Biofuel Development Opportunity Zone Rating **Wyoming County, PA**
Date of Issue: April 29, 2024
Rating Grade: **'A'**

A
High Quality

Rating Parameters:

Category	Rated Quantity	Delivered Cost	BDO Zone Size
Pulpwood	550,000 bdt/yr	$70-$110/bdt	75-mi drive
Forest residues	64,000 bdt/yr	$70-$110/bdt	distance from
Sawmill Residues	48,000 bdt/yr	$70-$86/bdt	Tunkhannock, PA

BDO Zone Assets

- **Over 662,000 bdt/yr woody biomass comprising 550,000 bdt/yr of pulpwood, 64,000 bdt/yr of forest residues, and 48,000 bdt/yr of sawmill residues available at low risk.**
- **Limited competition for pulpwood with no pulp and paper facilities in the region enhance favorable competitive dynamics in the BDO Zone for future biomass projects.**
- **Leading the nation in hardwood lumber production and export, the highly productive forest products industry ensures a stable feedstock supply.**

BDO Zone Liabilities

- **Migration of loggers and trucking companies to the local shale gas industry weakens supply chain capacity for biobased projects.**
- **Inactivity of pulpwood supply chains relative to pre-2000 levels necessitates capital investment to scale up.**
- **Aging ownership and management within logging companies may pose challenges for ownership transfer upon retirement.**

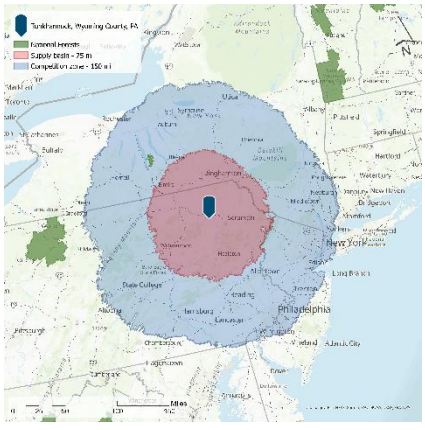
Rating Grade

The Wyoming County, PA, 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 supply chain, in particular the logging capacity for commercial pulpwood harvesting and transportation operations.

Wyoming County, PA BDO Zone



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 (Tunkhannock, PA).

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 $2 \times 8 = 16$.

If the analyst deems that a typical bio-based project could put in place 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 that 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. The BDO Zone score for Wyoming County is ***18.7 out of 100, resulting in an 'A' designation***.

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

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 the consideration of current competition, supply chain constraints (e.g., operational, accessibility, and market dynamics), and also 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 550,000 bdt/yr of pulpwood (about 70% of total available unutilized pulpwood in the BDO Zone), along with approximately 25% of the produced forestry residues amounting to 64,000 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 28% of the produced sawmill residues, equivalent to 48,000 bdt/yr, sourced from the 11 identified sawmills within the BDO Zone, can be procured at low risk for utilization in a new project. We expect that the rated pulpwood and forest residues quantity would be available at a price range of $70-110/bdt while the sawmill residues could be secured at $70-86/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 23 medium-risk indicators mainly related to the infrastructure and supply chain scale-up, in particular biomass harvesting and transportation. The other risk indicators (65) are low/very low risks which can be considered as the BDO Zone assets. Most of the 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

Wyoming County forms part of the Northern Tier Region and is responsible for 10% of saw timber production within Pennsylvania. Known for its robust sawmilling industry, the Northern Tier region has exhibited stability during recent economic downturns. Notably, medium-to-large sawmills (> 5 MMBF capacity) in the region have retained continual production amid these uncertain economic situations, further attesting to the sector's strength and continuity.

Many of the sawmills in the region are family-owned, many spanning four to five generations. The average age of the sawmills in the BDO Zone is 65 years, with the oldest sawmill surpassing 130

years. Loggers and landowners in the region have been practicing forestry generationally for over 100 years. Despite the market and labor challenges faced by loggers and sawmills, including market downturns, the overall production capacity has increased in the BDO Zone since 2011.

In the current market conditions, the absence of regional markets and the comparatively low price of pulpwood have resulted in a situation where both landowners and logging companies lack the incentive to engage in pulpwood harvesting. This has ultimately led to increased high grading, resulting in a change in the quality of stands. The pulpwood/saw log ratio is 2:1; in other words, the presence of pulpwood outweighs that of saw logs on a per-acre basis. That said, pulpwood has very limited demand and lacks substantial local markets.

No pulp mills operate in the region, and the BDO Zone around Tunkhannock, PA, has had low annual pulpwood removals of 7,500 bdt/yr since 2011. Overall, we consider the stability of historical pulpwood harvest removal data to be a positive factor indicating limited competing use.

The growth-to-removals ratio for pulpwood in the BDO Zone is highly tilted in favor of yearly net growth, indicating that the regional pulpwood resource can support a new biomass project development without jeopardizing the region's forest health.

BDO Zone Liabilities

The lack of regional pulpwood markets, low yearly pulpwood removals, low stumpage pricing, and the rise of the Marcellus Shale gas industry have weakened the local pulpwood supply chain. There has been a migration of those who had worked in logging and hauling to the shale gas industry, thus reducing the capacity required to scale a biobased project. However, outreach confirmed that there is potential interest from local trucking companies operating in the shale gas industry to expand operations and support biobased projects, contingent upon demand. Additionally, the shale gas industry has made substantial contributions to regional road network maintenance and enhancement.

Logging and other supply chain infrastructure are critical to the success of low-grade wood markets. Wood is necessary for a facility, but people, processing, and logistics equipment are also needed. While the region currently supports roundwood harvesting, substantial improvements are required to accommodate large biomass volumes. These improvements entail investments in new logging infrastructure, such as chippers and chip vans, to effectively capture and scale biomass procurement.

Declining employment in the logging industry is an industry-wide problem that is endemic. With the median age of loggers in northeastern Pennsylvania being 48, the industry faces potential shortages going forward. Factors contributing to the decline include the perceived unattractiveness of logging employment and the vulnerability of family-owned logging businesses to market fluctuations and economic conditions.

The logging sector faces many challenges, increasing its risk. Mechanization technology promises efficiency improvements but requires large capital investments and increases labor shortages due to workforce displacement. In addition, increased insurance prices and rising expenditures for new logging equipment and fuel erode profitability. Additionally, low log prices and rising worker compensation costs further exacerbate these issues. These challenges pose financial burdens for logging companies, making it difficult for them to maintain or expand their operations, thereby increasing the risk within the sector. However, solid and long-term demand for pulpwood by future biomass projects and financial support in the forms of grants and loans from the State and Federal agencies can mitigate the challenges faced by the existing logging companies to scale up.

Infrastructure Profile

An industrial site was chosen within close proximity to Tunkhannock for the purposes of scoring infrastructure related risk indicators and aligning with criteria suitable for hosting a biofuels project. The chosen location sits on

a 104.2-acre parcel southwest of the intersection of State Route 87 and Manning Rd. and is a 7-mile drive distance northeast of Tunkhannock.

In terms of site assets, the UGI Natural Gas Pipeline is located on the southern portion of the property. Access to three-phase power is facilitated via an existing connection on the southern segment, while water is readily available from an on-site well. Additionally, the site features a septic system, ensuring basic infrastructure requirements are met.

The industrial site's access is made possible through State Route 87, a two-lane highway connecting to U.S. Route 6, the main east-west roadway in Wyoming County, which is close to major highways, railways, airports, and markets, ensuring easy access.

With multiple rail lines within relatively close proximity to the industrial site that offer freight services including a transload facility situated 8-miles from the industrial site in Tunkhannock, there is good rail access potential.

The industrial site encompasses a land-clearing operation that offers timber management, logging, tree chipping, mulch, and fuel delivery.

With ample area available on the parcel to accommodate a bio-based project, coupled with potential synergies achievable by collocating on-site with the existing land clearing business, the proposed industrial site is suitable to host a biobased project.

Project Director
Darren Blanch
Project Director
Ecostrat Inc.
darren@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

Figure 1: Risk Indicators (Sorted by Risk Level)

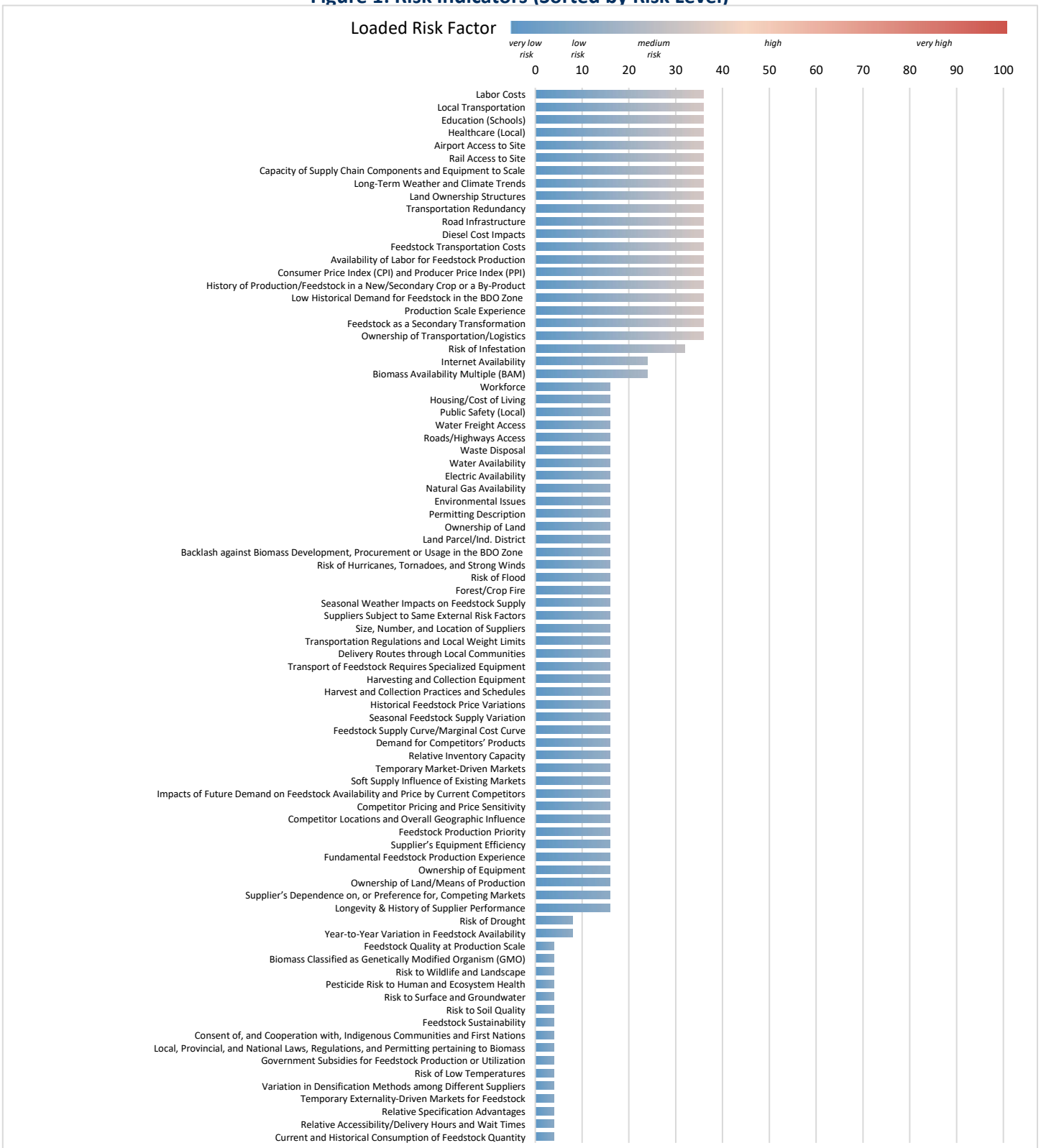


Table 1: Risk Indicators and Associated Scores

	Feedstock Supply Chain Risk Indicators	Raw Risk Likelihood	Raw Risk Impact	Gross Risk Indicator	Mitigation/ Notching	Loaded RI Score
	Category 1.0: Supplier Risk					
1.1.1	Longevity & History of Supplier Performance	4	4	16	NN	16
1.2.1	Supplier's Dependence on, or Preference for, Competing Markets	4	4	16	NN	16
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	6	6	36	NN	36
1.3.4	Feedstock as a Secondary Transformation	6	6	36	NN	36
1.4.1	Fundamental Feedstock Production Experience	4	4	16	NN	16
1.4.2	Production Scale Experience	6	6	36	NN	36
1.5.1	Supplier's Equipment Efficiency	4	4	16	NN	16
1.6.1	Feedstock Production Priority	4	4	16	NN	16
	Category 2.0: Competitor Risk					
2.1.1	Competitor Locations and Overall Geographic Influence	4	4	16	NN	16
2.1.2	Current and Historical Consumption of Feedstock Quantity	2	2	4	NN	4
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
2.2.1	Relative Inventory Capacity	4	4	16	NN	16
2.2.2	Relative Accessibility/Delivery Hours and Wait Times	2	2	4	NN	4
2.2.3	Relative Specification Advantages	2	2	4	NN	4
2.2.4	Demand for Competitors' Products	4	4	16	NN	16
	Category 3.0: Supply Chain Risk					
3.1.1	Biomass Availability Multiple (BAM)	4	6	24	NN	24
3.1.2	Feedstock Supply Curve/Marginal Cost Curve	4	4	16	NN	16
3.1.3	Seasonal Feedstock Supply Variation	4	4	16	NN	16
3.1.4	Year-to-Year Variation in Feedstock Availability	2	4	8	NN	8
3.2.1	Historical Feedstock Price Variations	4	4	16	NN	16
3.2.2	Low Historical Demand for Feedstock in the BDO Zone	6	6	36	NN	36
3.2.3	History of Production/Feedstock in a New/Secondary Crop or a By-Product	6	6	36	NN	36
3.3.1	Consumer Price Index (CPI) and Producer Price Index (PPI)	6	6	36	NN	36
3.3.2	Currency Risk	NR	NR	NR	NR	NR
3.3.3	Border Risk	NR	NR	NR	NR	NR
3.3.4	Temporary Externality-Driven Markets for Feedstock	2	2	4	NN	4
3.4.1	Harvest and Collection Practices and Schedules	4	4	16	NN	16
3.4.2	Harvesting and Collection Equipment	4	4	16	NN	16
3.4.3	Variation in Densification Methods among Different Suppliers	2	2	4	NN	4
3.4.4	Availability of Labor for Feedstock Production	6	6	36	NN	36
3.5.1	Feedstock Transportation Costs	6	6	36	NN	36
3.5.2	Diesel Cost Impacts	6	6	36	NN	36
3.5.3	Transport of Feedstock Requires Specialized Equipment	4	4	16	NN	16
3.5.4	Delivery Routes through Local Communities	4	4	16	NN	16
3.5.5	Transportation Regulations and Local Weight Limits	4	4	16	NN	16
3.5.6	Road Infrastructure	6	6	36	NN	36
3.5.7	Transportation Redundancy	6	6	36	NN	36
3.6.1	Size, Number, and Location of Suppliers	4	4	16	NN	16
3.6.2	Suppliers Subject to Same External Risk Factors	4	4	16	NN	16
3.6.3	Land Ownership Structures	6	6	36	NN	36
3.7.1	Seasonal Weather Impacts on Feedstock Supply	4	4	16	NN	16
3.7.2	Long-Term Weather and Climate Trends	6	6	36	NN	36
3.7.3	Forest/Crop Fire	4	4	16	NN	16
3.7.4	Risk of Infestation	4	8	32	NN	32
3.7.5	Risk of Hail	NR	NR	NR	NR	NR
3.7.6	Risk of Flood	4	4	16	NN	16
3.7.7	Risk of Drought	2	4	8	NN	8
3.7.8	Risk of Hurricanes, Tornadoes, and Strong Winds	4	8	32	50%	16
3.7.9	Risk of Low Temperatures	2	2	4	NN	4
3.8.1	Government Subsidies for Feedstock Production or Utilization	2	2	4	NN	4
3.8.2	Local, Provincial, and National Laws, Regulations, and Permitting pertaining to Biomass	2	2	4	NN	4
3.8.3	Backlash against Biomass Development, Procurement or Usage in the BDO Zone	4	4	16	NN	16
3.8.4	Consent of, and Cooperation with, Indigenous Communities and First Nations	2	2	4	NN	4

3.8.5	Food Security Concerns	NR	NR	NR	NR	NR
3.9.1	Feedstock Sustainability	2	2	4	NN	4
3.9.2	Risk to Soil Quality	2	2	4	NN	4
3.9.3	Risk to Surface and Groundwater	2	2	4	NN	4
3.9.4	Water Use	NR	NR	NR	NR	NR
3.9.5	Pesticide Risk to Human and Ecosystem Health	2	2	4	NN	4
3.9.6	Risk to Wildlife and Landscape	2	2	4	NN	4
3.9.7	Biomass Classified as Genetically Modified Organism (GMO)	2	2	4	NN	4
	Category 4.0: Feedstock Scale-up Risk					
4.1.1	Feedstock Quality at Production Scale	2	2	4	NN	4
4.1.2	Capacity of Supply Chain Components and Equipment to Scale	6	6	36	NN	36
	Category 5.0: Infrastructure					
5.1.1	Land Parcel/Ind. District	4	4	16	NN	16
5.1.2	Ownership of Land	4	4	16	NN	16
5.1.3	Permitting Description	4	4	16	NN	16
5.1.4	Environmental Issues	4	4	16	NN	16
5.2.1	Natural Gas Availability	4	4	16	NN	16
5.2.2	Electric Availability	4	4	16	NN	16
5.2.3	Water Availability	4	4	16	NN	16
5.2.4	Waste Disposal	4	4	16	NN	16
5.2.5	Internet Availability	6	4	24	NN	24
5.3.1	Roads/Highways Access	4	4	16	NN	16
5.3.2	Rail Access to Site	6	4	36	NN	36
5.3.3	Airport Access to Site	6	6	36	NN	36
5.3.4	Water Freight Access	4	4	16	NN	16
5.4.1	Healthcare (Local)	6	6	36	NN	36
5.4.2	Education (Schools)	6	6	36	NN	36
5.4.3	Local Transportation	6	6	36	NN	36
5.4.4	Public Safety (Local)	4	4	16	NN	16
5.4.5	Housing/Cost of Living	4	4	16	NN	16
5.5.1	Workforce	4	4	16	NN	16
5.5.2	Labor Costs	6	6	36	NN	36
					Average	**18.7**



Wyoming County, PA BDO Zone Independent Review Committee (IRC)

Shelby Chorba - Program Manager, Northern Tier Hardwoods Association
John Augustine - President/CEO, Penn's Northeast
Cynthia Traore - Business Development Administrator, Northern Tier Regional Planning and Development Commission
Dan Ciolkosz - Assistant Professor & Research Associate, Penn State Extension
Dave Taylor - E&S Dirt & Gravel Roads, Wyoming County Conservation District
Tom Henry - County Commissioner, Wyoming County Courthouse
Ben Lawson - Broker/Owner, Sherlock Homes & Properties
Matthew Sordoni - President, Real Estate, Sordoni Construction Services, Inc
Brad Georgetti - HR Manager, Deer Park Lumber
Matt Austin - President, Austin Corp, Holcombe Energy Resource, Eastern Freight Systems
Josh Brown - Manager - Projects, Williams
Alex Fried - Senior Purchasing Manager, Proctor & Gamble
Robert Sawicki - Owner, Elite Timber Harvesting LLC
Justin Shalata - Shalatas Land Clearing

APPENDIX A: BIOMASS AVAILABILITY AND PRICING

Tunkhannock is a borough in Wyoming County, Pennsylvania, 31 miles (50 km) northwest of Wilkes-Barre and located in the northeastern region of the state. The largest employer is the Procter & Gamble plant in nearby Washington Township. Wyoming County is part of the administrative region known as the Northern Tier, which includes a cluster of nine counties covering 6,584 square miles. It is known worldwide for the premier quality of its northern Appalachian hardwood lumber and related forest products.

Pennsylvania is one of the top timber-producing states in the Northeastern United States, leading the nation in the volume of hardwood forest and in the volume of hardwood lumber created and exported. Pennsylvania has more than 2.5 million acres of FSC-certified forests and more than 2.3 million acres of SFI-certified forests.[1] The state exhibits substantial forest coverage, with around 58 percent (equivalent to 16.9 million acres) of the total land area enveloped by forests. Approximately one-third of the forests, or 4.9 million acres, are in the hands of federal, state, and local governmental entities. The majority of forests and woodlands in the state are privately owned, accounting for approximately 71 percent of the total land area. These privately held lands span over 12 million acres, with only 3 percent owned by the forest product business. These private ownerships represent areas from one to thousands of acres held by an estimated 750,000 owners (e.g., individuals, families, partnerships, corporations),[1] where today the average ownership is around 11 acres.[2] Penn State University School of Forestry reports that 75 percent of forested land in Wyoming County is under private ownership, covering 137,000 acres, and has more than 5,600 owners.[3]

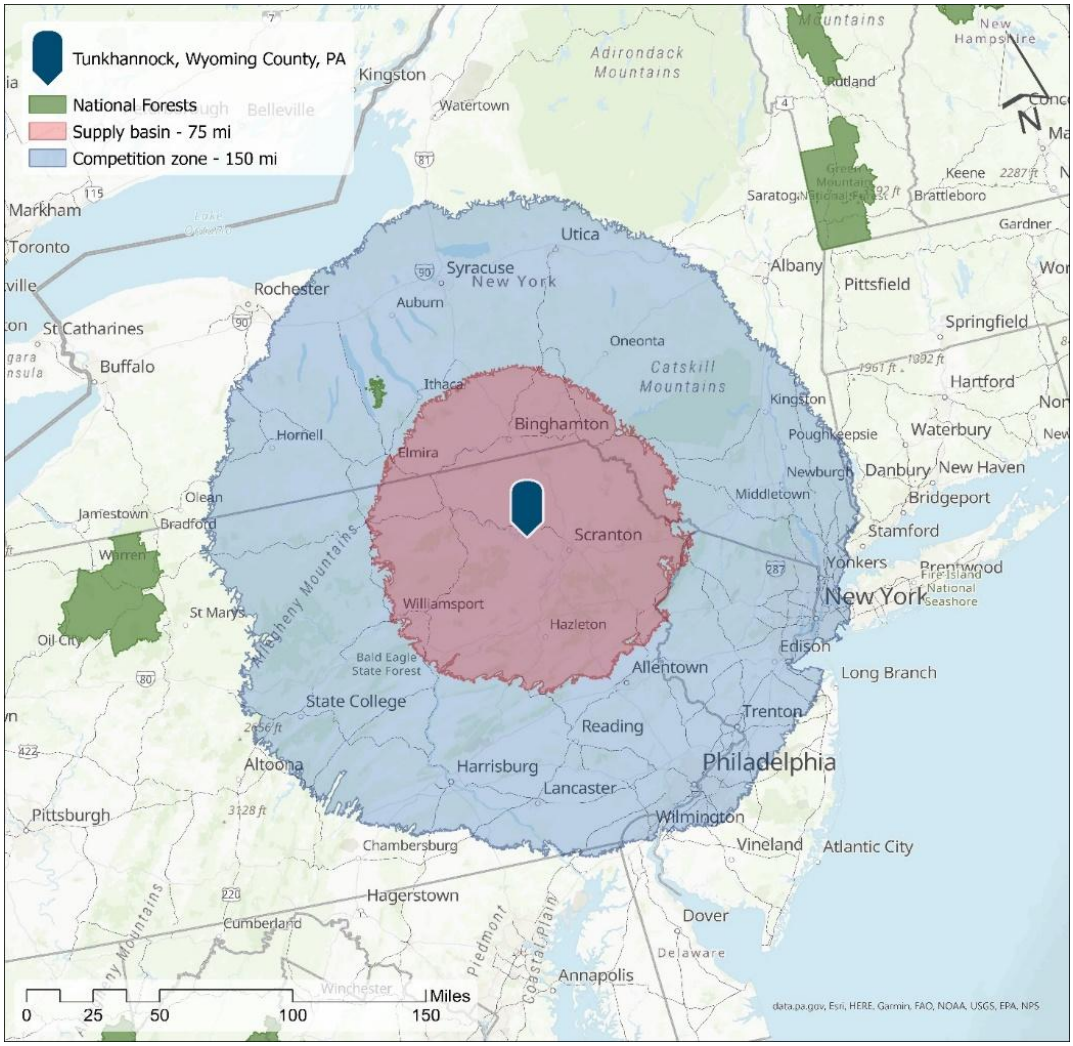
About two-thirds of the state's harvest is for high-quality hardwood sawlogs and veneer logs. About 90% of Pennsylvania's forest is hardwood, and 10% is softwood. The primary forest types include oak-hickory, northern hardwoods, and mixed oak-pine. Woods are growing twice as rapidly as the rate of harvest or natural loss they are experiencing. Annual timber harvest volume in Pennsylvania is below 1% of the total standing volume.[1] Pennsylvania has the most hardwood sawmills in the country, with a low average size. In 2017, the forest products industry supported over 152,000 jobs, $9.9 billion in labor income, $15.8 billion in value-added, and $36.5 billion in sales.[4]

BDO ZONE SUPPLY AND COMPETITION ZONES

BDO Zone Risk Indicators are scored with reference to specific feedstock quantities and prices. The rated feedstock quantities are determined by estimating the potential amount of biomass feedstock that can be produced within the BDO Zone, also referred to as the Supply Zone (75-mile drive distance from Tunkhannock). This estimate of total potential is reduced based on the expected demand for biomass in the competition zone (150-mile drive distance from Tunkhannock). Finally, a Biomass Availability Multiple (BAM) further reduces the available amount based on a consideration of supply chain constraints (e.g., operational, accessibility, and market constraints) and to account for data/model uncertainty. The resulting rated feedstock quantities are conservative, low-risk estimates of availability for new projects. The price range associated with each rated quantity is determined through outreach and market analysis in the Competition Zone and reflects the anticipated price that a new bio-project would have to pay to secure the rated quantity of biomass. The Wyoming County, PA BDO Zone/Supply Zone, and Competition Zone are shown in Figure A-1.

[1] https://www.agriculture.pa.gov/Business_Industry/HardwoodDevelopmentCouncil/Documents/2020%20State%20of%20the%20Industry.pdf
[2] https://aiaphiladelphia.org/news/context-winter-2023/329/329-Pennsylvania-Forests-and-the-Forest-Products-Industry
[3] https://ecosystems.psu.edu/research/centers/private-forests/outreach/legacy-planning
[4] http://www.northeasternforests.org/app/webroot/uploads/files/PA%20Forest%20Products%20Industry%20Report.pdf

Figure A-1. Wyoming County BDO Zone supply and competition zones with Tunkhannock as center point



Note on units: All quantity units are expressed as bone dry tons per year (bdt/yr). All prices are expressed either as freight-on-board (FOB) at the location of feedstock production or as delivered to a new bio-project.

