale Experience

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

Risk Information: Pulpwood and sawmill residue production is conventional for the industry and occurs at scale. The BDO Zone historically has maintained high levels of timber production and log processing for decades. Figure B-4 indicates that over 450,000 bdt/year of pulpwood is harvested in the BDO Zone. The industry is mature in the BDO Zone, reducing the risk of delay or loss if a scale-up is required for new industries entering the area.

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

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

1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity

1.5.1 Supplier's Equipment Efficiency

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

Risk Information: Logging and trucking are well established in the BDO Zone, as the forest products industry has been active for over 100 years, and suppliers have well-established knowledge of harvesting, handling, and transporting wood fibers. The efficiency of this equipment has a low-risk impact on the overall production of residual biomass.

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

1.6 Risk Factor: Supplier Motivation

1.6.1 Feedstock Production Priority

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

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

Risk Information: Sawmill residues are a by-product of the sawmill industry, and their production is part of the wood processing operations. Forest residues are a by-product of pulpwood and sawtimber harvesting and are usually piled at the harvest site. The production of both sawmill and forest residues is linked to normal operations.

Sawmill residues are produced in high volume and are a desired feedstock by the industrial pellet industry. Forest residues are not widely harvested, but the suppliers experience in other forestry operations could make this fairly simple transition.

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

CATEGORY 2.0: COMPETITOR RISK

2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets

2.1.1 Competitors' Locations and Overall Geographical Influence

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

Risk Information: Within the 150-mile Competition Zone from Hastings, MI, there are 14 competitors for woody biomass feedstock. Six of these are within 75-mile driving distance from the center of the BDO Zone. Included are two pulp and paper mills, three wood pellet mills, and nine biomass heat and power operations. These facilities are the main consumers of pulpwood and sawmill residues. The 14 mills are estimated to consume 1,700,000 bdt/yr of this material. Only 138,00 bdt of biomass will likely be sourced from within the BDO Zone. This represents a medium risk to new biofuel industries in the area due to the number of competitors for feedstock.

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

2.1.2 Current and Historical Consumption of Feedstock Quantity

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

Understanding current consumption and historical trends of feedstock utilization can provide valuable information about feedstock price elasticity during shortages and insight into events that may impact future supply conditions. It can enable more accurate estimates of the sensitivity of feedstock availability to potential future consumption levels or the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change).

Risk Information: Removals of pulpwood within the BDO Zone have increased by 24% (Figure B-4) from 2012 through 2021 and are expected to remain high. The pulpwood harvest volume showed a significant increase in 2021 with the restart of the pulp/paper mill in Kalamazoo but tapered off slightly as that facility reduced its operational level in 2023. The rated volume of available pulpwood in the BDO Zone is 250,000 bdt/yr.

The consumption of sawmill residues has reduced by 16% from 2011 to 2023 due to the closure of two pellet mills within the last five years. Sawmill residues, particularly shavings, sawdust, and residual chips, are preferred feedstocks for pellet production. The rated volume of available sawmill residues in the BDO Zone is 29,000 bdt/yr.

Forest residues have historically been an underutilized resource, with only about 5% of the total available biomass being harvested. This trend is unlikely to change soon, as this feedstock is more expensive to harvest than pulpwood and tends to be lower quality given the harvest methods. The rated volume of available forest residues in the BDO Zone is 57,000 bdt/yr. These residues are not being collected and processed very often. These residues were given a BAM of 4 to provide a lower-risk available volume.

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

2.1.3 Competitor Pricing and Price Sensitivity

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

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

Knowledge of competitor pricing and price sensitivity is also an essential prerequisite to formulating a feedstock cost curve, which can enable predictions of feedstock redundancy, i.e., how much feedstock could become available at different pricing levels (see Category 3–Supply Chain Risk 3.1.3).

Risk Information: Pulpwood prices, adjusted for inflation, have changed little over the past ten years (See Figure E-7), and the associated risk is rated low. However, with the reduced volume of sawmill residues in the BDO Zone region, the demand for pulpwood may increase, resulting in higher prices.

Price fluctuations reflect both economic indices such as CPI and the price of diesel fuel. There are also price fluctuations that arise from competitive situations, such as changes in the production volumes of the two pulp mills in the BDO Zone. This wood residues market is fairly stable, and prices are not projected to fluctuate more than 10% in the coming years. This represents a low pricing risk for new industries.

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

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

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

If current markets for feedstock have been publicly signaling the potential for increased demand for feedstock (in the case of a sawmill adding a shift or pulp mill potentially expanding into the production of renewable chemicals, for example), high interest in a supply zone can make suppliers overconfident, leading to a supplier-controlled market where short-term contracting becomes the norm and supply chain reliability is compromised for the Issuer. If and when it occurs, increased demand on feedstock may decrease availability and increase cost for new plants within the BDO Zone.

Risk Information: Two biomass-consuming facilities have been announced within the BDO Zone. With increased pulpwood harvesting the risk is low that that a new facility would greatly impact current price levels. The production of feedstock has shown the ability to adjust to fluctuations in capacities of both pulp/paper facilities and pellet mills over the last ten years.

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

2.1.5 Soft Supply Influence of Existing Markets

Rationale: In some cases, existing markets for feedstock may be able to exert high degrees of pressure over local suppliers, effectively enabling control of feedstock, especially during times of shortage. This control can derive from qualitative or "soft" factors, such as long previous relationships between local suppliers and existing markets for feedstock.

Risk Information:

Pulpwood: Landowners and forestry contractors commonly engage in the practice of selling their products or services to the bidder offering the highest price. Our outreach suggest that 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.

Sawmill residues: Our outreach suggests that owners and operators of sawmills will endeavor to sustain relationships with current purchasers of sawmill residuals. The rated quantity of 17,000 bdt/yr was determined by considering the sawmill's commitment to maintaining customer loyalty.

Forest residues: Current markets for forest residues 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. Considering the delivered price range of $96-$102/bdt and the small demand, a low risk exists that this feedstock is utilized.

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

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

2.1.6 Temporary Market-Driven Markets

Rationale: Alternative, non-traditional, market-driven competitors for feedstock can drive feedstock demand in unusual circumstances. A BDO Zone Rating Issuer based on corn stover as a feedstock, for example, would not typically compete with higher-end animal feed markets due to quality issues. However, in times of significant hay shortage (e.g., during drought), farmers use corn stover in place of hay, driving the price of feedstock and decreasing availability for bio-projects.[16]

Risk Information: Analysis of the quarterly feedstock prices for pulpwood, shavings, hog fuel, and whole tree chips does not indicate any seasonal variation in pricing (Figure E-7). In addition, no temporary markets were found for woody biomass in the BDO Zone region.

