Bioeconomy Development Opportunity Zone Rating Little Colorado River, AZ
Date of Issue: April 2, 2024
Rating Grade: **'A'**

A
High Quality

Rating Parameters:

Category	Rated Quantity	Delivered Price	BDO Zone Size
Woodland Biomass	95,800 bdt/yr	$44-$52 (bdt)	75-mi drive distance
In-Woods Chip	50,800 bdt/yr	$70-$85 (bdt)	from Springerville, AZ

BDO Zone Assets

- **Over 145,000 bdt/yr of low-risk woody biomass available for new bio-economy industries.**
- **Increased availability of woodland biomass expected from over-allocation of BLM and State Trust lands for future harvesting.**
- **Below-average employee wages, housing, and cost of living compared to State and national averages.**
- **Potential to acquire low-cost biomass feedstock in the local market for only a slight premium over current pricing.**

BDO Zone Liabilities

- **Lack of direct commercial airport, natural gas and rail access within the BDO Zone.**
- **Existing suppliers need substantial scaling up of biomass production to meet demand from a new bio-industry.**
- **Significant transport distances to major market centers due to the eastern Arizona location of the BDO Zone.**

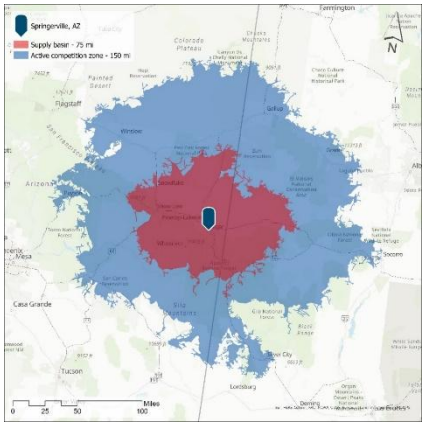
Rating Grade

The Little Colorado River, AZ, Bioeconomy Development Opportunity Zone is rated 'A,' or 'low' risk.

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

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

Little Colorado River, AZ BDO Zone



Scoring & Rating Methodology

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

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

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 either the likelihood (RRL) or the impact (RRI), or both, then the GRI will be notched accordingly.

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

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

The total risk rating for the BDO Zone is the average of all Loaded RI scores. The BDO Zone score for Location is ***18.87 out of 100, resulting in an 'A' designation***.

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

Analyst Notes

The Little Colorado River BDO Zone encompasses 17,600 square miles on the eastern edge of Arizona. It is defined by a 75-mile drive distance from the center point of Springerville, AZ.

Biomass feedstock for a new bio-economy facility would consist of chipped ponderosa pine residues (in-woods chip) and woodland biomass (pinyon-juniper) sourced from this area.

The Competition Zone extends to a 150-mile driving distance from the center point. Wood-using facilities within this area will likely compete for biomass with any new project.

BDO Zone Assets

The BDO Zone presents a unique market landscape characterized by limited competition among biomass users, primarily consisting of a 27-MW wood power plant and a pellet mill. These facilities consume nearly all harvested forest residues and woodland biomass within the area. This results in little price competition and a delivered price range of $38-$46 per bone dry ton (bdt). The eight suppliers and contractors operating in the Zone have a strong desire to expand and scale up their operations should a new bio-economy industry start-up in the area.

The urgent need to reduce wildfire threats by thinning pinyon-juniper and ponderosa pine stands presents a significant opportunity for biomass harvesting, with over 50,000 acres targeted for treatment in the next 3-5 years. This could yield over 400,000 bdt of biomass. These programs, managed by BLM and AZ State Trust Lands, have been in operation for decades and have accounted for hundreds of thousands of acres being treated.

Additionally, extending the BDO Zone into western New Mexico offers further harvesting opportunities, with permits for mitigating pinyon-juniper on state-owned lands expected within 9-12 months.

Furthermore, the area benefits from a favorable cost of living, making it attractive for new industries seeking to attract and retain staff. Springerville's Cost-of-Living score is 11.5% lower than the U.S. average and 16.8% lower than the average for Arizona.

Overall, the BDO Zone presents significant opportunities for new bio-economy industries, with potential access to abundant biomass resources, favorable living costs, and a market eager for competition and growth.

BDO Zone Liabilities

The BDO Zone faces limitations such as the absence of rail and natural gas access and considerable distances to commercial airports and interstate highways. These factors pose logistical challenges and increase transportation costs for businesses operating within the area.

However, the availability of an industrial site within the BDO Zone offers potential opportunities for mitigating some of these distance risks.

The primary risk for new development in the BDO Zone lies in the ability of current suppliers to scale up their operations to meet increased demand. While the feedstock material is available within the zone, scaling up forestry operations can be costly and carries inherent risks.

For a new bio-industry considering locating in the area, evaluating whether its financials can support a delivered price point of $44+ per bone dry ton (bdt) for feedstock is crucial. This price point is just slightly above the current price being paid in the Zone. This price point would introduce competition and enable suppliers to generate the increased revenue necessary to fund scale-up efforts.

Overall, while the BDO Zone presents opportunities for new bio-industries, potential entrants must carefully assess the challenges posed by logistical limitations and the ability of current suppliers to scale up operations to meet increased demand.

Infrastructure Profile

The industrial site selected for review in the BDO Zone is a 30-acre parcel situated just south of Springerville. It is zoned for industrial development and benefits from available electric service; however, it lacks natural gas and rail service. The site is privately owned, and the owner is motivated to sell or lease to prospective developers, offering flexibility for potential investors.

Moreover, the BDO Zone enjoys a lower cost of living and housing cost index compared to both the rest of Arizona and the nation, making it an attractive location for businesses and residents alike. Additionally, the area has one of the lowest crime rates in the state, enhancing its appeal for attracting new employees.

Furthermore, healthcare and education opportunities in the Springerville area are satisfactory. The highly regarded St. Johns Unified School District provides quality education, and the White Mountain Regional Medical Center serves as the primary healthcare facility within the BDO Zone.

Overall, the industrial site offers promising development potential. It is supported by favorable living costs, low crime rates, and adequate healthcare and education amenities, making it an appealing location for prospective investors.

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Figure 1: Risk Indicators (Sorted by Risk Level)