Woody Biomass Types in the BDO Zone

The Wyoming County BDO Zone risk rating was evaluated with reference to specific quantities and prices of three woody biomass feedstock types: pulpwood, forest residues, and sawmill residues.

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

[5] https://sfiofpa.org/pdf.php?id=21

(MDF). Pulpwood is also used to produce wood pellets, pallets, boxes, pulpwood, landscape ties, and various engineered wood products like particle board.[6]

For the purposes of the analysis, forest residues are defined as the by-products or leftover materials resulting from forestry operations, such as timber harvesting and thinning. These residues typically consist of branches, tops, stumps, bark, and other woody debris that remain on-site after the sawtimber has been harvested. Forest residues differ from whole tree chip as the roundwood, or log, portion of the tree is not usually included.

Sawmill residues refer to the byproducts of sawmill operations, produced from the conversion of sawlogs into finished wood products such as lumber and engineered wood. About half of the sawlogs are converted to finished wood products, and the remaining portion is sawmill residues, comprised of wood chips, sawdust, shavings, bark (also known as hog fuel), log yard breakage, and finished trims.

Woody Biomass Demand in the Competition Zone

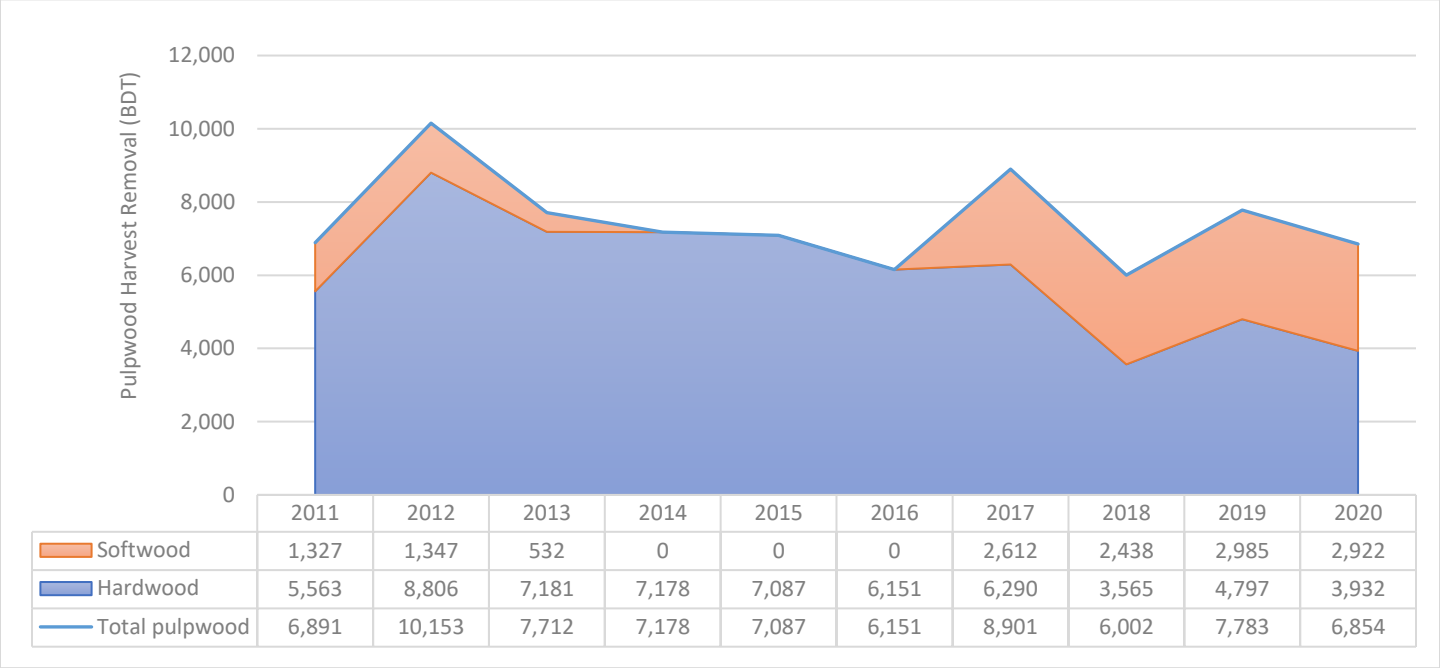
First, the historical and current demands for woody biomass in the BDO Zone region are discussed to understand the availability of woody biomass for future biomass projects.

To estimate historical pulpwood harvest levels, USFS Forest Inventory and Analysis (FIA)[7] data was queried for a 75-mile radius around Tunkhannock, PA, using the online EVALIDator tool. Data on total net removals indicate that the average net pulpwood-sized tree removals in the area between 2011 and 2020 were approximately 7,471 bdt/yr (Figure A-2), with relatively stable harvest levels. Most of the harvest is hardwood, which rose to 100% of total removals in 2014 through 2016, thereafter decreasing to 64% of total removals in 2020. Softwood removals declined from 19% in 2011, with no recorded removals from 2014 to 2016, then rose to 43% in 2020.

The fluctuations during this period reflect the effects of a depressed U.S. housing market and an overall reduced pulpwood production year over year in the eastern U.S. from 2012 to 2017.[8] The relatively low removal of pulpwood is a function of the low demand, given that there are no pulp and paper mills within the BDO Zone to drive such demand.

[6] https://ucanr.edu/sites/Mendocino/files/17406.pdf
[7] https://www.fia.fs.usda.gov/
[8] https://www.srs.fs.usda.gov/pubs/rb/rb_srs231.pdf

Figure A-2. Annual pulpwood harvest removal data in the 75-mile driving distance of Wyoming County, PA



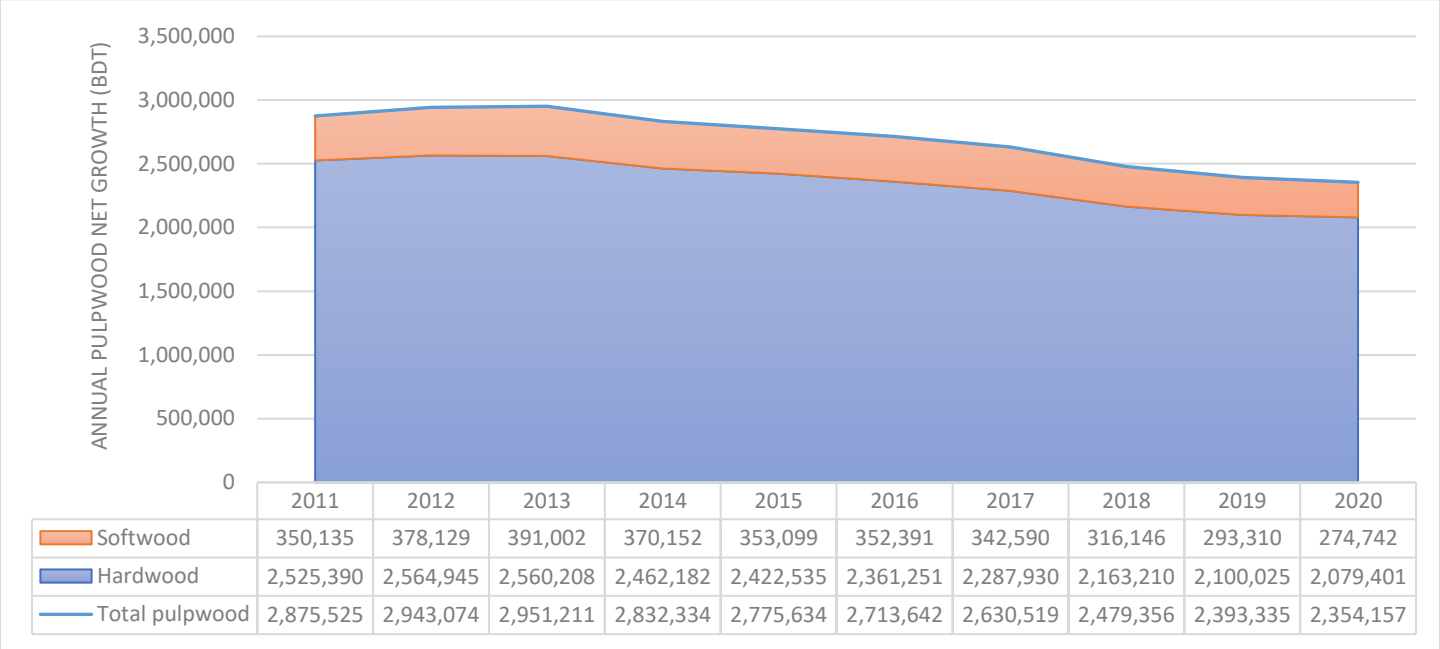
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Softwood	1,327	1,347	532	0	0	0	2,612	2,438	2,985	2,922
Hardwood	5,563	8,806	7,181	7,178	7,087	6,151	6,290	3,565	4,797	3,932
Total pulpwood	6,891	10,153	7,712	7,178	7,087	6,151	8,901	6,002	7,783	6,854

Another major factor impacting low pulpwood removals is the low volume and density of high-quality stands. Sawlog grade hardwood trees are outnumbered around 2:1 by less valuable trees such as pulpwood on a per-acre basis. Thus, the cost of extracting harvested timber is normally justified by the value of 1/3 of the trees on a site.[8] Aside from the challenge of finding high-volume, high-quality stands, there are significant costs connected with building forest haul roads, log landings, and associated skid trails to get the trees out. If sufficient valuable timber is unavailable in a forested area, it does not make economic sense for an operator to enter and collect it.

Harvests on private forestland frequently remove only the finest-grade sawtimber, leaving the lower-value, less desirable species to occupy the "selectively harvested" site and produce the visual look of a mature forest. Biomass harvesters are expected to have difficulty convincing forest landowners to harvest these low-value trees.

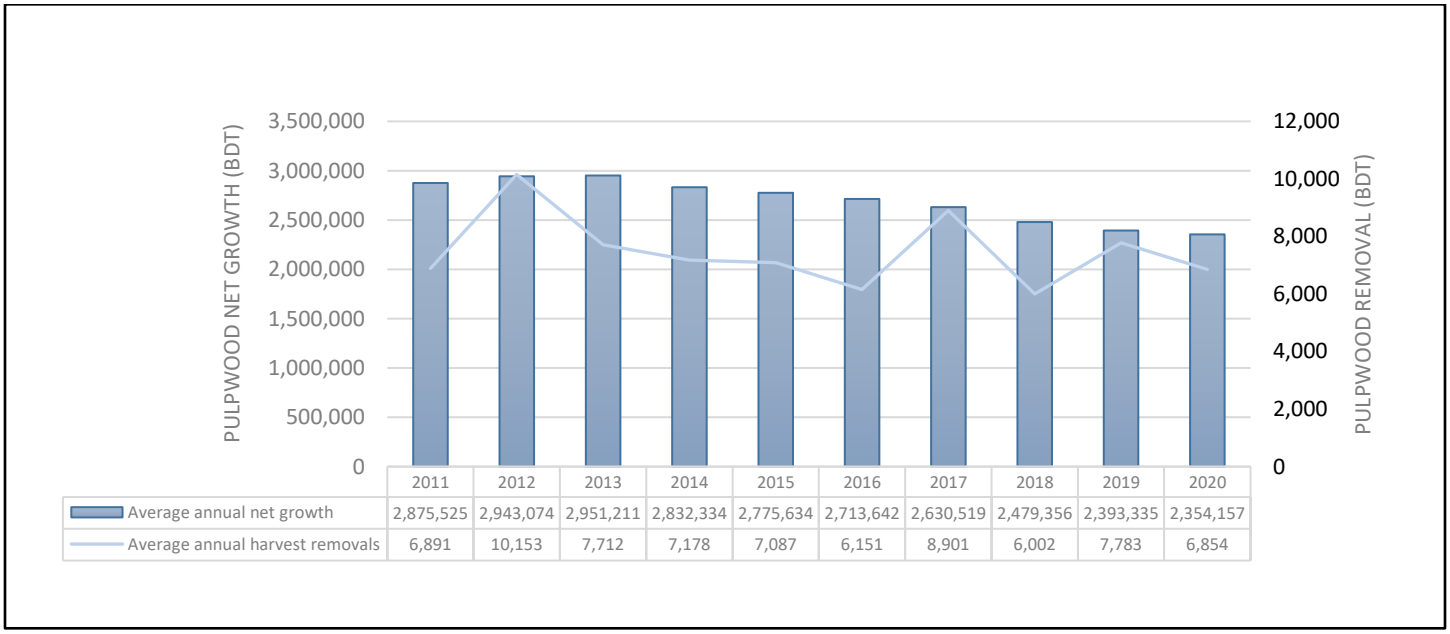
Annual pulpwood net growth data (Figure A-3) indicates an average growth of close to 2.7 million bdt/yr between 2011 and 2020, with little change in the softwood-hardwood composition, which remains around 87% hardwood to 13% softwood. Figure A-4 illustrates the growth-to-removals for pulpwood in the BDO Zone, which is heavily skewed for the annual net growth, indicating that the regional pulpwood resource can support new biomass project development without creating implications for the health of the forest in the region. The growth-to-removals data reflects the lack of demand for pulpwood, which in turn is due to the fact that no pulp and paper mills are operating in the area.

Figure A-3. Annual net growth data for pulpwood in the 75-mile radius of Wyoming County, PA



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Softwood	350,135	378,129	391,002	370,152	353,099	352,391	342,590	316,146	293,310	274,742
Hardwood	2,525,390	2,564,945	2,560,208	2,462,182	2,422,535	2,361,251	2,287,930	2,163,210	2,100,025	2,079,401
Total pulpwood	2,875,525	2,943,074	2,951,211	2,832,334	2,775,634	2,713,642	2,630,519	2,479,356	2,393,335	2,354,157

Figure A-4. The growth-to-removal data for pulpwood in the 75-mile radius of Wyoming County, PA



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average annual net growth	2,875,525	2,943,074	2,951,211	2,832,334	2,775,634	2,713,642	2,630,519	2,479,356	2,393,335	2,354,157
Average annual harvest removals	6,891	10,153	7,712	7,178	7,087	6,151	8,901	6,002	7,783	6,854

There are nine operational wood pellet facilities, one orientated strand board (OSB) mill, and one medium-density fiberboard (MDF) mill operating in the 150-mile competition zone (see Figure A-5), out of which two pellet plants and one MDF mill are located within the BDO Zone. These facilities are the main consumers of pulpwood and sawmill residues (sawmill residues of hardwood lumber or other residues from hardwood processing). These 11 mills have the production

capacity to consume about 649,000 bdt/yr of biomass feedstocks (Table A-1). As shown in Figure A-6, woody biomass consumption in the Competition Zone increased 5% from 614,690 bdt/yr in 2011 to 649,000 bdt/yr in 2023. Between 2014 and 2016, biomass consumption jumped by 20% from 544,290 bdt/yr to 659,790 bdt/yr and has remained fairly stable at 659,790 bdt/yr since 2016.[12]

Table A-1. Summary of Competitors in the Competition Zone

Category	Number of Companies	Production Capacity	Annual Wood Demand (bdt)	Estimated distance-adjusted competition (bdt)
OSB	1	10 MMSF[9]	10,000	3,300
MDF	1	137 MMSF	109,500	67,890
Wood Pellets	9	469,000 tons	529,290	88,279
Totals	11		649,000[10]	159,500[11]

In order to account for the actual likely consumption for each competitor, distance-based consumption is used to estimate the balance between the supply of residues in the BDO Zone and consumption in the competition area, as defined in Figure A-1. The distance between each competitor and the BDO Zone is used to calculate the discount rate for the consumption of residues. In other words, the probability that a competitor will extract residues from the BDO Zone diminishes with increased distance. For the nine pellet, one OSB, and one MDF mills operating in the Competition Zone, the distance-based consumption is estimated to be 159,500 bdt/yr (See Table C-3).

Figure A-6 shows the number of operational wood processing facilities and their historic biomass consumption (bdt/yr) over the period of 2011 to 2023 within the competition zone. In 2011, TreeCycle LLC closed its wood pellet facility, which consumed 88,000 bdt/yr of hardwood. Following this closure, in 2013, Great American Pellet Company closed its wood pellet facility, which had consumed close to 35,200 bdt/yr of hardwood and softwood at capacity. In 2016, Lignetics Schuyler decreased product capacity by 8%, or 7,700 bdt/yr, which has remained at this level to date. Most recently, in February 2023, Kingdom Biofuels, which had consumed close to 11,000 bdt/yr of mixed wood, announced its closure. Taken together, decreases in consumption amounted to 141,000 bdt/yr. On the other hand, production increases at Barefoot Pellet and Energex American in 2016 led to a combined increase of 112,200 bdt/yr of wood, whereas another 11,000 bdt/yr was added in 2016 with the Kingdom Biofuel plant coming online. As a result of new facilities coming online, shutting down, and increases/decreases in production capacity, there was a net increase of 34,100 bdt/yr from 2011 to 2023 within the competition zone.

[9] MMSF stands for million square feet
[10] Rounded to nearest 1,000
[11] Rounded to nearest 100

Figure A-5. Location of the current consumers of woody biomass in the competition zone

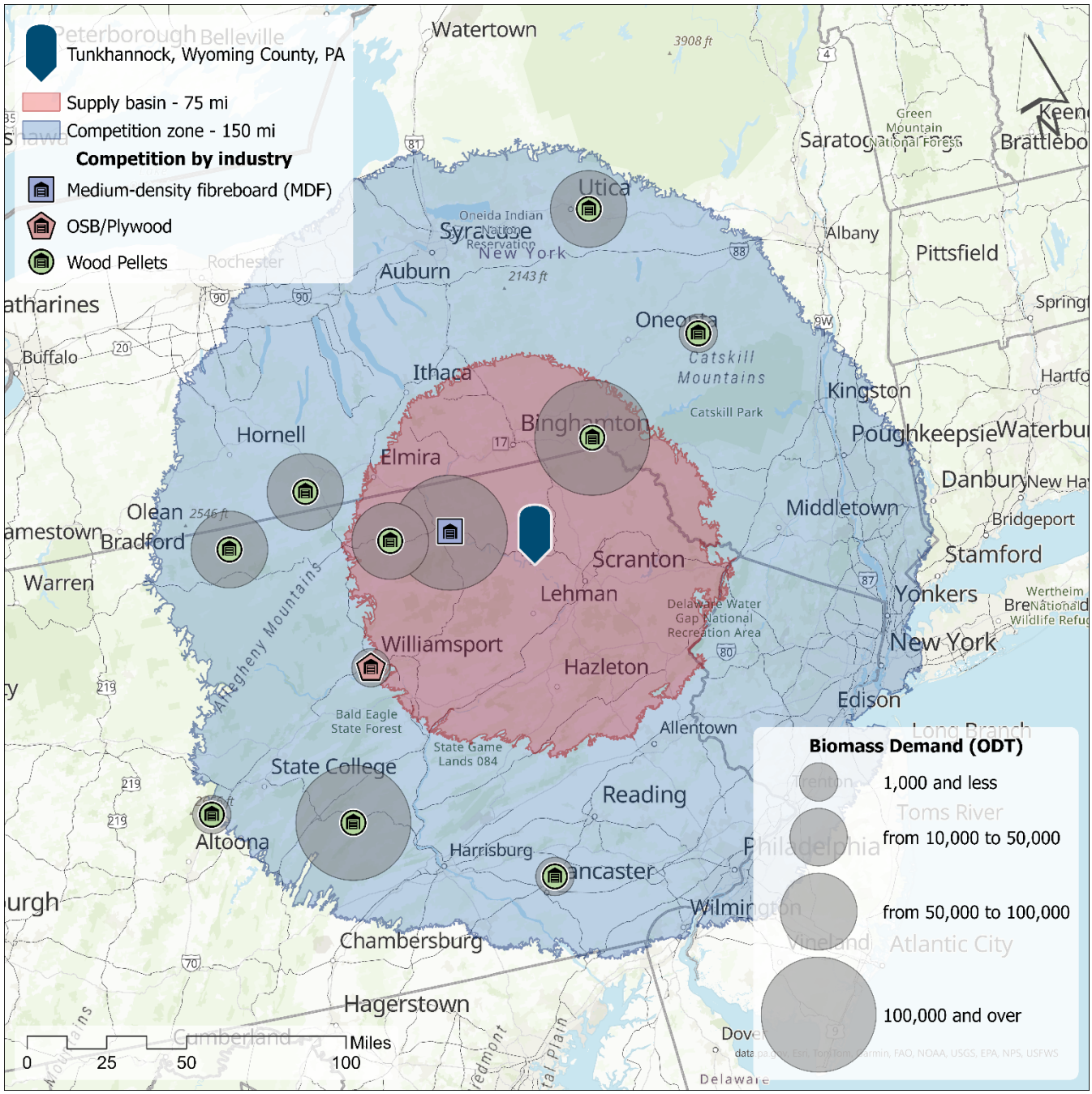
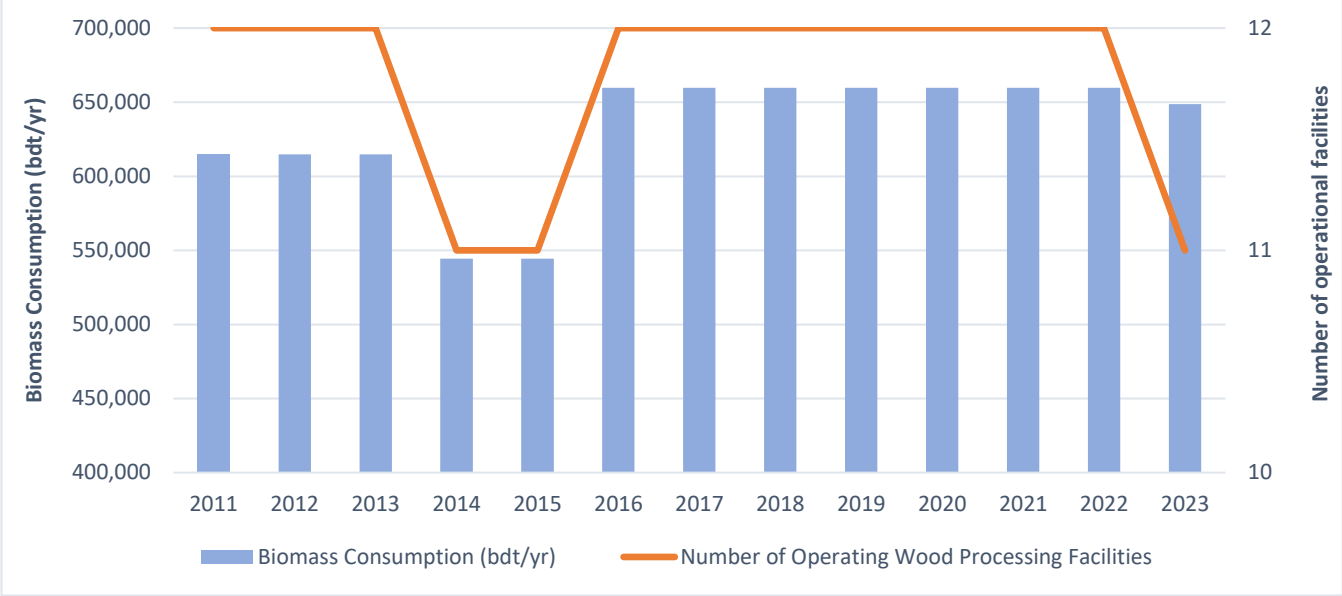


Figure A-6. Number of operational wood processing facilities and their historic biomass consumption (bdt/yr) (2011-2023) within 150-mile competition zone



Pulpwood and Forest Residue Availability in the BDO Zone

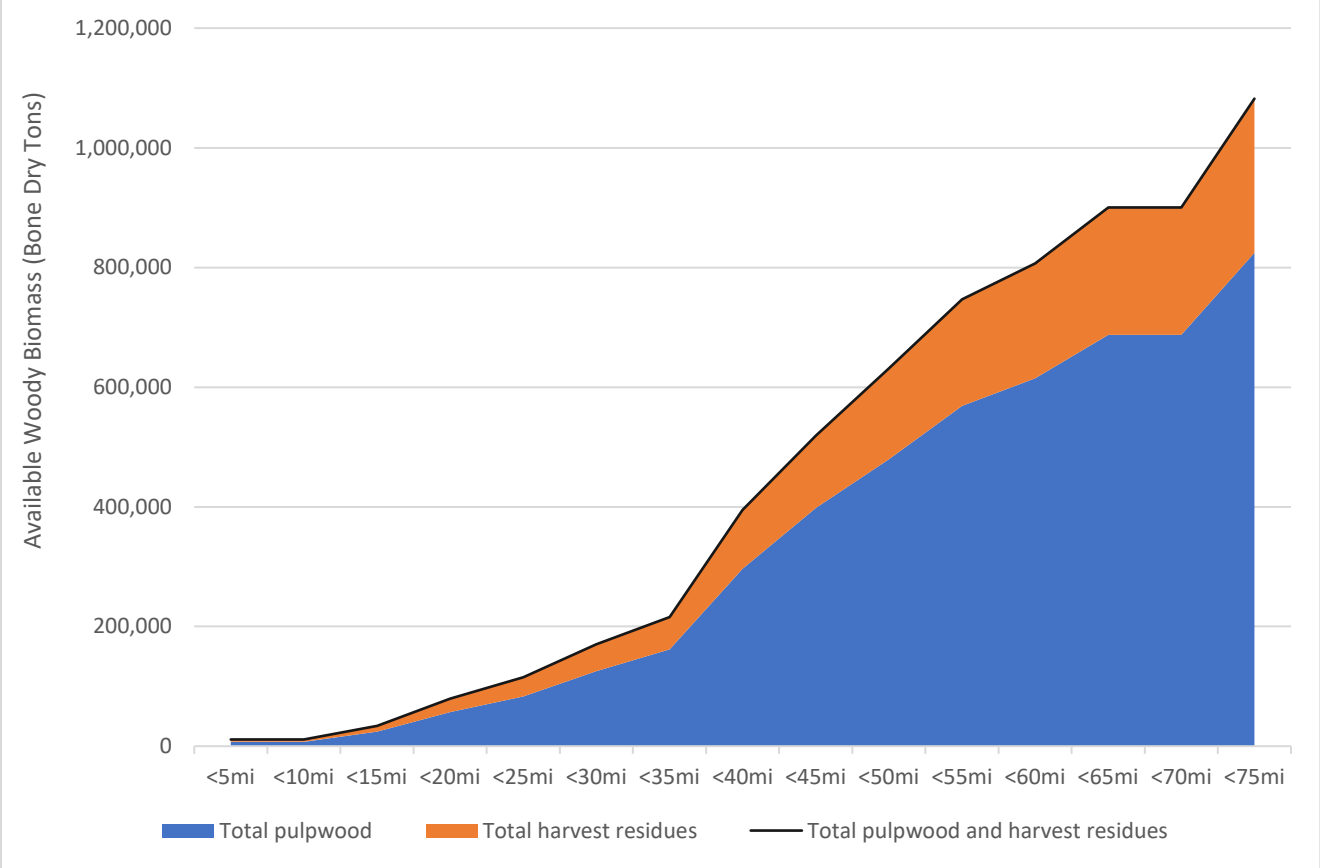
The annual quantity of unharvested, standing pulpwood and forest residue in the BDO Zone that could be made available to a new project was estimated using datasets available from the US Department of Energy (DOE) 2016 Billion-Ton Report. The 2016 Billion-Ton Report projects biomass availability up to the year 2040 using a number of assumptions, constraints, and market demand projections (Table A-2). County-level estimates of the availability of pulpwood (logs produced from trees between 5-11 inches DBH) for all available years (2015, 2020, 2025, 2030, and 2040) were downloaded using the Vol. 1 Data Download Tool for the 2016 Billion-Ton Report. Using GIS software, a polygon for the BDO Zone (75-mile maximum transport distance) was developed and used to estimate the percentage area of each county included in the BDO Zone (percentage overlap value). For each county, the percentage overlap value was then multiplied by the average annual pulpwood and forest residue availability for 2015 to 2040 to estimate the total quantities of standing pulpwood and forest residue in the BDO Zone available for a new entrant.