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

2.2 Risk Factor: Specific Competitors' Competitive Advantage

2.2.1 Relative Inventory Capacity

Rationale: The more inventory a competing biomass facility is able to store, the more competitive pressure it can exert on supply. Ability to store large inventories allows competitors to purchase inventory when the prices are low, potentially giving it an economic advantage. Additionally, the ability to store inventory during feedstock supply surpluses can enable competitors to continue to intake feedstock when the Issuer's plant (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity on the part of competing markets creates supplier loyalty and can make it more difficult for new projects to secure supply without paying a significant premium.

Risk Information: According to local experts, biomass users are cutting back on the amount of feedstock they are storing on site. This is being done to minimize the amount of feedstock maintenance required. Typical storage volumes being carried are for two weeks production needs. This reduction in inventory levels represents a lower risk for new industries to secure feedstock.

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**

[16] Bergtold, 2018.

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

2.2.2 Relative Accessibility/Delivery Hours and Wait Times

Rationale: The value attributed by suppliers to local competing markets for biomass is often directly related to the degree of flexibility the market provides in terms of delivery hours, and the more efficient discharge can occur.

Risk Information: Local experts reveal that there are no facilities with significant wait times for unloading. The majority of biomass-using facilities have delivery quotas to the contracted loggers and mills that are appropriate for their needs and unloading capacities. This does not enhance the position of new industries as the current consumers are managing their delivery of feedstock and not causing concern to suppliers about extended delivery times. This is a low-risk item.

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

2.2.3 Relative Specification Advantages

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

Risk Information: The specifications of available feedstock are uniform across pulpwood, sawmill residues, and forest residues. Biomass production methods and processing of that biomass have been following standardized techniques for decades.

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

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

2.2.4 Demand for Competitors' Products

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

Risk Information: Industrial wood pellet production is projected to increase due to worldwide demand. A pellet mill within the BDO Zone plans to increase capacity by 10-20% in 2024. This situation will likely further increase demand and competition for sawmill residues in the BDO Zone. It is possible that as the sawmill residue market tightens, pellet mills will start sourcing pulpwood if pellet demand continues to increase. This creates an increased risk situation in the future.

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

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: In this project, BAM is applied to the total estimated quantity to ensure adequate feedstock redundancy for each feedstock type. Specifically, a BAM of 1.5 is applied to pulpwood, resulting in a rated quantity of 250,000 bdt/yr, while a BAM of 4.0 is applied to forest residues, resulting in a rated quantity of 57,000 bdt/yr. There is a higher risk of availability for obtaining forest residues.

Sawmill residues also have a BAM of 2.0 applied to the available quantity, resulting in a rated available quantity of 17,000 bdt. This higher BAM reflects the higher risk that these residues would be available to new industries.

However, assumptions of future biomass supply and demands are part of the BAM factors. Unforeseen supply and market factors such as new competitors, weather events and economic conditions can have high levels of impact on our assumptions and thus biomass availability.

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

3.1.2 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 the core supplier.

Risk Information: The supply of pulpwood and forest residues is roughly linear, with more biomass available at increasing distances from the center point (Figure B-10). Half of the feedstock (150,000 bdt) is available 50 miles from the center point (Hastings, MI).

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.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100.	**24**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100.	**24**

3.1.3 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[17] and can manifest in shortages and higher costs for Issuers.

Risk Information: Timber harvests occur throughout the year, indicating continuous operation. Winter and spring are typically wetter months, posing a challenge for loggers when moving wood to mills. This limitation is temporary and does not last for an extended period. During wetter periods, loggers may be relocated to "wet weather" tracts, usually on higher ground or with soils that resist moisture better (sandy/sandy loam). This suggests an initiative-taking approach to managing weather-related challenges. To prepare for the upcoming winter and spring, mills focus on building up inventory during the drier fall months. This strategic planning helps mitigate potential disruptions caused by adverse weather conditions. The management of seasonal limitations in timber harvesting has been practiced for decades, indicating a well-established and experienced approach to handling challenges. Low risk of seasonal feedstock variation.

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

[17] Golecha & Gan, 2016.

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: Year-to-year availability for pulpwood has been consistent over the past decade. Historic pulpwood removals in the BDO Zone have shown a slight increase (12%) over the past ten years, reflecting changes in the pulp and paper market. The growth-to-harvest ratio for pulpwood has remained consistent, with three times more pulpwood being grown than harvested. This suggests sustainable surplus growth in pulpwood resources. Sawmill residues have maintained reasonable levels of availability year over year.

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

3.2 Risk Factor: Historical Issues

3.2.1 Historical Feedstock Price Variations

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

Risk Information: Forisk data has shown that both hardwood and softwood chips in the Lakes States have remained constant in delivered prices except in early 2023, for a six-month period, when they increased over 6% to $100/bdt delivered. They have since returned to consistent levels of $75-$95/bdt delivered. The local market has operated consistently over the past ten years. With price inclusions based on CPI and diesel fuel costs (Tables C-5 and C-6), there have been obvious year-to-year increases in overall feedstock prices but nothing to indicate swings that would pose a risk to new industries.

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

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

3.2.2 Low Historical Demand for Feedstock in the BDO Zone

Rationale: If Issuer BDO Zone does not have a history of developed large-scale feedstock procurement, suppliers may not have sufficient expertise in feedstock production to ensure reliable supply, especially in the early years. This can be particularly true for forest residues, where typically, the infrastructure for collection, processing, and delivery is immature.

Where supply chains are not well-established, risk can be mitigated when new bio-based plants control a higher degree of feedstock processing. For example, if a BDO Zone rating is issued for clean wood chips and the historical demand in the Zone has been exclusively for pulpwood, then supply chain risk will be decreased for new bio-based plants that intake pulpwood and manage log debarking and chipping internally. Rather than requiring inexperienced suppliers to deliver debarked wood chips.

Risk Information: Forestry has been a major industry in the BDO Zone for decades, and the supply chains for timber and sawmill residues are well established. Forest residues have not been harvested in large quantities. The methods used for their harvest is varied and could increase the risk.

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

3.2.3 History of Production/Feedstock is a New/Secondary Crop or By-Product

Rationale: If feedstock is a new/secondary crop or a by-product, suppliers may either lack sufficient experience to mitigate risk or be unable to react to such risk. Secondary crop or by-product producers may be less likely to prioritize production.