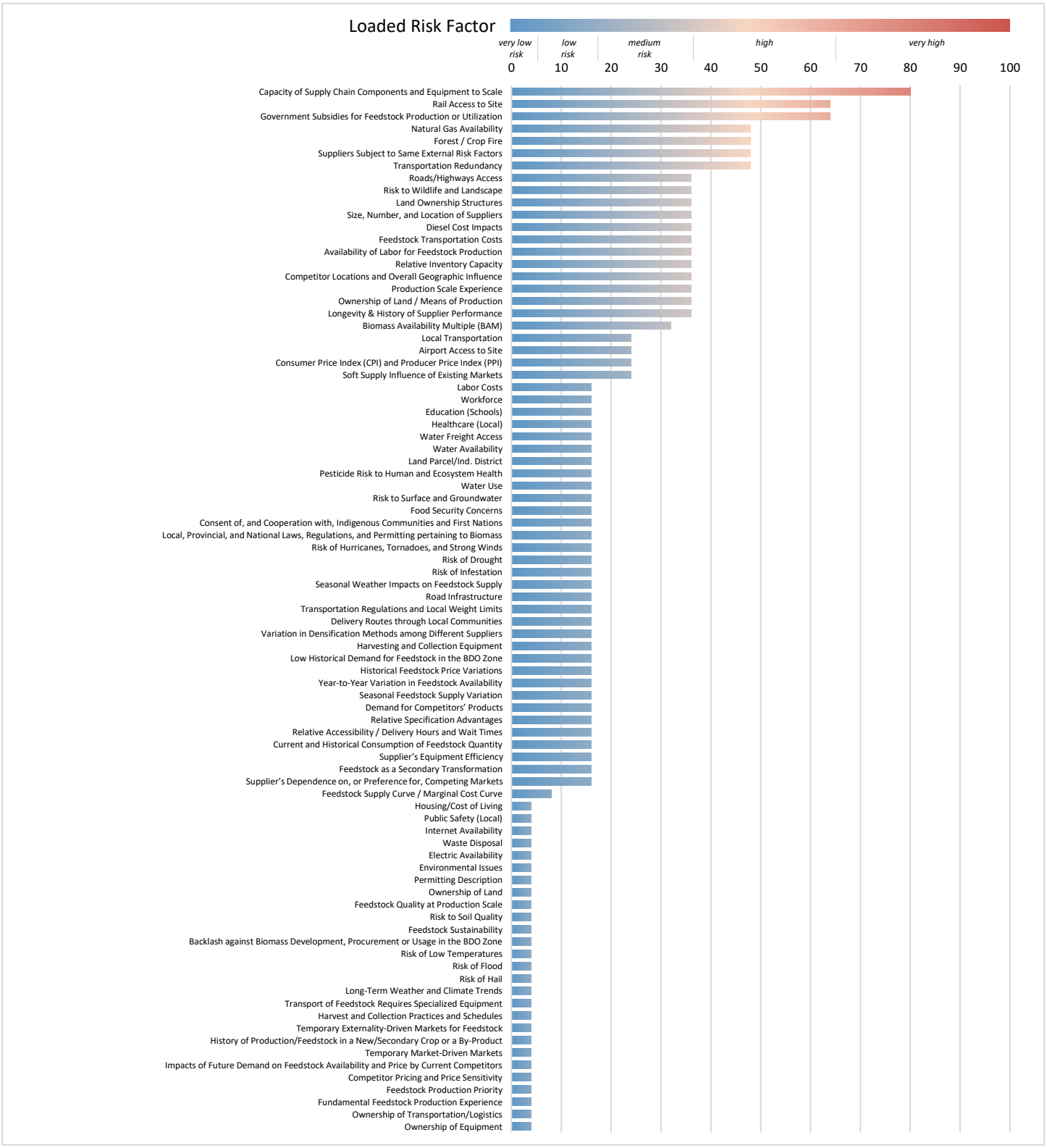


Table 1: Risk Indicators and Associated Scores

	Feedstock Supply Chain Risk Indicators	Raw Risk Likelihood	Raw Risk Impact	Gross Risk Indicator	Mitigation /Notching	Loaded RI Score
	Category 1.0: Supplier Risk					
1.1.1	Longevity & History of Supplier Performance	6	6	36	NN	36
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	6	6	36	NN	36
1.3.2	Ownership of Equipment	2	2	4	NN	4
1.3.3	Ownership of Transportation/Logistics	2	2	4	NN	4
1.3.4	Feedstock as a Secondary Transformation	4	4	16	NN	16
1.4.1	Fundamental Feedstock Production Experience	2	2	4	NN	4
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	2	2	4	NN	4
	Category 2.0: Competitor Risk					
2.1.1	Competitor Locations and Overall Geographic Influence	6	6	36	NN	36
2.1.2	Current and Historical Consumption of Feedstock Quantity	4	4	16	NN	16
2.1.3	Competitor Pricing and Price Sensitivity	2	2	4	NN	4
2.1.4	Impacts of Future Demand on Feedstock Availability and Price by Current Competitors	2	2	4	NN	4
2.1.5	Soft Supply Influence of Existing Markets	8	6	48	50%	24
2.1.6	Temporary Market-Driven Markets	2	2	4	NN	4
2.2.1	Relative Inventory Capacity	6	6	36	NN	36
2.2.2	Relative Accessibility / Delivery Hours and Wait Times	4	4	16	NN	16
2.2.3	Relative Specification Advantages	4	4	16	NN	16
2.2.4	Demand for Competitors' Products	4	4	16	NN	16
	Category 3.0: Supply Chain Risk					
3.1.1	Biomass Availability Multiple (BAM)	4	8	32	NN	32
3.1.2	Feedstock Supply Curve / Marginal Cost Curve	4	2	8	NN	8
3.1.3	Seasonal Feedstock Supply Variation	4	4	16	NN	16
3.1.4	Year-to-Year Variation in Feedstock Availability	4	4	16	NN	16
3.2.1	Historical Feedstock Price Variations	4	4	16	NN	16
3.2.2	Low Historical Demand for Feedstock in the BDO Zone	4	4	16	NN	16
3.2.3	History of Production/Feedstock in a New/Secondary Crop or a By-Product	2	2	4	NN	4
3.3.1	Consumer Price Index (CPI) and Producer Price Index (PPI)	4	6	24	NN	24
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	2	2	4	NN	4
3.4.2	Harvesting and Collection Equipment	4	4	16	NN	16
3.4.3	Variation in Densification Methods among Different Suppliers	4	4	16	NN	16
3.4.4	Availability of Labor for Feedstock Production	6	6	36	NN	36
3.5.1	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	2	2	4	NN	4
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	4	4	16	NN	16
3.5.7	Transportation Redundancy	6	8	48	NN	48
3.6.1	Size, Number, and Location of Suppliers	6	6	36	NN	36
3.6.2	Suppliers Subject to Same External Risk Factors	6	8	48	NN	48
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	2	2	4	NN	4
3.7.3	Forest / Crop Fire	6	8	48	NN	48
3.7.4	Risk of Infestation	4	4	16	NN	16
3.7.5	Risk of Hail	2	2	4	NN	4
3.7.6	Risk of Flood	2	2	4	NN	4
3.7.7	Risk of Drought	4	4	16	NN	16
3.7.8	Risk of Hurricanes, Tornadoes, and Strong Winds	4	4	16	NN	16
3.7.9	Risk of Low Temperatures	2	2	4	NN	4
3.8.1	Government Subsidies for Feedstock Production or Utilization	8	8	64	NN	64
3.8.2	Local, Provincial, and National Laws, Regulations, and Permitting pertaining to Biomass	4	4	16	NN	16
3.8.3	Backlash against Biomass Development, Procurement or Usage in the BDO Zone	2	2	4	NN	4
3.8.4	Consent of, and Cooperation with, Indigenous Communities and First Nations	4	4	16	NN	16

3.8.5	Food Security Concerns	4	4	16	NN	16
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	4	4	16	NN	16
3.9.4	Water Use	4	4	16	NN	16
3.9.5	Pesticide Risk to Human and Ecosystem Health	4	4	16	NN	16
3.9.6	Risk to Wildlife and Landscape	6	6	36	NN	36
3.9.7	Biomass Classified as Genetically Modified Organism (GMO)	NR	NR	NR	NR	NR
	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	10	8	80	NN	80
	Category 5.0: Infrastructure					
5.1.1	Land Parcel/Ind. District	4	4	16	NN	16
5.1.2	Ownership of Land	2	2	4	NN	4
5.1.3	Permitting Description	2	2	4	NN	4
5.1.4	Environmental Issues	2	2	4	NN	4
5.2.1	Natural Gas Availability	8	6	48	NN	48
5.2.2	Electric Availability	2	2	4	NN	4
5.2.3	Water Availability	4	4	16	NN	16
5.2.4	Waste Disposal	2	2	4	NN	4
5.2.5	Internet Availability	2	2	4	NN	4
5.3.1	Roads/Highways Access	6	6	36	NN	36
5.3.2	Rail Access to Site	8	8	64	NN	64
5.3.3	Airport Access to Site	4	6	24	NN	24
5.3.4	Water Freight Access	4	4	16	NN	16
5.4.1	Healthcare (Local)	4	4	16	NN	16
5.4.2	Education (Schools)	4	4	16	NN	16
5.4.3	Local Transportation	6	4	24	NN	24
5.4.4	Public Safety (Local)	2	2	4	NN	4
5.4.5	Housing/Cost of Living	2	2	4	NN	4
5.5.1	Workforce	4	4	16	NN	16
5.5.2	Labor Costs	4	4	16	NN	16
					Average	**18.87**



Little Colorado River, AZ BDO Zone Independent Review Committee (IRC)

Preston Raban – Director, Apache County Economic Development
Karalea Wiltbank – President, Foundation for Little Colorado Revitalization
Malena Hannah – Project Manager, MH Consulting
Jon Orona – District Forester, AZ Dept of Forestry and Fire Mgmt.
Travis Noth – Chief, Alpine/Nutrioso Fire District
Randy Nicoll – Owner, AZ Log and Timberworks
Terry Reidhead – Owner, Reidhead Lumber
Daric Knight – President, Apache Natural Resources Conservation District
Rob Lever – Forest Supervisor, Apache Sitgreaves National Forest
Nick Perrone – Asst Chief, Vernon Fire District
Steve Nicoll – AZ Log and Timber Works

APPENDIX A: BIOMASS AVAILABILITY AND PRICING

This section assesses the availability and pricing of woody biomass as feedstock for bioenergy, biofuels, and potentially other bio-based products in Little Colorado River, Arizona, as a BDO Zone. The center point for the woody biomass availability assessment is the town of Springerville, Arizona.

Springerville is in northeastern Arizona, 15 miles east of the New Mexico border. The surrounding area is known as the Round Valley within the White Mountains and is partially covered by ponderosa pines as part of the Apache-Sitgreaves National Forest. The remaining landscape is pinyon-juniper woodland and grassland/desert scrub. At an elevation of nearly 7,000 feet, the high plateau experiences some moderate to severe winter conditions and cooler summers.

BDO ZONE SUPPLY AND COMPETITION ZONES

The BDO Zone is defined as the area from which feedstock can be economically sourced. The BDO Zone is shown in red in Figure A-1 and encompasses a 75-mile driving distance around Springerville, AZ, as the center point. This area includes portions of Apache and Navajo counties in Arizona, as well as Cibola and Catron counties in western New Mexico. The surrounding area, shown in blue in Figure A-1, defines the 150-mile competition zone, which was used to evaluate the feedstock utilization by existing users of woody biomass, which may impact biomass availability for future biomass projects.

Figure A-1. BDO Zone Supply and Competition Zones

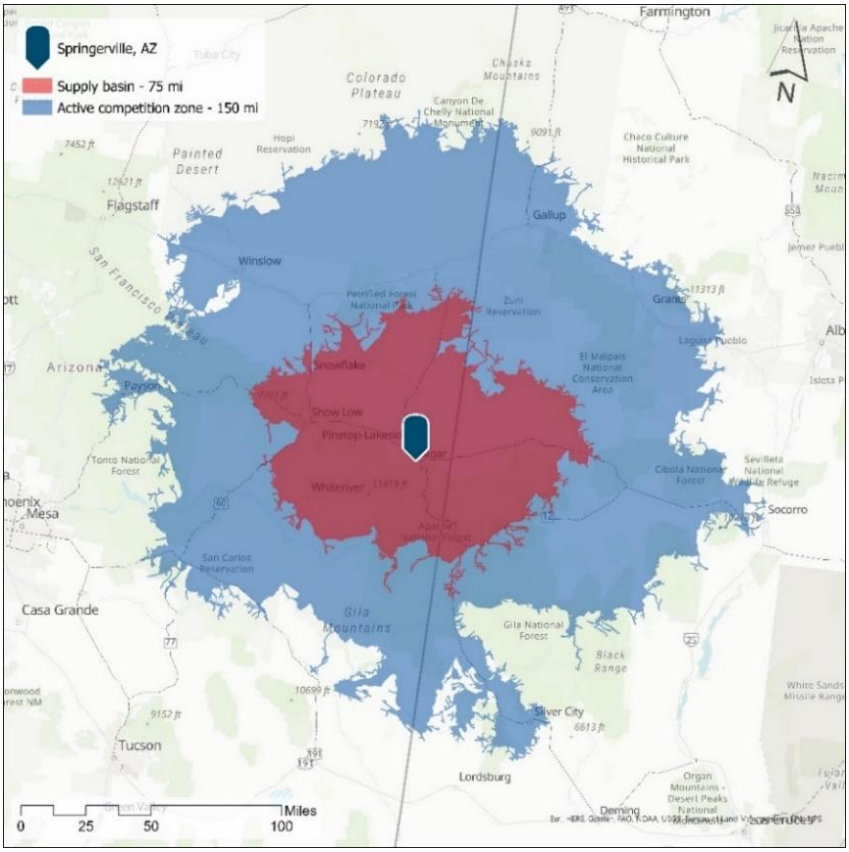
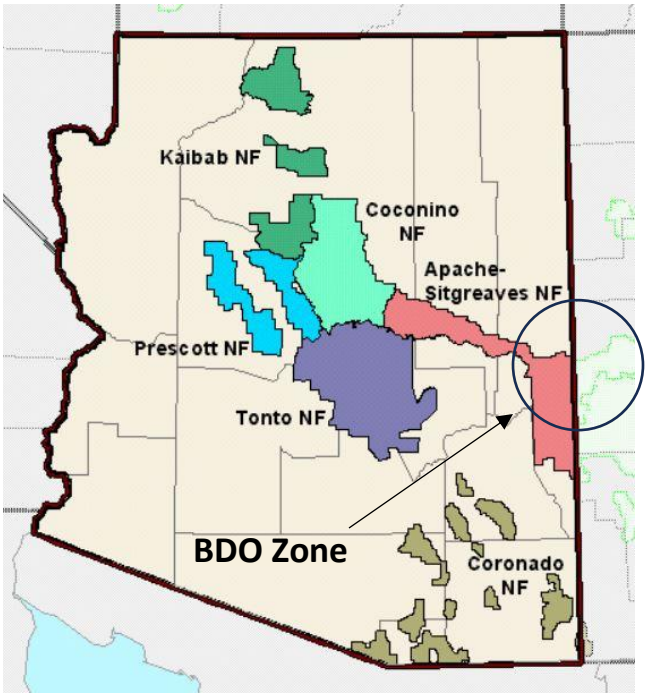


Figure A-2. Location of the BDO Zone on the border of Arizona and New Mexico



Types of Woody Biomass in the BDO Zone

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

Ponderosa Pine is categorized as pulpwood and is the most common conifer species in the BDO Zone. It is easily recognized by its tall, straight, thick trunks clad in scaled, rusty-orange bark that has split into big plates, as shown in Figure A-3. Since there is very little, if any, demand for pulpwood in log form, it is usually cut and chipped in the forest. A category of feedstock created from this ponderosa pine forest within the BDO Zone is to be called in-woods chip. This is defined as a combination of pulpwood and forest residues. Forest residues refer to the by-products or leftover materials resulting from forestry operations. These residues typically consist of branches, tops, stumps, bark, needles, and other woody debris that remain on-site after the smaller trees (pulpwood) are harvested. These are generally chipped or ground in the woods together with pulpwood and transported to either the biomass power plant or the pellet mill. Depending on the quality specifications of the biomass end users, pulpwood and forest residues can also be harvested and processed separately. Historically, a small portion of forest residues have been left in the forest, and based on USFS and contractor outreach suggestions, this is expected to continue.