Table A-2. Billion-Ton Report assumptions and parameters included in analysis

Bioenergy – Knowledge Discovery Framework, US Department of Energy **Billion-Ton Report – 2016 Vol. 1 Data Download Tool (https://bioenergykdf.net/2016-billion-ton-report)**		
Data retrieval		County level
		Year 2015, 2020, 2025, 2030, 2035, 2040
Data presented as		Bone dry tons per year (bdt/yr)
		Average of years 2015 to 2040, with 5-year increments
Resource Category	**Forestry**	All biomass resources modeled on forestland timberland, i.e., forest residues and small-diameter trees.
Demand for feedstock		Based on 2016
Scenario	**Medium housing, medium energy demands**	**1.)** Growth in housing starts returns to long-term average by 2025. The long-term average of housing starts from 1959 through 2011 is slightly less than 1.1 million per year. **2.)** Growth in wood biomass demand for energy increases by 86% by 2040. Actual wood biomass production in 2010 was 58.2 million dry tons for all scenarios. **3.)** New plantation management intensity in the South - Based on current FIA pine plantation growth rate. Current average FIA growth rate on pine plantations across the South (all owners, all ages) is approximately 108 cubic feet/acre per year (1.6 dry ton/acre per year). Increasing management intensity by 50% only on new plantations results in an increase in the average South-wide growth rate over time up to 140 cubic feet/ac per year in 2040 (2.1 dry tons/acre per year).
Biomass price	Specified biomass price after harvest cost as applicable but before transportation costs, in 2014 dollars per dry ton equivalent. *If these prices are used within the report, they will include inflation rates and newest transportation costs.*	
Resources	Hardwood, lowland forest residues, Hardwood, lowland whole trees, Hardwood, upland forest residues, Hardwood, upland whole trees, Mixed wood forest residues, Mixed wood whole trees, Softwood, natural forest residues, Softwood, natural whole trees, Softwood, planted forest residues, Softwood, planted whole trees – logging resides = harvest/forest residues; whole trees = only small diameter trees = Pulpwood	
Class	**RSDF**	Residues, forestry (i.e., forest residues)
	TREE	Small-diameter trees
Section	**PFRS**	Primary forestland resources including forest residues (i.e., Class RSDF) and small-diameter trees (i.e., class TREE).
Diameter class	**1**	Timberland trees with diameter at breast height >11 inches
	2	Timberland trees with diameter at breast height 5-11 inches
	3	Timberland trees with diameter at breast height <5 inches
Operation Type	**Clear Cut**	Clearcut harvest of small-diameter trees or production of forest residues.
	Thinning	Thinning harvest of small-diameter trees or production of forest residues.
Supply Class	**LE40**	Timberland resources harvested from slopes less than or equal to 40 degrees.

It is estimated that an average total quantity of around 825,000 bdt/yr of standing pulpwood and 258,000 bdt/yr of forest residues is potentially available for future biomass projects. Figure A-7 shows the availability of these two types of woody biomass within a 5-mile incremental driving distance from Tunkhannock, PA, as the center point. About half of the pulpwood and forest residues supply is available within a 55-mile drive distance supply radius.

Figure A-7. Biomass supply curve showing the average total standing pulpwood and harvest residues potentially available for future biomass projects within 75-mile drive distance



It is important to acknowledge that a portion of the biomass generated may not be accessible for future biomass initiatives due to a range of factors. These factors include the reluctance of private landowners to sell their wood fibers for future biomass endeavors, inadequate infrastructure in terms of road and logistics networks, limited availability of labor for harvesting and transportation activities, and adverse weather conditions during the harvest season. Furthermore, it is important to acknowledge that estimating total potential biomass availability relies on certain assumptions, which may not accurately reflect the actual circumstances. In order to account for the inherent uncertainties in our evaluation of woody biomass availability, we employ the Biomass Availability Multiple (BAM) approach to the average annual availability depicted in Table A-3.

The BAM represents the average proportion of biomass feedstock accessible to a given project, relative to the cost of delivery, divided by the project's average annual rating quantity of biomass available. It serves as a robust measure of supply chain resilience when confronted with supply shortages or supplier breaches. As the level of uncertainty regarding the biomass available for a given project increases, the BAM factor correspondingly increases.

In this project, BAM is applied to the total estimated quantity to ensure adequate feedstock redundancy for each feedstock type due to the uncertainty associated with future feedstock availability, such as economic situations, forest fires, and logistics constraints. A BAM of 1.5 is applied to pulpwood, resulting in a rated quantity of 550,000 bdt/yr, meaning about 30% redundancy in the pulpwood supply to capture future uncertainties. In contrast, a BAM of 4 is applied to forest

residues, resulting in a rated quantity of 64,000 bdt/yr, meaning a 75% redundancy due to the lack of an established supply chain. There is limited experience in the region in harvesting and using this woody biomass stemming from inactivity of pulpwood supply chains relative to pre-2000 levels.

In summary, we estimate that the low-risk quantity of pulpwood and forest residues available for future biomass projects in the BDO Zone is 550,000 bdt/yr for pulpwood and 64,000 bdt/yr for forest residues, as shown in Table A-9.

Table A-3. Estimate of Average Annual Pulpwood and Forest Residues Availability through 2040

Biomass Type	Average Annual Availability (bdt/yr)	Low-Risk Quantity after incorporating BAM (bdt/yr)[12]
Pulpwood	825,000	550,000
Forest residues	258,000	64,000

Sawmill Residual Availability in the BDO Zone

There are 11 sawmills located within the BDO Zone, as indicated in Figure A-8. Our estimates reveal that these sawmills collectively generate approximately 172,000 bdt/yr of sawmill residues while operating at their nominal capacity of 147 million board feet (MMBF) (See Table C-2). During the process of converting roundwood to the final product, byproduct materials are generated. The estimated production of sawmill residues in the BDO Zone is shown in Table A-10. These sawmills produce 95,155 bdt/yr of wood chips, 19,223 bdt/yr of sawdust, 30,276 bdt/yr of shavings, and 26,997 bdt/yr of bark.[13] These data were calculated using an Ecostrat internal model, which estimates the production of each residue based on the total nominal capacity of these mills. Figure A-9 shows the supply of sawmill residues based on distance from the BDO Zone center point. It is noted that while there are large numbers of sawmills in the BDO Zone, these mills are relatively small, resulting in a large distribution of small quantities of sawmill residues.

Although the number of mills decreased from 2011 to 2023, Figure A-10 highlights that lumber production capacity increased by 5% over that same period.

[12] Figures rounded to nearest 1000
[13] Bark includes 4,367 bdt breakage and trims

Figure A-8. Operating sawmills within 75-mile drive distance from Wyoming County, PA

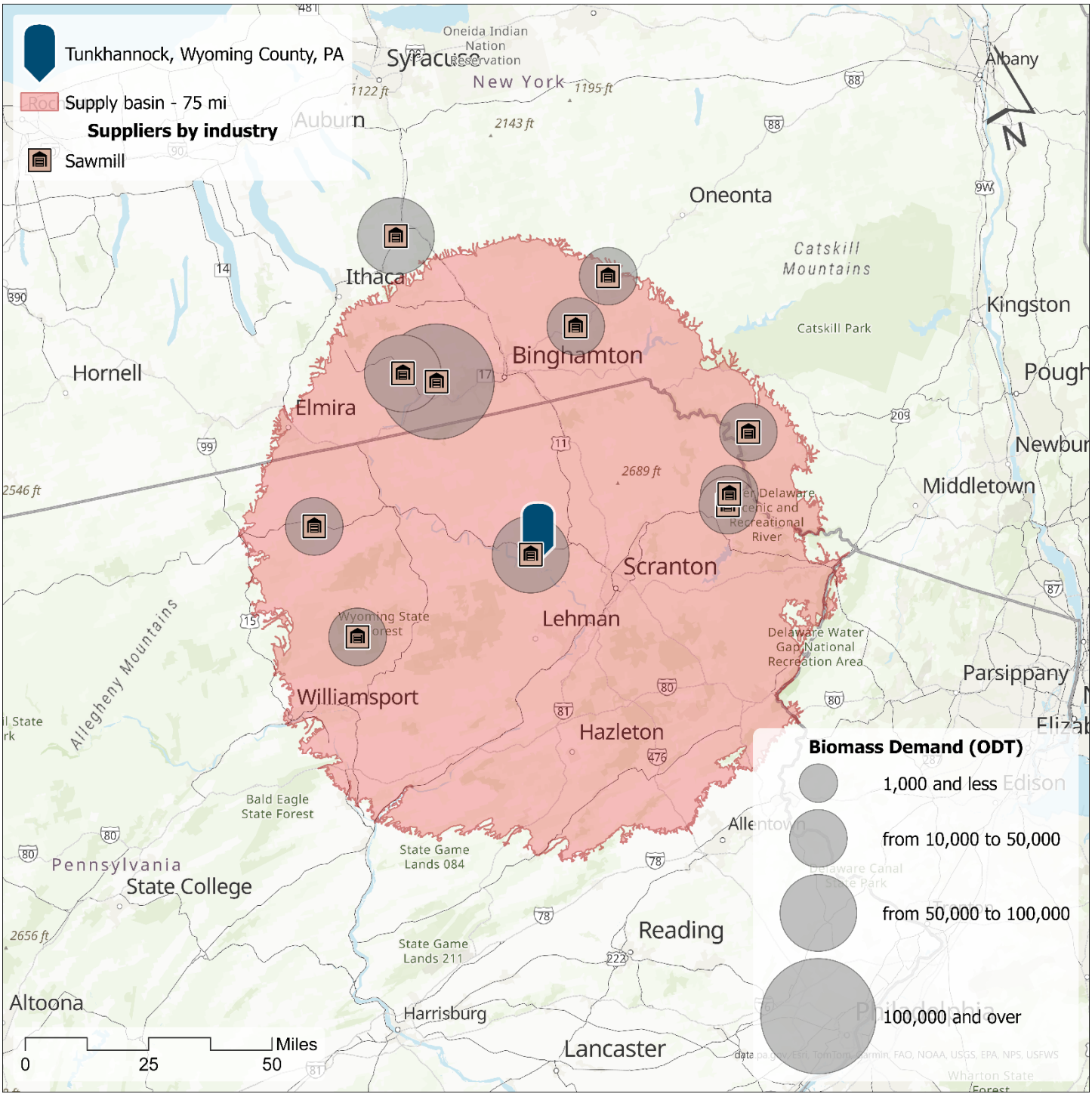
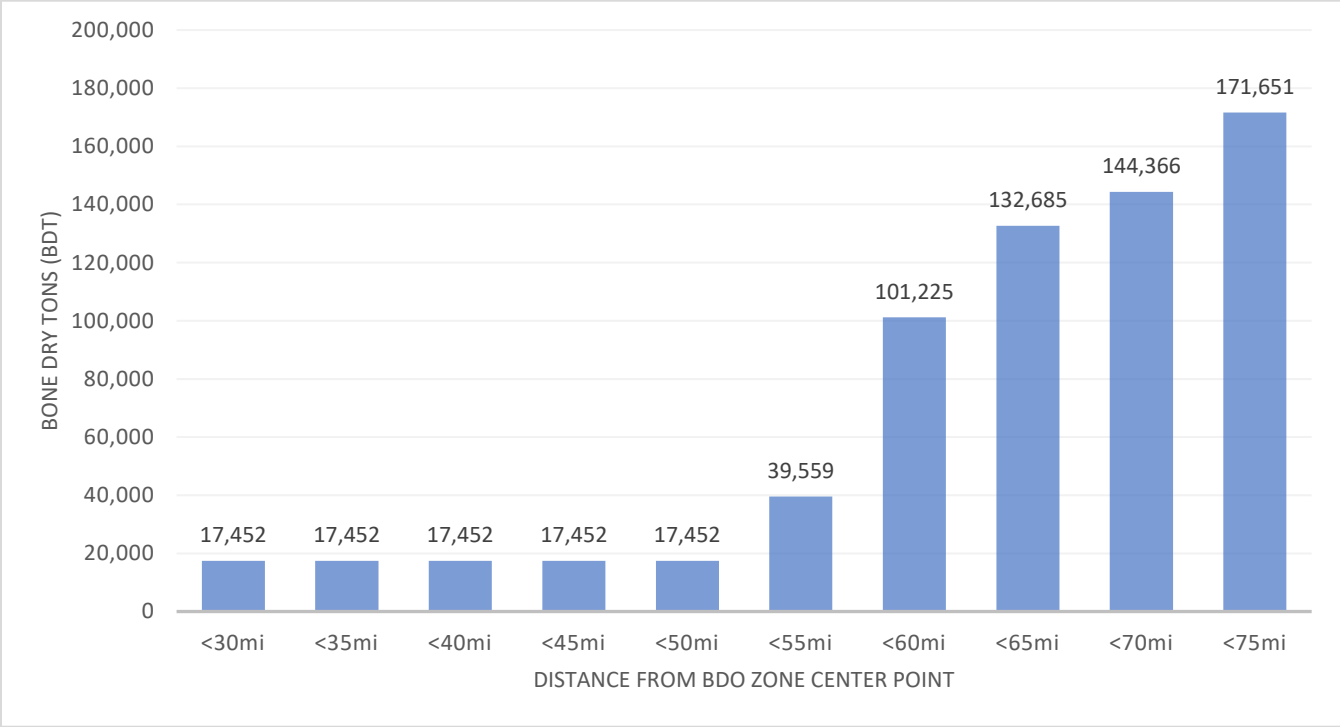


Table A-4. Estimated Sawmill Residues Production in the BDO Zone

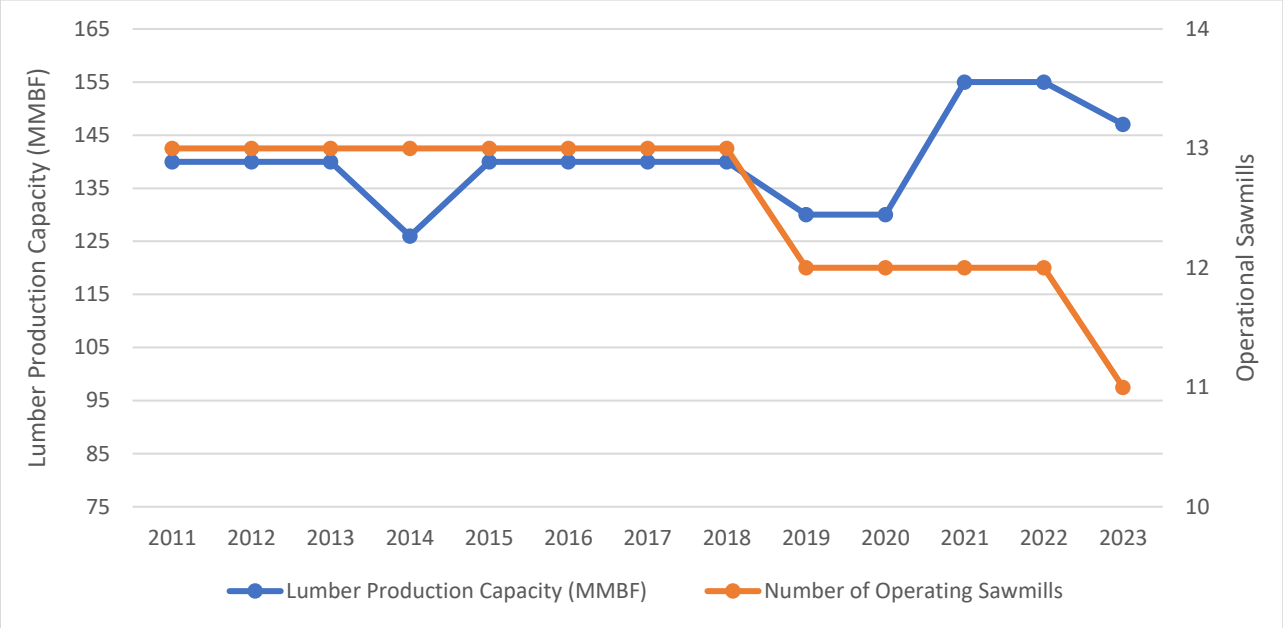
Biomass Type	Average Annual Generation (bdt/yr)
Residual Chips	95,155
Sawdust	19,223
Shavings	30,276
Bark	22,630
Breakage & Trims	4,367
Totals	172,000[14]

Figure A-9. Annual Sawmill Residue Generation in the BDO Zone – Distance by Volume



[14] Rounded to nearest 1,000

Figure A-10. Historic lumber production capacity (MMBF) and operational sawmill count (2011-2023)



With no pulp mills or large biomass power plants within the Competition Zone, the majority of residues have gone to mulching (mainly bark), wood pellet plants (sawdust and, to a lesser extent, wood chips), and the advanced wood heating (AWH) market, or industrial and commercial boilers (wood chips and bark). Other consumption of residues includes the manufacturing of fiber composites (mainly chips) and animal bedding (mainly sawdust). Several mills within the BDO Zone utilize the sawdust and bark produced as an industrial fuel or reuse it onsite. The remaining mills have their residues under short-term contracts and spot contracts that could potentially become available as they expire. According to outreach conducted with two of Pennsylvania's largest biomass aggregators, mulching makes up one of the largest markets for bark produced by sawmills, with the market picking up in March through June. Animal bedding is a key market for the sawdust as well as the advanced wood heating market.

In addition to 11 sawmills within the BDO Zone, we conducted direct outreach to another seven sawmills in the Competition Zone to better understand the supply and demand dynamics for the sawmill residues. Some of these sawmills are owned by the same forest company. We also contacted two forestry experts and three large woody biomass aggregators.[15] Based on our outreach results, we estimate that about 57,217 bdt/yr of sawmill residues will be available for future biomass projects, including 31,718 bdt/yr of wood chips, 6,408 bdt/yr of sawdust, 10,092 bdt/yr of wood shavings and 8,999 bdt/yr of hog fuels/bark. Given the high level of pellet production in the BDO Zone (97% of the distance-adjusted demand comes from within <50 miles of Tunkhannock. See Table C-3), the unresponsive sawmills likely have supply contracts in place for their residue production. A portion of the competition for sawmill residues likely comes from internal use by the sawmills, as several operate heat and/or power generation facilities that are fired by all or part of the generated residues.

[15] Each of the biomass aggregators also provides services including harvesting, land clearing, log transport, chipping and had a product offering including wood chips, mulch products, sawmill residues, and firewood.

As with pulpwood and forest residues, BAM is applied to estimate the amount of sawmill residues that are low risk. As such, a BAM of 1.2 was applied for the amount of sawmill residues available in the BDO Zone after deducting 2/3 of the sawmill residue generation in the BDO Zone to account for the current competition (Table A-5).

Table A-5. Sawmill residue model estimates and rated quantities

Biomass Type	Sawmill generation in the BDO Zone (bdt/yr)	Available Sawmill Residues after the competition (bdt/yr)	Low-Risk Quantity after incorporating BAM factor (bdt/yr)
Residual Chips	95,155	31,718	26,430
Sawdust	19,223	6,408	5,340
Shavings	30,276	10,092	8,410
Bark[16]	26,997	8,999	7,500
Total[17]	**172, 000**	**57,000**	**48,000**

Woody Biomass Pricing

In this section, we discuss the current delivered price of sawmill residues, pulpwood, and forest residues to the BDO Zone's center point, provided by the local sawmills and other local experts. Eighteen sawmills were contacted, but none disclosed pricing information. However, we collected eight pricing data points from timber brokers, foresters, and industry experts in the region. It is noted that pricing data was typically acquired in dollars per green ton and was converted to dollars per bone dry ton, assuming 50% moisture content for pulpwood, forest residues, and sawmill residues (wood chips, sawdust, and bark) with the exception to shavings at 12%.

Table A-6 presents the rated delivered pricing for different types of wood biomass in the BDO Zone. Current and historic residue pricing and price volatility were determined through outreach. Historical pricing for pulpwood (roundwood and chipped) and sawmill-sourced wood chips have been quoted as high as $20 to $30/bdt above the current market-rated price ranges. For the rated price ranges, securing the rated quantities over the long term is considered a low-risk proposition at the rated price ranges ($70-$110/bdt for pulpwood, $90-$120/bdt for chipped pulpwood, $70-$110/bdt for forest residues, and $70-$86/bdt for wood chips, sawdust, and shavings). Information relevant to the determination of rated quantities and pricing is presented in Table A-6.

[16] Includes 4,367 bdt breakage and trims
[17] Totals rounded to nearest 1,000

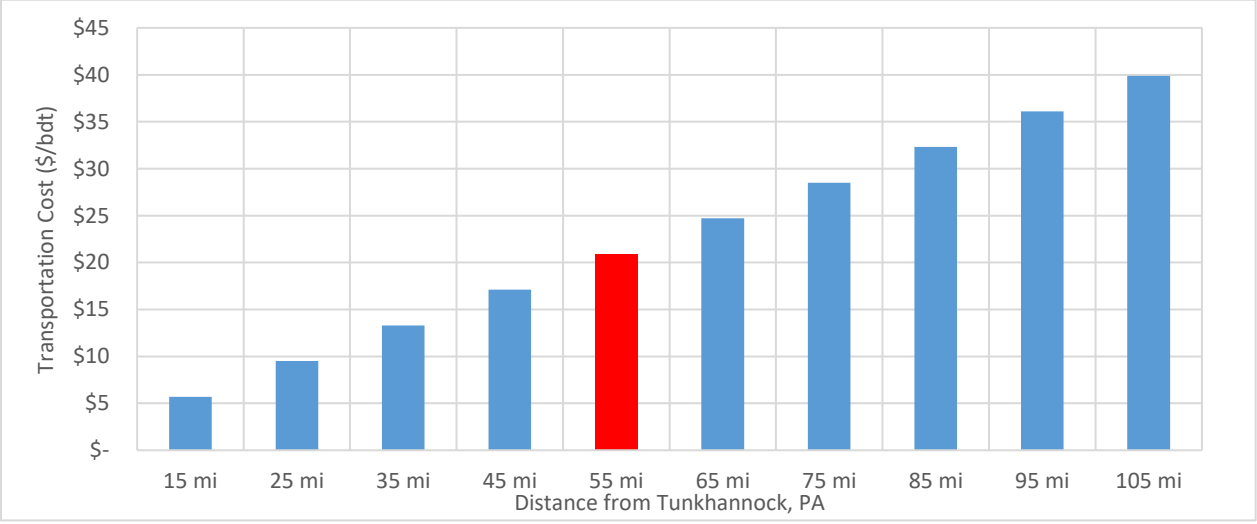
Table A-6. Pricing estimates for woody biomass in the BDO Zone based on the outreach

Biomass Type	Asking Price at the supply source – FOB ($/bdt)[18]	Asking price delivered within < 55 miles ($/bdt)	Comments/Assumptions
Pulpwood	-	$70 - $110	50% moisture content
Chipped Pulpwood	-	$90 - $120	50% moisture content
Forest residues		$70 - $110	
Chipped			Assumes 50% moisture content
Wood Chips	$50 - $70	$80 - $100	40% - 50% moisture content
Sawdust	$49- $69	$70 - $90	50% moisture content
Shavings	$47 - $53	$68 - $74	9% - 12% moisture content
Hog Fuel/Bark	$16 - $24	$37 - $45	40% - 50% moisture content
Weighted price range for Sawmill Residues	$32 - $65	$70 - $86	Based on procurement of 55% wood chips, 11% sawdust, 18% shavings, and 16% Bark/Hog Fuel

Transportation Cost

The transportation of woody biomass from timberland to the mill in the BDO Zone is done through trucking. Logs are transported by log truck. Chipped whole trees, harvest residues, and sawmill residues are transported using open bin trailers or walking floor trailers. The pricing tables above for biomass include the cost of transportation. The assumed average transport distance in the BDO Zone is 55 miles drive from the center point, with an average cost per green ton per loaded mile of $0.19.[16, 19] As such, the average transport cost is estimated to be $20.90/bdt. Figure A-11 below shows the cost of various haul distances. These data have been converted to cost per bone dry ton to remain consistent with other data in this document.

Figure A-11. Transportation Cost Based on Distance.



[18] Transportation cost of $20.90 per bdt based on 55-mile distance from center point and $0.19 per green ton per loaded mile
[19] TimberMart-South- Biomass, Logging Rates, & Species Detail (4th Quarter 2023)

APPENDIX B: RISK INDICATOR SCORING METRICS

CATEGORY 1.0: SUPPLIER RISK

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

1.1.1 Longevity & History of Supplier Performance

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

Risk Information: The forest industry in the BDO Zone has a rich and longstanding history. Many of the sawmills in the region are family-owned, many spanning four to five generations. The majority of the lumber in the region is produced in medium-to-large sawmills (> 5 MMBF capacity), while at the same time, the region is characterized by a large number of smaller sawmills. The average age of the sawmills situated within the BDO Zone is 65 years, with the oldest sawmill exceeding 130 years. This extended period of operation reflects the industry's resilience and enduring presence in the region.

Wyoming County forms part of the Northern Tier Region, which contains approximately 10 percent of the entire saw timber produced within the Commonwealth of Pennsylvania. The Northern Tier region, known for its robust sawmilling industry, has exhibited stability during recent economic downturns. Notably, medium-to-large sawmills (> 5 MMBF capacity) in the region have retained continual production amid these recessions, further attesting to the sector's strength and continuity.

Loggers and landowners have been practicing forestry generationally for over 100 years in the region. Loggers are generally independent contractors rather than employees, which is somewhat driven by the high cost of insurance for those in this high-risk occupation. The high cost of insurance combined with start-up costs and an aging workforce are challenges being faced industry-wide. Despite the market and labor challenges faced by loggers and sawmills, including market downturns, the overall production capacity has increased in the BDO Zone, as displayed in Figure A-10.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**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 to supply to specific competitors for biomass feedstock. Preferences may be due to historical, long-term, or personal relationships, less stringent feedstock quality requirements, more flexible operating hours by competing markets, or supplier's dependences on competing markets to accept or purchase other products/by-products. During periods of feedstock shortage such suppliers may be more likely to allocate the scarce supply to a competitor resulting in supply disruptions for the Issuer.