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

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

Risk Information: There is an extensive history of forestry and use of forest products in the region. Pulp and paper mills were established 50+ years ago, with sawmills dating back to the 1800s. Harvesting of forest residues, while feasible, is practiced only rarely.

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

3.3 Risk Factor: Non-Weather Based Externalities

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

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

Risk Information: General economic trends can influence the price of delivered feedstock. Economic indicators such as the Producer Price Index or the Consumer Price Index can be used to track trends in prices that can affect biomass logistics operations and their associated costs such as the cost of fuel, labor, equipment parts, and administration. Figure E-5 shows the change in CPI over the past three years for the Midwest Region of the US. There was a substantial peak in June 2022 showing a 9% change from previous months, primarily caused by COVID-19 recovery efforts. But, in 2024, the CPI has essentially returned to its early 2021 level of 3% annual change. This presents a low risk to new development.

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

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

3.3.2 Currency Risk

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

Risk Information: This item is not relevant for this rating.

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

3.3.3 Border Risk

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

Risk Information: There is no border risk associated with this BDO Zone.

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

3.3.4 Temporary Externality-Driven Markets for Feedstock

Rationale: Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances. For example, an Issuer using corn stover as a feedstock would not typically compete with the higher-end animal feed market. However, in times of significant hay shortage (e.g., during drought), farmers may use corn stover as hay replacement, driving the price of stover feedstock and decreasing its availability for bio-projects.[18]

[18] Bergtold, 2018.

Risk Information: There is no history of alternative, non-traditional, externality-driven competitors for feedstock within the BDO Zone region. The feedstock supply chains, and manufacturing processes are well established in the area.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. — **4**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. — **16**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. — **16**

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

3.4.1 Harvest & Collection Practices & Schedules

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

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

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

Risk Information: Harvesting occurs year-round with few slowdowns or shutdowns. Forest operations in the BDO Zone are fully mechanized and involve conventional harvesting practices. Crews operate feller-bunchers, grapple skidders, and processors to recover merchantable roundwood and pile residue, but this is not expected to present significant problems to feedstock quality.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. — **4**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. — **16**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN** No adjustment. *RRI Mitigation (Notch)*

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

3.4.2 Harvesting & Collection Equipment

Rationale: Different types of harvesting and collection equipment used by suppliers in a BDO Zone can have a significant impact on the quality and availability of feedstock. Using different types and combinations of harvesting, collection, and processing equipment among suppliers can lead to non-homogeneous feedstock. Equipment that is not designed specifically for biomass cultivation, harvesting, and collection can increase feedstock quality risks.

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

Risk Information: Virtually all forest operational activity in the BDO Zone is mechanized, involving feller-bunchers and grapple skidders. The advanced level of operational mechanization in the region reduces risks associated with harvesting and collection equipment.

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

3.4.3 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.[19]

Risk Information: The pulpwood and sawmill residues are delivered either in the form of logs (pulpwood), chipped, or ground, depending on the end users' biomass quality specifications. The existing suppliers can provide either form.

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**

[19] Huhnke, 2018.

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

3.4.4 Availability of Labor for Feedstock Production

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

Risk Information: For a new biomass facility in the BDO Zone, using the rated volume of 250,000 bdt per year, 14 additional logging crews, 28 truck drivers, additional logging equipment, and trucks are required.

There is an industry-wide concern that the average age of logging company owners and employees is rising. There is a limited number of new and younger employees entering the industry. Two-thirds of logging company owners predict that their companies would cease to exist upon retirement, as none expect a family member to take over the business. This trend may be offset by increasing consolidation, creating larger logging companies, and increased education and trade-related educational opportunities.

The likelihood of problems hiring new logging crew members is low; however, logging truck driver recruitment has been identified as a bottleneck. A nationwide shortage of truck drivers has made it difficult to recruit log truck drivers. Additionally, log truck insurance in Michigan and other neighboring states has risen, contributing to the log truck driver shortage. Difficulty in hiring logging truck drivers would have a direct impact on biomass deliveries.

This is a long-term risk for biomass-based operations within the BDO Zone.

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

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

3.5 Risk Factor: Transportation

3.5.1 Feedstock Transportation Costs

Rationale: Transportation can be one of the most significant cost components of biomass supply chains. The average transport cost and percentage of total feedstock cost attributable to transport should be known.

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

Understanding average transport distance can help flag higher-risk BDO Zones where transport distance materially exceeds the average.

Risk Information: The available biomass within the 75-mile BDO Zone increases linearly from the center point. The average transportation cost per ton-mile for the 75-mile radius is about $0.13 per ton.[20] 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 BDO Zone, noted a 30% increase in prices for tires and occasional diesel prices of more than $6/gallon over the past three years. The purchase price of trucks was also observed to have increased more than inflation. The exit of small independents from the trucking business is partly attributed to the high costs of ownership and maintenance. These factors represent a medium risk to new industries.

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

3.5.2 Diesel Cost Impacts

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

Risk Information: Diesel fuel is used through all aspects of forestry biomass harvesting. Fluctuation in diesel price is directly tied to the delivered price of biomass. One study suggests that each increase of $2.00 in diesel price leads to an

[20] Klammer, SSH 2017, To Chip or Not to Chip, Michigan State University

increase of approximately $2.43 per green ton of logs.[21] Increases in fuel costs get passed on to the end user of biomass through either fuel surcharges or escalators built into the contract.

Diesel fuel prices in the Michigan area have tracked upward for the past decade (Section E, Figure E-6), with a low point of just below $2.00 per gallon in 2016 and a high of $5.73 in 2022. These price fluctuations closely parallel the national average price of diesel. Changes in diesel prices could have a significant effect on the delivered price of biomass.

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

3.5.3 Transportation of Feedstock Requires Specialized Equipment

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

Risk Information: Forest residues, when collected, do not require any specialized equipment. Three methods are employed in the BDO Zone. 1) Tops of 20' minimum are picked up with a knuckle boom and double-bunked onto standard logging trucks. 2) Tops and branches are picked up with a knuckle boom or other grapple and loaded into chip vans. 3) Tops and branches are chipped on site and blown into a chip van.

Overall, no specialized equipment is needed for harvesting and transporting forest residues. The equipment needed for harvesting forest residues is readily available and common in the BDO Zone.