Figures A-3. Ponderosa Pine (3)







Woodland Biomass – Pinyon-Juniper (PJ) Pinyon pine and Western/Utah juniper are collectively referred to as "PJ" and will also be referred to as woodland biomass in much of this report. Their main use is for biomass applications rather than forest products such as lumber and pulp and paper. Pinyon pine wood is sometimes called the hardwood of softwoods. Even though it is technically a softwood, it is harder, denser, and has a higher BTU than most softwoods. In the Southwest, pinyon is a common fireplace and stove wood. It keeps an active flame, produces good heat, repels mosquitoes, emits a pleasant aroma, and burns much longer than other softwoods. Figures A-4 and A-5 show examples of pinyon pine and Utah juniper.

Figure A-4. Pinyon Pine



Figure A-5. Utah Juniper



Juniper trees commonly grow in association with pinyon pine at elevations as low as 3000 feet and as high as 10,000 feet. Junipers are coniferous trees or shrubs (meaning they bear seeds that are cones). A juniper standing only five feet tall may be 50 years old. Junipers typically live from 350 to 700 years, some even passing the millennium mark. Despite their longevity, junipers rarely exceed 30 feet in height or three feet in diameter. There are more than 60 varieties of Juniper, including trees and shrubs. Figures A-6 and A-7 show the dispersions of these feedstocks in the western US. The specific BDO Zone vegetation cover is shown in Figure A-8.

Figure A-6. Ponderosa Pine Forests in North America



Figure A-7. PJ Woodlands in the Western US

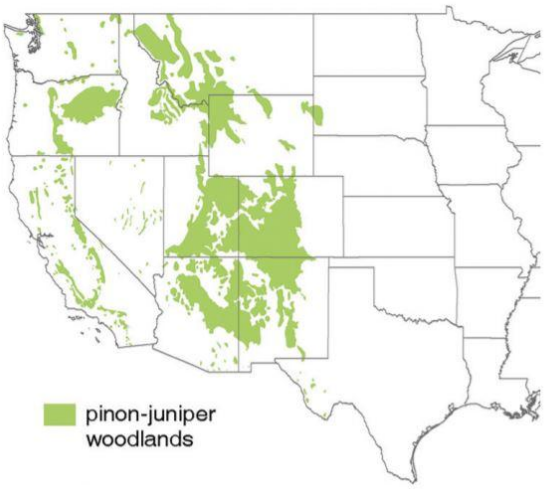
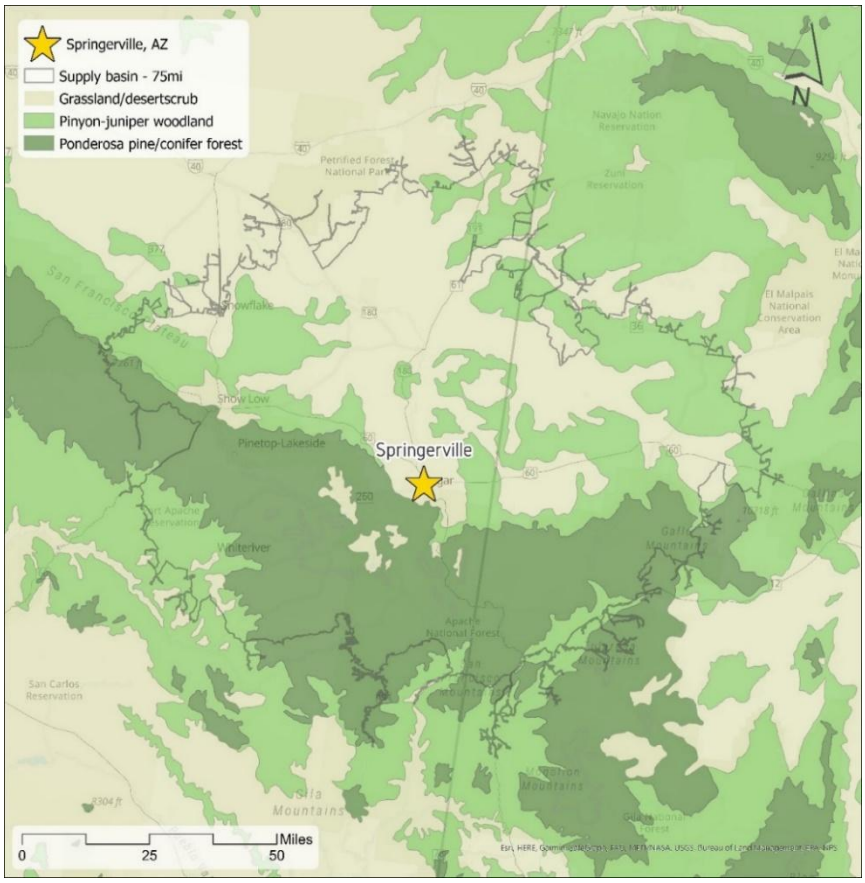


Figure A-8. Vegetation Cover in the BDO Zone



Both ponderosa pine and pinyon-juniper have very high BTU values, which makes them ideal feedstock for combustion applications (power plants) and many of the new bio industries.

Table A-1. Heating Values of the trees in the BDO Zone[1]

Species	Moisture content	Ash content	BTU/lb. (Heating Value)
Ponderosa Pine	41%	0.70%	8,611
Pinyon Pine	45%	0.81%	9,033
Juniper	44%	3.56%	8,656

It should be noted that juniper is known for having a much higher ash content than other conifers. This higher ash level is sometimes impactful to certain types of boilers and combustion-based processes. It also tends to be dustier when handled for grinding and transporting.

Harvesting Practices

Ponderosa pine is harvested using traditional logging methods. Chain saws or feller bunchers cut at the stump (see Fig. A-9). Pulp logs are ground in the forest. Their residual limbs, tops, and needles are either gathered as part of the grindings, scattered in the forest, or piled and burned. These residues are available to new bio-economy industries.

Woodland Biomass (pinyon-juniper) is either masticated and spread over the area or gathered and processed through a grinder. During mastication, live trees are shredded with a spiked, rotating drum attached to a large-wheeled tractor or tracked excavator (see Fig. A-10). This can be done any time the soil is dry enough to avoid excessive compaction. Shredding produces woody mulch that covers former tree mounds and some space between them, which can increase water infiltration rates and reduce erosion.[2] Shredding trees increases the time that soil water is available in the spring, which increases understory growth and cover.

For biomass feedstock processing, the PJ is pushed over (dozer or chain drag) and loaded into a horizontal grinder (see Fig. A-11). This biomass is transported in trucks, normally to a biopower or pellet facility. Some pinyon trees are large enough to saw into lumber for furniture.

Our outreach found that there are eight harvesting firms operating in the BDO Zone. They demonstrate a moderate level of efficiency and resource management. Their ability to secure permits, timber sales, and contracts reflects a certain level of competency in navigating regulatory processes and market dynamics. However, their profitability appears constrained, with revenues approaching breakeven levels due to factors such as diesel prices, limited material users, and transportation distances. The firms exhibit a cautious approach, with many opting to minimize operations to mitigate financial risks. Many own harvesting equipment or maintain seasonal or longer-term leases, indicating a commitment to efficient resource management.

[1] Nathan L. Cline https://www.sciencedirect.com/science/article/abs/pii/S1550742410500526
[2] USFS.gov Pinyon-Juniper Fact Sheet June 2015

Figure A-9
Feller Buncher



Figure A-10
Juniper Mastication Head



Figure A-11
Grinding PJ for Biomass



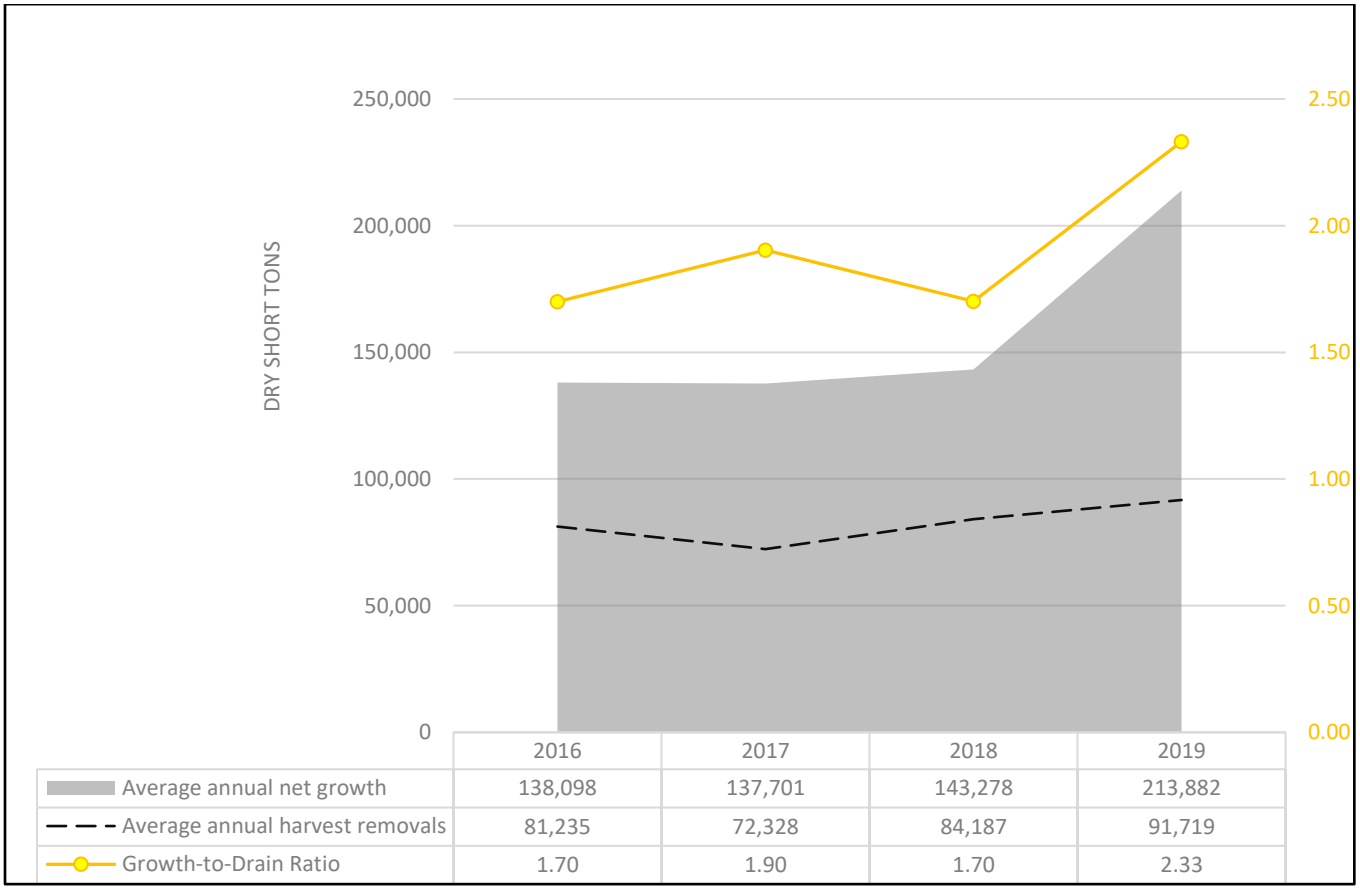
Additionally, the use of truck contracting for material transportation highlights a pragmatic approach to logistics management, allowing for cost-effective transportation solutions Overall, their performance warrants a moderate rating, as they effectively balance operational demands with economic constraints but may face challenges in achieving sustainable profitability.