Risk Information: The majority of sawmill owner-operators contacted through outreach have expressed interest in supplying sawmill residues to a new project for a modest premium. Feedback from some of these sawmills indicates that there are no dependencies on current consumers and that decisions with respect to the choice of the market for sawmill residues are mainly made based on pricing and transportation distance.

In summary, suppliers are open to business and ready to negotiate pricing, meaning the feedstock can likely be accessed if the right price is offered.

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

1.3 Risk Factor: Supplier Control Over Production and Transportation

1.3.1 Ownership of Land/Means of Production

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

Risk Information: Historical data shows that harvested quantities are continually stable from year to year, indicating that the harvesting system functions properly and should not pose a significant risk to the supply chain, even with the introduction of new projects.

Close to 75% of the forest land in Wyoming County is under private ownership, which comprises 137,000 acres. These forests have close to 5,623 owners, with the average private land owner in the state having an average ownership size of around 11 acres.[1,20] There are at least four large mills representing close to 60% of the sawmill production capacity within the BDO Zone, which are fully integrated, owning their land and managing timberland on behalf of private owners. These mills include Deer Park Lumber in Tunkhannock, PA, managing close to 80,000 acres of timberland,

[20] http://elibrary.dcnr.pa.gov_1

including their own land; Gutchess Lumber, which owns and manages over 29,000 acres; and Wagner Lumber, with a forestry division that manages over 2 million acres, including 1 million acres across Maine and New Hampshire.

Many of the sawmills within the BDO Zone are fourth and fifth generation family owned and have a well-established supply chain. These sawmills manage and own production facilities, allowing them to maintain good control over the quantity and quality of sawmill residuals. These factors suggest that the land ownership is in support of new biomass projects in the Wyoming County 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 × 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 × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

1.3.2 Ownership of Equipment

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

Risk Information: Within the BDO Zone, the logging industry is primarily composed of small, family-owned companies. The majority of loggers are full-time, independent contractors or employees of logging companies. Sawmills only employ a small portion of loggers directly.

While logging firms typically own equipment, a large portion of equipment is valued under $500,000 (see Table C-1 in Appendix C for costs related to the machinery used for harvesting and skid trail establishment).[19] A large portion of the logging companies work with one crew, and there is an equal split of operations between those that contract with only one mill and those that contract with two or more mills.[16] That said, when loggers require additional equipment, they will hire other contractors to provide the equipment and labor on a temporary basis. However, the sector faces various challenges, such as an aging workforce, higher insurance costs, and increased capital and equipment expenses. These factors have led many loggers to decide to close down their businesses. As a result, some sawmills opt to invest in establishing their own logging crews and acquiring logging equipment to secure a stable supply of timber. However, it is important to note that the extent to which sawmills currently own logging equipment remains relatively limited. Despite

the move towards internalizing logging operations, most sawmills still rely on external logging contractors to fulfill their timber harvesting needs.

Some mills will operate logging operations, although this is becoming less common. The mill owns the equipment for these crews.

There are approximately 57 independent logging/trucking companies in the BDO Zone.[21] Change in equipment ownership status is unlikely to occur across the majority of these companies. Logging is a major industry and is likely to continue regardless of equipment ownership status.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × 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 forest or field are lower risk than those who do not. However, in some circumstances, reliance on third parties to transport biomass is common practice and does not contribute to risk.

Risk Information: The transportation of sawmill residues is typically facilitated through the use of walking-floor trailers or open-top vans. Notably, while some sawmills possess an adequate fleet of trucks and trailers to transport all or a portion of their entire sawmill residual output, others rely on third-party trucking outfits and contractors. As a result, the risk associated with bark and chip transportation equipment is considered low.

The transportation of pulpwood involves the utilization of log trailers, typically owned by logging companies. At present, the market possesses a sufficient number of log trailers to cater to the transportation needs of existing sawmills and pulp mills. Our estimates indicate that an additional demand of 550,000 gmt/yr of pulpwood would necessitate approximately 26 logging trucks.[22] While a considerable portion of this demand can be met using existing infrastructure, some would require new log truck purchases.

The challenges confronting the logging sector, such as an aging workforce, low stumpage rates and value for pulpwood, and increased costs, contribute to the moderate risk related to pulpwood transportation equipment. Although the existing infrastructure can accommodate a portion of the increased demand, there remains a need for additional log truck purchases to fulfill the entirety of the new demand for pulpwood transportation. Based on the outreach

[21] Logging equipment operators make up 1% of the agriculture and resource conservation
[22] Assumptions: 30 green tons per payload; average 2 trips per truck per day; 350 operational days per year: 550,000 / (30*350*2) = 26

conducted, including an interview with a large local transportation company, we felt that the local shale gas industry trucking outfits could be leveraged due to the appetite for some of the industry's trucking companies to expand their fleet and grow their trucking services business into other market segments.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed *medium*, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**Score** **36**

1.3.4 Feedstock as a Secondary Transformation

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

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

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

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

Risk Information: The main source of feedstock in the BDO Zone is pulpwood, which is not a byproduct of the forest industry, but its harvesting level usually depends on sawlog harvesting. In contrast, the production of forest and sawmill residues mainly depends on the housing market, a leading indicator for the US economy, as well as export markets. Despite there being two sawmill closures in the BDO Zone from 2011 to 2023, there had been an overall increase in sawmill production capacity of close to 5%, attributed mainly to a major capacity expansion at an existing mill during the same period. Nevertheless, while the price of lumber has been declining, the price of pulpwood has remained low due to the limited regional markets to tap into and the lack of incentives for harvesting low-value pulpwood. With that said, however, this has occurred during a period of constrained export markets relating to the ongoing trade relations with China and a cooling off of the U.S. and Canadian housing markets. This further highlights the resiliency of the

industry. A contributor to this trend, aside from increased housing starts, is the migration of lumber production from Canada and the Pacific Northwest. This further reinforces PA's status as the leading state in the U.S. for the production and export of hardwood lumber.

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

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 Pennsylvania and in the BDO Zone, with well over 200 years of sawmills and harvesting. The forest supply chains are well-established for pulpwood and sawmill residues. Modern forestry practices and methods for planting, growing, harvesting, and collecting wood fibers have been in place for decades within the BDO Zone. Pennsylvania leads the nation in the production and export of hardwood lumber, and with 16.6 million acres of forestland, it has the most abundant hardwood forest.

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

1.4.2 Production Scale Experience

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

Risk Information: Our analysis indicates that sawmills in the BDO Zone generate approximately 172,000 bdt/yr of sawmill residuals, of which approximately 57,217 bdt/yr would be available for use by a new bio-project. Importantly, this quantity of feedstock is already produced as a by-product of existing sawmill operations, eliminating any significant concerns related to scale-up risk. Furthermore, local sawmills in the region have been in operation for several decades, suggesting that production scale experience is not of concern.

Our analysis indicates a lack of significant demand for forest residue in the region, which has resulted in limited infrastructure available for its collection and processing. This is a major factor contributing to the significant scale-up risk associated with forest residue production. However, forest residues are not the main source of available feedstock in the BDO Zone. Additionally, we have observed that while most logging companies in the region are relatively small, there is the ability to support scale-up with existing equipment and the purchase of new equipment, subject to market demand being in place. With that said, scale-up risks still exist due to the lack of significant experience in processing forest residual and transportation in the short term. This further exacerbates the existence of some scale-up risks associated with forest residue production.

Our analysis indicates that the logging infrastructure in the region is robust and healthy, as evidenced by the ongoing operational success of the local sawmilling and pulp and paper industries. This suggests that the region has significant experience and expertise in logging, and it is believed that the risks related to pulpwood harvesting and transport scale-up are moderate.

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

1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity

1.5.1 Supplier's Equipment Efficiency

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

Risk Information: Logging and trucking are well established in the BDO Zone, as the forest products industry has been active for over 200 years. Suppliers have well-established knowledge of harvesting, handling, and transporting wood fibers.

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

1.6 Risk Factor: Supplier Motivation

1.6.1 Feedstock Production Priority

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

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

Risk Information: Pulpwood production does not decrease the production of higher-value sawlogs. Pulpwood recovery increases revenue (when markets are available) and can improve the long-term value of timberlands by freeing up space for additional growing stock. Conversely, forest residue production can reduce the efficiency of conventional logging operations, including felling/delimbing and product separation at landings. Contractors in the region have some familiarity with integrated operations and mobile chipping, and therefore, the risk of inconsistency in production owing to inefficiency is reduced. The rated quantity of forest residue (64,000 bdt/yr) is assessed as having a moderate feedstock production priority risk. There is no feedstock production priority risk associated with sawmill 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 *low*, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**

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

Category 2.0: Competitor Risk

2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets

2.1.1 Competitor Locations and Overall Geographical Influence

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

Risk Information: There are nine wood pellet plants, one OSB mill, and one MDF facility operating in the 150-mile competition zone. Based on nominal production capacity, these mills consume close to 648,790 bdt/yr, with the four largest competitors making up close to 68% of total consumption. There are 7 of the 11 identified competitors located outside of the BDO Zone, with an average drive distance of more than 100 miles from Tunkhannock. Furthermore, these competitors only source a portion of their feedstock requirements from the BDO Zone and, therefore, will have a limited impact on feedstock supply. When applying the adjustment for distance-based consumption, the total annual consumption from these mills is reduced to 159,500 bdt/yr.

Current demand and pricing for pulpwood produced within the BDO Zone are significantly reduced relative to earlier periods. The current market for pulpwood in the region is limited due in part to the fact that there are no operating pulp and paper mills in the BDO Zone and low pulpwood stumpage rates, which between 2022 and 2023 averaged $2.50 per ton for hardwood and $0.58 per ton for softwood on private land based on available pricing (See Table C-5).[23] Pulpwood has been left standing or felled and left on-site due to a lack of proximal markets and the demand for higher value and quality wood. As shown in Table A-3, there is close to 550,000 bdt/yr of low-risk pulpwood available and 64,000 bdt/yr of forest residues available at low risk.

More than half of this low-risk woody feedstock is available within 50 miles of Tunkhannock. Furthermore, the identified available feedstock quantities take current competition into account and still leave 662,000 bdt/yr of feedstock available for prospective projects.

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

[23] https://extension.psu.edu/pennsylvania-timber-market-report-first-quarter-2023

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

2.1.2 Current and Historical Consumption of Feedstock Quantity

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

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

Risk Information:

Pulpwood: Historical use of pulpwood in the region is mainly attributed to a pulp mill located a 10-mile drive distance from Tunkhannock in Mehoopany, PA, which shut down around 1999 as a result of switching from the use of local pulpwood to importing its pulp requirements. The plant utilized close to 250,000 bdt/yr of pulpwood, both chipped and roundwood, from over 120 suppliers throughout 20 counties.[24] With the shutdown of the plant, landowners and loggers were not incentivized to harvest the pulpwood in the absence of a market for it, and high grading was more likely to occur, which ultimately led to a change in the quality of stands. The consequences on stand quality can be observed in the fact that present regional forests are growing in volume twice as quickly as they are being cut down or lost to natural mortality, as well as the proportion of high value trees on a per-acre basis being outnumbered 2:1 by less valuable pulpwood. Pulpwood is seen as a problem in regards to regeneration if it is left standing by blocking sun for upcoming trees. As such, pulpwood is often cut down and often left lying in the forest or at roadside. Figure A-4 illustrates the growth-to-removals for pulpwood in the BDO Zone, which is heavily skewed for the annual net growth, indicating that the regional pulpwood resource, which is the main source of feedstock, can support new biomass project development without creating implications for the health of the forest in the region.

Since the closure of the plant, there has been minimal demand and no significant local markets for pulpwood. This is further highlighted by the fact that there are no operating pulp mills in the region, and the BDO Zone surrounding Tunkhannock, PA, has experienced steady low average annual pulpwood removals since 2011, which equates to 7,500 bdt/yr (See figure A-2). As such, we believe that the risk related to historical pulpwood consumption is low. Overall, we consider the stability of historical pulpwood harvest removal data to be a positive factor.

Forest Residue: Our analysis indicates that historically, there has been relatively little consumption of forest residue in the BDO Zone. Given this situation, the lack of historical data related to forest residue consumption is expected and not considered a significant risk in our assessment of potential feedstock sources for bio-projects in the region. There is close to 258,000 bdt/yr of forest residues potentially available within the BDO Zone, of which a rated quantity of 64,000 bdt/yr can be made available to a new project (See Table A-3).

Sawmill Residues: There are nine wood pellet plants, one OSB facility, and one MDF facility operating in the 150-mile competition zone. One facility is within a 55-mile drive distance from Tunkhannock, and the remaining ten have an average drive distance of 63 miles from the project center point. Based on nominal production capacity, the sawmills within the BDO Zone consume close to 538,000 bdt/yr of wood and produce roughly 172,000 bdt/yr of residues (see Table C-2). The four largest competitors make up close to 68% of total consumption, with the largest active facility situated in Towanda, PA, consuming close to 109,500 bdt/yr of wood chips. With no pulp mills or large biomass power

[24] https://www.timesleader.com/archive/935754/chipping-away-at-business-pg-move-puts-squeeze-on-wood-providers

plants within the Competitive Zone, the majority of residues in the past have gone to mulching (mainly bark), wood pellet plants (sawdust and, to a lesser extent, wood chips), and advanced wood heating (AWH) markets or industrial and commercial boilers (wood chips and bark). Other consumption for residues includes the manufacturing of fiber composites (mainly chips) and animal bedding (mainly sawdust). Several of the mills within the BDO Zone utilize the sawdust and bark produced as industrial fuel or reuse onsite. The remaining mills have their residues under short-term contracts and spot contracts that could potentially become available as they expire. According to outreach conducted with two of Pennsylvania's largest biomass aggregators, mulching makes up one of the largest markets for bark produced by sawmills, with the mulch market picking up in March through June. Animal bedding is a key market for sawdust as well as the AWH market. That said, outreach confirmed that markets for wood chips produced from sawmills within our BDO Zone have traditionally been limited due to their distance from more active markets.

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

2.1.3 Competitor Pricing and Price Sensitivity

Rationale: Understanding how much competitors pay (or receive) for different feedstock types is an essential step to determining competitiveness of Issuer and to accurate assessment of the delivered cost range in the BDO Zone rating.

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

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

Risk Information:

Pulpwood: Based on outreach, the current pricing for pulpwood delivered (<55 miles) within the BDO Zone ranges between $70-$110/bdt for pulpwood roundwood and $90-$120/bdt per ton for chipped roundwood pulpwood.[25] Historically, during strong markets with increased pulpwood demand, prices for chipped and roundwood pulpwood have been $20-$30/bdt higher than current prices. Furthermore, pulp mills would procure pulpwood from well over 100 miles from their facilities and pay $50-$60 per ton for transportation. Prices, in part, depend on the volume of

[25] Pulpwood assumed moisture content of 40- 50%

pulpwood. Based on discussions with several logging companies, dedicated harvests will be more steadily available, but at a higher cost. The upper end of pricing for pulpwood reflects pricing for hardwood pulpwood and is the likely pricing for spot market arrangements, whereas it was suggested that better pricing could be achieved with a purchase agreement in place. The region's wood products industry experienced sustained conditions in the second half of 2022 through the first half of 2023, with pricing for softwood and hardwood lumber convergent to multi-year lows. Stumpage pricing for pulpwood has been depressed during the same period. This volatility can be viewed as an indicator of the declining pulp and paper industry and the lack of demand and associated markets for pulpwood within the BDO Zone. Log prices have started to fall post-COVID, with a pivot in the hardwood pulpwood market and continued softness in the hardwood lumber market. The hardwood pulp and pulpwood market experienced a significant transition, with pulp mills enacting supply quotas and reducing pricing by up to 20%.[26]

Forest residues: Our analysis indicates a lack of significant demand for forest residue in the region, and pricing has generally been insufficient to cover the costs of slash pile comminution and transportation. The delivered price per ton depends on format, properties, and timing. Most logging residues in the BDO Zone will be chipped on the landing and delivered in that format. Based on feedback received during our outreach, forest residues pricing ranges between $70 -$110/bdt delivered within <55 miles. In order to get favorable access and pricing for residues, having a complimentary market for pulpwood would create a situation where the residues price is lessened to ~ $80/bdt delivered within <55 miles.[27] Prices for forest residues have historically been steady.

Sawmill Residues: Wood chips produced by sawmills in the region range between $50-$110/bdt FOB mill, whereas two years ago, pricing was $80-$100/bdt FOB mill. Sawmills depend on current consumers, and those decisions with respect to the choice of the market for sawmill residues are mainly made based on pricing and transportation distance. Price fluctuations reflect both economic indices, such as the CPI and the price of diesel fuel. There are also price fluctuations that arise from competitive situations. Sawdust pricing is in the $49-$60/bdt range FOB mill, whereas some customers are having it delivered to their facility in the $70-$90/bdt range. Pricing for sawdust is highly variable, depending on availability and competing end users. Historically, the availability, not price, has varied the most over time. The bulk of available sawdust that is not being utilized for drying by the mill is sold into the animal bedding and wood pellet markets. Bark prices range from $16-$30/bdt FOB mill. The majority of available bark that is not being utilized for drying by the mill is sold into the mulching market, advanced wood heating markets, and wood pellet markets. Shavings are priced at around $68-$74/bdt delivered.

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

[26] https://www.farmcrediteast.com/en/resources/Industry-Trends-and-Outlooks/Reports/Timber-and-Forest-Products-Snapshot
[27] Based on outreach discussions with large biomass aggregators.

Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × 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 can lead to higher prices, feedstock disruptions, shortages or supplier breach or other types of supply chain disruption.

If current markets for feedstock have been publicly signaling the potential for increased demand for feedstock (in the case of a sawmill adding a shift, or pulp mill potentially expanding into production of renewable chemicals, for example), high interest in a BDO 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:

Pulpwood: The rated quantity of pulpwood (550,000 bdt/yr) represents ~67% of the total amount of pulpwood that could be generated annually given harvesting levels in recent history (825,000 bdt/yr). Current demand and pricing for pulpwood produced within the BDO Zone are significantly reduced relative to earlier periods. The current market for pulpwood in the region is limited due in part to the fact that there are no operating pulp and paper mills in the BDO Zone and low stumpage rates (see Table C-5). As such, pulpwood has been left standing or felled and left on-site due to a lack of proximal markets. Due to a large surplus of pulpwood and forest residue within the BDO Zone, the risk of shortage is deemed low. This implies that the supply should not be endangered by any suppliers' preference for competing markets. Given that there are no known large projects slated to come online or plant expansions, there is sufficient room in the market for new projects without risking oversaturation or upward pressure on prices.

Forest residue: There are no current markets for forest residue. Historically, utilization has been limited to smaller generation facilities and combined heat power at mills, primarily in the forest products sector. Residue is typically piled and left on the roadside or is subject to open burning. A complimentary market for the pulpwood currently does not exist, and prices generally do not incentivize the comminution, loading, and transportation of forest residue. As such, there are no indications that regional demand for residue will increase.

Sawmill Residues: Some risk can be expected for sawmill residues due to the existing demand for bedding, mulch, wood pellets, advanced wood heating, and reuse of residues by sawmills in the region. Sawdust was not rated for new projects, whereas wood chips, a likely secondary source of wood fiber for future pellet mills, were rated conservatively (31,718 bdt/yr, or ~33% of annual wood chip production by sawmills 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 × 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 × RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score (1-Total Notch) × GRI Score) is 16 out of 100. **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 feedstock, especially during times of shortage. This control can derive from qualitative or "soft" factors such as long previous relationships between local suppliers and existing markets for feedstock.

Risk Information:

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

Forest residue: Current markets for forest residue are limited, and historical markets have been temporary. Markets have generally been constrained to utilization in smaller generation facilities and combined heat power at mills – primarily in the forest products sector, characterized by uncertain demand patterns and relatively low prices (between $70 and $110/bdt delivered). Based on outreach with different logging companies, the complementary demand for pulpwood would be seen as beneficial to landowners and would help leverage access and obtain favorable pricing for forest residues.

While the risk of soft supply influence of existing markets is a valid consideration, we consider it to be negligible in relation to pulpwood and forest residues, as these materials are abundantly available in the region, and the markets in the region are limited.

Sawmill Residues: The majority of sawmill owner-operators contacted through outreach have expressed interest in supplying sawmill residues to a new project for a modest premium. Feedback from some of these sawmills indicates that there are no dependencies on current consumers and that decisions with respect to the choice of the market for sawmill residues are mainly made based on pricing and transportation distance.

Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed *low*, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) × 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.[28]

Risk Information: Certain temporary (seasonal) markets for bark and pulpwood include mulch and firewood. Where demand picks up in March through June for the mulch market, demand for firewood experiences a surge in demand from November through March. While these markets can exert a notable influence, we have already factored in the demand they generate, resulting in their risk being assessed as low.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × 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 competitively pressure it can exert on supply. Ability to store large inventories allows competitors to purchase inventory when the prices are low, potentially giving it an economic advantage. Additionally, the ability to store inventory during feedstock supply surpluses can enable competitors to continue to intake feedstock when the Issuers plant (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity on the part of competing markets thereby creates supplier loyalty and can make it more difficult for new projects to secure supply without paying a significant premium.

Risk Information: While data regarding the inventory capacities of the 11 plants that make up the key competitors within the BDO Zone was not accessible, it is reasonable to assume that these mills, being sizable operations, likely possess substantial inventory capacities. However, it is important to acknowledge that the relatively considerable distance of these mills from Tunkhannock, in particular the five wood pellet plants, constrains the extent of competitors' influence on the BDO Zone, even if their feedstock inventory capacities are indeed substantial.

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

[28] Bergtold, 2018.

Raw Risk Impact (RRI) The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **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 efficiently 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 that are appropriate for their needs and unloading capacity.

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

2.2.3 Relative Specification Advantages

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

Risk Information: New bio-projects would likely need woody biomass that is available in the market (e.g., wood chips and sawdust). From this perspective, competitors do not have a relative feedstock specification advantage.

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

2.2.4 Demand for Competitors' Products

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

Risk Information: There are currently no pulp and paper facilities contained within the BDO Zone. The nine wood pellet plants within the BDO Zone make up close to 82% of the total wood consumption by competitors identified within the BDO Zone. When adjusting consumption from these pellet plants based on distance from Tunkhannock, PA, their consumption represents 55% of the total consumption. Despite the strong growth in wood pellet production and sales within North America over the past two decades, there has been a net decrease of 2% in production capacity and wood consumed by wood pellet plants within the BDO Zone from 2016 to 2023. There are no indications that the nine pellet plants currently operating in the BDO Zone will increase production.

Close to 43% of the distance adjusted consumption, or 67,890 bdt/yr, comes from a large MDF plant located just under 40 miles drive distance from Tunkhannock in Towanda. With the current owner of the plant forced to divest its interest in the plant, new ownership is currently unknown. While the U.S. engineered wood products market size declined 4.9% in 2023, it is expected to experience moderate growth over the long term.[29] There are no known biofuel projects slated to come online within the BDO Zone, and as such, there is limited risk associated with increased feedstock consumption from competitors.

While it remains uncertain how local producers will respond to this global demand, our assessment indicates that increases in production from competitors in response to future demand are possible, but this is regarded as 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 × RRI) is 16 out of 100.	**16**

[29] https://www.ibisworld.com/industry-statistics/market-size/engineered-wood-product-manufacturing-united-states/

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

CATEGORY 3.0: SUPPLY CHAIN RISK

3.1 Risk Factor: Feedstock Availability

3.1.1 Biomass Availability Multiple (BAM)

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

Risk Information: The likelihood of the BAM factors being incorrect is low. The sources that were consulted for the availability of pulpwood, sawmill residues, and forest residues were in agreement with regard to biomass availability. More details on our BAM estimation are provided in Appendix A. However, assumptions of future biomass supply and demands are part of the BAM factors. Unforeseen supply and market factors, such as new competitors, can have high levels of impact on our assumptions and biomass availability; thus, the impact of BAM risk is deemed to be medium.

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 × 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 × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**24**

3.1.2 Feedstock Supply Curve/Marginal Cost Curve

Rationale: The greater the feasible transport distance, the more feedstock is accessible to the Issuer, but at a higher delivered cost. The feedstock supply curve, sometimes referred to as the marginal cost curve, is a function of feedstock availability over its cost which is primarily, but not exclusively, a function of distance. The feedstock supply curve is used

to determine the availability of redundant feedstock at various price points, and the cost of replacing feedstock with substitutes located at different distances.

Feedstock cost curves are useful in determining supply chain resilience; they provide information about the cost of feedstock availability in times of supply disturbance. Biomass supply chains are prone to supply disturbances over time; suppliers can become insolvent, or weather events can temporarily disrupt feedstock availability. When a disturbance occurs, the Issuer may need to source replacement feedstock from different suppliers at different locations and costs. A biomass supply curve indicates quantities of feedstock available at various price levels from suppliers generally located further away than core supplier.

Risk Information: The supply of pulpwood and forest residues is roughly linear, with more biomass available with increasing distance from the center point (Figure A-7). Sawmill residues, on the other hand, are only available at a limited number of sawmills, so availability increases in a stairstep manner (Figure A-9).

- 58% of the total available pulpwood (479,430 of 825,000 bdt) are within a 50-mile driving distance.
- 59% of the total available forest residues (151,950 of 258,000 bdt) are within a 50-mile driving distance.
- 60% of the total generated sawmill residues (101,225 of 172,000 bdt) are within a 60-mile driving distance.

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

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 and can manifest in shortages and higher costs for Issuers.[30]

Risk Information: Warmer and wetter conditions are affecting the forest products supply chain at every stage, from forest owners and managers, to loggers and wood processing mills. The winter logging season is historically the most productive time of the year; however, it is shorter, and frozen conditions are less reliable. Wet ground conditions are more common due to periods of intense precipitation and unexpected thaws. Climate unpredictability creates start-stop patterns in forest operations, resulting in altered harvesting schedules and wood procurement challenges; however, this is often intermittent and does not endure for a prolonged duration. Some of the mitigation measures being taken include:

[30] Golecha & Gan 2016

- Loggers are occasionally relocated to "wet weather" areas during the winter and spring seasons. These areas are typically situated on elevated terrain and/or consist of sandy or sandy loam soils, which are more resistant to water saturation.
- Undertaking road maintenance and improvements necessary to accommodate supply chain demands and climate challenges;
- Timber harvesting systems are being adapted in response to climate impacts and threats, embracing local and regional conditions as required;
- Emphasizes the importance of short haul, local concentration yards, which focus on maximizing productivity on sensitive sites during dry or frozen conditions; and
- Adopting new practices to navigate Best Management Practices ("BMPs"): Keeping skidding distance to a minimum, using woody debris for temporary runoff control, and adding new equipment to address BMPs (largely through repairs and restoration after logging is completed).

Seasonal limitations are managed and have been practiced for decades. The timberland base is extensive, and access to harvest sites is good.