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

[21] Reflections on the current state of fuel prices in logging and transport. https://bellwetherfp.com/reflections-on-the-current-state-of-fuel-prices-in-logging-and-transport/

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

3.5.4 Delivery Routes through Local Communities

Rationale: Transportation of biomass can become a nuisance to local communities, especially if a large number of trucks pass through residential and school areas. Local communities often have the power to force regulations regarding truck transport, impeding the ability of BDO Zone suppliers to transport feedstock.
Risk Information: Hastings is a rural community of 8,000 people. Most of the industry that would require trucking operates on the outskirts. There are no major forestry operations in the City that would cause traffic issues. The community is supportive of biomass-based industries and would work to mitigate any traffic concerns created by new industries.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed very low, therefore the RRL is 2 out of 10. **2**
Raw Risk Impact (RRI) **Score** The risk impact is deemed very low, therefore the RRI is 2 out of 10. **2**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL X RRI) is 4 out of 100. **4**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100. **4**

3.5.5 Transportation Regulations & Local Weight Limits

Rationale: In many BDO Zones, transportation is regulated based on seasonal road conditions. These regulations (e.g., "frost laws") often take the form of weight restrictions or limits on the number of trucks allowed on roads. Such regulations can impede the project's ability to source sufficient feedstock or increase the cost of doing so at certain times of the year.
Risk Information: Michigan supports an 80,000 lb. transport weight limit on commercial traffic. Some local roads and streets may reduce limits. This weight limit is common for most forestry transportation.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed low, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL X RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch**

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

3.5.6 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: Generally, road access within the lumbering and forestry sections is not an issue for most timber tracts in Michigan. Since a large portion of timberland in Michigan has experienced at least one harvest in the past century, there is, at minimum, an old roadbed that the logger can work with. Sometimes, the roads may be maintained to varying degrees, but loggers typically have a bulldozer used to improve roads and/or build new ones if needed. The road system to move residual forestry biomass represents a low risk for new industries.

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

3.5.7 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: To meet the demands of a new biomass facility in the BDO Zone, handling a rated volume of 250,000 bone dry tons (bdt) per year, several additional resources will be necessary, including logging crews, truck drivers, logging equipment, and trucks. Pulpwood is the most likely biomass to be transported in this region, given that forest residues are not actively harvested, and there is competition for acquiring sawmill residues. To manage the transportation of this volume, the facility would need to accommodate roughly 75 deliveries by logging trucks per week, requiring an additional 24 logging truck drivers. Insurance company regulations have impacted the number of qualified logging truck drivers, as new standards dictate a minimum truck driving experience of three years before operating a logging truck. This is viewed as the main limitation to logging.

Hiring additional log truck drivers may be a challenge, but it is somewhat minimized in that facility construction, and the ramp-up to full production will likely take over two to four years. This will give new companies time to recruit new logging truck drivers. So, we consider a medium likelihood for this risk.

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

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: There are five major sawmills in the BDO Zone for which biomass production data is available (Table A-7). However, outreach has indicated as many as 20 additional sawmill operations owned by the local Amish community. There may be sawmill residues available from these facilities for new industries, but there is no data to support that. This is called opportunity feedstock and somewhat mitigates the small number of publicized sawmills as unknown quantities of biomass could be available. There are also 35 independent logging/trucking companies within the BDO Zone[22] that process forest residues.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 8 out of 100.	**8**

[22] Michigan Timber Services, 2019

Mitigation/Notching	Notch
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 8 out of 100.	**8**

3.6.2 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: New projects that rely on pulpwood but are not related to the paper industry should be able to source pulpwood. However, if the paper industry decreases significantly, many logging companies may go out of business. This represents a medium risk.

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

3.6.3 Land Ownership Structures

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

Risk Information: The USDA Forest Inventory and Analysis database indicates that the land base for pulpwood and forest residues in the BDO Zone is primarily (71%) under private ownership. High levels of private timberland ownership reduce risk, as the biomass contracts are not subject to government programs.

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

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

3.7 Risk Factor: Climate and Natural Risks

3.7.1 Seasonal Weather Impacts on Feedstock Supply

Rationale: Seasonal weather impacts are defined as those deriving from natural weather variations (i.e., spring thaws, rainy seasons, or dry seasons – as opposed to from singular weather events like fires, droughts, or hurricanes). Seasonal weather changes can be a significant risk factor affecting feedstock availability, quality, and price.

Given the major influence that weather has on multiple aspects of growing, harvesting, and transporting biomass, it is difficult to predict the availability of biomass at a specific location at different points in the future with a high degree of certainty. However, it is still possible, using past data and statistical models, to generate reasonable upper/lower bound estimates of biomass production in any given year in a wider supply zone. Such estimates are important in assessing feedstock risk and enable accurate assessment of the efficacy of Issuer's mitigation methods.

Risk Information: Timber harvests occur year-round, with the winter and spring typically being wetter months. This can limit loggers' ability to move wood to the mills, though this is usually temporary and does not last for an extended period of time. During the winter and spring months, loggers are sometimes moved to "wet weather" tracts, which are usually on higher ground and/or have sandy/sandy loam soils that stand up better when wet. Fall is usually drier, and that is when mills try to build up inventory for the coming winter/spring months.

Overall, procedures are in place to avoid harvesting stoppages due to seasonal weather patterns. In addition, the terrain is varied enough to avoid harvest areas subject to seasonal moisture issues.

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

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

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: According to local experts, climate change is affecting almost all aspects of the forestry industry. Droughts and higher average temperatures can increase insect infestations in the forested area. This could cause a reduction in harvest quantities of pulpwood and forest residues. While the effects of climate change are hard to predict for any specific region, it should be assumed that these changes will continue and create a higher risk value for the production of biomass within the BDO Zone.

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

3.7.3 Forest/Crop Fire

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

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

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

Risk Information: Typically states such as Colorado, Arizona and California are considered at higher risk of forest fires. Michigan experiences an average of 8,000 to 10,000[23] wildfires each year. Most of these are small fires, and keep

[23] Michigan State University 2022

Michigan rated in the bottom third of US States for forest fires.[24] But even these small fires can damage or destroy homes and property. This is a medium risk to the biomass supply chain.

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

3.7.4 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: Most of Michigan's 19.3 million acres of forest are in good health, with the biggest threats coming from invasive insects. The Mountain Pine Beetle and the Bark Beetle are seemingly prominent[25] in the forests but, to date, have not had a major impact on tree mortality.

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

[24] https://hazards.fema.gov/nri/wildfire
[25] https://www.michigan.gov/invasives/id-report/insects/mountain-pine-beetle

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

3.7.5 Risk of Hail

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

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

Risk Information: Hail is not a relevant risk in the BDO Zone.

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

3.7.6 Risk of Flood

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

Risk Information: Flooding can affect the ability to harvest standing timber as the vehicles needed can sink into saturated soil, becoming stuck or causing soil compaction. The risk of flooding is very low, according to the Michigan Department of Natural Resources Flood Map.[26] Standing timber is flood-resistant to a high degree. Timber users typically stockpile several weeks or months of feedstock as a mitigating measure against harvesting disruptions.