Availability of Woody Biomass in the BDO Zone

A modeling tool, the **Forest Inventory and Analysis (FIA)** data produced by the USDA Forest Service, was used to estimate the availability, growth rate and removal rate of pulpwood within the 75-mile radius of Springerville.

The average net annual forest growth in the BDO Zone is shown in Figure A-12. This figure also incorporates the harvest removals to allow a direct comparison of the ratio of growth to harvest, known as the *growth-to-drain ratio*. The growth-to-drain ratio is essential in understanding the relative abundance of standing woody biomass inventory, and it is the rate of regrowth accounting for harvest. A negative ratio indicates a shrinking forest biomass resource as more wood is removed than grown. A positive ratio, as in the case of the BDO Zone, shows that wood is growing faster than is being harvested. This situation indicates an opportunity for additional removal of biomass for industries in the BDO Zone. As shown in Figure A-12, for the period 2016-2019, the growth-to-drain ratio for the forest in the BDO Zone has been in the range of 1.7-2.33, suggesting an increase in standing biomass inventory.

Figure A-12. Average annual net growth and removals of pulpwood 2016-2019



	2016	2017	2018	2019
Average annual net growth	138,098	137,701	143,278	213,882
Average annual harvest removals	81,235	72,328	84,187	91,719
Growth-to-Drain Ratio	1.70	1.90	1.70	2.33

This model represents slightly more than 91,700 bdt of pulpwood as harvest removals in the BDO Zone in 2019. This volume is currently being utilized by the existing competitors in the area. There is additional growth of 122,100 bdt (213,900-91,800 bdt). To maintain a healthy forest, the growth-to-drain ratio should be at least 1.2 or higher, meaning growth adequately exceeds harvest volumes. Applying that to the above for 2019, 101,700 bdt of the total 122,200 will be shown as available for new bio-economy industries and future biomass projects. There have been no competitor changes during the past five years within the BDO Zone (still only a biomass power and wood pellet facility). Therefore, 101,700 bdt will be used as a current available volume of pulpwood (in-woods chip) material.

Historically, the forests in Arizona have been thinned to mitigate wildfire risk, generate feedstock, and improve wildlife habitat. Table A-2 below shows the harvesting that has taken place within the State over the past 12 years. Throughout 2010-2022, over 291,400 acres of forest land from the Apache-Sitgreaves forest alone were harvested under different treatment regimes.

Table A-2. Summary of the Arizona land harvested between 2010-2022[3]

Forest	Acres with One or More Treatment*	BDT Created (6 tons/acre)	Average BDT per Year
Apache-Sitgreaves[4]	**291,402**	**1,748,412**	**145,701**
Coconino	189,956	1,139,736	94,978
Kaibab	142,136	852,816	71,068
Tonto	96,372	578,232	48,186
TOTAL ACRES	719,866	4,319,196	359,933

*Such treatments might be piling brush, pruning lower branches of trees, or creating fuel breaks to encourage the right kind of fire. Tools used to perform the mechanical treatment of hazardous fuels range from hand tools such as chainsaws and rakes to large machines like bulldozers and woodchippers.

This harvesting activity in the Apache-Sitgreaves forest has shown to be consistent over the past 12 years averaging 145,700 bdt per year. This is expected to continue in the coming years assuming no changes in the current supply/competitor mix.

In addition to the government's reports above, the local forestry agencies were asked for a listing of upcoming harvesting sales within the BDO Zone. Many of these sales will be focused on pinyon-juniper (woodland biomass) thinning and removal. These land managers project out several years for timber and woodland sales acreage to be thinned. Table A-3 below identifies the current and future acreages targeted within the BDO Zone for harvesting. These timber and woodland sales will be the basis of our feedstock availability assessment for future bio-economy projects.

Table A-3. Upcoming woodland biomass (primarily PJ) sales within the BDO Zone

Mgmt. Area	Miles from Springerville	When Available	Acreage	Yield (bdt/acre)[5]	Approved harvesting quantity (bdt)
BLM Lands[6]	5-70 miles	2024 -2026	20,000	6	120,000
State Trust Lands[7]	10-50 miles	2024 - 2026	29,000	6	174,000
USFS Lands[8]	20-40 miles	2024 - 2027	5,000	10	50,000
Total upcoming quantity to be harvested over the next three years					344,000
Average annual quantity to be harvested (next three years)					**115,000**

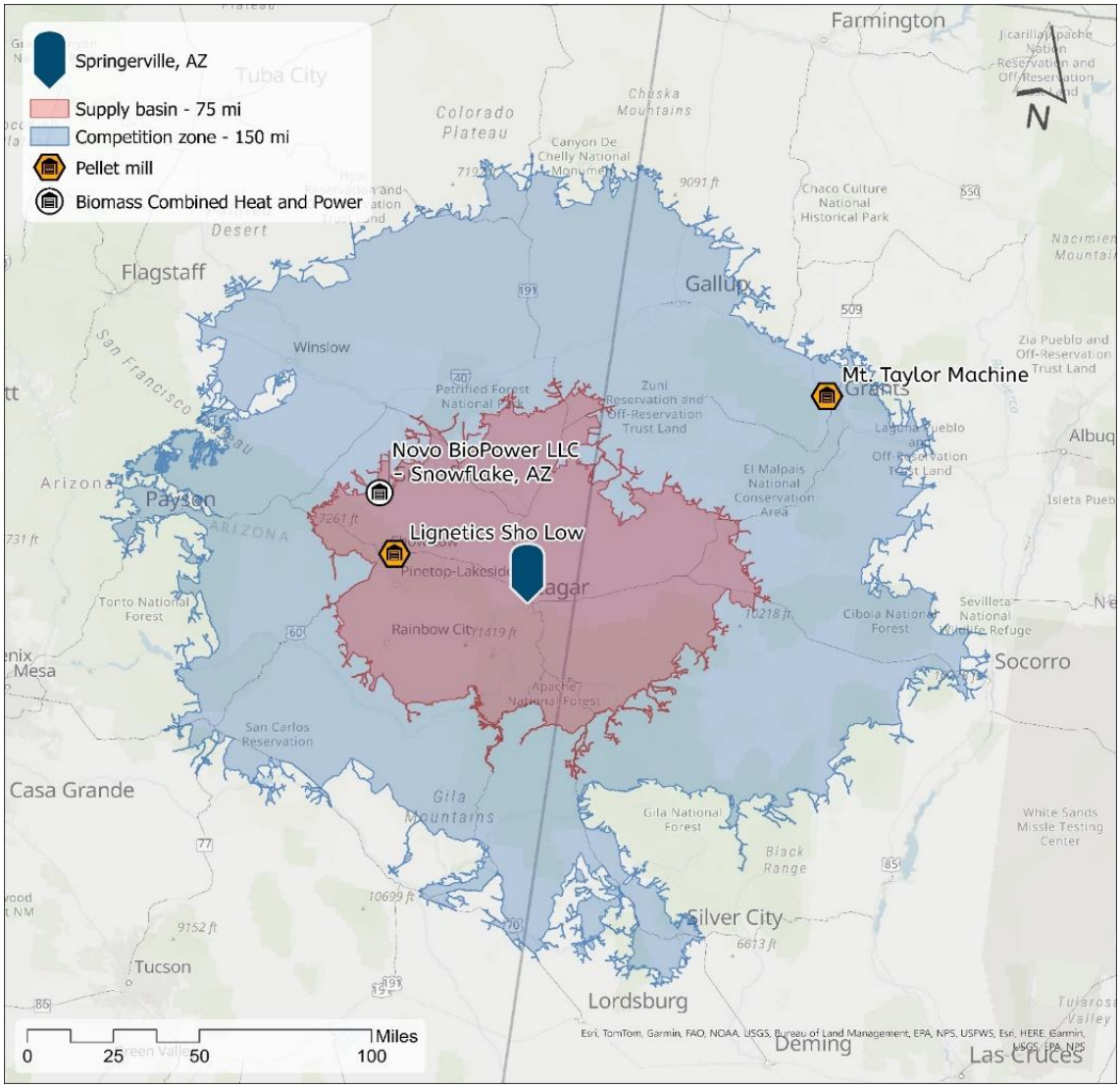
The annual quantity of 115,000 bdt above will be used to estimate the rated quantity of woodland biomass available annually within the BDO Zone.

[3] Four Forest Restoration Monthly Report – Dec 2023 Page 3
[4] Apache-Sitgreaves is the only Forest within the BDO Zone
[5] USDA, 2019, and also from local outreach. (Baird)
[6] See figure C1 BLM Future Juniper Thinning (appendix C) Dan Quintana BLM
[7] See Figure C-3 State Trust Projects overview map (appendix C) Jon Orona Dept of Forestry and Fire Management
[8] Per Stephanie Coleman – USFS Apache-Sitgreaves National Forest Supervisors Office

Primary Competitors for Woody Biomass in the BDO Zone

Harvesting of both ponderosa pine and woodland biomass in the BDO Zone has been limited to the amount that the primary users of this material can take in. The three largest consumers are a biomass power plant in Snowflake, a pellet mill in Show Low, and a lumber and pellet facility in Milan, New Mexico (Figure A-13 below). Together, these three facilities demand 190,000 bdt annually of woody biomass (Table A-4 below).

Figure A-13. Woody Biomass Competitors within the Competition Zone



The biomass power plant is Arizona's only biomass-fueled power plant. Constructed in 2008, the facility produces a maximum of 27 MWs of renewable electricity sold to Arizona Public Service (APS) and Salt River Project (SRP), the State's two primary utilities, under long-term contracts. As the largest consumer of woody biomass in the competition zone (150-mile radius of Springerville), this operation significantly influences both volumes and prices of material produced and utilized. It can accept up to 40% woodland biomass (PJ) material mixed with its pine pulpwood and grindings. Per outreach with the facility's manager, their current demand level is 97,200 bdt annually.

The pellet manufacturing facility is located just 45 miles west of Springerville in Show Low, AZ. Its current production is 50,000 tons of pellets annually, and it utilizes a mixture of pine residues, which can be termed "dirty biomass." This material can include some percentages of limbs, tops, needles, and bark. Per outreach with the facility, their current demand is 1.1 bdt of feedstock to 1.0 ton of pellets.

The lumber and pellet facility in Milan, New Mexico, is within the competition area of the BDO Zone. It produces pellets, lumber, and various finished wood products. Its woody feedstock source is outside the BDO Zone and comes primarily from timber harvests in northern New Mexico. It uses some PJ to produce firewood and produces some residues which, due to transport distance, are generally sold within central New Mexico. Its 38,000 bdt of annual demand is not considered part of this BDO Zone's competition profile since its feedstock is obtained elsewhere in New Mexico.