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

3.1.4 Year-to-Year Variation in Feedstock Availability

Rationale: Biomass can have significant year-to-year supply variations due to variability in yield from biomass harvesting operations, particularly with agricultural biomass.

Risk Information: Year-to-year availability for pulpwood and sawtimber has been relatively consistent for the past decade. Historic pulpwood removals for the BDO Zone have remained consistently low from year to year (Figure A-2) beginning in 2014, with a slight drop in harvest over the past ten years as a reflection of the pulp and paper market. Figure A-4 illustrates the growth-to-removals for pulpwood in the BDO Zone, which is heavily skewed for the annual net growth, indicating that the regional pulpwood resource can support new biomass project development without creating implications for the health of the forest in the region. The growth-to-removals data reflects the lack of demand for pulp wood, which in turn is due to the fact that there are no pulp & paper mills or similar pulp wood consuming facilities operating in the area.

Likewise, the sawmill capacity (Table C-2) has paralleled removals. The growth-to-drain ratio for all timber had an average of 3.68 from 2011-2013, with average growth increasing over this period and was 4.23 from 2014–2020 without large variations. This indicates a surplus of wood available which can be sustainably harvested.

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

3.2 Risk Factor: Historical Issues

3.2.1 Historical Feedstock Price Variations

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

Risk Information:

Pulpwood: Stumpage pricing for pulpwood has been relatively low during the second half of 2022 to current day. This volatility can be viewed as an indicator of the declining pulp and paper industry and the lack of demand and associated markets for pulpwood within the BDO Zone. Log prices had started to fall since post-COVID, with a pivot in the hardwood pulpwood market and continued softness in the hardwood lumber market. The hardwood pulp and pulpwood market experienced a significant transition, with pulp mills enacting supply quotas and reducing pricing by up to 20%.[20] Within the Zone, the average stumpage values from Q1 2022 - Q4 2024 for northeastern Vermont had ranged from $0-$0.82/ton for pulpwood on private land.[31, 28] Data from the Bureau of Forests shows an average of $4.29/ton for pulpwood over the same period.[32] In contrast, prices in the second half of 2001 ranged from $1.83-$3.70/ton for hardwood pulpwood on private land and averaged close to $7/ton for hardwood pulpwood during the same period.[33] Historically and in good markets, prices for pulpwood both chipped and roundwood delivered, have run $20-$30/bdt higher than current prices ($70-$110/bdt for pulpwood roundwood and $90-$120/bdt for chipped pulpwood), where mills were extending out well over 100+ miles and paying for transportation into the $50-$60/ton range.

Forest residue: Based on feedback received during our outreach, chipped forest residue pricing ranges between $70-$110/bdt delivered within <55 miles.[34] Prices for forest residues have historically been steady. Any volatility in historical

[31] Includes both hardwood and softwood
[32] https://extension.psu.edu/timber-market-report-archives
[33] ibid
[34] Assumes a moisture content of 50%

pricing can be tied to the temporary nature of forest residue demand and, therefore, is not regarded as a noteworthy risk.

Sawmill Residues: With the exception of wood chips, sawmill residue pricing has been volatile in recent years. Prices for wood chips (80% lower than chipped roundwood on the low end of the price range) are currently within the range of $50-$110/bdt delivered, whereas two years ago, sawmill chips were within the $70-$130/bdt delivered range, according to outreach conducted. Bark has sold at a price within the range of $16-$24/bdt over the past five years.[35] Pricing for sawdust and shaving is highly variable, depending on availability and competing end users. Historically, availability, not price, has varied the most over time.

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

3.2.2 Low Historical Demand for Feedstock in the BDO Zone

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

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

Risk Information: Forestry has been a major industry in the BDO Zone for decades, and the supply chains for timber and sawmill residues are well established. The Mehoopany, PA plant, which had shut down around 1999 as a result of switching from the use of local pulpwood to importing its pulp requirements, had utilized close to 250,000 bdt/yr of pulpwood (chipped and roundwood) from the region. The supply chains for pulpwood and forest residues have been inactive relative to pre-2000 levels, and as such, investment in equipment, roads, and training would be required in order to support scale-up for a new bio-based project. Despite the period of relative inactivity, the methods used for harvesting are well-established and common to forestry operations.

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

[35] Based on outreach

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

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

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

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

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

Risk Information: The region has a rich and extensive history of forestry and the utilization of pulpwood and sawmill residues. Sawmills have been in operation for more than two centuries. Pulp and paper mills were built approximately 90 years ago. The practice of harvesting forest residues is rare despite its feasibility.

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

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 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 C-7 shows the change in CPI over the past four years for the Northeastern Region and reflects rising inflation between September 2020 and July 2022. At that point, the rate of inflation generally decreases until the present time.

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

3.3.2 Currency Risk

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

Risk Information: Currency risk is not a factor in the BDO Zone.

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

3.3.3 Border Risk

Rationale: Where feedstock is transported cross-border to another country, risk exposure to border closures and crossing delays becomes present. The availability of trucks willing to do cross-border runs is limited, which can decrease

supply chain flexibility and resilience. Plants near the US-Canada border which intake feedstock from both countries are exposed to these risks.
Risk Information: Border risk is not a factor in the BDO Zone.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed *not relevant*, therefore the RRL is not rated. — **NR**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed *not relevant*, therefore the RRI is not rated. — **NR**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL × RRI) is not rated. — **NR**
Mitigation/Notching — **Notch**
The Total Notch (RRL Notch × RRI Notch) is not rated. — **NR**
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) × 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.[25]
Risk Information: The feedstock supply chains and manufacturing processes are well established in the BDO Zone. There is a low likelihood of temporary externalities affecting the BDO Zone. In addition, no history of alternative, non-traditional, externality-driven competitors for feedstock was found in the BDO Zone region.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed *very low*, therefore the RRL is 2 out of 10. — **2**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed *very low*, therefore the RRI is 2 out of 10. — **2**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100. — **4**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100. — **4**

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

3.4.1 Harvest & Collection Practices & Schedules

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

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

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

Risk Information: Forest harvesting practices have been in place for decades. Some in-woods chipping is conducted, but most timber harvesting is conducted using either cut-to-length harvesting systems or traditional chainsaw and skidder operations primarily designed to deliver sawlogs to the sawmills in the state. For cut-to-length, this consists of two types of equipment: the processor and the forwarder. The processor cuts the tree with a chain saw located on the felling head, removes the branches, and saws the tree into appropriate product lengths (e.g., 8 feet, 12 feet, 16 feet, etc.). Typically, the branches and tree tops are left in the forwarder trail to minimize impact on the forest floor. The forwarder loads the logs onto the forwarder with a grapple loader and transports them to the roadside landing. The products are either loaded onto the ground at the roadside landing or directly onto an empty log-trailer.

Forest residues (the tops and branches) can be collected in several ways. The bundler and forwarder approach uses two types of equipment: the bundler and the forwarder. The bundler travels throughout the harvest job site and collects, compacts, and bales harvesting residue into biomass bundles. The forwarder loads the bundles onto the forwarder with a grapple loader and transports them to the roadside, where the material is transferred, without chipping, into a chip van. Alternately, tops and branches can be chipped and blown into a chip van.

Increasing the volume of forest residue harvest will not have any negative effect on harvest of pulpwood or sawtimber as it occurs in a separate operation after timber harvest.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × 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. Use of different types and combinations of harvesting, collection and processing equipment among suppliers can lead to non-homogeneous feedstock. Equipment that is not designed specifically for biomass cultivation, harvesting and collection, can increase feedstock quality risks.

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

Risk Information: None of the equipment used in the regional forestry supply chain constitutes a risk to wood fiber quality and availability. Trees are felled, delimbed, and sectioned into logs with harvesters. Logs are extracted to roadside with forwarders. Logs and residues are delivered to destinations using conventional trucks. None of this equipment poses a feedstock quality or availability risk when managed and operated properly.

Raw Risk Likelihood (RRL) The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **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.[36]

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 have the capability to provide either form.

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

[36] Huhnke, 2018.

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

3.4.4 Availability of Labor for Feedstock Production

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

Risk Information: During the recession and recovery in 2022, several small sawmills closed in the BDO Zone, and logging jobs were lost to more lucrative jobs in the oil and gas industry. In Pennsylvania, the majority of loggers are full-time, independent contractors or employees of logging companies. According to a 2009 logging industry survey, nearly 20% of employers have five or more crews, with most being wood workers or truck drivers.[37] About 40% of companies do their own trucking, 40% contract it out, while the other 20% do both.[31]

The most important concerns facing loggers are worker compensation costs and job safety. Sawmills have been utilizing subcontracting to avoid paying out worker compensation, thereby passing off the high costs of insurance to loggers. With an aging workforce that has an average age of close to 44 years in the state and the challenge of recruiting new people into the industry, it is posing a risk to the availability of labor moving forward. This trend, however, may be offset by increasing consolidation and the creation of larger logging companies. Furthermore, high start-up costs due to equipment requirements and the high cost of insurance are deterrents for those looking to get into the industry. The growth of the shale gas industry in the BDO Zone has led to the migration of transportation equipment and labor away from the logging industry due to increased employment and wages.

Based on feedback received from outreach, we concluded that there should be adequate labor and transportation available for a large biomass project given the prices we would be paying and offer of steady work. Furthermore, based on discussions with local transportation companies, there is a willingness to invest in additional equipment to service the needs of a project as long as a stable project exists.

Permitting and construction of a new project is likely to span a two-to-four-year time frame, possibly more. During this period and the ramp-up to full production, new logging truck drivers can be recruited and trained.

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

[37] http://elibrary.dcnr.pa.gov/PDFProvider.ashx?action=PDFStream&docID

Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**Score** **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 average transport distance from suppliers to Issuer is high, the supply chain is subject to greater sensitivities to risks, such as increases in diesel cost, weather impacts, mechanical breakdown, and by the demand for scarce feedstock from competitors closer to the source.

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

Risk Information: Transportation costs account for 20 - 50% of the total biomass delivered price, depending on the type of biomass, the distribution of the biomass in the BDO Zone, and the supply/demand dynamics in the region. Biomass transport is priced by the bdt per mile in the BDO Zone. The biggest impact on haul rates is fuel cost. Based on our estimation, on average, 25% of a logging operation's revenue is attributed to the cost of fuel. Rising diesel prices can have a significant impact on costs.

After accounting for recent increases in diesel costs, transportation costs are estimated to be $0.19 per green ton per loaded mile. Furthermore, we assume an average drive distance for delivery of feedstock in the BDO Zone to be 55 miles. As such, the average cost of transportation determined is $20.90 per bone dry ton per loaded mile. Note that this figure was utilized in determining pricing (refer to Figure A-11).

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

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

3.5.2 Diesel Cost Impacts

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

Risk Information: Diesel fuel prices in the US Central Atlantic region had generally tracked upward for the past two decades (Appendix C, Figure C-6), with a low point of just below $2.00 per gallon in 2002 and a high of $6.26 in 2023. These price fluctuations closely parallel the national average price of diesel. Changes in diesel prices could have a significant effect on the delivered cost of biomass.

Transportation companies typically include an additional charge for fuel when the cost goes beyond a certain level, known as the fuel price baseline. During the period of 2021-2022, there was a noticeable increase in diesel prices. This led to a fuel surcharge ranging from 15-40%. As a result, the cost of delivering biomass increased by $3-$8/bdt. Given that 58% of the pulpwood and forest residues are within 55 miles from the center point, the impact of this increase can be considered medium.

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

3.5.3 Transportation of Feedstock Requires Specialized Equipment

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

Risk Information: Forest residues, when collected, do not require any specialized equipment. Overall, no specialized equipment is needed for harvesting and transporting forest residues. The equipment needed for harvesting forest residues is readily available. Outreach confirms that the logging contractor would be willing to make the investment in additional equipment requirements should there be stable business to justify the investment.

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

The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **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 power to force regulations regarding truck transport, impeding the ability BDO Zone suppliers to transport feedstock.

Risk Information: Tunkhannock is located in a rural area, with the industrial site situated northwest of the main town center. The industrial site is situated just 6.5 miles away, which translates to a 10-minute drive from the main street of Tunkhannock. It is strategically positioned on the property of an established forestry business that takes full advantage of the well-connected network of delivery routes in the area. Route 87 runs in a north/south direction and connects to U.S. Route 6, which runs east/west through the state, including Tunkhannock.

Given the extensive experience in the forestry industry and the convenient location of the manufacturing plants near the project, there are established delivery routes that play a crucial role in the local communities within the Zone. Based on our analysis, the potential risk of using delivery routes through local communities is minimal.

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

3.5.5 Transportation Regulations & Local Weight Limits

Rationale: In many BDO Zones, transportation is regulated based on seasonal road conditions. These regulations (e.g., "frost laws") often take the form of weight restrictions or limits on the number of trucks allowed on roads. Such

regulations can impede the project's ability to source sufficient feedstock or increase the cost of doing so at certain times of the year.
Risk Information: In many regions, 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. In many counties, logging truck drivers must obtain a permit to operate on logging roads. None of the local forestry professionals contacted by Ecostrat identified transportation regulations as a barrier to wood supply. Truck owner-operators are able to satisfy weight regulations by adding axles if necessary. The maximum allowable gross vehicle weight (GVW) before special permit requirements is 80,000 pounds. This is in line with most states in the central and eastern regions of the USA. Generally, special permits are not applied for because this can result in excessive wait times and costs.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**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: Intensive forest management in the region has led to a significant number of logging roads. However, based on feedback received in market outreach, it has been noted that, comparatively, the road quality is less favorable than in other areas of Pennsylvania. Occasionally, the condition of the roads may vary, but loggers usually have access to a bulldozer that can be used to enhance existing roads or construct new ones if necessary. Driving becomes challenging when the roads are wet. During the early part of spring, specifically April to May, there is a period called spring break-up. Due to the melting snow and frost, the ground becomes soft and muddy, resulting in a slowdown in logging activity. It is important to note that during this time, road damage is more likely to occur due to the use of heavier vehicles. Based on an interview with a local sawmill, it is anticipated that their log inventory could decrease significantly, potentially from 1.5 million board feet reaching as low as 400,000 board feet in a worst-case scenario during this period. Due to the expansion of the shale gas industry in the area, they have made substantial contributions to the maintenance and enhancement of sections of the regional road network.

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

The risk impact is deemed *medium*, therefore the RRI is 6 out of 10.	**6**

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

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: Our estimations suggest that an additional demand of approximately 550,000 tons/yr of pulpwood would necessitate approximately 26 logging trucks.[38]

Although there is a certain portion of the demand that can be fulfilled using the current infrastructure, there would likely be a need to obtain additional logging truck capacity. We lack specific data on the exact number of trucks and trailers in the region. However, we anticipate that the equipment quantity is well-matched with local supply chain demands, with very little redundancy.

Simply put, the implementation of a new bio-project would result in a substantial surge in the need for woody biomass. However, there might not be enough transportation equipment to meet this demand. Nevertheless, in the immediate future, potential deficits in transportation equipment within the supply chain could be alleviated by importing equipment from neighboring areas. In order to meet the increased demand, it is essential for the supply chain to make necessary adjustments in the long run. Possible disruptions in transportation can have a substantial effect on the supply chain. Additionally, there is some uncertainty surrounding the exact number of trucks and trailers that are available for delivering feedstock.

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

[38] Assumptions: 30 gmt per payload; average 2 trips per truck per day; 350 operational days per year: 550,000 / (30*350*2) = 26

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

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: 11 suppliers were identified within the Wyoming County BDO Zone. The following chart highlights some of the key metrics related to the size and location of suppliers within the BDO Zone:

Distance from Center Point	Number of Sawmills	Capacity (MMBF)	Sawmill Residues (bdt)
<50 miles	1	15	17,452
50 and <60 miles	4	58	67,484
60 and <70 miles	4	51	59,431
70 and <85 miles	2	23	27,284
Total	**11**	**147**	**172,000**[39]

Sawmills range in production capacity from 5 million board feet ("MMBF") to 39 MMBF. The average distance from the center point for sawmills is 57 miles, and average production capacity is 13 MMBF. Around 49% (or 85,000 bdt/yr) of the total residues produced are within < 60 miles drive distance from Tunkhannock, whereas the remaining 51% (or ~87,000 bdt/yr) are >60 miles from the project center point.

The supply of pulpwood and forest residues is roughly linear, with more biomass available with increasing distance from the center point (Figure A-7). Sawmill residues, on the other hand, are only available at a limited number of sawmills; thus, their availability increases in a stairstep manner (Figure A-9).

- 58% of the total available pulpwood (479,430 of 825,000 bdt) are within a 50-mile driving distance.
- 59% of the total available forest residues (151,950 of 258,000 bdt) are within a 50-mile driving distance.
- 60% of the total generated sawmill residues (101,225 of 172,000 bdt) are within a 60-mile driving distance.

We estimate that there are at least 190 trained/qualified logging professionals based on those who had enrolled in the SFI Professional Timber Harvester Training Program, which were situated in the overlapping counties within the BDO Zone as well as outreach conducted.[40]

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

[39] Rounded to nearest 1,000
[40] https://www.sfiofpa.org/search-results.php?fcurrent=

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

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: Over the previous decade, there has been a clear pattern in the harvesting of sawtimber and pulpwood. The extraction of pulpwood (as shown in Appendix A, Figure A-2) has experienced a consistent decline that mirrors the drop in paper use. As such, this has resulted in less competitive pressure on pulpwood, and there should be access to pulpwood supply to support a bio-based project.

Downturns in the market can threaten sawmill viability, which in turn, can impact the harvest of sawtimber and forest residues. In addition, increased prices of natural gas could generate risk as facilities may resort to burning their own residues (mainly sawdust and bark/hog fuel). This, in turn, makes these sawmill residual streams less available and more expensive for potential projects.

These risks are common to all areas of North America and are considered low.

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

3.6.3 Land Ownership Structures

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

Risk Information: The USDA Forest Inventory and Analysis database indicates that the land base for pulpwood and forest residues in the BDO Zone is overwhelmingly (over 83%) under private ownership. Parcelization, the fragmentation of extensive forested land holdings into smaller parcels owned by an increasing number of individuals, has been taking place across Pennsylvania. The transfer of ownership of a forest tract occurs, on average, every seven years, which poses a risk due to the difficulty of long-term forest planning. Furthermore, the continued growth of carbon markets could lead to reductions in timber harvesting.

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

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 take place throughout the year, with the winter and spring usually experiencing higher levels of precipitation. This can impede loggers' capacity to transport timber to the mills, however, this is often transient and does not endure for a prolonged duration. In the winter and spring, loggers are occasionally relocated to "wet weather" areas, typically located on elevated terrain and/or consisting of sandy or sandy loam soils that are more resistant to moisture. Autumn typically has reduced precipitation, prompting mills to actively accumulate stock in preparation for the upcoming winter and spring seasons.

In general, measures are implemented to prevent interruptions in harvesting caused by seasonal weather patterns. Some of these measures include the requirement to have Erosion and Sedimentation (E and S) Control Plans and the development of Best Management Practices. Furthermore, there is an abundance of timber available that exceeds the current demand.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed *low*, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × 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: Floods and droughts in the Wyoming County BDO Zone are likely to become more severe in the future due to climate change.[41] The state has experienced a large increase in extreme precipitation events. Future increases in winter and spring precipitation will expand the risk of springtime flooding along rivers and streams.[42] Wildfires and extreme storms also constitute threats to feedstock supply chain management within the BDO Zone, as they can destroy inventory and bring transportation to a temporary halt. The state and its agencies are taking measures to mitigate future impacts from climate change. These measures include building hazard mitigation infrastructure, encouraging forest management to maximize forest health, monitoring forestry operations for the correct implementation of Best Management Practices, and continually developing new varieties of forest plantation stock that will resist the stresses brought about by climate change.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10. **6**
Raw Risk Impact (RRI) **Score** The risk impact is deemed *medium*, therefore the RRI is 6 out of 10. **6**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 36 out of 100. **36**

[41] https://www.wyomingco.net/DocumentCenter
[42] https://statesummaries.ncics.org/chapter/pa/

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

3.7.3 Forest/Crop Fire

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

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

Other climate change impacts that could add damaged or dead-wood to the forest fuel load (e.g., as a result of insect outbreaks, ice storms, or high winds) may increase the risk of fire activity. New research is aimed at refining these climate change estimates of fire activity, and at investigating adaptation strategies and options to deal with future fire occurrence. There is growing consensus that as wildfire activity increases, fire agency suppression efforts will be increasingly strained.

Risk Information: Wildfires, specifically, are considered low probability. According to the NYS Hazard Mitigation Plan, only one municipality in the county has a wildfire event on record.[30] Based on the Wild Fire Assessment System by the US Forest Service, the BDO Zone is classified as a "Low" Danger Class, both observed and forecasted. Forest fires can be a concern in the BDO Zone, but the risk is somewhat mitigated because the forests in the area are a mix of different species types, making them less prone to insect infestations. Outbreaks of this nature can result in the death of trees, making forests more susceptible to forest fires. However, the projected rise in heat waves caused by climate change suggests that forest fires continue to pose a potential threat to the woody biomass supply chain.

The increased awareness of forest fire risks and the damage that can be caused to forest inventory will foster an environment that promotes biomass harvesting as a measure to mitigate fire hazards.

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

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

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: Forest insects and diseases are major concerns for the overall health and sustainability of forest ecosystems in the BDO Zone. In Pennsylvania, pests such as the emerald ash borer, spongy moth, hemlock woolly adelgid, beech bark disease, and oak wilt have caused substantial damage in recent years. These threats are a concern for oak and beech trees, which play a vital role as sources of hard mast for wildlife. The Pennsylvania Department of Conservation and Natural Resources (DCNR) conducts aerial and ground surveys to monitor and manage forest insects and diseases. The surveys help in detecting and mapping tree dieback, mortality, defoliation, and foliage discoloration. The gathered data is utilized to evaluate damage, predict outbreaks, and provide management suggestions.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *high*, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 32 out of 100.	**32**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 32 out of 100.	**32**

3.7.5 Risk of Hail

Rationale: Hail has a 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 increase.

Risk Information: Irrelevant to this rating.

Raw Risk Likelihood (RRL) The risk likelihood is deemed *not relevant*, therefore the RRL is not rated.	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed *not relevant*, therefore the RRI is not rated.	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is not rated.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch × RRI Notch) is not rated.	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is not rated.	**Score** **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: Floods happen all year round, but a significant number of them take place in the spring due to intense rainfall and snowmelt. Spring break-up in Wyoming County typically transpires from late March to potentially extending through June annually. This period amplifies the susceptibility to drought. Given its predictable recurrence, we anticipate minimal escalation in flood hazards or disturbances to forestry activities beyond the customary seasonal variability. Consequently, this risk is assigned a low score.

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

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.

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

Risk Information: There is no significant risk of drought within the BDO Zone. If prolonged drought does occur, it is unlikely to affect wood supply.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed *very low*, therefore the RRL is 2 out of 10.	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**Score** **8**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 8 out of 100.	**Score** **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 the 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: The risk of severe wind storms within the BDO Zone is moderate and includes tornados, hurricanes, tropical cyclones, and strong winds. According to the U.S Wind Zone Map, the BDO Zone intersects with two wind hazard zone classifications. Zone III (winds up to 250 mph) and Zone II (winds up to 160 mph), which are both primarily contained west of the BDO Zone center point, are the two zones with the largest intersecting areas, respectively. Note that the Zone II area is also contained within the hurricane-susceptible region.[43] These occurrences can lead to tree blowdowns that can complicate and raise the cost of timber harvesting.

Tornados and hurricanes are rare occurrences within the BDO Zone, with eight tornadoes recorded in Wyoming County during the past 105 years.[36] Tropical cyclones occasionally pass through the state and are yet another cause of heavy rainfall and widespread flooding. Over a 2-week period in 2011, the remnants of both Hurricane Irene and Tropical Storm Lee drenched Pennsylvania in heavy rains and caused historic flooding, leading to damages exceeding $100 million across the state. Tropical Storm Agnes in 1972 caused torrential rainfall and led to statewide damages estimated at almost $3 billion.[35]

[43] https://www.nist.gov/image/windzonemapjpg

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *high*, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 32 out of 100.	**32**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* Weather interruptions in the BDO Zone are relatively short; a large inventory should effectively mitigate any risks related to seasonal weather impacts on feedstock supply. The Total Notch (RRL Notch × RRI Notch) is 50%.	**Notch** **50%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

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: Although temperatures in the BDO Zone can occasionally drop to low levels, anecdotal evidence suggests that they have not been severe enough to significantly hinder forest activities for long periods of time. Extreme cold temperatures can adversely affect specific crop species. Woody biomass generally does not cause problems unless non-indigenous species are deliberately cultivated to achieve unusually fast growth. The timber species present in the BDO Zone are indigenous to the region.

The typical temperature range for Wyoming County, PA, throughout the year is normally between 16°F and 81°F, with extremely few incidents of temperatures going below 28°F or exceeding 98°F. Consequently, we expect minimal threats to the supply chains due to low temperatures.

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

3.8 Risk Factor: Political and Social

3.8.1 Government Subsidies for Feedstock Production or Utilization

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

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

Risk Information: As far as we are aware, there are no government subsidies available to incentivize feedstock production in the Wyoming County BDO Zone. Therefore, suppliers do not depend on government funding to produce and use feedstock.

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

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

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

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

Risk Information: The DEP has developed a set of Best Management Practices ("BMPs") and policies that help guide and regulate timber harvesting activity. The following highlights some of those key BMPs and policies that relate:

- Timber harvesting operations in the state must have a plan in place to effectively manage erosion and sedimentation.
- Permits and approved erosion and sedimentation control plans are necessary for logging access roads and skid trails that cross wetlands, as required by state and federal law.
- Operations that disturb >25 acres of land must obtain an erosion and sedimentation control permit.
- A range of 15-30% of pre-harvest biomass – depending on mainly soil type and forest composition, should always be left on site to buffer against nutrient depletion, erosion, loss of wildlife habitat, and other factors.[8]

Furthermore, alongside the mentioned practices and policies that govern timber harvesting, Pennsylvania has also implemented measures to promote the utilization of woody biomass, such as the Alternative Energy Portfolio Standards Act (or "AEPS Act"). The legislation mandates that all load-serving energy companies in the state must generate a specific portion of their electricity from alternative sources, which includes woody biomass.[44] The Act sets minimum thresholds for Tier I and Tier II, with increasing requirements over a fifteen-year period. Retail energy suppliers must use Alternative Energy Credits (AECs) to show compliance, with each 1,000 kWh of electricity from a qualified source generating one AEC. This system facilitates financing and investment in alternative energy by separating AECs from the power itself.

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

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: We have not found any evidence of negative public perception or opposition towards a biomass project and the use of low-grade woody feedstock in the Wyoming County BDO Zone. The region has a long-standing wood products industry. Given aspects such as the prospect of job creation, benefits to local industry, and the use of low-grade wood that is otherwise underutilized, we anticipate that the local population will be supportive of any new project.