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 X RRI) is 8 out of 100.	8
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment.	NN
RRI Mitigation (Notch) No adjustment.	

[26] https://www.michigan.gov/egle/about/organization/water-resources/floodplain-management/floodplain-mapping

The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 8 out of 100.	**8**

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: Mild meteorological drought conditions are common in Michigan, but meteorological droughts reaching severe thresholds are infrequent and generally of short duration.

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 X RRI) is 8 out of 100.	**8**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment.	**NN**
RRI Mitigation (Notch) No adjustment.	
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 8 out of 100.	**8**

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: On average, Michigan has 15 tornadoes per year. The largest tornado alley is from the Grand Rapids to the Lansing and the Flint/Saginaw areas. This alley is completely included within the BDO Zone. Tornadoes can

certainly damage forests and interrupt forest operations. This could pose a medium to high risk to the production of biomass in the area.

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

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: Low temperatures can damage some crop species. For woody biomass, this is generally not a problem unless exotic species are planted in the hopes of achieving especially high growth rates. The timber species in the BDO Zone are native to the area. Michigan does experience periods of severely cold weather, but historically, those times have not impacted the forest and biomass production.

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

3.8 Risk Factor: Political and Social

3.8.1 Government Subsidies for Feedstock Production or Utilization

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

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

Risk Information: There have been no instances in recent history of feedstock subsidies in the region.

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

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

Rationale: Feedstock whose production is directly dependent on local, provincial, or national laws or government regulations can pose greater long-term risk than feedstock that is not, since laws and regulations may be subject to amendment or repeal.

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

Risk Information: Permitting and regulations are established and clear. There is nothing required specifically for biomass, other than existing logging permitting. Michigan has many biomass operations, so the process has been developed over time. Consulting firms that specialize in permitting new projects are available. This represents a low risk to new developers.

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

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

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

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

Risk Information: There has been no public reaction to biomass-based industries looking to locate in Michigan. The pro-business perspective allows developers and investors the ability to propose new opportunities within the BDO Zone with limited concern for protest. Economic development is highly encouraged, and the area's history of forestry-based businesses is attractive to bio-economy-based industries.

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

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

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

Risk Information: There are dozens of Native American tribes and settlements within the BDO Zone. To date they have not provided negative input into the development of new business opportunities. This is considered a low risk.

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

No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	
Loaded RI Score The Loaded RI Score ((1-Total Notch) X 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, the removal of biomass may raise public concerns relating to food security if Issuer feedstock requires the use of land that would otherwise be used for growing food.

Risk Information: Not relevant.

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

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

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

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

Risk Information: The historical growth-to-drain ratio of 1.8 (Fig. A-5) confirms that the forests are outgrowing harvest levels and, therefore, show sustainability. Michigan Forestry Best Management Practices (BMP)[27] are organized and executed by the Michigan SFI Implementation Committee in collaboration with the Michigan Departments of Natural Resources and Environmental Quality. The 2015 and 2016 BMP monitoring project layout, field monitoring methods, and report analyses included improvements in sample size, statistical validity, and consistency of methods. The forests in the BDO Zone are well-managed and subject to regular audits for BMP (Best Management Practices) compliance. BMPs are guidelines for maintaining forest health, with a focus on soil and water during forest management and harvesting.

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**

[27] www.michigan.gov/dnr

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

3.9.2 Risk to Soil Quality

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

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

Risk Information: Mitigation of risk to soil as a result of forestry operations is one of the primary goals of BMPs. A 2021 report on BMP compliance by the Michigan Forestry Commission[28] indicated that statewide implementation of BMPs overall was 92%. With regard to soil-related issues, BMP compliance was over 90% for practices directly related to soil quality.

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

[28] IC4011_SustainablePracticesForest. www.michigan.gov/dnr

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: Mitigation of risk to water as a result of forestry operations is one of the primary goals of BMPs. Compliance with BMPs, including water related BMPs, was high.[29] BMPs are implemented to comply with all state and federal regulations to prevent point-source pollution. This poses a low risk to new incoming industries.

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

3.9.4 Water Use

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

Risk Information: Not relevant.

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

[29] https://www.stateforesters.org/districts/michigan/

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: The use of pesticides in timberlands is regulated by the state of Michigan and requires a permit and adherence to Best Management Practices. No risk was identified in the BDO Zone.

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

3.9.6 Risk to Wildlife and Landscape

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

Risk Information: Changes to the landscape through forestry operations such as tree planting, forest management, building logging roads, and harvest operations have the potential to disrupt landscapes and wildlife habitats.

Forestry in Michigan is practiced according to Best Management Practices (BMPs) prepared by the Environmental Protection Division of the Michigan Department of Natural Resources. These are a set of guidelines that dictate methods to be used in all aspects of forestry operations to protect water and soil quality, minimize impact to wildlife and landscape and to maintain diversity. A low risk was assigned.

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

3.9.7 Biomass Classified as Genetically Modified Organism (GMO)

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

Risk Information: Not relevant.

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

CATEGORY 4.0: FEEDSTOCK SCALE-UP RISK

4.1 Risk Factor: Feedstock Scale-Up

4.1.1 Feedstock Quality at Production Scale

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

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

Risk Information: Production, harvesting, transport, and processing of sawmill residues and pulpwood have been well established in the BDO Zone for decades. Consistent feedstock quality is engrained in the system.

Forest residues, while not widely collected, are a by-product of sawtimber and pulpwood harvesting. Forest residue harvest begins with piling the residues at the loading site, a practice already in place. Loading and transporting the forest residues uses established methods and standard logging equipment. If the demand for forest residues increases, it is expected that the existing forest industry will have the capability and experience in managing the quality of forest residues delivered to future biomass projects.

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

Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X 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: Forestry supply chains are well-established in the BDO Zone and have been operating at a professional level for decades. Forestry is a top component of the local economy and is supported by the local, county, and state governments. The components of the supply chain: land base, roads, equipment, and labor availability.

Scale-up to meet the demands of a new project has occurred many times in the BDO Zone and is well within the capacity of the existing forestry industry. There are concerns about trucking biomass within scale-up operations. As mentioned, this is an industry-wide concern and is no different in Michigan. This is a medium-risk item to be considered.