Therefore, the total current feedstock demand in the BDO Zone is estimated to be 121,200 bdt/year from the remaining two competitors above, as shown in Table A-4.

Table A-4 Largest Competitors' Demand in the BDO Zone

Competitor	Location	Annual Biomass Demand (bdt)	Biomass secured from the BDO Zone (bdt)
27-MW Biomass Plant	Snowflake, AZ	97,200	97,200
50,000-ton Pellet Mill	Show Low, AZ	55,000	24,000[9]
NM Lumber Mill	Milan, NM	38,000	0
	Total Competitor Consumption	**190,200**	**121,200**

Notably, an additional four operating sawmills and two pallet-making facilities are within the competition zone. These are all very small operations and generally do not produce a sizable volume of residues from operations. Their demand is usually in the form of sawlogs.

Fort Apache Reservation

The BDO Zone around Springerville incorporates nearly half of the Fort Apache Reservation. This 1.6MM acre reservation is not considered part of the Apache-Sitgreaves National Forest and operates under its own forestry and logging guidelines. There are a series of lumber operations in the White River area owned and managed by the tribe, as well as logging crews and a fleet of transport vehicles. The limited data available indicates that these facilities consume nearly 200,000 tons of forest material annually from reservation lands and use it to produce lumber for construction. This BDOZ Report will not include this harvest and processing volume in the availability calculations for woody biomass in the area. The sovereign nature of these operations makes it difficult to project what volumes, if any, could be made available outside the reservation and to new bio-industries and, thus, not included in the biomass availability potential for future projects.

Rated Quantity of Woody Biomass Available in the BDO Zone

In reality, not all produced biomass will be available for future biomass projects for various reasons, such as the unwillingness of private landowners to sell their wood fibers due to low stumpage rates, lack of established road and logistics networks, lack of access to labor for harvesting and transportation operations, forest fires, and unfavorable weather conditions during the harvest season. In addition, assumptions are made to estimate total potential biomass availability, which may not reflect the real situations.

[9] Per discussion with the facility, nearly half of their feedstock is sourced from outside the BDO Zone.

To reflect such uncertainties, we apply the Biomass Availability Multiple (BAM) to the total potential in-woods chip material available (shown in Figure A-13) and the woodland biomass quantities in Table A-3 above. BAM indicates the degree of redundancy in the biomass supply in the BDO Zone. BAM is the mean ratio of biomass feedstock available to a project, in relation to delivered cost, divided by the biomass project's mean rated quantity. BAM is a strong indicator of supply chain resilience when stressed by supply shortage and/or supplier breach. The higher the uncertainty on biomass available for a project, the higher the BAM factor.

In this project, BAM is applied to the total estimated quantity to ensure adequate feedstock redundancy for each feedstock type. BAM of 1.2 is applied to woodland biomass as the removal of this biomass has been a common practice, and annual harvest sales are determined by the local forest agencies, as shown below in Table A-3. This results in an annual quantity of 95,800 bdt.

In contrast, a BAM of 2.0 is applied to in-woods chip material, as it has been used as a secondary source of woody biomass in the regions, and crews with experience collecting forest residues are usually present. Thus, a BAM of 2.0 is used for in-woods chip material, as the risk is slightly higher than this material will be removed at an economically positive rate. A BAM of 2.0 applied below results in a rated quantity available of 45,860 bdt/yr of in-woods chip.

These numbers are reflected in Table A-5 below as the rated quantity of biomass available annually for a new project. In summary, we estimate that the total rated quantity of woody biomass in the BDO Zone is 141,600 bdt, most of which is woodland biomass (68%).

It is noted that very small quantities of sawmill residues from the facilities in the BDO Zone are being sold to the pellet mill and are not available to new incoming industries. We expect these insignificant quantities will not be available for future biomass projects.

Table A-5 Rated Biomass Quantities Available in the BDO Zone

Biomass Type	Average Annual Availability (bdt/yr)	Low-Risk Quantity after incorporating BAM factor (bdt/yr)
In-Woods Chip	101,700	50,800 (BAM 2.0)
Woodland Biomass	115,000	95,800 (BAM 1.2)
Total Rated Biomass Available in the BDO Zone		**146,600 bdt/yr**

Woody Biomass Pricing

The biomass power plant plays a central role in setting the pricing dynamics for forest residues and woodland biomass in the BDO Zone. Currently, the price for woodland biomass is $38 to $46 per bdt delivered, which is the price currently being paid by the biomass power plant. This pricing structure reflects the market equilibrium established by the power plant's purchasing practices. It also reflects responses from outreach from three contractors in the area.

Given the lack of strong competition and limited expansion among existing end users, future biomass projects would be expected to secure feedstock within a similar price range, with a small premium, to that of the current end users. This indicates stability in pricing dynamics within the BDO Zone. A reasonable premium would be 12-15% based on outreach and market conditions. For this report, a 15% premium over current prices will be used. Therefore, the available woodland biomass delivered price would be $43.70-$52.90/bdt

In woods chip, as stated, are not currently being gathered consistently within the BDO Zone. The quantity shown in Table A-5 is available feedstock for new industries. Based on historical practices and a recent Arizona BDOZ report for a

neighboring county, the estimated delivered pricing of these materials is $70-$85/bdt. Moreover, the exclusive nature of biomass feedstock uptake by the biomass plant and pellet facility, coupled with transportation challenges to distant users like Phoenix, creates a unique scenario where demand equals availability. This presents opportunities for new industries willing to pay competitive prices to enter the local market.

Overall, the pricing framework established by the biomass power plant and the limited competition in the BDO Zone warrants a moderate rating, as it provides stability but also challenges potential entrants seeking to compete in the local market.

Snapshot of the Woody Biomass Situation Within the BDO Zone Today

- Eight independent logging companies/contractors harvest about 121,000 bdt per year of woody biomass each year. This material consists of ponderosa pine from USFS timber sales, some private lands, and pinyon-juniper grindings from State Trust lands and private acreage.
- This material is being sold to two primary users in the BDO Zone who together consume just over 120,000 bdt per year (Table A-6 above). Some biomass material, approximately 25,000 bdt annually, is being transported from outside this BDO Zone supply area to support these two users.
- The amount being harvested is virtually the same as the amount consumed, as there are no other economic markets for excess harvesting material
- The biomass power plant is essentially setting the pricing of woody biomass sold within the BDO Zone. Today, the average price is between $35 and $46 per bdt delivered to the power plant and pellet mill.

APPENDIX B: RISK INDICATOR SCORING METRICS

CATEGORY 1.0: SUPPLIER RISK

1.1 Risk Factor: Creditworthiness/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 BDO Zone has a limited number of suppliers (loggers/contractors). Most have been in business for at least five years. This is a medium risk, but it could increase because of the limited suppliers in the area.

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**

1.2 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 contractors in the BDO Zone have only two or three potential competitors for their woody biomass feedstock. Most of the material goes to the biomass power facility in Snowflake, and the pellet mill in Show Low is also a primary player. The suppliers have no competitive loyalty to either operation**.**

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	**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 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: The supplier contractors do not own the land they harvest. It is either controlled by the USFS, State Trusts, BLM, or is privately owned. This is considered a medium risk to new incoming industries.

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

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: The supplier contractors within the BDO Zone own (or lease) their harvesting equipment, which is considered very low risk for future biomass projects.

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

Raw Risk Impact (RRI) 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**

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 suppliers own or lease most of the trucks and trailers used in transporting the woody biomass. A small percentage of hauling is contracted to local carriers.

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**

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 primary feedstock produced by the main suppliers is from pinyon-juniper and pulpwood thinning. There is limited sawlog harvesting in the area from the USFS.

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**

1.4 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: All the suppliers in the area are very seasoned and experienced in harvesting woody biomass. This is not a new material to be handled in the area.

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

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: The suppliers have extensive experience producing the feedstock. Scaling up to higher levels does pose some risk. Outreach has suggested that most suppliers would welcome a scale-up opportunity and could do so in a reasonable amount of time. Still, this is a medium risk level, as any new volumes produced will involve some scaling up from current operations.

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**

1.5 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: Suppliers use standard logging and harvesting equipment to produce woody biomass. Some technological improvements are available, but most of this equipment has operated effectively for years**.**

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

Gross Risk Indicator (GRI)	**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: The supplier base is focused on producing woodland biomass and ponderosa pulpwood feedstock, which is nearly always the primary product.

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**

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 only three competitors within the BDO Zone, all within 50 miles of each other and easily accessible by road. However, this limited number of competitors is a medium for any new 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**
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**

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: Three major competitors consume 190,000 bdt of woody biomass within the BDO Zone each year. This volume has been consistent for many years and is predictable with the current competition scenario.
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**

2.1.3 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: The biomass price within the BDOZ is essentially set by the largest competitor – the biomass power plant. This operation consumes nearly 2/3 of the harvested material. They currently pay $38-$46/bdt delivered to the plant in Snowflake. This opens the ability of a new industry to pay a slightly higher price (premium) and gain control of substantial volumes of biomass. A much healthier market could evolve, especially for the contractor suppliers of the material. This is considered an asset for a new industry to know, upfront, what the market price of the material will be**.**

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**

2.1.4 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 supply basin can make suppliers overconfident, leading to a supplier-controlled market where short-term contracting becomes the norm and supply chain reliability is compromised for the Issuer. If and when it occurs, increased demand on feedstock may decrease availability and increase cost for new plants within the BDO Zone.

Risk Information: The primary competitors, the power and pellet plant, operate at their nameplate capacities—27MWs and 50,000 tons of pellets. Neither is expected to increase its current demand levels without long-term capital expansion.

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**

2.1.5 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: Current competitors can exert a very high degree of pressure, especially pricing pressure, on the bank of suppliers. They can also dictate over-demand and under-demand quantity changes, interrupting the suppliers' operations. This is considered a medium-high risk.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *high*, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *medium*, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**48**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) Any new competitor entering the market can mitigate and gain current competitors' control over the supply volumes and prices paid for feedstock by offering a 10% premium over the market price today. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**50%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**24**

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.[10]
Risk Information: A review and analysis of the quarterly feedstock prices for in-woods chip and pinyon-juniper do not indicate any seasonal variation in pricing. In addition, no temporary markets were found for woody biomass in the BDO Zone region.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *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**

2.2 Risk Factor: Specific Competitors' Competitive Advantage

2.2.1 Relative Inventory Capacity

Rationale: The more inventory a competing biomass facility is able to store, the more competitive pressure it can exert on supply. Ability to store large inventories allows competitors to purchase inventory when the prices are low, potentially giving it an economic advantage. Additionally, the ability to store inventory during feedstock supply surpluses can enable competitors to continue to intake feedstock when the 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: The biomass power facility can effectively store about a month's supply of material to power its 27MW operations. It can increase that amount by storing logs instead of wood chips and exert pressure on suppliers by fluctuating their intake of harvested material, putting pressure on new industries to secure 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**

[10] Bergtold, 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 36 out of 100.	**36**

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: The primary consumers of woody biomass in the BDO Zone receive shipments 5-6 days per week. When walking-floor trailers are not used, each has truck dumpers. During busy periods, we can expect wait times of 45 minutes to an hour, but generally, off-loading takes about 30-45 minutes.