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

[44] https://www.puc.pa.gov/filing-resources/issues-laws-regulations/aeps-act/

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

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 no Indigenous reserves or federally recognized Native American tribes in the BDO Zone. Although Pennsylvania recognizes ten Native American tribes, their recent activities have focused on cultural preservation and education.

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

3.8.5 Food Security Concerns

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

Risk Information: Risks related to food security concerns are irrelevant to woody biomass supply chains.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *not relevant*, therefore the RRL is not rated.	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *not relevant*, therefore the RRI is not rated.	**NR**

Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is not rated.	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is not rated.	**NR**

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

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

Risk Information: The forests in the BDO Zone are carefully maintained and undergo regular audits to ensure compliance with Best Management Practices ("BMPs"). Pennsylvania began implementing forestry BMPs in 1993 and has since been consistently evaluating their implementation. BMPs provide guidelines for maintaining the health of forests, with a specific emphasis on soil and water conservation during forest management and harvesting activities. The state currently has nearly 2,300,000 acres certified to the SFI Forest Management Standard. Additionally, there are 22 companies that hold SFI Certified Sourcing certificates and 68 companies that hold SFI Chain of Custody certification.[45] Pennsylvania's state forestlands have maintained Forest Stewardship Council (FSC) certification since 1998 and will continue to hold this certification alongside SFI. In addition to FSC and SFI standards, American Tree Farm (ATF) standards are also used.

It is important to note that third-party certification is not mandatory. However, companies have the option to pursue certification if they consider it significant to their customers.

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

[45] https://forests.org/forestmanagementstandard/

3.9.2 Risk to Soil Quality

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

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

Risk Information: Best Management Practices (BMPs) provide guidelines for maintaining the health of forests, with a specific emphasis on soil and water conservation during forest management and harvesting activities. Harvesting activity, particularly during spring break up and periods of high precipitation, leaves soils susceptible to soil erosion and damage. BMPs help to mitigate risks present during harvesting. Some of these mitigation methods contained within the BMPs include:

- To minimize soil compaction and rutting, match operating techniques, equipment, and seasons to soil types and moisture levels.
- Use soil surveys, topographic maps, and on-site evaluations to plan log landing, skid road, and haul road locations.
- Keep networks small for efficient timber removal and avoid soil contamination with chemicals.

Further measures administered by the state include a requirement to obtain an erosion and sediment control permit along with an approved erosion and sedimentation control plan for timber harvesting involving >25 acres of earth disturbance.

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

3.9.3 Risk to Surface and Groundwater

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

Risk Information: Pennsylvania's forest management guidelines include Best Management Practices ("BMPs") that focus on conservation practices that maintain surface and subsurface water flow, the structure and function of riparian and wetland vegetation, and minimize site level run-off and erosion. Furthermore, the Clean Streams Law is the main law designed to protect Pennsylvania's water resources. Timber harvesting activities must be done in conformance with the applicable federal and state laws, including sections 401 and 404 of the Clean Water Act, Clean Streams Law, Dam Safety and Encroachments Act, and the regulatory requirements of 25 Pa. Code Chapters 93, 102, and 1.

Permit requirements accompany harvesting activities, which involve working around watersheds, creeks, and existing runoff areas where there is a risk of sedimentation, contamination, and soil disturbance, which can adversely affect the local environment. In addition to the permits, further requirements include approved plans (stormwater management, BMPs, soil, and erosion) depending on the type of activity being done and where it is occurring.

The risk is assessed as very low due to strict regulations requiring buffer zones around riparian areas.

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

3.9.4 Water Use

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

Risk Information: Irrelevant to this rating.

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

3.9.5 Pesticide Risk to Human and Ecosystem Health

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

Risk Information: Pesticides can be used to control insects in agriculture. For tree species, pesticides are most commonly used in fruit and nut operations. Although pesticides are used in forest management within the BDO Zone, the use of pesticides in timberlands is regulated by the Pennsylvania Department of Agriculture (PDA) Bureau of Plant Industry and requires a permit and adherence to Best Management Practices.

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

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. One of the key considerations with respect to harvesting that relates to protecting wildlife habitats is leaving up to 15-30% of harvestable biomass as coarse woody debris. While this would restrict the potential supply of forest residues to a project, it is common practice and ensures that there is mitigation against the reduction of habitat for small mammals, reptiles, amphibians, and beneficial insects.

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

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

3.9.7 Biomass Classified as Genetically Modified Organism (GMO)

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

Risk Information: In February 2023, 60,000 GMO poplar seedlings were planted for the first time outside a research trial in the U.S. in both Georgia and Pennsylvania.[46] The company that developed the seeds plans to plant another 4 million trees throughout 2023-2024. In lab conditions, these poplars accumulated biomass up to 53 percent faster than non-engineered poplar trees, trapping as much as 27 percent more carbon.[6] GMO seedlings are seen as a means to combat the effects of climate change and enhance forest economies. These trees are engineered to maximize carbon uptake and for rapid growth, which is beneficial to the health of the forest and supports the security of wood fiber for future biomass projects.

The GMO poplar trees are not a major forestry species for the BDO Zone, with an estimated volume harvested according to a 2016 state survey indicating that roughly half a million cubic feet of yellow poplar is harvested annually within the BDO Zone.[47] Although the USDA had determined that it lacks the authority to regulate the poplar GMO seedlings, the commercialization and continued adoption of these seedlings face hurdles such as significant public opposition and extensive approval processes. As such, the likelihood of this risk occurring for a future biomass project is deemed to be very low.

While the public reaction to GMO trees may be negative, it is unlikely to impact forestry in the BDO Zone. These GMO trees are the first plantings and represent a small portion of all timberland in the BDO Zone if they were to be eventually utilized. Any negative reaction to GMO trees will be positive for non-GMO forestry, so the impact of this risk on future biomass projects is deemed to be very low.

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

[46] https://bio.news/agriculture/biotech-helps-to-fight-climate-change-with-carbon-devouring-gm-trees/
[47]http://elibrary.dcnr.pa.gov/PDFProvider.ashx?action=PDFStream&docID=1742579&chksum=&revision=0&docName=ub-grtf-08&nativeExt=pdf&PromptToSave=False&Size=11999961&ViewerMode=2&overlay=0

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

CATEGORY 4.0 FEEDSTOCK SCALE-UP RISK

4.1 Risk Factor: Feedstock Scale-Up

4.1.1 Feedstock Quality at Production Scale

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

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

Risk Information: The BDO Zone has had a long-standing and well-established practice of producing, harvesting, transporting, and processing sawmill residues and pulpwood. The technology is inherently designed to provide consistent production quality. While forest waste is not collected in significant quantities, it is a byproduct of the harvesting of sawtimber and pulpwood. Forest residue harvesting is an established practice that entails collecting post-harvest residues, pilling, and chipping at a designated loading site, which is a pre-existing practice. The process of loading and transporting forest leftovers employs well-established techniques and conventional logging machinery. Assuming there is a rise in demand for forest residues, it is anticipated that the current forest industry possesses the capacity and expertise to effectively manage the quality of forest residues delivered to a future biomass project.

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

4.1.2 Capacity of Supply Chain Components & Equipment to Scale

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

Risk Information: 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 are the land base, roads, equipment, and labor. Scale-up to meet the demands of a new project had occurred in the BDO Zone historically with the Mehoopany, PA, plant, which had shut down around 1999 and had utilized close to 250,000 bdt/yr of pulpwood (chipped and roundwood) from the region. As a result of the shutdown of the plant and the absence of pulp and paper plants in the region, the BDO Zone experienced a loss of regional markets for low-grade wood. Furthermore, with the growth of the shale gas industry in the region, more supply chain capacity in terms of transportation/loggers has migrated to this industry.

According to the findings from outreach conducted with logging contractors, the infrastructure in the BDO Zone is not as strong as compared to other regions of the state. This is primarily due to the absence of markets for low-grade wood, limited equipment, transportation limitations, and a less developed road network. Nevertheless, there is potential for improvement in the future. A major trucking company suggested scaling up transportation operations in terms of drivers and equipment in response to stable demand. With this in mind, a medium level of risk is attributed to the capacity of supply chain components and equipment to scale up.

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

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Ind. District

Risk Information: The project center point is located in the town of Tunkhannock, situated in the Northern Tier region of Pennsylvania. A project location was chosen within Tunkhannock for the purposes of scoring infrastructure related risk indicators and based on siting criteria related to suitability to host a biofuels project. The chosen location is 12 /22 Mannings Rd., Tunkhannock, Wyoming County, PA, which sits on a 104.2-acre parcel with ample area available to locate a bio-based project. The property is southwest of the intersection of state route 87 and Manning Rd. and 7 miles

northeast of Tunkhannock (see Figures C-8 to C-10). With ample area available on the parcel to locate a bio-based project.

The industrial site is home to an established land clearing operation that also provides timber management, cut-to-length logging, whole tree chipping, mulch, and fuel delivery. The company also uses forest residues from their land clearing activities, as well as sawmill residues obtained from local mills, to produce a variety of goods such as mulch, wood chips, firewood, sawdust, topsoil, and enriched soils. The forest residues gathered during land clearing are processed and stored as inventory on-site. There are also four existing outbuildings on the property. Refer to Figures C-9 and C-10. Collating on the industrial site with an existing business working within the same supply chain offers an opportunity to realize potential synergies.

Wyoming County does not have county-wide zoning. Ten individual municipalities in Wyoming County have adopted their own Zoning Ordinance. Tunkhannock does not have a zoning ordinance. The industrial site falls within the Washington township ordinances and is zoned M1 Manufacturing. M1 Manufacturing zoning aims to provide for manufacturing and other industrial activities as well as for heavy commercial uses such as warehousing, wholesaling, and distribution operations at appropriate locations where they will not conflict with residential, commercial, and farm uses. Maximum building heights range from 35 to 50 feet, depending on whether they are classified as agricultural or other uses, respectfully. This would only be applicable to human occupancy structures. Appendix C Figure C-11 depicts a zoning map of Washington Township, including the industrial site zoning as well as those surrounding parcels. Zoning designations for parcels surrounding the project include M1 manufacturing, C3 heavy commercial, C2 regional commercial, and R2 medium-density residential.

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

5.1.2 Ownership of Land

Risk Information: Both the industrial site and the bulk of the surrounding land parcels are privately owned. To the north of the property, there are multiple private residences, and to the east, a trucking and logistics company (Schneider Resources). To the west of the industrial site, the land is owned by a private resident of the area, whereas to the south, the land is owned by Procter & Gamble. The proximity of properties owned by companies offering services and synergies complementary to the supply chain needs of a biofuels project, such as trucking, logistics, chipping, logging, and residue aggregation, helps to reduce the risk associated with ownership of nearby land.

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

5.1.3 Permitting Description

Risk Information: The commercial development process typically starts with an application to the Washington Township planning department. The application's approval, which includes site plans, may take 3-4 months, along with securing specific permits (such as a Certificate of Use), which may also take another 1-2 months. The application for obtaining a certificate of occupancy, permitting, and commercial development approvals is straightforward for the region and can be found on the Township website: https://washingtontwpwyco.org. The Department of Environmental Protection ("DEP") provides an environmental permitting handbook for applicable environmental permit information and guidance.[48] An environmental permit application would be required where there will be work conducted within a flood zone and for development, which may cause disturbances generally in earth/soil, waterways, and air quality. For an air emissions permit, for example, this would involve a technical review with an expected timeline of at least 180 days and another 30 to 60 days for the issuance of a permit, or 6 – 8 months. This process, depending on the requirements of the project, could roughly encompass 6-12 months or more.

Note that improvements to the DEP's permitting process have been made by adding personnel, cleaning up records, adding e-permitting and e-inspections, improving communications with applicants, and stressing the importance of accurate applications. Furthermore, the Permit Application Consultation Tool (PACT) has been designed to help potential applicants determine which environmental permits, authorizations, or notifications would be needed for specific projects.

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

[48] https://www.dot.state.pa.us/public/pubsforms/Publications/PUB%20783.pdf

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

5.1.4 Environmental Issues

Risk Information: The air quality rating is generally classified as good in the region.[49] A review of historical air quality through the U.S Air Quality Index as reported for the Scranton and Wilkes-Barre region, which Tunkhannock falls within, indicates good daily ozone levels and moderate daily PM2.5. A review of other environmental, habitat, and cultural concerns, such as those related to wildlife, Native Americans, soil, flooding, and stormwater, was conducted, and no relevant concerns were identified.

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

5.2 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: Natural gas in Wyoming County is provided by UGI Utilities. Operating within a deregulated framework, UGI allows customers to actively negotiate their gas rates with approved marketers, ensuring competitive pricing structures. This introduces a level of flexibility for commercial clients. Medium-large-sized commercial operations can expect fixed rates between $0.43-$0.49/Therm/CCF.[50]

UGI Natural Gas Pipeline is located on the southern portion of the property and has no hookup currently. UGL would cover at least the first 20 meters for connecting to the gas service; beyond that, the cost would be roughly $12-$25 per

[49] https://www.iqair.com/us/usa/pennsylvania/tunkhannock
[50] Estimate based on 15% increase over December 2023 fixed rate

linear foot installed.[51] Refer to Appendix C, Figure C-8, for the location of the UGI pipeline on the southern portion of the property.

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

5.2.2 Electric Availability

Risk Information: The electricity sold in Tunkhannock has to be sourced from neighboring cities and rural areas since there are no power production plants in the city. The two main utilities in the county are UGI Utilities and First Energy (Penelec). These entities provide both residential and commercial consumers in the county with reliable electric services. Operating within a deregulated framework, the different utility companies allow customers to actively negotiate their electricity rates with approved marketers, ensuring competitive pricing structures, which introduces a level of flexibility for commercial clients. The following table displays the average electricity rates paid across the three segments of energy consumers in the state compared to local, state, and national averages. The industrial average electricity rate in Wyoming County is 3% less on average than the state rate and 9% less than the national average.[52]

Energy Market	Residential (cents/kwh)	Commercial (cents/kwh)	Industrial (cents/kwh)
Tunkhannock	16.38	13.20	7.43
Pennsylvania	18.43	11.10	7.67
United States	16.21	12.91	8.09

The industrial site has access to three-phase power through an existing connection on the southern portion of the property.

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

[51] https://homeguide.com/costs/gas-line-installation-cost
[52] https://findenergy.com/pa/wyoming-county-electricity/ Note that averages were taken from the period ending in Sept /2023

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

5.2.3 Water Availability

Risk Information: There are 30 water systems in Wyoming County that provide potable water and wastewater services. The two largest water systems in terms of people served are the Tunkhannock Borough Municipal Authority, which serves 2,440 people, and the Washington Township Sewer/Water Authority, which serves 500 people.[53] A review of current and historical EPA testing on both water systems shows a consistent track record of clean, potable water. The Washington Township Sewer/Water Authority rules and regulations require the regular inspection of backflow preventors on all non-residential connections to the public system. The Tunkhannock Borough Municipal Authority (TBMA) supplies water and wastewater services to Tunkhannock Borough.

The industrial site has access to fresh water supply sourced from a well on site located in the southern portion of the property. As for drainage and stormwater management, there are no FEMA floodplains onsite. Stormwater for new development must meet National Pollutant Discharge Elimination System (NPDES) Permit requirements for post-construction stormwater management, which will also satisfy local ordinances. A septic system is located onsite in the southern portion of the property.

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

5.2.4 Waste Disposal

Risk Information: The major landfills managing waste streams in Wyoming County were Keystone Sanitary Landfill, with which Wyoming County had a capacity agreement, and Commonwealth Environmental in Schuylkill County, which was

[53] https://www.nytimes.com/interactive/projects/toxic-waters/contaminants/pa/wyoming/index.html

used as a backup. Other regional landfills that have reported receiving volumes of waste from Wyoming County include Alliance Sanitary Landfill and Bradford County Sanitary Landfill.

- **Keystone Sanitary Landfill (30 miles from the center point):** Located at Dunham Drive, Dunmore, PA, in Lackawanna County. Keystone is owned and operated by Keystone Quarry Inc. and receives waste from up to 14 Pennsylvania counties, which varies slightly depending on the year. The landfill receives more waste originating in Lackawanna and Luzerne, than in other Pennsylvania counties. Wyoming County transporters delivered 5,170 tons to Keystone in 2016 or 35 percent of the County municipal waste. Overall, Wyoming County's municipal waste accounts for less than one percent of all the waste disposed of at Keystone annually.
- **Alliance Sanitary Landfill (22 miles from the center point):** Located at 398 S Keyser Ave. in Taylor, PA, Lackawanna County. Managed by Waste Management, the site receives municipal waste and residual waste from up to 11 Pennsylvania counties, as well as from Maryland, Connecticut, New Jersey, and New York.
- **Bradford County Sanitary Landfill (50 miles from the center point):** Located at 108 Steam Hollow, West Burlington, PA, in Bradford County. The Northern Tier Solid Waste Authority owns and operates the Bradford County Landfill. The landfill is located in West Burlington Township, Bradford County. The landfill receives waste from up to 6 counties, but primarily Bradford and Tioga. The site reported no out-of-state waste in 2016.

The average tipping fee for landfills in 2020 in PA was $73.45 (± 15.23).[54] A state-imposed surcharge is also added to the existing tipping fee to fund state and municipal recycling and local land conservation programs, which equates to a $6.25-per-ton surcharge. This surcharge is comprised of the Act 101 recycling fee ($2.00/ton), Act 68 environmental stewardship fee ($0.25/ton), and Act 90 disposal fee ($4.00/ton).

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

5.2.5 Internet Availability

Risk Information: Wyoming County's broadband and telecommunications services are provided by multiple companies, including Xfinity, Verizon, Frontier, HughesNet, Viasat, T-Mobile, and Frontier. These providers offer regionally competitive packages for internet, cloud accessible services, and 5G network cellular coverage; however, the internet speeds are in the 50 mbps range within the proximity of the industrial site location. Options such as Starlink can be explored that have better speeds, however are more expensive. Note that for wireless coverage, T-Mobile has the best

[54] https://assets.website-files.com/602b605a94315c491a4fb4b8/610aed49f0ef85f4566dbe3f_Tipping-Fees-Data-Summary%20Jan%202021.pdf

speed and coverage in Wyoming County. T-Mobile has fixed wireless that covers 99.48% of the county offering average speeds of 52 Mbps. Cell service of any type reaches 99.42% of Wyoming County homes.[55]	
Raw Risk Likelihood (RRL) The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: Road and Highway Access from the industrial site is through State Route 87, a 2-lane highway not posted or bonded north of the industrial site that runs east/west and connects to U.S. Route 6. U.S. Route 6 is the principal east-west roadway in Wyoming County, connecting Bradford County to the west and 1-81 and I-476 (PA Turnpike) to the east. The distance from Tunkhannock to a major interstate exchange, I-81, is approximately 18 miles east. I-81 connects southward to Interstate 80, which runs across the whole U.S. Distance from industrial site to Tunkhannock 7 miles or close to 10 min. The distance from the industrial site to other major cities can be seen in Appendix C Table C-4. Figure C-3 provides an overview of major highways within the BDO Zone.

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

[55] https://bestneighborhood.org/tv-and-internet-wyoming-county-pa/#availability

5.3.2 Rail Access

Risk Information: The main rail line is owned by Norfolk-Southern and runs parallel to the Susquehanna River from upstate New York to the Scranton/Wilkes-Barre area (~32 miles from the industrial site). Portions from Athens south to Mehoopany are operated by the Lehigh Valley line, and portions south of Mehoopany are operated by the Reading, Blue Mountain, and Northern Railroads.

The Canadian Pacific Railroad operates a north-south rail line that runs from Binghamton to Nicholson to Scranton, which has since been acquired by Norfolk-Southern (~25 miles from industrial site). The Lehigh Railway is a short-line railroad in Wyoming County and Bradford County, Pennsylvania, connecting to Reading Blue Mountain, the Northern Railroad, and Norfolk Southern. The railway operates 56 miles of track along the Susquehanna River (~5 miles from the industrial site). The railroad carries major commodities like drilling supplies, frack sand, chemicals, building products, and agricultural products. Reading & Northern has a transload facility in Tunkhannock, which is 8 miles from the industrial site and handles material for Marcellus natural gas projects and other transload businesses. The Meshoppen Station is privately owned and located at Loomis Lane at US-6 (5.4 miles from the industrial site). The station is a combination of passenger and freight. The station is 5 miles and 8 minutes' drive time from the industrial site. For locations and maps of existing rail lines and infrastructure within the BDO Zone, see Figures C-4 and Figure C-12.

With multiple rail lines within relatively close proximity to the industrial site that offer freight services including a transload facility situated 8-miles from the industrial site in Tunkhannock, there is good rail access potential.

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

5.3.3 Airport Access

Risk Information: Skyhaven Airport is a local privately owned small airport open to the public with a 1,975 ft. runway. The airport is located in Wyoming County, one nautical mile (1.85 km) south of the central business district of Tunkhannock. Regional airports include Wilkes-Barre/Scranton International Airport in Pittston County, which is about 25 miles and a 40-minute drive time from Tunkhannock. The airport has close to 11,800 ft. of track across 2 runways, 38 based aircraft, and services more than 300,000 passengers annually.[56] The Lehigh Valley International Airport in Allentown, PA, is 90 miles from Tunkhannock and about 1 hour 40 min drive time. The airport has 13,500 ft of track

[56] https://www.gcr1.com/5010ReportRouter/AVP.pdf

across 2 runways, a passenger volume of over 900,000 annually, and a cargo volume of close to 2.5 million lbs. annually.[57] Another regional airport is Elmira/Corning Regional Airport which is based in NY state. The airport has 15,400 ft of track across 3 runways and 33 based aircraft. The airport is located 85 miles from Tunkhannock with a drivetime of 1 hour 40 min.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10. **6**
Raw Risk Impact (RRI) **Score** The risk impact is deemed *medium*, therefore the RRI is 6 out of 10. **6**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100. **36**

5.3.4 Water Freight Access

Risk Information: There are no major water freight access ports within economic proximity to Tunkhannock, PA. with the bulk of shipping options via Atlantic ports and Lake Erie being more than 150 miles away.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed *low*, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100. **16**

[57] https://www.gcr1.com/5010ReportRouter/ABE.pdf

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: Tyler Memorial Hospital in Tunkhannock, Virginia, is a 48-bed hospital that discontinued inpatient and surgical care in 2001, and ER services in 2022. In 2023, a local business owner purchased the hospital and is working on reopening it. Plans for the hospital include offering a range of services such as urgent care, onsite lab collection, dialysis, x-ray, and imaging services, a primary care office, as well as space for ambulance services and the community health foundation. In the meantime, patients requiring specialized treatment are referred to one of Commonwealth Health's larger hospitals in Scranton or Wilkes-Barre.

The Regional Hospital of Scranton is a 186-bed acute care hospital with one emergency room. It is well known for its services in orthopedics, robotic surgery, cardiac care, stroke care, and neurology. The hospital is located approximately 25 miles (~35 min drive time) from Tunkhannock.

The Wilkes-Barre General Hospital is the largest community hospital in Northeastern Pennsylvania, with 369 beds and a medical staff of over 400 physicians who cover nearly 60 medical and surgical specialties. The hospital is located approximately 26 miles (40 min drive time) away from Tunkhannock.

In addition to the hospitals in the region, there are fourteen physician offices, eight dental offices, three chiropractic offices, three optometrist offices, and one podiatrist office.[58]

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

5.4.2 Education (Schools)

Risk Information: In 2021, universities in Pennsylvania awarded 193,498 degrees, whereas in Wyoming County, a total of 252 degrees were awarded by universities. Keystone College stands out as the largest university in Wyoming County. The student population of Pennsylvania in 2021 was comprised of 283,633 male students and 387,170 female students. The average tuition cost in Wyoming County, PA, for private four-year colleges is $14,800 which is substantially lower than the average for the state of $36,811.59 For the period 2018-2022, the percentage of individuals aged 25 or older

[58] http://www.northerntier.org/upload
[59] https://datausa.io/profile/geo/wyoming-county-pa

with a bachelor's degree or higher was 21.5%. Of individuals aged 25 or older during the same period, 92.8% had obtained a high school degree or higher.[60]

The Tunkhannock Area School District holds the distinction of being the largest school district in Bradford, Susquehanna, Sullivan, and Wyoming counties. The Tunkhannock Area School District has a student enrollment of around 3,100. The district consists of four elementary buildings for grades K-4, a middle school for grades 5-8, and a high school for grades 9-12. The four elementary centers can be found in Evans Falls, Mill City, Mehoopany, and Tunkhannock, while both the middle and high schools are situated in Tunkhannock. The Lackawanna Trail School District is home to two school facilities. The Lackawanna Trail Elementary Center is a state-of-the-art facility catering to students from kindergarten through sixth grade. Additionally, Lackawanna Trail Junior/Senior High provides education from for seventh through 12th grade students.

Keystone College is a fully accredited, independent, private college that currently serves 1,700 students. It offers 32 associate and baccalaureate degrees, as well as a variety of certificates. Lackawanna College has multiple locations in northeastern and central Pennsylvania, including one in Tunkhannock. The Tunkhannock location for Lackawanna College, provides students with a range of resources, including dedicated classroom space and a computer lab, in addition to both associate degree and certificate programs.

Several other colleges are located within commuting distance from many portions of Wyoming County, some of which (including drive distance from and drive time from Tunkhannock) are: University of Scranton (25 miles and 35 min), Penn State University campuses: Hazelton (60 miles and 1 hr.), Wilkes-Barre (25 miles and 45 min) and Scranton (25 miles and 35 min), Marywood University (25 miles and 40 min), and Wilkes University (30 miles and 45 min).

In terms of workforce training and education in the forestry industry, our outreach found that the bulk of training has traditionally been passed down generationally and learned on the job. That said, Pennsylvania offers a variety of educational programs related to forestry and ecosystem management. These programs cater to different educational needs and career aspirations in forestry and related fields, albeit with varying proximity to Tunkhannock. Penn State Mont Alto offers an Associate in Science degree program in forest technology, focusing on fieldwork, tree care, and wildlife management. Penn State University Park offers undergraduate and graduate programs in ecosystem science and management, focusing on conservation and management across different ecosystems. Penn State Extension provides forest management and forestry business programs tailored to various communities, while Pennsylvania College of Technology offers an Associate of Applied Science Degree in Forest Technology. The PA Sustainable Forestry Initiative provides training for timber harvesters, loggers, and landowners. Somerset County Technology Centre offers a comprehensive forestry program covering measurement, surveying, mechanics, dendrology, wildlife management, and forest products.

Outreach with sawmills and other stakeholders in the forestry sector within the BDO Zone has revealed a consensus: there exists a notable demand for enhanced technical training initiatives, especially those geared towards workforce safety. This sentiment underscores a prevailing gap in locally available training opportunities, highlighting an opportunity for targeted interventions to address critical safety concerns within the industry.