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

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Industrial District

Risk Information: The parcel submitted is a 9-acre greenfield site located in the Hastings Industrial Park, southeast of town (Figures C-1, C-2, and C-3). No identified development impacts include wetlands/streams, floodplains, or easements. A rather flat site with no real impact from topography. The parcel is irregularly shaped, the key focus area being roughly 6 acres. The current zoning in place is D2 – Industrial. Based on the existing zoning, the site would not require rezoning for bio-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 X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**

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

5.1.2 Ownership of Land

Risk Information: The City of Hastings currently publicly owns the site. It is in the city's existing industrial park, which includes an equipment casting and manufacturer and electrical supply distributor. Surrounding zoning in the area is light-heavy industrial with some residential to the west. The site is for sale and the community has indicated no issue for a potential prospect to gain control of the land within 90 days. This represents an asset to any new developer.

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

5.1.3 Permitting Description

Risk Information: Dependent on the operation's air emissions profile a federal air permit may be required. A federal wetlands permit will not be required as the site does not have potential risk of impacts. This is a small building parcel and as such would not create permitting concerns for vehicle traffic or material storage as operations would be limited. Estimated approval time for all local permits is 3-6 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 X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)*	**Notch** **NN**

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

5.1.4 Environmental Issues

Risk Information: The site is in Flood Zone Z, an area of minimal flood hazard. There are no development restrictions on site. Hasting, MI, is in an attainment zone for all air pollutants. 90% of the site is within Hydrological Group A (well drained), and one of the access points is in Hydrological Group C/D (moderately drained). US Geologic Association indicates no real risk for seismic activity in the area. This is considered low risk.

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

5.2 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: Consumers Energy is the site's natural gas provider. A 2", 60 psi medium capacity line is available and installed on site. This line can service small to mid-size users. To service a high-pressure gas user, an additional gas line, at the project's costs, would be extended from the north along State Street to the property boundary. Delivery pressure and hourly load will determine what system upgrades will be required for a significant user. This connection is an asset for new development.

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

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

5.2.2 Electric Availability

Risk Information: Consumers Energy is the distribution and transmission provider at the site for electricity. Distribution level service is available on-site with up to 2 MW capacity. For additional capacity, the electric system will require upgrades. A 46 kV line is within 1 mile west of the site. Additionally, a 138 kV line is within 2 miles southwest of the site. 5 MW of service will require minimal upgrades, 10 MW will require moderate upgrades, and 50 MW will require significant upgrades. Depending on the project load and a formal transmission study, the 46 kV or 138 kV line would be extended to an on-site substation. Having existing power to the site is an asset to any new construction or industry.

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

5.2.3 Water Availability

Risk Information: City of Hastings is the water service provider in the area. The system is rated for a total capacity of 4 MGD with a peak capacity of 1.2 MGD and an excess capacity of 2.8 MGD. Water service is not currently available at the physical site but can be provided in less than 24 months. A 12" water main will require an extension of less than 1 mile. Construction costs were not provided, but metering fees range from a 4" meter at $60,000 to a 6" meter at $115,000. Because this is a necessary utility and new development costs will be needed, this is a medium risk.

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

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

5.2.4 Waste Disposal

Risk Information: A Waste Management owned landfill serves Hastings, MI, and is located 3.6 miles from the site. Waste Management allows the disposal of non-hazardous materials at this facility. On-site wastewater service is provided by the City of Hastings, and an 8" line is located within 0.25 miles. The City of Hastings plant has a total rated capacity of 2 MGD, a peak of 1 MGD, and an excess capacity of 1 MGD. Similar to water (above), this critical utility is deemed a medium risk since potential expense and construction delays may occur with new industries.

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

5.2.5 Internet Availability

Risk Information: More than 80% of the population in the City of Hastings has access to broadband or high-speed internet, including the site. However, there is a need for expansion and improvement of the current networks. It is estimated that each business/residence in Hastings has an average of 4 wired providers available at their location to provide service. Outreach has suggested that there are still many areas outside the City of Hastings that require improved internet service.

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

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

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: Primary access to the site would be off Enterprise Dr. The site has a potential second entrance point on Star School Rd. E State Street is just north of the site, which connects to Highway 37 (2-lane divided) on the west side of town. Highway 37 can also be accessed by traveling south for 1.6 miles on Star School Rd, but it will face impacts of the elementary school located 0.7 miles south of the site. Access to a 4-lane divided highway or interstate is not within proximity. I-96 is 21 miles to the north, and I-69 is 27.6 miles to the east. Downtown Grand Rapids is 40 miles to the northwest.

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

5.3.2 Rail Access

Risk Information: The site will not be feasible for rail service. Hastings, MI, does not have an active rail line in the vicinity. The nearest line is over 12 miles away. For those prospective industries that could utilize or require rail access for their finished products, this represents a high-risk site for development.

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

The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	**64**

5.3.3 Airport Access

Risk Information: Gerald R. Ford International Airport (Grand Rapids, MI) is 25 miles from the site, with an estimated drive time of 38 minutes. The airport offers flights on six airlines (Delta, America, United, Southwest, Allegiant, and Frontier). They offer 12 year-round nonstop destinations. Key cities include Atlanta (Delta), Chicago-O'Hare (American & United), Dallas (American), Detroit (Delta), and Houston (United). Having full air passenger service within 25 miles of a new development site is considered an asset (very low risk) to the prospective owners for the movement of personnel.

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

5.3.4 Water Freight Access

Risk Information: The site has no water freight access.

The Burns Harbor Port on the southern tip of Lake Michigan, is located 140 miles to the southwest in Indiana. The St. Lawerence Seaway and Great Lakes offer port access for international ships, and year-round barge access to 20 states in addition to the Gulf of Mexico via the inland waterway systems. This is a low-risk item as water access is not usually critical for new 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 X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**

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

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: Barry County, MI, ranks 12th of 83 counties in the state for health. Five hospitals operate within Barry County. The Corewell Health Pennock Hospital is located 2.16 miles from the site and is equipped with a full medical staff and surgical capabilities. This level of healthcare is attractive to incoming industries to retain employees.

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

5.4.2 Education (Schools)

Risk Information: The largest University in Barry County is Michigan Career and Technical Institute, which awarded 189 Degrees in 2021. Nursing, culinary, and machine tool technology are the most popular fields of study. In addition, Kellogg Community College in Hastings offers a variety of degree programs, including manufacturing, skilled trades, and applied technology. 34.7% of Barry County residents are high school graduates, compared to 26.6% for the state of Michigan and 25.3% in the USA. Barry County has 8,614 students currently enrolled in K-12, with 718 students enrolled in grade 12. This established educational network will attract and retain new workers to the area, which is low risk.