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	**Noch**
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**

2.2.3 Relative Specification Advantages

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

Risk Information: The power plant generally takes a cleaner quality of chips and woody material than the pellet mill. Each end user accounts for the moisture content of the wood in their final pricing of the material. Otherwise, the competitors will take what is harvested so long it is ground to 3" minus size.

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**

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: As stated previously, the primary competitors for the woody biomass within the BDO Zone operate at their nameplate capacities. No increases in demand for the material are foreseen, so this is 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**
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 3.0: SUPPLY CHAIN RISK

3.1 Risk Factor: Feedstock Availability

3.1.1 Biomass Availability Multiple (BAM)

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

Risk Information: In this project, BAM is applied to the total estimated quantity to ensure adequate feedstock redundancy for each feedstock type. Specifically, a BAM of 1.5 is applied to woodland biomass (PJ) and a BAM of 2.0 to in-woods chip material, resulting in a total rated quantity of 146,600 bdt/yr.

To summarize this multiple, we estimate that the low-risk quantity of in-woods chip and woodland biomass (PJ) available for future biomass projects in the BDO Zone is 146,600 bdt. This represents a low risk to available supply.

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

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

3.1.2 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: Today, the transport distance to the two primary competitors is 10 – 200 miles. So, the transport costs do not impact supply as there are no other places to take the material. For a new industry, there would have to be a small premium paid over the current price in order to incent the suppliers to provide feedstock to the new industry. The marginal cost curve would be based on a 50-mile average transport distance:

Price per bdt (delivered) $45 – volume available to new industry- there would be no biomass available for new biomass projects as the suppliers would remain (*current price today, no competitor switch*)

Price per bdt (delivered) $51 – volume available to new industry, 100,000 tons (55%) Price per bdt (delivered) $65 – volume available to new industry, 180,000 tons (100%)	
Raw Risk Likelihood (RRL) The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed *very low*, therefore the RRI is 2 out of 10.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**Score** **8**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. 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**

3.1.3 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[11] and can manifest in shortages and higher costs for Issuers.

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

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**

[11] Golecha & Gan 2016.

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**

3.1.4 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: There has been minimal variation in feedstock availability over the past ten years. The quantities consumed by the primary competitors of pine forest residues and pinyon juniper have consistently been between 150,000 bdt and 200,000 bdt. Appendix A highlights how that number can increase with new industries.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × 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 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: Pricing on the material has escalated with inflationary pressures over the years. However, there have been no sudden or abnormal increases during that 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 *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**

3.2.2 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: Neither the suppliers nor the consumers have changed much in the last decade, and the amounts of woody biomass harvested and consumed have remained constant. Should a new industry be in the area, more of a scale-up will take place to provide more significant amounts of the material, but the expertise to produce it is low-risk**.**

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

3.2.3 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: There is a very low risk here as that feedstock would change for a new bio-industry. No other new feedstock, of any volume, is present within the BDO Zone supply area.

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**

3.3 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 price trends affecting biomass logistics operations and their associated costs, such as fuel, labor, equipment parts, and administration. The Consumer Price Index's historical trend is shown in Figure C-4 (Appendix C). They indicate an upward transition reflectively due to inflationary pressures in recent years but is going downward. CPI has always been a significant factor in the price of biomass operations, particularly transportation.

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

3.3.2 Currency Risk

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

Risk Information: There is no currency risk as all products are bought and sold in US dollars within 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**

3.3.3 Border Risk

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

Risk Information: There is no border risk here as all goods and services typically stay in the county.

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.[12]

Risk Information: Within the BDO Zone, there are no temporary or unusual competitor markets for feedstock, which is very low risk.

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**

3.4 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: Much of the harvesting, especially for pinyon-juniper, is completed to restore native areas and improve wildlife and soils. There is very little public opposition, and harvesting is done almost year-round.

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**

[12] Bergtold, 2018.

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**

3.4.2 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: The list of equipment needed for harvesting the in-woods chip and PJ feedstock is industry standard. Shears, skidders, loaders, grinders, and semi-trucks do not vary extensively in make or model. All should produce similar material.

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.[13]
Risk Information: All the feedstock provided by the suppliers is either ground or chipped woody biomass. Generally, the target size is 3" minus.
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**

3.4.4 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: Labor availability in the BDO Zone is a risk. Pay scales have not been escalated appropriately in the last five years, making employee retention an issue. Should a new industry start-up, labor will quickly be drawn from surrounding counties based on the security the opportunity offers. This is still a medium-risk concern.
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**

[13] Huhnke, 2018.

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: Based on supplier outreach, transportation costs account for 20-30% of the total biomass delivered price within the BDO Zone. The primary feedstock sources are within 50 miles of the major competitors. Therefore, the risk of per-mile transportation costs affecting the cost of feedstock is somewhat mitigated, but transportation costs always involve a medium risk due to potential diesel fluctuations.

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**

3.5.2 Diesel Cost Impacts

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

Risk Information: The average diesel price fluctuates (see Figure C-5), but the volatility related to the impact on biomass fuels is only medium. Local diesel prices have virtually doubled from 2003 to 2023, going from $2 to $4/gallon on average. This is always a risk item for any transport-reliant commodity.

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	**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: All the trailers used to haul in-woods chip and PJ are industry standard. Walking floor trailers are most common as they self-unload. "Possum belly" trailers and standard vans are also used extensively. No special equipment is needed.

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**

3.5.4 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: Only primary highways are used for transport. Little harvesting takes place anywhere near residential areas. The competitor locations are all in industrial or woodland areas**.**

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**

3.5.5 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: The statewide weight limitation for trucks is 80,000 pounds. The standard weight distribution is a 50,000-pound load and a 30,000-pound truck and trailer weight. This is the weight limit in most states.

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**

3.5.6 Road Infrastructure

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

Risk Information: Generally, the competitors' locations are accessible via paved roads. However, due to the nature of harvesting the feedstock, some areas in the woodlands have primitive, if any, roads in place. This is common in most forestry situations. This risk factor is low risk based on the road infrastructure to deliver the material.

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**

3.5.7 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: Transportation needs are not seasonal. However, there are limited trucks and trailers in the area that are not already being used. This is more of a scale-up issue, but there is little redundancy currently in the transportation area. There is a medium risk of additional truck availability and a high risk of a shortage.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *high*, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**48**
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 48 out of 100.	**48**

3.6 Risk Factor: Supply Chain Resiliency

3.6.1 Size, Number, and Location of Suppliers

Rationale: In general, a supply portfolio involving multiple suppliers of various sizes (and from multiple BDO Zones) is important for ensuring steady and uninterrupted feedstock supply with minimal price fluctuations. If a small number of large suppliers provides a high proportion of total feedstock, a disruption or supplier breach will have greater impact on the supply chain. In such cases the risk of disruption is lower, but the impact of those disruptions is higher. Conversely, many small suppliers are less likely to have the capacity to withstand internal disruptions and thus may be

more likely to breach. Here, risk of disruption is higher, but their likely impact is lower. The number of suppliers as well as the ratio of small to large suppliers should be optimized.

There is no pre-determined number or optimal ratio of suppliers, although having too many or too few can both pose higher degrees of risk.

Risk Information: Eight contractors and logging operations serve the BDO Zone. Most have headquarters, but the crews are highly mobile. A crew consists of 16-18 employees, including transportation. There is only a limited amount of biomass to be harvested (~125,000 annual tons) due to the limited competitors for the material. Some companies operate single crews. Others have multiple crews and their own transportation. There is healthy competition between these suppliers, but only due to the limitations of the operations. This will become a scale-up issue if new industries come into the area.

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

3.6.2 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: Since the suppliers are in the same vicinity and produce similar materials, a risk event such as wildfire, infestation or disease could impact the normal production of feedstock. This is a medium to high risk as the supply chain is volatile to external events that impact biomass demand.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *high*, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**48**

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 48 out of 100.	**48**

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 suppliers own very little, if any, of the land. State Trust Land, BLM, USFS, and private owners dominate ownership. This creates a medium-risk situation as stumpage and per-acre harvesting costs can vary between entities.

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 basin. Such estimates are important in assessing feedstock risk and enable accurate assessment of the efficacy of Issuer's mitigation methods.
Risk Information: The BDO Zone is at an elevation of +/- 7,000 feet. Winter storms are expected but not overly common. Break-out periods of rain and snow can postpone harvesting activities, sometimes for a month or two in the spring. Generally**,** the warmer weather, the rest of the year is sprinkled with some rain but not enough to affect production**.**
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed *low*, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × 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: No long-term climatic trends exist within the BDO Zone, except worldwide climate changes.
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**

3.7.3 Forest/Crop Fire

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

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

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

Risk Information: There has been a checkered history of large wildfires within the BDO Zone and surrounding areas. Within the last twenty years, the Rodeo-Chediski and Wallow fires alone devastated nearly a million acres of Arizona timber and woodland areas. Wildfires occur every year in some areas of the State; most are in the east and southern portions, where the drier climates prevail. If a fire occurs, there is a medium risk for likelihood and a high risk for impact.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *high*, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**48**
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 48 out of 100.	**48**

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: During the past two decades, much of the Southwestern Region has periodically experienced severe drought conditions, causing our forests to experience elevated water stress. As a result, several native bark beetle species attacked these drought-stressed trees, leading to elevated widespread tree mortality. Recent improvements in rain have mitigated this risk to a low level.

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

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

3.7.5 Risk of Hail

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

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

Risk Information: The in-woods chip and pinyon-juniper are not affected by hail from a biomass production standpoint.

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**

3.7.6 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: The BDO Zone is located on a 7,000-foot desert plateau. Everything flows downhill from the area. Floods are only a potential issue in areas following wildfire devastation, and the lack of natural vegetation has been disturbed**.**

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**

3.7.7 Risk of Drought

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

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

Risk Information: From October to December 2023, moderate (D1) long-term drought developed in Gila, Graham, Greenlee, Apache, Navajo, and Cochise counties.[14] This has been a common situation for over a decade, is expected to continue, and is considered a low risk to biomass production.

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**

[14] AZ Dept of Water Resources

3.7.8 Risk of Hurricanes, Tornadoes, and Strong Winds

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

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

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

Risk Information: Hurricanes and tornadoes are very rare in the area. High winds are common, especially in the spring, and can cause minor delays in feedstock harvesting.

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

3.7.9 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: The elevation of the BDO Zone averages 7000'. Low temperatures occur but not usually for an extended period (weeks). This is a very low risk item to produce biomass.

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**

3.8 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: There is little incentive from local, state, or federal sources to harvest and consume woody biomass. Although energy credits are available in neighboring California, they are not in place here. Because there are no subsidies or incentives available to harvest the biomass material with the BCO Zone, this is deemed to be a high risk to new industries wanting to gain access to that feedstock.

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

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: There are no existing laws in Arizona pertaining to the harvesting, collecting, and transporting biomass. The contracting agencies, like USFS, BLM, and State Trust Lands, impose their own criteria but it is specific to the prescription of the treatment and the specific area.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed *low*, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × 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**

3.8.3 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: The consumers and producers of woody biomass within the BDO Zone have been operating for many (10+) years. There are no public concerns with feedstock operation and use in the area.
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**

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

Risk Information: The biomass summarized in this report is not sourced from Native American lands.