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**

[60] https://www.census.gov/quickfacts/fact/table/wyomingcountypennsylvania/SBO020217

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

5.4.3 Local Transportation

Risk Information: Susquehanna-Wyoming County Transportation (SWCT) is a shared-ride transportation service sponsored by the Pennsylvania Department of Human Services, PENNDOT, and other funding sources. They offer demand-responsive transportation, which is available to the general public and operates on a non-fixed route basis. The Office for the Aging provides transportation to medical appointments within Wyoming County for individuals aged 60 and over. There are no commuter trains running through Tunkhannock. Larger commercial bus lines such as Greyhound, Martz, and Flixbus, as well as several local and regional bus lines, have depots in nearby Scranton (25 miles and 40 min drive time) and Walkes Barre (27 miles and 42 min drive time). Based on our review, there are no bus depots located in Tunkhannock. Private transportation is available through multiple taxi services or on-demand ride-sharing services. There are several bicycle routes and trails throughout the community and region.

While Tunkhannock lacks direct access to larger commercial bus lines and commuter train lines, this is indicative of similar low-density rural areas throughout the state and the country in general. As such, we rate local transportation as having moderate 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 × RRI) is 36 out of 100.	**36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

5.4.4 Public Safety (Local)

Risk Information: The Wyoming County courthouse, correctional facility, and sheriff's office are all located in Tunkhannock, PA. The Tunkhannock Borough Police Department offers law enforcement services to Tunkhannock, while

the Pennsylvania State Police, stationed in Tunkhannock, provides protection to Wyoming County. Fire protection and emergency response services are offered by the 10 Fire and Emergency Medical Service (EMS) departments, which include two stations situated in Tunkhannock. The Pennsylvania Department of Conservation and Natural Resources (DCNR) is responsible for overseeing search-and-rescue operations in state forest and state park properties.

Washington Township and Meshoppen Township have a shared arrangement for fire, police, and ambulance services.

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

5.4.5 Housing/Cost of Living

Risk Information: According to the latest census data from 2021, the population of Wyoming County stands at approximately 26,073, with a total of 12,865 units.[61] Of all the units that are currently occupied, the majority, 77.4%, are owned by their occupants. The remaining 22.6% are rented out, with a median rent of $876.[61] The median value of mortgaged homes is currently $194,700.[61] Typically, the monthly housing expenses for residents of Wyoming County amount to around $590.[61] According to 2017 U.S Census data, 35% of Wyoming renters and 40% of those statewide are paying 35% or more of household income on rent, which reflects the percentage of county renters who are challenged by housing affordability.[62] The living wage is the hourly rate that an individual in a household must earn to support his or herself and their family for one adult. In Wyoming County, for a single adult, it is $15.16 per hour, whereas for two adults and a child, it is $31.36 per hour.[63]

Tunkhannock, on the other hand, has a total of 858 units and a population of roughly 1,759 as of the 2021 census data. Out of the occupied units, owner-occupied properties account for 56% (versus Wyoming County at 77.4%), while the balance of 44% is rented.[63] The median gross rent is 27% lower in Tunkhannock at $876 than in Pennsylvania, where it is $1,116.5. Close to 61% of these homes are financed through mortgages, with the median value of mortgaged homes standing at $167,000.[64]

The Wyoming County Housing & Re-Development Authority (WCHRA) owns and manages housing for low-income residents at affordable rents. The U.S. Department of Housing and Urban Development (HUD) is in charge of overseeing

[61] https://www.census.gov/quickfacts/fact/table/wyomingcountypennsylvania/SBO02021
[62] wyoming-county-profile-report-2019
[63] https://livingwage.mit.edu/counties/42131
[64] https://datausa.io/profile/geo/tunkhannock-pa

the federally funded Public Housing (PH) program, which offers rental assistance to qualified low-income families, the elderly, and people with disabilities.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

5.5 Risk Factor: Labor

5.5.1 Workforce

Risk Information: As of November 2023, Wyoming County had a labor force of 13,800, with a 3.9% unemployment rate compared to Pennsylvania's unemployment rate of 3.4%.[65] Roughly 13,713 residents commute for work in Wyoming and live in the county. According to the Pennsylvania Department of Labor and Industry, Wyoming County is one of three counties in the Scranton, Wilkes-Barre, and Hazleton Metropolitan Statistical Area (MSA) and has an unemployment rate of 4.1%.[65] The region has access to a skilled, diverse, and highly productive workforce. The Wyoming County workforce does make minor commutes for employment, with a 26.2 min average commute time.[66] As of Q2 2023, the five largest employers in Wyoming County were (starting with the largest): The Procter & Gamble Paper Products Co, Exel Inc, Tunkhannock Area School District, Wal-Mart Associates Inc, and Williams WPC-I Inc.[67]

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

[65] https://www.workstats.dli.pa.gov/
[66] https://datausa.io/profile/
[67] https://www.workstats.dli.pa.gov/Documents

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

5.5.2 Labor Costs

Risk Information: Wyoming County's labor force has a median age of 45.3 with females making up 53%.[67] The average household income is $67,968, with a per capita income in the last 12 months (2022 dollars) of $36,533.[68] Roughly 92.8% of people 25 years or older have graduated high school or higher, whereas only 21.5% possess a Bachelor's degree or higher.[68] From 2020 to 2021, employment in Wyoming County declined at a rate of -3.52%, from 12.6k employees to 12.1k employees. The most common employment sectors for those who live in Wyoming County, PA, are Manufacturing (1,639 people), Retail Trade (1,538 people), and Health Care & Social Assistance (1,476 people).[68]

Comparatively, Tunkhannock has a median age of 51.9 which is 20% higher than Wyoming County (45.3) and close to 25% higher than Pennsylvania (40.8).[69] The median household income for Tunkhannock is $78,036 which is 20% higher than Wyoming County, 10% higher than the state, and 28% more than the national median income. However, the per capita income in the last 12 months (2022 dollars) of $34,870 represents close to 85% of the state's figure.[69] At the close of 2023, Pennsylvania had yet to increase its minimum wage above the federal minimum wage.

As can be seen in Appendix C Figure C-14, there is an increasing number of the population in the 45-64 years age group (approaching retirement, social security eligibility, and older age), with a slightly less pronounced change for the 25-34 age groups (potentially working, contributing to the tax base, buying homes, and/or starting families).[70] This alludes to a growing concern across the forestry industry, in particular, where there is an increasingly aging workforce and a trend of fewer new entrants into the industry to fill in the gaps.

Based on the outreach conducted, one of the more important issues facing the logging industry in Pennsylvania is worker compensation and safety issues. Pennsylvania's rates are among the highest in the country. Many loggers work alone to avoid these high costs, but this also increases the risk of death or injury. The logging industry has a fatal work injury rate of 133 per 100,000 full-time equivalent workers. AmeriSafe reports that an average of one logger is killed every week, while 10 suffer major permanent or partial disabilities and nine suffer minor disabilities. Similar states, like New York, have successfully reduced workers' compensation costs through regulatory requirements and safety training.

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

[68] https://www.census.gov
[69] https://censusreporter.org/profiles/06000US4213177792-tunkhannock-township-wyoming-county-pa/
[70]https://aese.psu.edu/research/centers/cecd/publications

Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 64 out of 100.	**36**

APPENDIX C: TABLES AND FIGURES

Table C-1. Costs (US$) related to the machinery used for harvesting and skid trail establishment.[71]

Element	Felling	Extraction	Processing	Sorting and loading
Make and model	John Deere 753G, 2008	John Deere 748H, 2011	John Deere 200 LC, 2004	Serco 300, 2008
Purchase price ($)	$275 000	$320 000	$345 000	$200 000
Variable and operating cost ($)	$37	$53	$77	$28
Salvage value ($)	52 250	73 600	34 500	50 000
Labor cost ($ PMH−1)	$43	$43	$35	$40
Fuel use (L PMH−1)	18.93	22.71	22.71	22.71
Utilization (%)	70%	65%	80%	80%
Machine rate ($ PMH−1)	$130	$160	$175	$103

Fuel cost was set at $0.72 L−1 as per the market conditions during harvest time. Machine rates $ PMH−1 were calculated based on 2200 SMH/year, 10 percent interest, and 3 percent insurance (provided by the company that operated and owned the machines). Same machines and operators were employed for both Hyb TL and WT treatments

[71] https://academic.oup.com/forestry/article/93/3/389/5715926

Table C-2. Sawmill Residual Production in BDO Zone

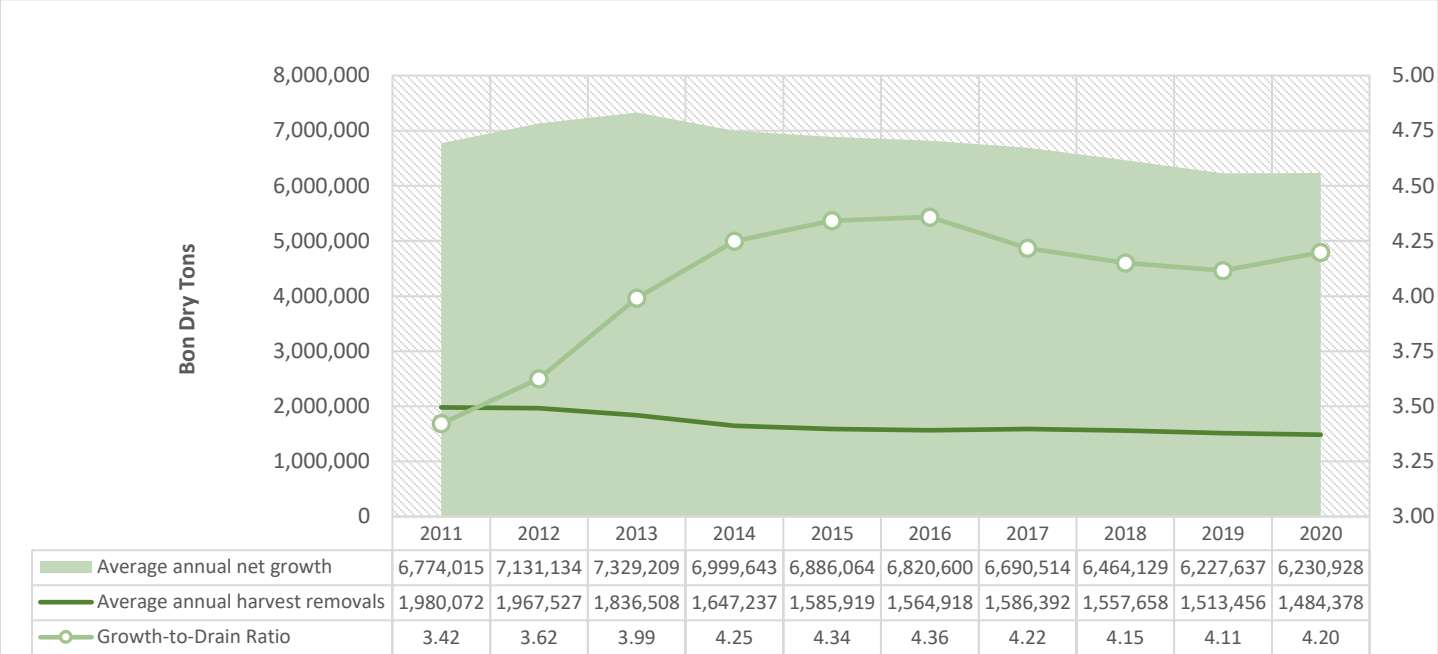
	City/State	Drive distance from Center Point (Miles)	Current Capacity (MMBF)	Fiber Demand (bdt)	Total Sawmill Residues (bdt/yr)
Sawmill #1	Callicoon, NY	3	10	34,965	11,681
Sawmill #2	Tunkhannock, PA	53	15	52,448	17,452
Sawmill #3	Candor, NY	54	17	59,441	19,779
Sawmill #4	Hillsgrove, NY	54	6	20,979	6,982
Sawmill #5	Honesdale, PA	57	5	17,483	5,817
Sawmill #6	Cortland, PA	60	18	87,413	21,467
Sawmill #7	Troy, PA	61	10	34,965	11,681
Sawmill #8	Honesdale, PA	63	5	17,483	5,817
Sawmill #9	Beach Lake, PA	67	8	27,972	9,308
Sawmill #10	Owego, NY	75	39	136,364	45,377
Sawmill #11	Nineveh, NY	85	14	48,951	16,289
		Total[72]	**147**	**538,000**	**172,000**

- 11 sawmills identified falling within <75 miles of project center point (Tunkhannock, PA)
- These data were calculated using an Ecostrat internal model, which estimates production of each residue based on the total mill capacity.

[72] Totals for fiber demand and sawmill residue rounded to nearest 1,000

Figure C-1 provides trends in annual average net growth and average harvest removals in the BDO Zone for all timber types. These data include pulpwood and sawtimber. In addition, this figure also provides the ratio of growth to harvest, also known as the growth-to-drain ratio.

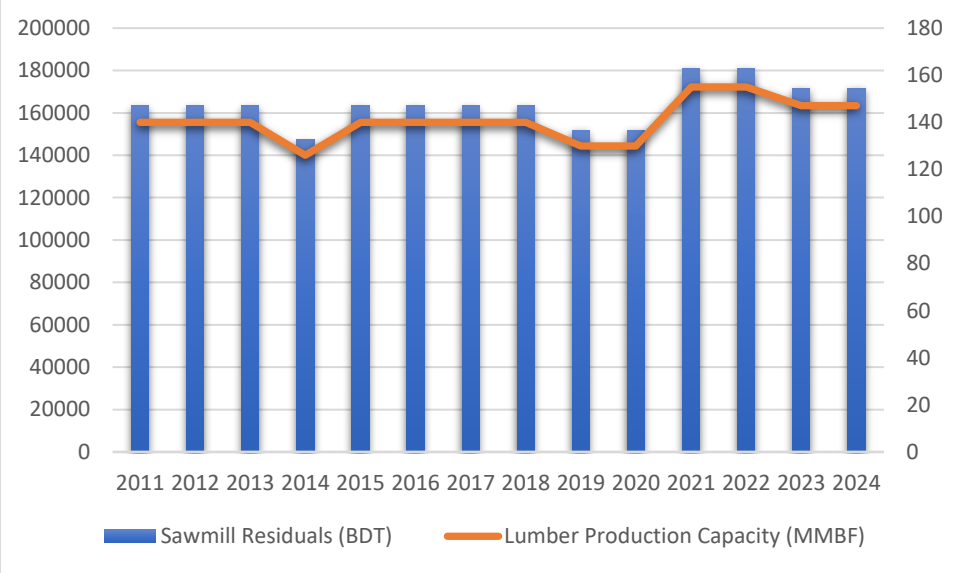
Figure C-1. Total Wood: Average Annual Net Growth and Harvest Removals in Supply Zone



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average annual net growth	6,774,015	7,131,134	7,329,209	6,999,643	6,886,064	6,820,600	6,690,514	6,464,129	6,227,637	6,230,928
Average annual harvest removals	1,980,072	1,967,527	1,836,508	1,647,237	1,585,919	1,564,918	1,586,392	1,557,658	1,513,456	1,484,378
Growth-to-Drain Ratio	3.42	3.62	3.99	4.25	4.34	4.36	4.22	4.15	4.11	4.20

- The growth-to-drain ratio for total wood had an average of 3.68 from 2011-2013 with average growth increasing over this period and was 4.23 from 2014-2020 without large variations
- Total wood removals decreased steadily between 2011 and 2020
- Excess total wood in the BDO Zone averaged approximately 6.755 million bdt annually between 2011 and 2020

Figure C-2. Supply Zone: Production of Sawmill Residues Vs. Production Capacity



Although there were mill closures during the period of 2011 – 2024, capacity increases at existing mills drove a 5% increase in the production of sawmill residues from 2011 to 2024.

Table C-3. Distance-Based Consumption for Competitors within BDO Zone

Industry	Competition overlap adjustment	Current Capacity	Consumption BDT/Yr	Distance Adjusted Consumption (BDT/yr)
Pellet Plant	0%	7000 MMBF	7,260	
Pellet Plant	44%	70,000 M Tons	77,000	33,880
OSB/Plywood	33%	10 MMSF	10,000	3,300
Pellet Plant	0%	125,000 M Tons	137,500	
Pellet Plant	4%	5,000 M Tons	5,500	220
Pellet Plant	0%	1,000 M Tons	1,150	
Pellet Plant	49%	85,000 M Tons	107,500	53,105
Pellet Plant	0%	77,000 M Tons	84,700	
Pellet Plant	2%	49,000 M Tons	53,680	1,074
Pellet Plant	0%	50,000 M Tons	55,000	
MDF Door Skins	62%	137 MMSF	109,500	67,890
		Total Demand	**649,000**[73]	**159,500**[74]

- The four largest competitors make up close to 68% of the total consumption however, when applying distance adjusted consumption, represent 76% of total consumption within the BDO Zone.
- Of the identified competitors representing more than 50% of the consumption, are located outside the BDO Zone and more than 100 miles from the project center point
- The average distance of competitors to the center point for those that impact the BDO Zone is 61 miles.

[73] Rounded to nearest 1,000
[74] Rounded to nearest 100

Figure C-3. BDO Zone – Infrastructure: Major Highways

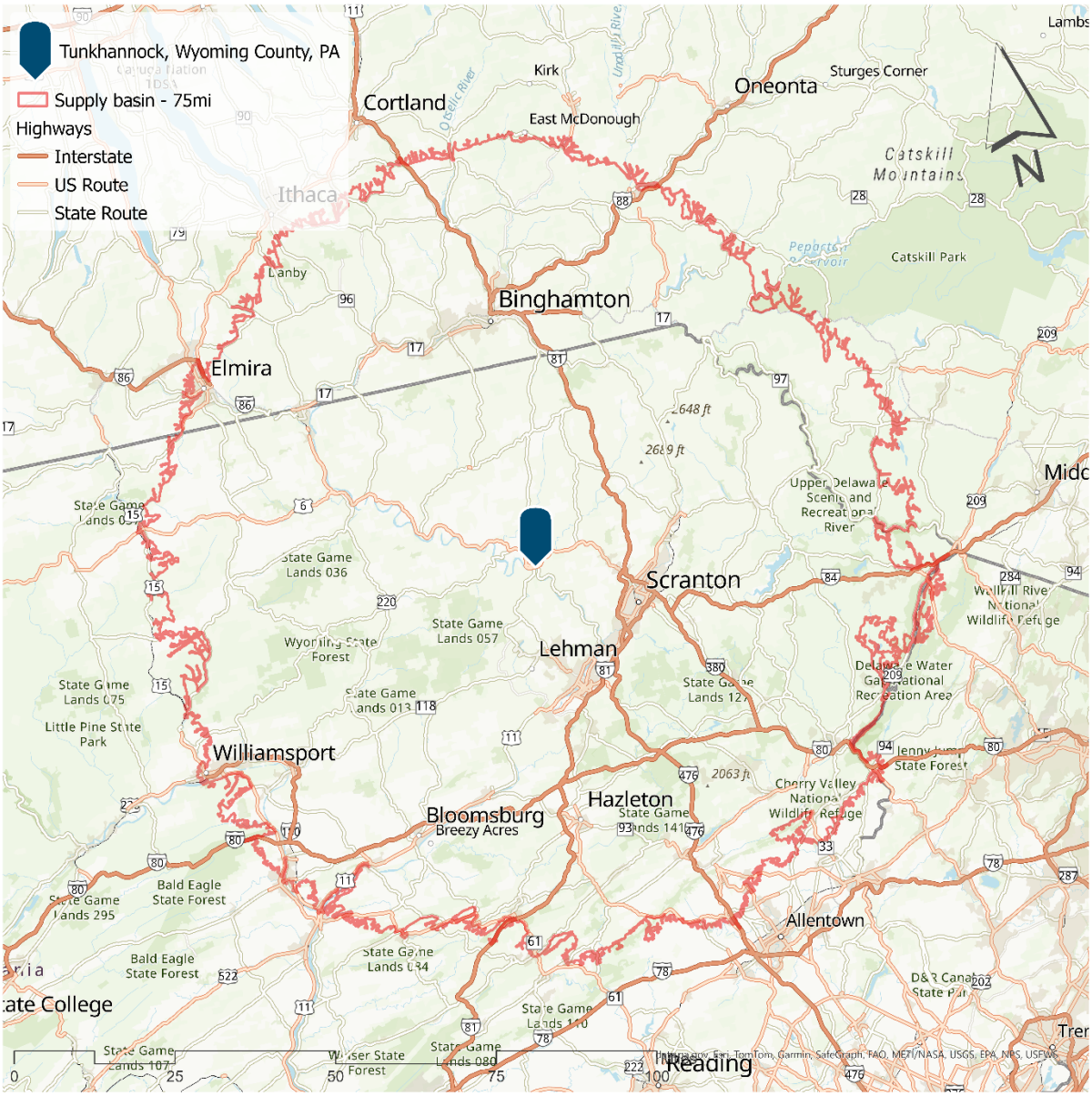


Figure C-4. BDO Zone – Infrastructure: Rail, Air, and Sea

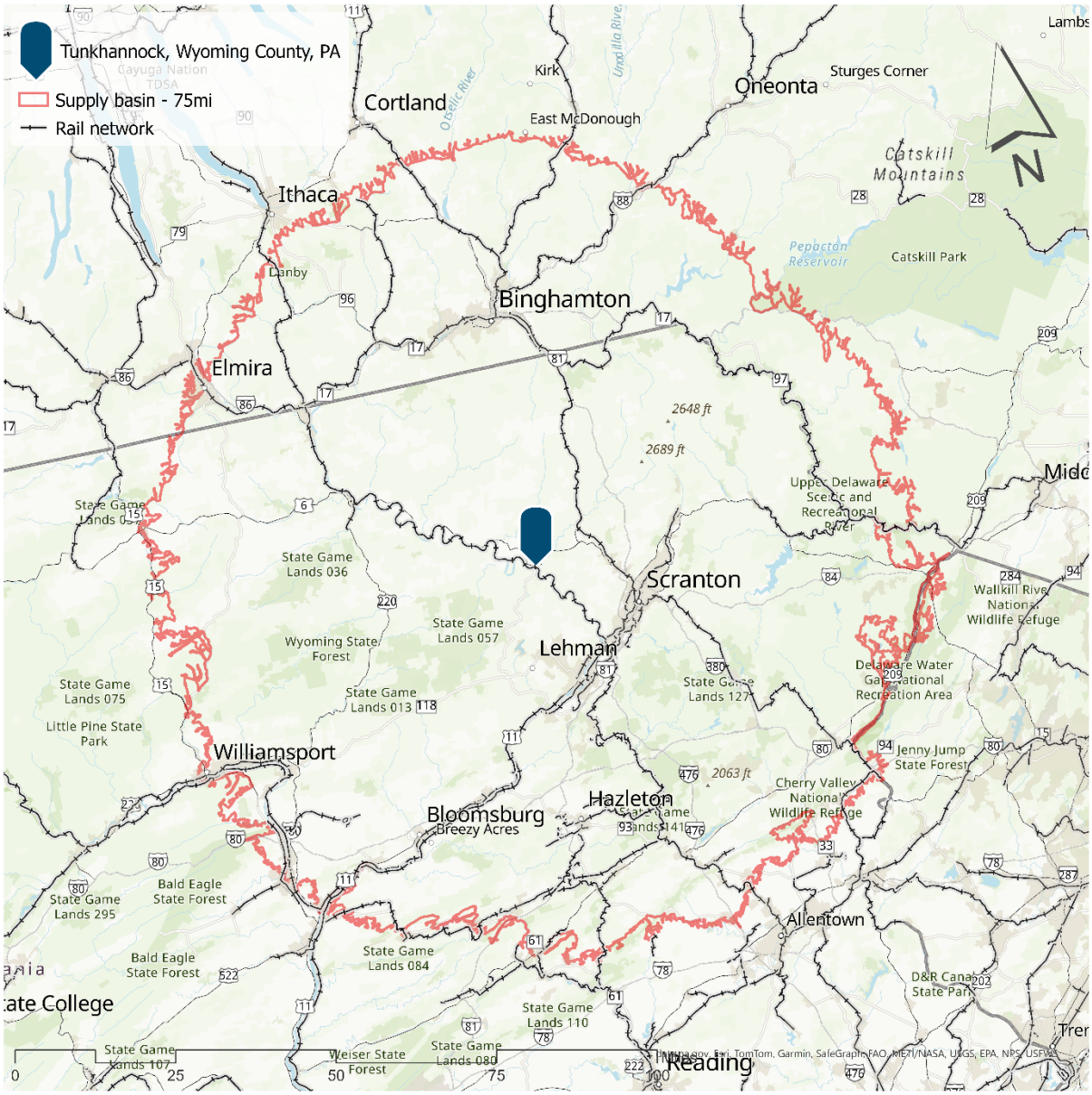
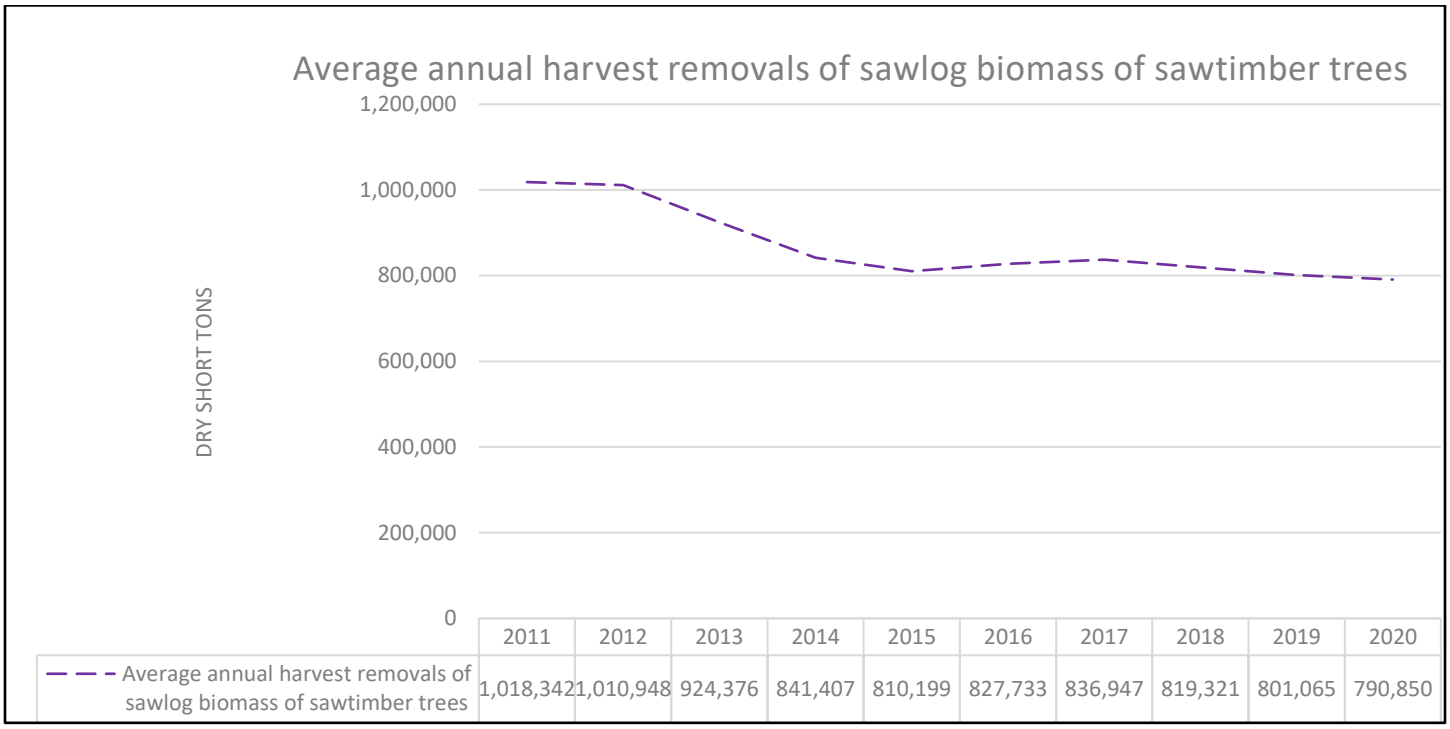