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

5.4.3 Local Transportation

Risk Information: Barry County Transit, based out of Hastings, MI, carries over 120,000 customers per year throughout the area including walking distance to the site. This level of service improves new employee options for commuting to and from work.

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

5.4.4 Public Safety (Local)

Risk Information: Barry County is one of the safest counties in the state of Michigan, ranking within the 94th percentile for crime. The total violent crime rate is 2.176 per 1,000 Barry County residents. The Barry County Sheriff's Office is located 2 miles from the site. This personal risk item is very important to attract workers and provide long-term comfort in their jobs and surroundings.

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

5.4.5 Housing/Cost of Living

Risk Information: Barry County has 27,288 total housing units, with a median house value of $187,100. Homeowner vacancy is 0.3% in Barry County, compared to 1.1% in Michigan and 1.2% across the USA. Rental vacancy is 2.0% in Barry

County, 4.8% in Michigan, and 5.7% across the USA. The cost-of-living index in Barry County is 95.7, which is lower than the Michigan index of 101.8. The availability, or in this case, the shortage of housing, in the area presents a medium-high risk for new companies to attract workers to the area.
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 X RRI) is 48 out of 100. **48**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100. **48**

5.5 Risk Factor: Labor

5.5.1 Workforce

Risk Information: The unemployment rate in Barry County is 3.50%, which is lower than the Michigan rate of 6.2%.

Educational Attainment:

- No High School Diploma: Barry: 6.1%, Michigan: 7.7%, USA: 10.3%
- High school Graduate: Barry: 34.7%, Michigan: 26.6% USA: 25.3%
- Some College, No Degree: Barry: 24.1%, Michigan:23.1%, USA: 20.1%
- Associate degree: Barry: 10.9%, Michigan: 10.3%, USA: 9.3%
- Bachelor's Degree: Barry: 18.2%, Michigan: 20.2%, USA: 22.0%
- Postgraduate Degree: Barry: 6.1%, Michigan: 12.0%, USA: 13.1%

Barry County has a population of 62,014 with a labor force of 30,481. Manufacturing employment makes up 3,765 of Barry's labor force. The labor force participation rate is 61.1% in Barry County, compared to 61.5% in the State of Michigan, and 63.4% in the USA. This is a low-risk situation for worker availability in the area.

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

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

5.5.2 Labor Costs

Risk Information: The regional average wage for Chemical Equipment Operators and Tenders is $41,900, compared to the national average of $57,100. Chemical Plant and System Operators' regional average wage is $62,000, compared to the national average of $83,200. Chemical Engineers in Barry County are paid, on average, $91,100, compared to $121,100 for the national average. Following the trend of below-average wages, manufacturing annual average wage per worker in Barry County is $65,172, with a national average of $81,506. On January 1, 2024, the minimum wage in the state of Michigan was set at $10.33/hour.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. — **4**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. — **16**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. — **16**