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**

3.8.5 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: The biomass described in this report is unrelated to food or other consumables.

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**

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

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

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

Risk Information: The timberlands and forests in the BDO Zone are professionally managed and subject to regular audits for Best Management Practices (BMP) compliance. BMPs are guidelines for maintaining forest health, focusing on soil and water during forest management and harvesting. Adhering to these guidelines assures the sustainability of the forests. The future of the forests in Arizona is a strong asset to new development.

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

3.9.2 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: See 3.9.1 above. BMPs include soil-related guidelines for sustainability.

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**

3.9.3 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: Mitigating risk to water from forestry operations is one of the primary goals of BMPs. The limited rain and runoff in the BDO Zone limit the risk of water contamination.

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**

3.9.4 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: The harvesting operations, especially for pinyon-juniper, improve the water use for woodland and prairie grasses. They allow the understory growth of the area's ground cover plants to control runoff and water use better.

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**

3.9.5 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: There is no pesticide risk within the forest and woodlands 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 *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**

3.9.6 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: There are two arguments about the effect of PJ on wildlife: 1) Pinyon-juniper woodlands are a staple ecosystem across the western US. Not only do they provide habitat for a variety of wildlife and recreational land for outdoor enthusiasts, but they are also key players in balancing water storage, runoff, and erosion. 2) Oregon Invasive Species have described Western juniper as "degrading sage grouse and other wildlife habitat, shading out native grasses, sucking up groundwater, and creating opportunities for invasions of weeds and other undesirable species." Consider this a medium risk due to the two different public views that could cause harvesting concerns with the private and public sectors.

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**

3.9.7 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: This does not apply to this BDO Zone. Risk not rated

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**

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: Harvesting a greater quantity is unlikely to negatively impact feedstock quality, as the current end users have been using biomass in large quantities for pellets and power generation.

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**

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: For a new industry to enter this BDO Zone, harvesting operations must be scaled up considerably. Each crew can produce about 25,000 bdt/year of woody biomass, requiring a substantial financial investment in equipment and personnel. This creates a high-risk scenario to attract these operations to start or transfer in from other woodland areas.

Raw Risk Likelihood (RRL) The risk likelihood is deemed *very high*, therefore the RRL is 10 out of 10.	**Score** **10**
Raw Risk Impact (RRI) The risk impact is deemed *high*, therefore the RRI is 8 out of 10.	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 80 out of 100.	**Score** **80**
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 80 out of 100.	**Score** **80**

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Ind. District

Risk Information: The land parcel highlighted for this report is a privately owned, 30-acre site just southwest of Eagar, AZ, along Hwy 260. It is currently undeveloped but has access to electric and water utilities and is located along a primary

access road in the region. An aerial view and additional site details are provided in Appendix C Figure C-6. This site is pro-development and potentially available for immediate sale to a new bio-economy industry owner. This location represents a low risk for the industry.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed *low*, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × 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**

5.1.2 Ownership of Land

Risk Information: As mentioned in 5.1.1, this representative parcel is privately owned by a local family trust. They own many parcels of land within the BDO Zone and have indicated a willingness towards new industries coming into the area. This situation is considered very low risk for developers.
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**

5.1.3 Permitting Description

Risk Information: New permitting for buildings, businesses, utility services, and land use are handled in nearby St Johns and requires 30-60 days for processing (non-hazardous). The county is very pro-business and encourages new industries by special handling and expediting inspections, issuance, and enforcement. This is a very low risk for new industries.

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**

5.1.4 Environmental Issues

Risk Information: Air quality is excellent within the BDO Zone (attainment zone). There are no existing or proposed hazardous waste sites anywhere within eastern Arizona. There is no existing soil contamination from surface water runoff. Only a single landfill in the vicinity with 15 years+ capacity. There are no Native American cultural areas to avoid. This is a very low risk item.

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**

5.2 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: No natural gas service is in the immediate Springerville, AZ area. There are several propane service providers for both residential and industrial gas services. The nearest natural gas pipeline service is in Show Low, AZ, 47 miles east of Springerville. This represents a medium to high risk for new developing industries coming into the area.

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

Raw Risk Impact (RRI)	**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 48 out of 100.	**48**
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 48 out of 100.	**48**

5.2.2 Electric Availability

Risk Information: Navopache Electric Co is the primary power provider within the BDO Zone. For industrial services, there is both a three-phase 14.4KV distribution voltage and a 69KV transmission level if desired. The service line to the highlighted parcel is available for connection with minimal cost to new connections. The current industrial power rate is ≈$.0735/kWh. This represents an attractive electrical rate for new industries and a very low risk.

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**

5.2.3 Water Availability

Risk Information: The southern portion of the BDO Zone is atop the Salt River Aquifer (underground) created by the headwaters (surface) of the Salt River. The aquifer is an average of 300 feet below the surface and is constantly being recharged. There are several hundred wells in the vicinity with excess capacity. Moving to the northern portion of the BDO Zone, water supply becomes scarce and is reliant on only limited rainfall. This represents a low risk for obtaining water supply for new industries as long as they locate within the area's lower portion.

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

Raw Risk Impact (RRI) The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × 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: Blue Hills Environmental Association provides trash and landfill services to the BDO Zone. The nearest landfill to Springerville is in St John, approximately 25 miles northwest. The current landfill fee is $60/ton for industrial, non-hazardous waste. This is a very low risk for new industries.

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**

5.2.5 Internet Availability

Risk Information: The Arizona Commerce Authority in 2022 awarded over $100M in grants to develop internet service to underserved areas of the State. Apache County received $9.7M to work with CommNet, the local provider, to upgrade and expand service in the area. This is a very low risk item for developers**.**

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**

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: The BDO Zone is served by three primary state highways: 60, 191, and 180. These highways are well-maintained and seldom close due to weather. The nearest Interstate is just outside the 75-mile supply area to the north (I-40). These limited access highways could be a moderate risk to the transportation of both raw and finished goods utilized and created by new bio-economy industries.

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

5.3.2 Rail Access

Risk Information: BNSF Railroad is in the northern portion of the BDO Zone with lines around St Johns. Union Pacific Railroad has lines to the south but is more than 75 miles from Springerville. There is very limited access within the supply area to consider using rail to transport woody-based feedstock. This is a medium to high risk factor for new industries wishing to utilize rail for transporting liquid or solid finished products.

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

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

5.3.3 Airport Access

Risk Information: The Springerville airfield can handle most private and business traffic. The Regional Airport in Show Low (25 miles from Springerville) provides commercial flights to Phoenix and Flagstaff. It can be utilized for all sizes of private planes and business jets. Phoenix International Airport is 164 miles away, and it takes 4.5 hours to get to Springerville. This accessibility is considered a low-medium 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 *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**

5.3.4 Water Freight Access

Risk Information: There are no navigable waterways within the BDO Zone. Since this is a seldom-used method of transportation within inland States, the default value is 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**

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: The White Mountain Regional Medical Center, located in Springerville, AZ, is the primary healthcare facility in the BDO Zone. It is a primary care facility but generally moves acute and long-term care patients to Phoenix or Flagstaff hospitals. Since the facility is in the center of the Zone, it is rated as a low-risk item for new industries.

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

5.4.2 Education (Schools)

Risk Information: The St. Johns Unified School District, centered in St. Johns, has 930 K-12 students. Northland Pioneer College has remote campuses in Springerville and St. Johns. This public, fully accredited community college offers technical, vocational, and scholastic curricula and has one of the lowest tuition rates in the Country.

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**

5.4.3 Local Transportation

Risk Information: There are no scheduled local transportation options (bus service) in and around Springerville, AZ. Shuttle/bus service White Mountain Connects has its hub in Show Low, 25 miles to the west. Taxis and Uber are available in the Springerville area. This is a medium risk item for employees to get to and from work.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed *low*, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) 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**

5.4.4 Public Safety (Local)

Risk Information: Springerville maintains an impressively low crime rate, registering at a mere 703 out of 100k people, sharply contrasting with the national average of 2324 crimes/100k people. There is both a local Springerville Police Department and County Sheriff available. This represents a very low risk for new industries and their employees**.**

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**

5.4.5 Housing/Cost of Living

Risk Information: The cost-of-living index for Springerville and the surrounding BDO Zone is 88.5, which is well below the national average of 100 and the balance of Arizona's average of 106.4. Housing costs in the area are even lower, at 55.9 out of 100. The average home price in the Zone is between $235,000 and $350,000, showing a 13% increase in the last two years. This is a very positive risk factor for new industries in attracting employees to the area**.**

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**

5.5 Risk Factor: Labor

5.5.1 Workforce

Risk Information: The unemployment rate in Apache County is 7.2%, compared to the Arizona average of 4.3%**.** More than 84% of adults aged 25+ have a high school diploma or higher, and 13% have a bachelor's degree or higher. 58% of the county's total population of 66,000 is between 18 and 65, working age. This appears to be a low-risk situation for new industries to staff.

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**

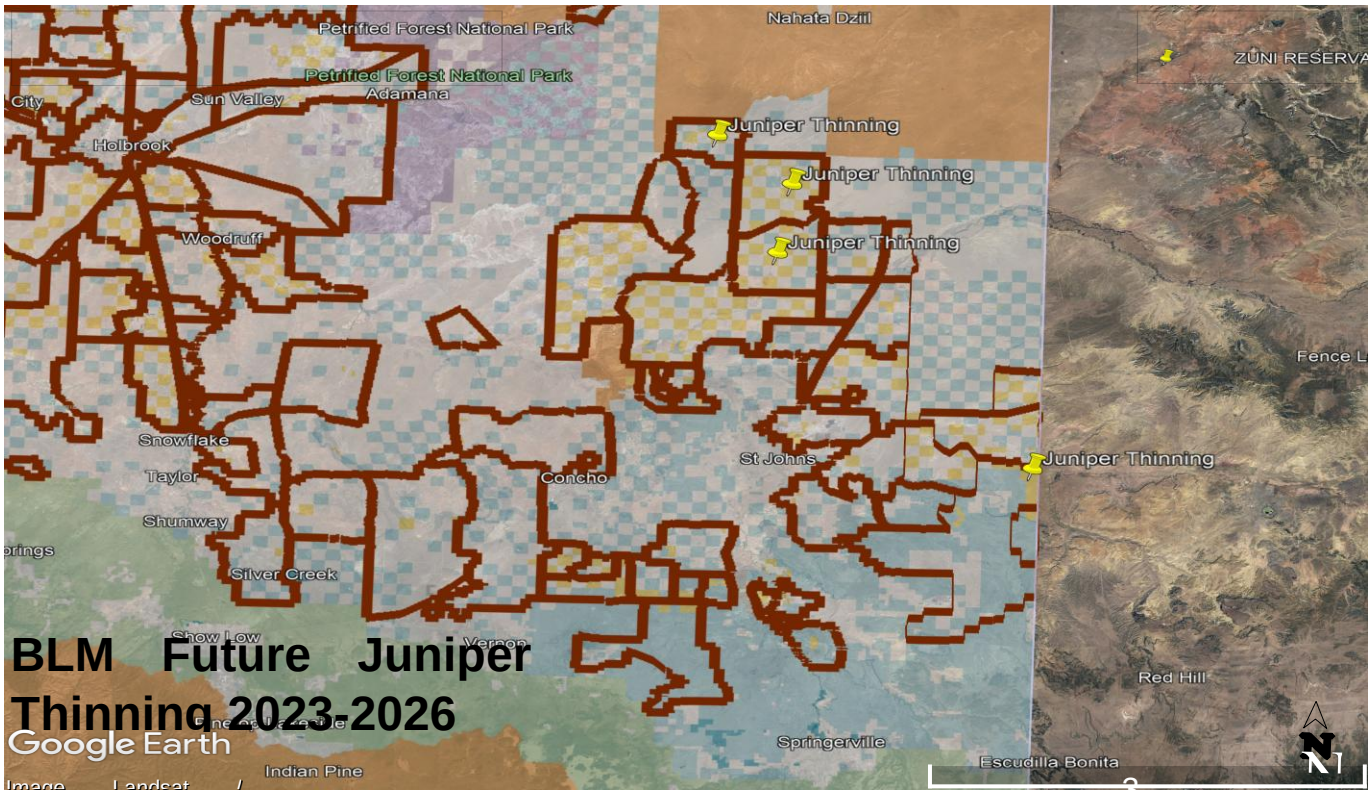
5.5.2 Labor Costs

Risk Information: The current minimum wage in Arizona is $13.85 per hour. Living Wage calculators for Apache County for two adults, one working and two children, is $37.72/hour. This represents a minimum target, household income, and compensation for new industries to attract sustainable employees in the area. This compares favorably to the Phoenix area (Maricopa County), with a living wage of $41.03 for the same parameters.