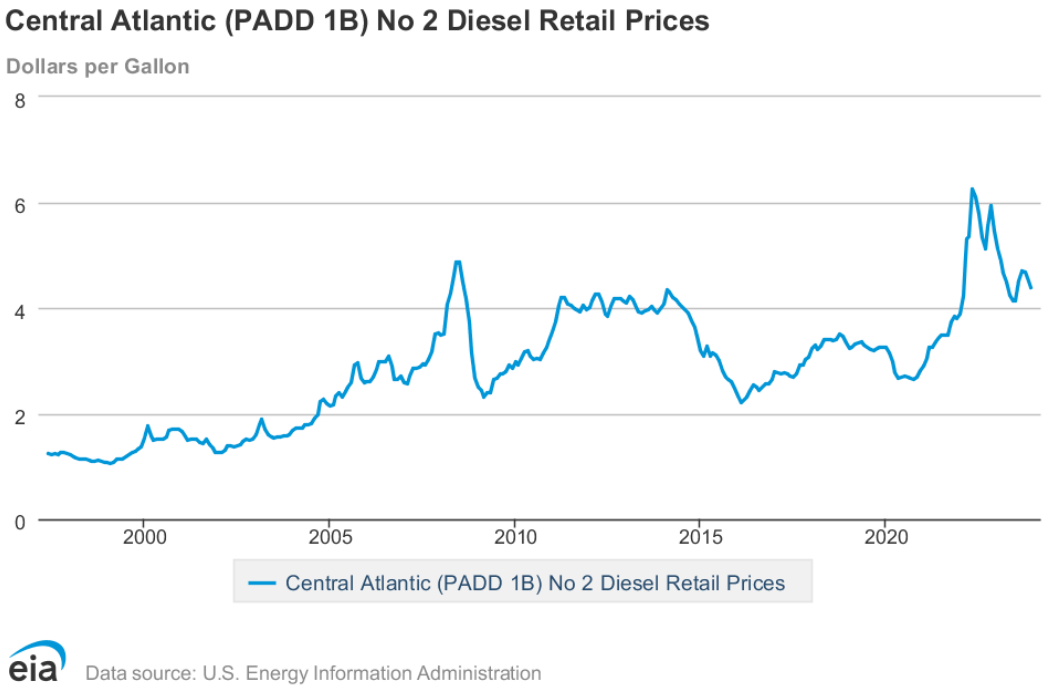
Figure C-5. Sawtimber - Average Annual Harvest Removals in BDO Zone



- Between 2014 and 2020 there have been steady sawlog removals.
- The increase in sawtimber removals over this period is approximately 40%.
- The fluctuations during this period reflect the effects of a depressed U.S. housing market during this period as well as an overall reduced pulpwood production year over year in the eastern U.S. from 2012 to 2017.[75]

[75] https://www.srs.fs.usda.gov/pubs/rb/rb_srs231.pdf

Figure C-6. 10 yr Retail Price Diesel Central-Atlantic[76]

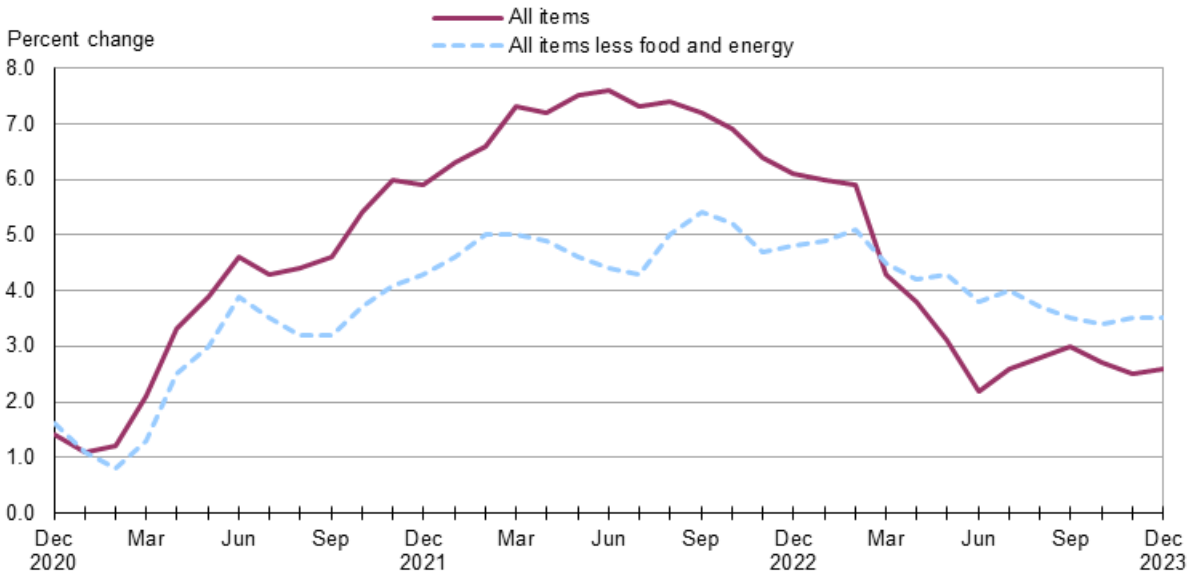


- Retail diesel prices for the US Central-Atlantic tracked very closely to the national average.
- US Central-Atlantic retail diesel prices ranged from $1.067/gal to $6.262/gal over the past 20 years.
- Retail diesel prices have experienced volatility over the past 20 year and reached an all-time high at the end of 2022 at a price of $6.26 which represents an almost 5x increase over the 1999 price of $1.07

[76] US Energy Information Administration. https://www.eia.gov/ Accessed Nov 29, 2023.

Consumer Price Index (CPI) for the past three years for the US Central Atlantic is presented in Figure C-7.

Figure C-7. Consumer Price Index – Pennsylvania, Northeastern Region[77]



- The rate of inflation increased between Oct 2020 to Jun 2022
- Inflation has been steadily falling from Jun 2022 to the present

[77] US Bureau of Labor Statistics. https://www.bls.gov/. Accessed Nov 29, 2023.

Figure C-8. Industrial Site - Parcel Location and Infrastructure

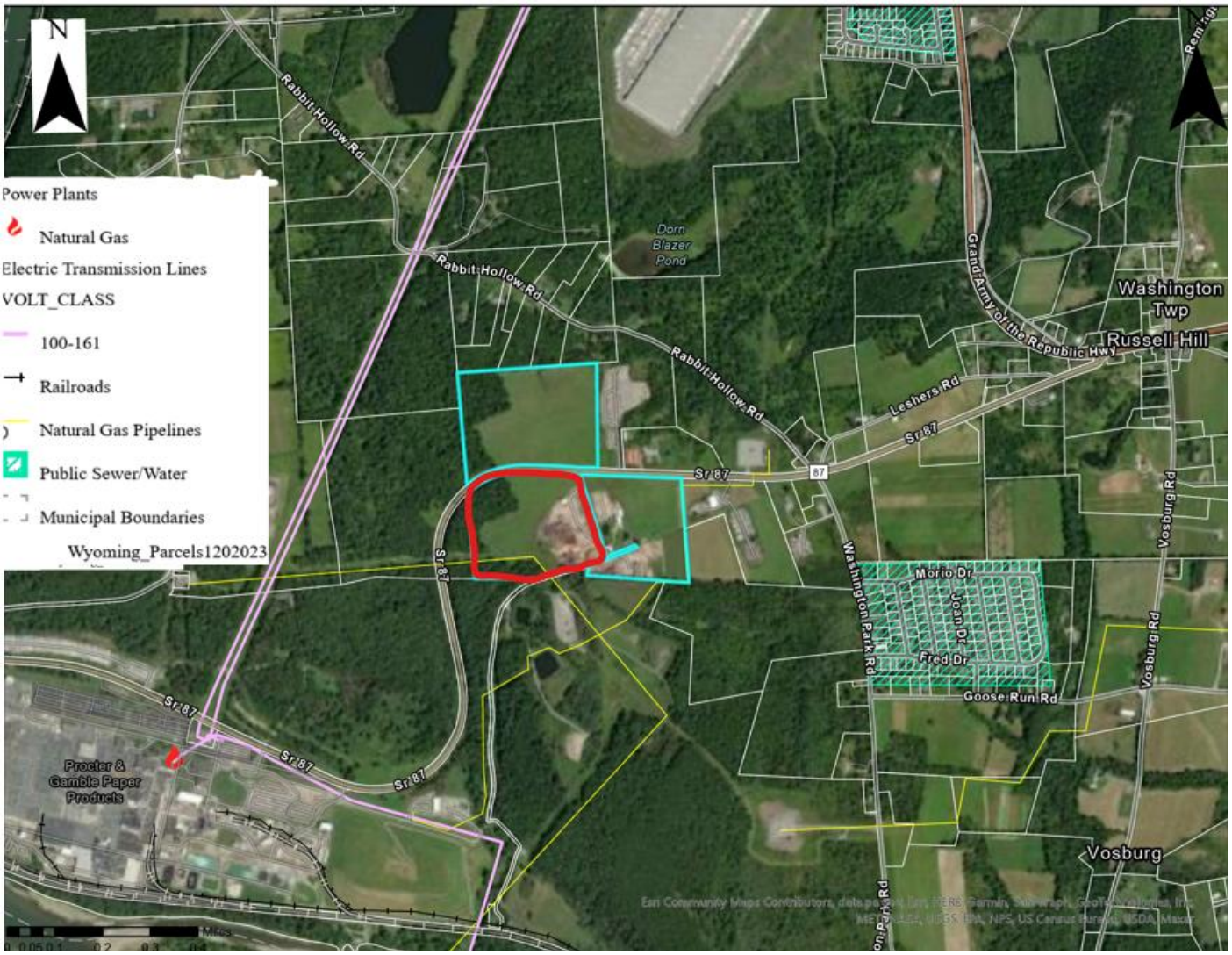


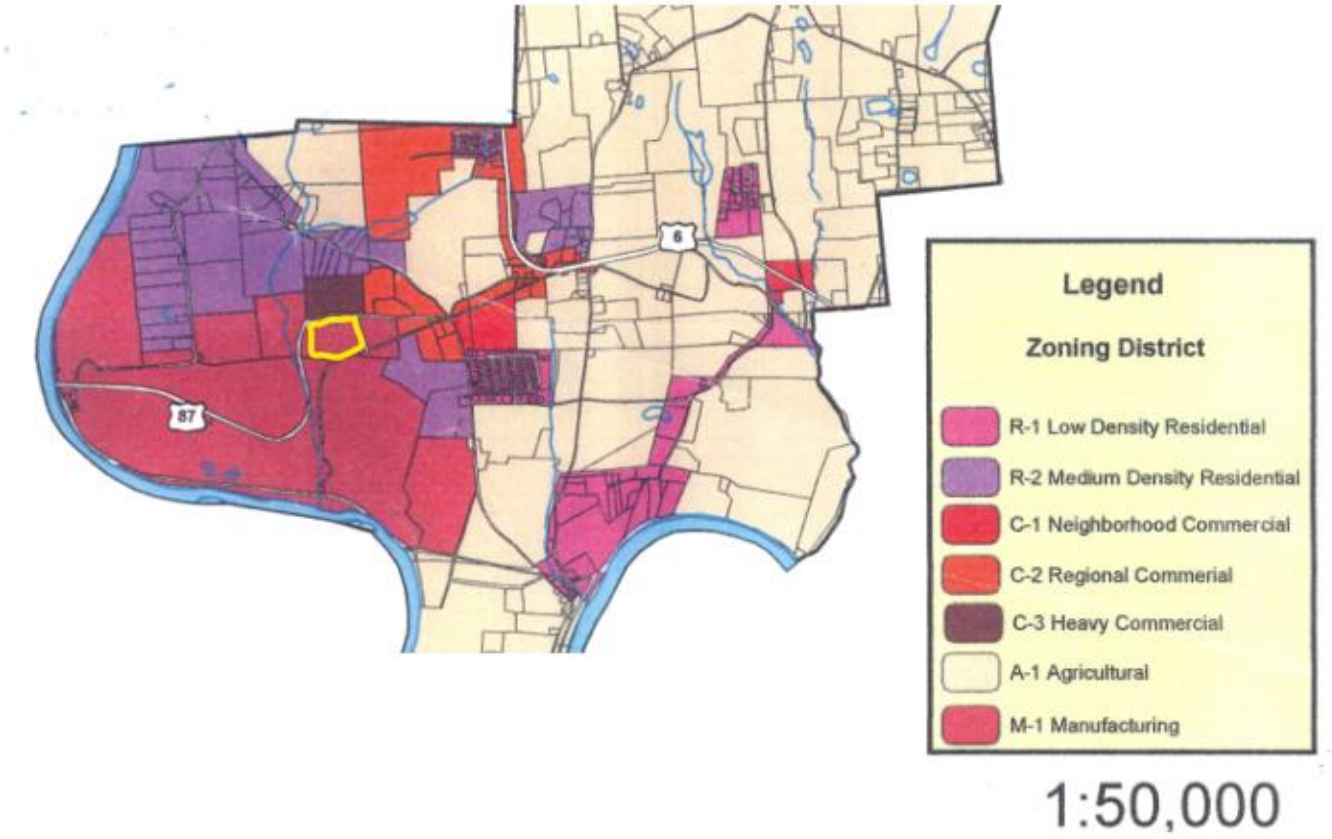
Figure C-9. Industrial Site Location - Street View



Figure C-10. Industrial Site Location – Aerial Map View



Figure C-11. Industrial Site - Washington Township Zoning Ordinance Map



- South/Southwest/West/East - M1 manufacturing
- North/Northeast – C3 heavy commercial and C2 regional commercial
- Northwest -R2 medium density residential
- East – R2 medium density residential

Table C-4. Major Cities distance from Tunkhannock

Length of Transit (from Tunkhannock to)		
City	**Miles**	**Estimated Travel Time**
Baltimore, MD	213	3 hours, 32 minutes
Boston, MA	314	5 hours, 13 minutes
Buffalo, NY	216	4 hours
Chicago, IL	691	10 hours, 38 minutes
Cleveland, OH	365	5 hours, 50 minutes
Detroit, MI	516	8 hours, 2 minutes
Indianapolis, IN	636	9 hours, 49 minutes
New York, NY	142	2 hours, 43 minutes
Philadelphia, PA	137	2 hours, 32 minutes
Pittsburgh, PA	271	4 hours, 50 minutes
Toronto, Canada	315	5 hours, 44 minutes

Figure C-12. Rail Infrastructure in Tunkhannock

- Green marking on Figure C-12 below represents the industrial site location and the map displays rail lines and infrastructure within proximity of industrial site.

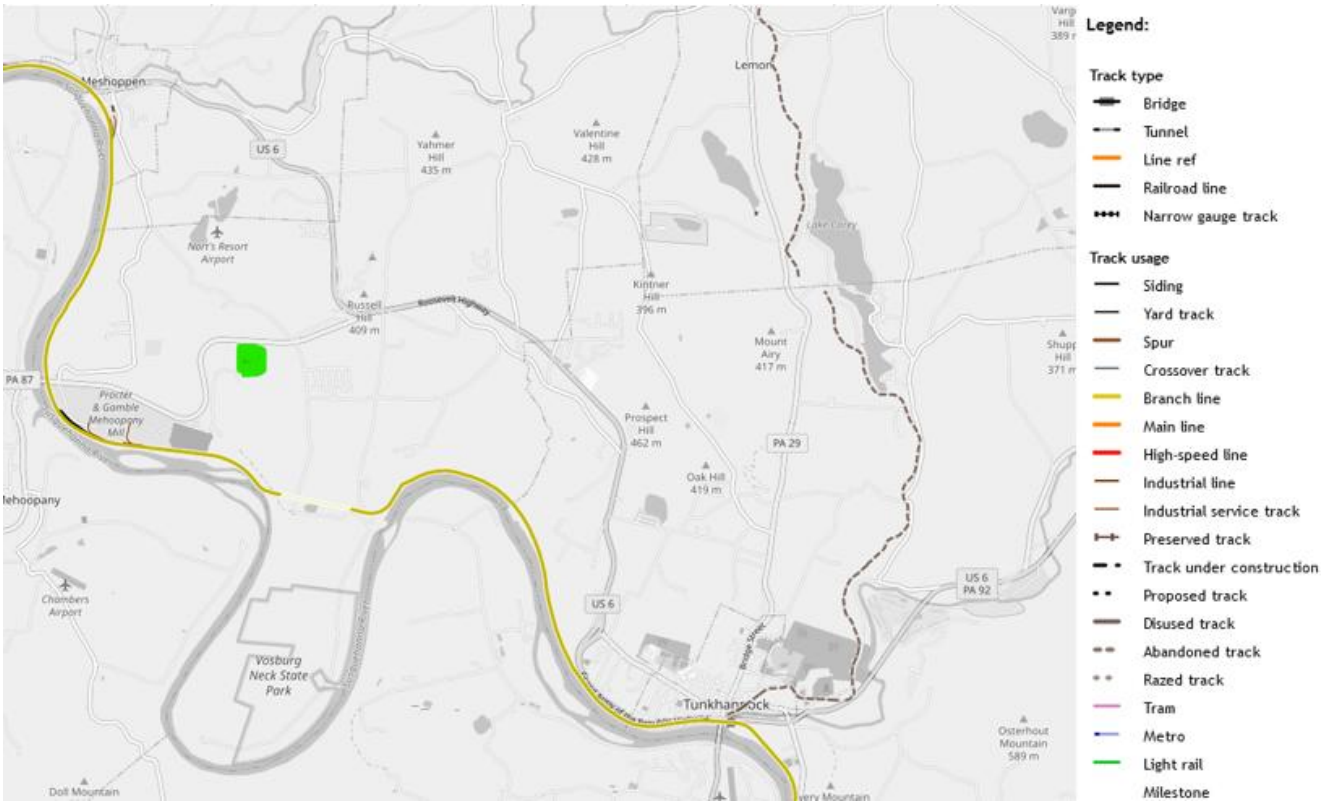


Figure C-13. Comparable Educational Attainment for Wyoming County[78]

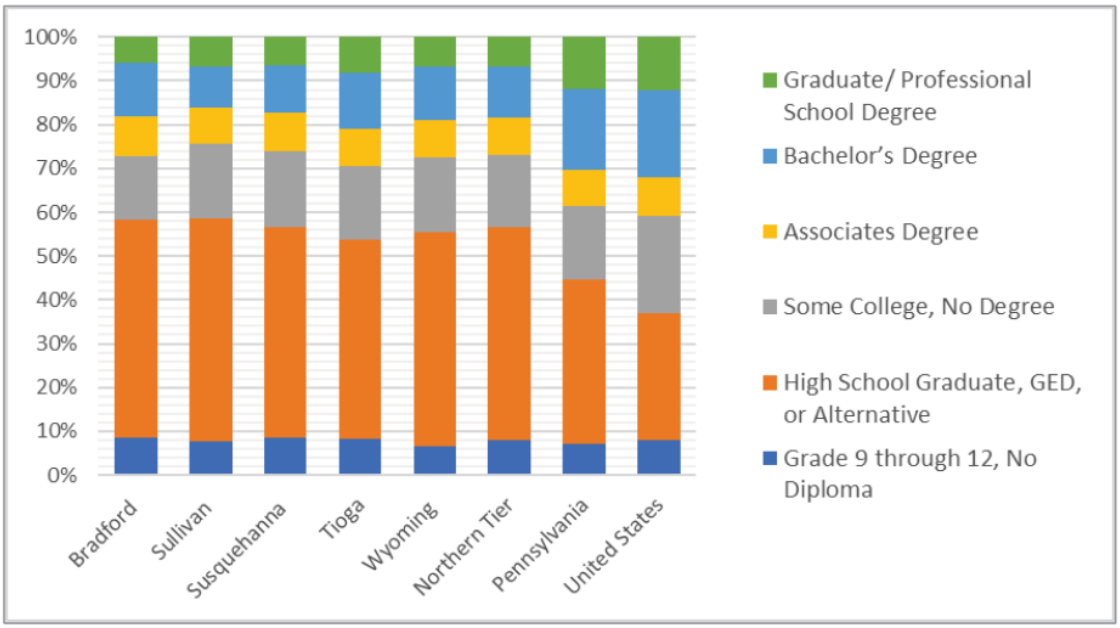
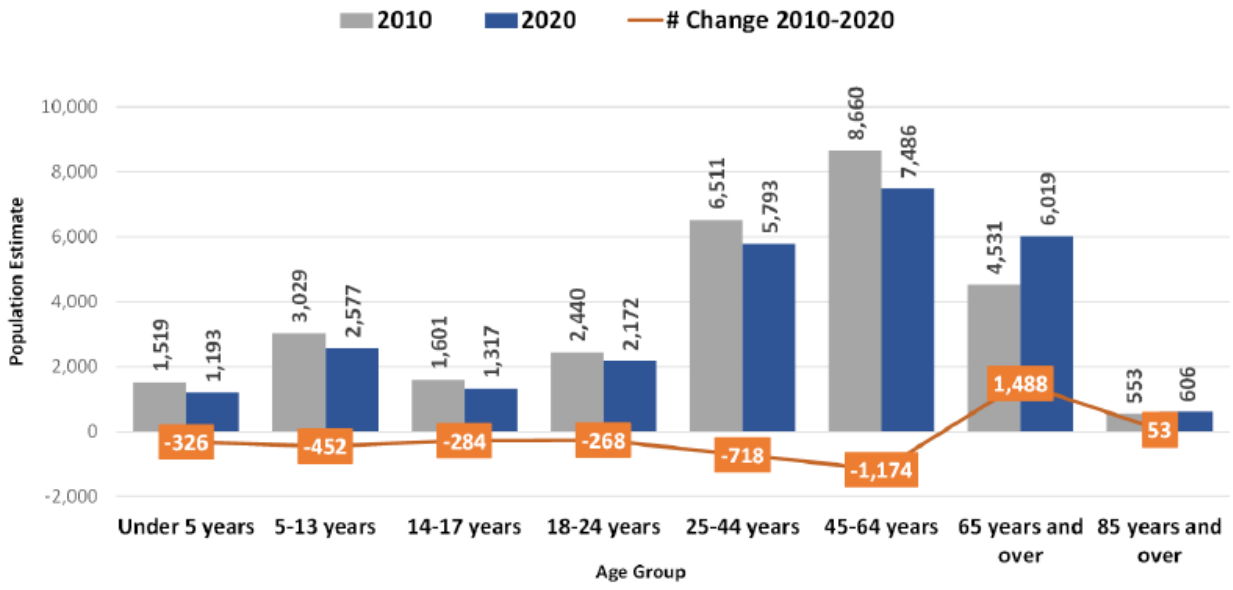


Figure C-14. Population by Age Group: Wyoming County, 2010-2020[79]



[78] https://aese.psu.edu/
[79] *Source: U.S Census Bureau, Annual Resident Population Estimates: April 1,2010 to July 1,2020*

Table C-5. Stumpage Prices ($/ton) for Pulpwood (Hardwood/Softwood) in Northeastern PA 2022 - 2023[80]

		Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023
Avg NE PA Hardwood Pulp ($/ton):	**Private or Public other**	$0.00	$1.00	$2.00	$1.00	$0.83	$0.00	$0.00	$1.00
	Bureau of Forest	$5.36	$3.79	$5.29	$3.16	$4.41	$4.49	$3.25	$4.31
		$2.68	**$2.39**	**$3.65**	**$2.08**	**$2.62**	**$2.25**	**$1.63**	**$2.66**
Avg NE PA Softwood Pulp ($/ton):	**Private or Public other**	$0.67	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.75
	Bureau of Forest	$0.00	$6.14	$0.00	$0.00	$0.00	$1.77	$0.00	$0.00
		$0.34	**$3.07**	**$0.00**	**$0.00**	**$0.00**	**$0.89**	**$0.00**	**$0.38**

2022 - 2023: Avg NE PA Hardwood Pulp ($/ton): $2.50
2022 - 2023: Avg NE PA Softwood Pulp ($/ton): $0.58

- Stumpage prices as reported quarterly for 2022 - 2023 by Pennsylvania timber and logging companies, forestry consultants, and state land management agencies to the Pennsylvania State University.
- Both hardwood and softwood pulp stumpage prices reported from two source categories over (1) private or public other and (2) Bureau of Forest over 8 quarters from 2022 - 2023
- Whereas feedback from outreach reported values of $0 for hardwood and softwood pulpwood stumpage prices for northeastern region. As such, this value was used for periods where data was absent from the quarterly reports.

[80] https://extension.psu.edu/timber-market-report-archives

APPENDIX D: LEGAL DISCLAIMER

This BDO Zone Rating (the "Rating") is prepared for, and provided to, Wyoming County Chamber of Commerce, Tunkhannock, PA, 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.

Neither Ecostrat nor the members of the BDO Zone Advisory Committee make any representation or warranty as to the accuracy or completeness of the information and content in this Rating and shall have and accept no liability for any statements, opinions, information or matters (expressed or implied) arising out of, contained in or derived from this Rating or any omissions from this Rating, or any other written or oral communication transmitted or made available to any other party in relation to the subject matter of this Rating. Any use which a third party makes of this Rating, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Decisions made, or actions taken based on or resulting from Ecostrat's work product shall be the responsibility of the parties directly involved in those decisions or actions. There are no third-party beneficiaries with respect to this Rating, and Ecostrat expressly disclaims any liability whatsoever (whether in contract, tort or otherwise) to any third party. Ecostrat makes no representation or warranty (express or implied) to any third party in relation to this Rating. A decision by any entity to disclose this Rating to the public or privately to a limited number of potential institutional accredited investors or other qualified investors shall not constitute any permission, waiver, or consent from Ecostrat for any third party to rely on this Rating except for informational purposes, and as such, is provided on such basis. Access to this Rating and its use by any third party implies acceptance by the third party of the terms and conditions contained in this section and other parts of this Rating.

All information included is based on information available on the date hereof and neither Ecostrat nor the members of the BDO Zone Advisory Committee are under any obligation to update the information herein. No investor, security holder, or other person should rely on the content of this report in any way in connection with the purchase or sale of any security.