SECTION E: TABLES AND FIGURES

Figure E-1. Location of Hastings in Barry County, Michigan



Figure E-2 Selected Industrial Site

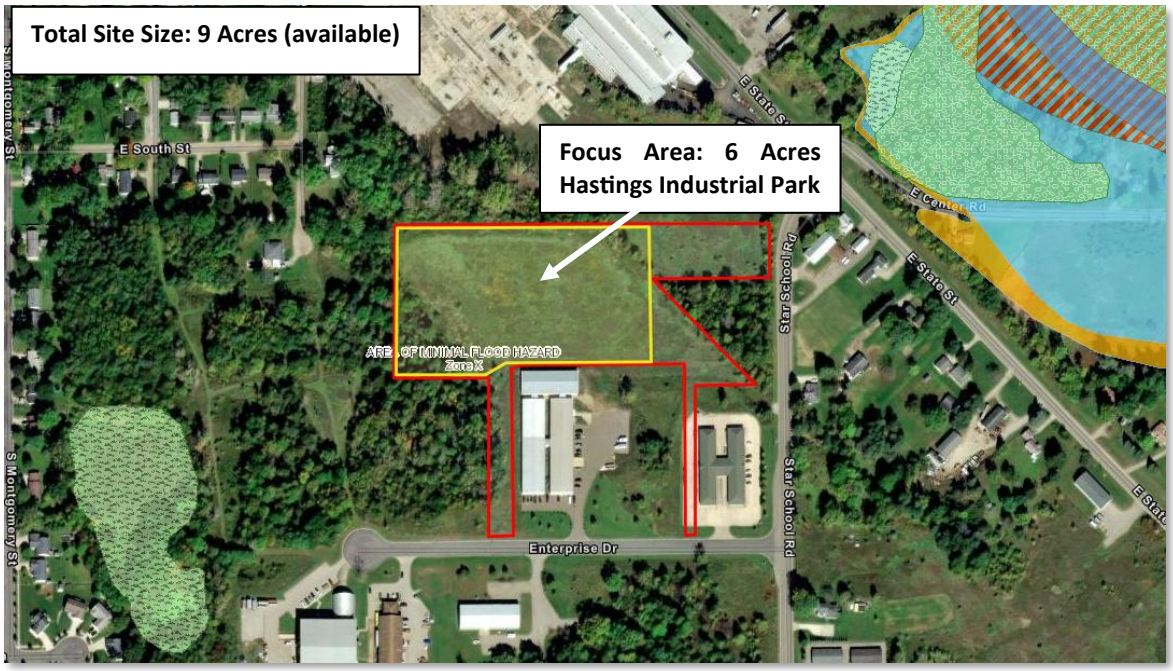


Figure E-3. Hastings Industrial Site Utility Locations



Figure E-4. Mileage to Interstates from Hastings, Michigan

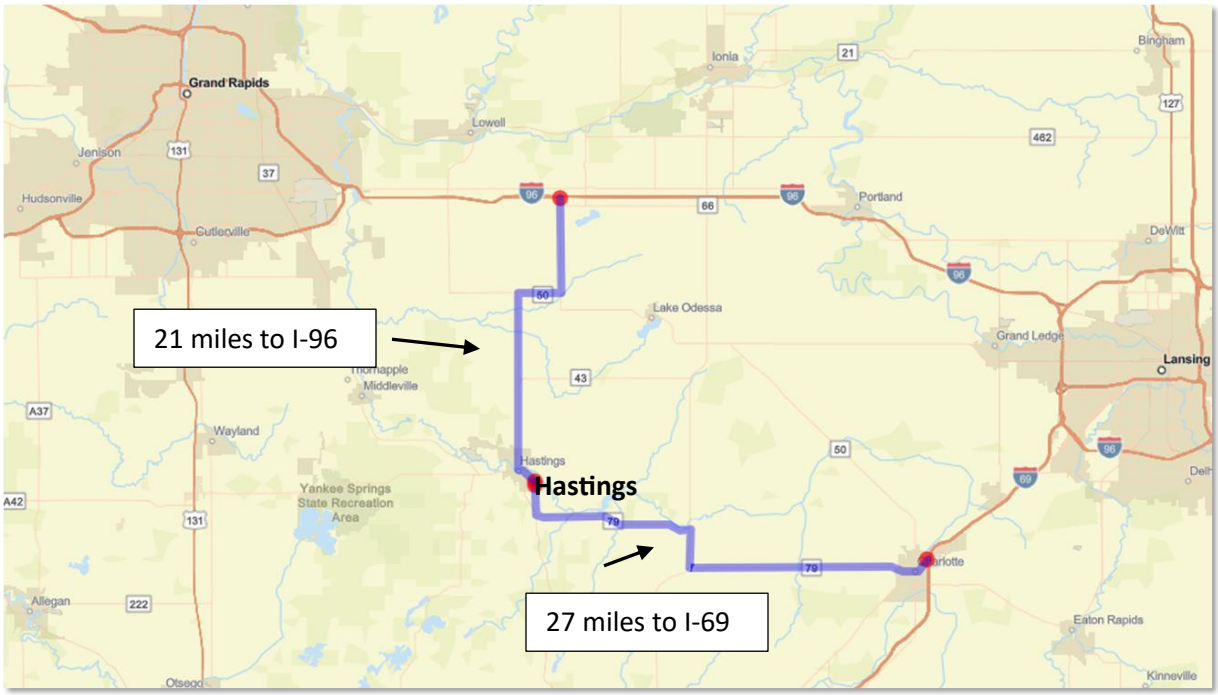


Table E-1. Michigan Counties Included Within the BDO Zone (percentage with BDO Zone)

State	County	BDO Zone
Michigan	Barry	100%
Michigan	Kalamazoo	100%
Michigan	Kent	100%
Michigan	Montcalm	100%
Michigan	Calhoun	100%
Michigan	Clinton	100%
Michigan	Eaton	100%
Michigan	Ingham	100%
Michigan	Ionia	100%
Michigan	Van Buren	100%
Michigan	St. Joseph	100%
Michigan	Allegan	99%
Michigan	Ottawa	99%
Michigan	Branch	98%
Michigan	Jackson	88%
Michigan	Shiawassee	55%
Michigan	Gratiot	54%
Michigan	Muskegon	46%
Michigan	Cass	46%
Michigan	Mecosta	42%
Michigan	Livingston	38%
Michigan	Hillsdale	36%
Michigan	Newaygo	32%
Michigan	Isabella	10%
Michigan	Berrien	9%
Michigan	Washtenaw	3%
Michigan	Saginaw	0%
Michigan	Lenawee	0%
Indiana	LaGrange	25%
Indiana	Steuben	19%
Indiana	Elkhart	1%

Figure E-5. CPI Index for the US Midwest Region 2021-2024

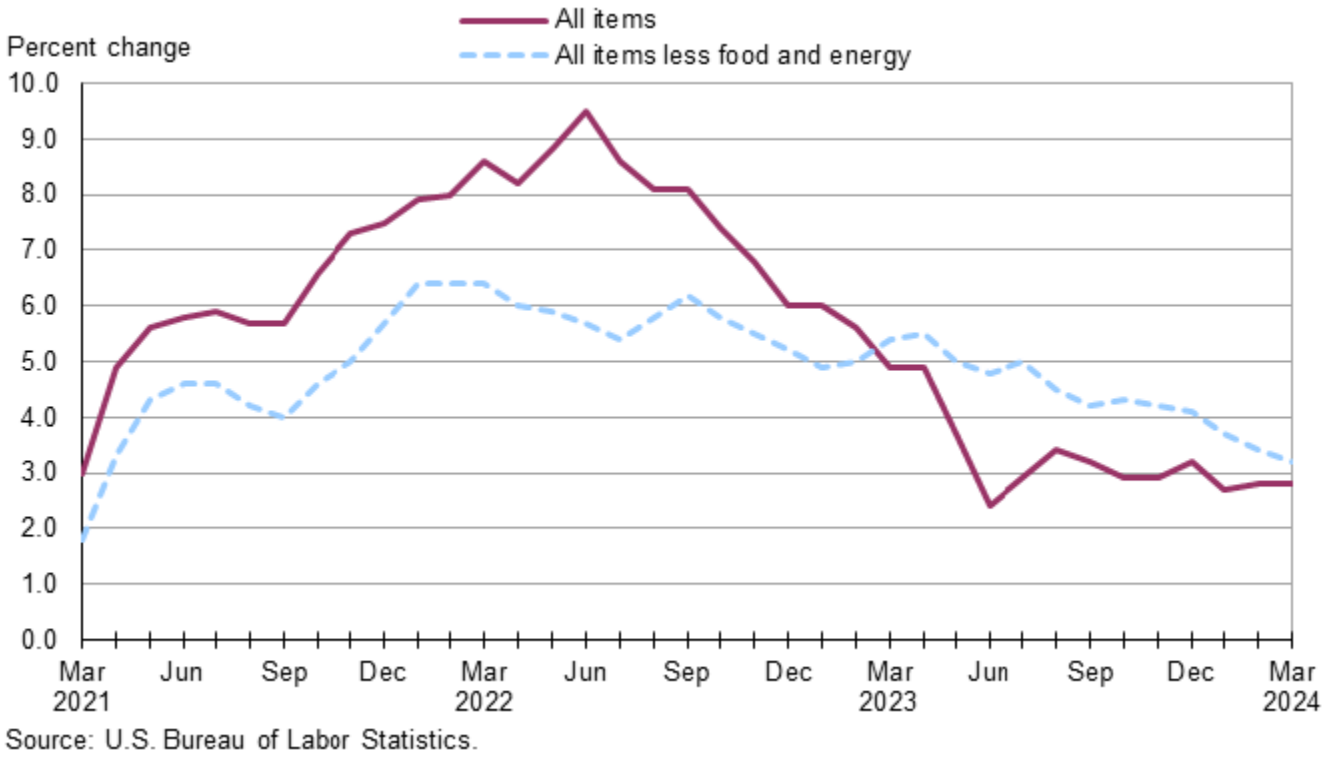


Figure E-6. Michigan Diesel Prices Since 1995



SECTION F: LEGAL DISCLAIMER

This BDO Zone Rating (the "Rating") is prepared for, and provided to, Barry County, Michigan, 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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