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**

APPENDIX C: ADDITIONAL TABLES AND FIGURES

Figure C-1. BLM lands for future harvesting of woodland biomass (PJ)



The map above represents 20,000+ acres of BLM Land slated to be released in the fall of 2024 for juniper harvesting. BLM estimates there to be 3-12 bdt per acre in the targeted areas or 160,000 bdt (using 8 bdt/acre yield)

Note: The areas with "yellow pins" are to leave all pinyon pines standing, only harvesting, grinding, and hauling away only the Junipers.

Figure C-2. Arizona State Trust Land projects identified for pinyon-juniper harvesting

Year	District	Project Name	Ownership	Acres	Status	*8 bdt per acre* Bdt/Yr
2024	A25	Y Fuels	State Trust	2,200	Underway	17,600
2024	A25	Little Co River Watershed	State Trust	2,000	To Be Bid	16,000
2024	A25	Silver Creek	State Trust	2,683	Completed	21,464
2024	A25	White Mountain Lake	State Trust	3,911	To Be Bid	31,288
2024	A25	Hidden Meadows Pile	State Trust	780	To Be Bid	6,240
2024	A25	Camps Pile Burn	State Trust	75	To Be Bid	600
2024	A25	Wolde/Tillman Pile	State Trust	50	To Be Bid	400
2025	A25	Atascacita	State Trust	1,644	To Be Bid	13,152
2025	A25	Sierra Montosa	State Trust	4,693	To Be Bid	37,544
2025	A25	Mineral	State Trust	4,766	To Be Bid	38,128
2025	A25	Molina Basin	State Trust	1,288	To Be Bid	10,304
2025	A25	Sepulveda	State Trust	41	To Be Bid	328
2026	A25	Lower Nutioso Creek	State Trust	780	To Be Bid	6,240
2026	A25	Wildcat	State Trust	4,220	To Be Bid	33,760
			Totals	29,131		**233,048**
				Acres		Bdt

Woodland Biomass Harvesting Per District Forester

Arizona Department of Forestry and Fire Management Projection

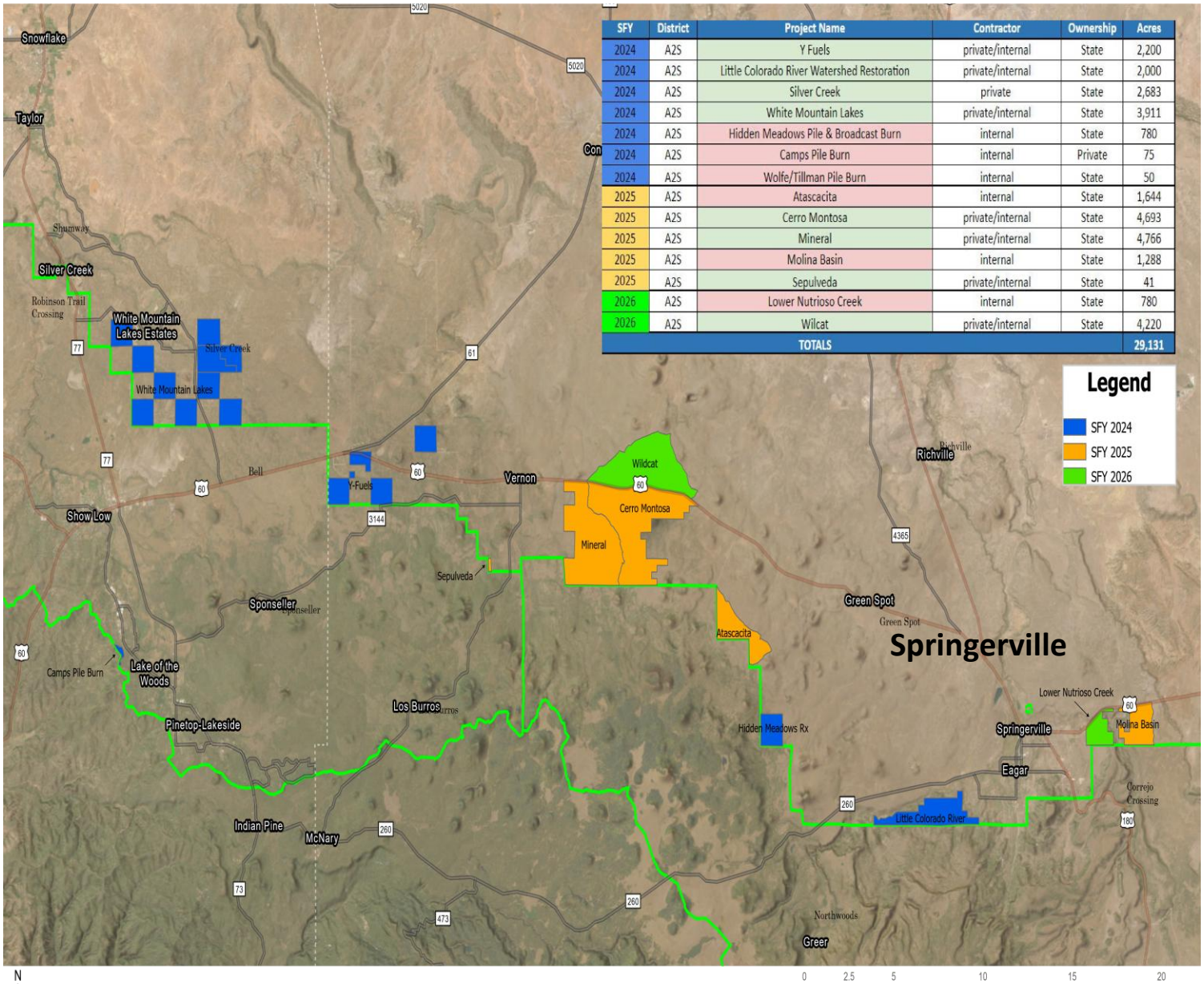
The map on the next page highlights the projects shown above.

Figure C-3. State Trust Land PJ projects around Springerville

Northeast District (A2S) - Projects Overview Map

Internal HFI Project Areas 2023-2026 (DRAFT)

SFY	District	Project Name	Contractor	Ownership	Acres
2024	A2S	Y Fuels	private/internal	State	2,200
2024	A2S	Little Colorado River Watershed Restoration	private/internal	State	2,000
2024	A2S	Silver Creek	private	State	2,683
2024	A2S	White Mountain Lakes	private/internal	State	3,911
2024	A2S	Hidden Meadows Pile & Broadcast Burn	internal	State	780
2024	A2S	Camps Pile Burn	internal	Private	75
2024	A2S	Wolfe/Tillman Pile Burn	internal	State	50
2025	A2S	Atascacita	internal	State	1,644
2025	A2S	Cerro Montosa	private/internal	State	4,693
2025	A2S	Mineral	private/internal	State	4,766
2025	A2S	Molina Basin	internal	State	1,288
2025	A2S	Sepulveda	private/internal	State	41
2026	A2S	Lower Nutrioso Creek	internal	State	780
2026	A2S	Wilcat	private/internal	State	4,220
TOTALS					29,131



N

Scale: 1:250,000

Created By: Jon Orona

State Fiscal Years (SFY) 2024, 2025, and 2026 (Draft Subject to Change).

0 2.5 5 10 15 20 Miles

Figure C-4. Arizona Consumer Price Index (Historical)

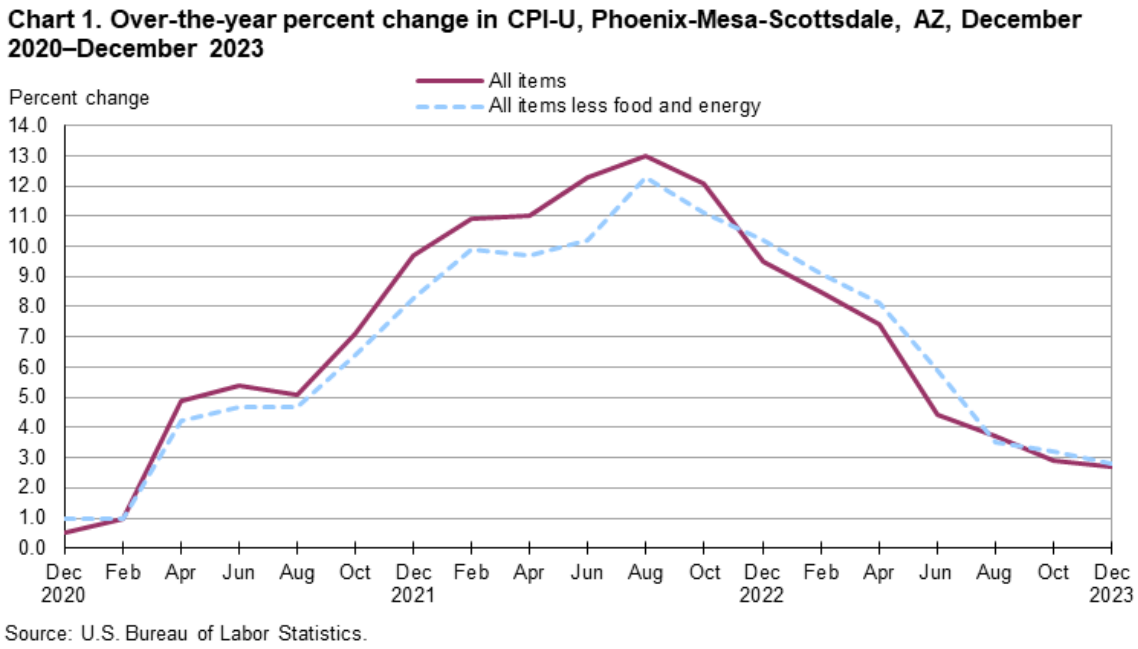


Figure C-5. Historical Diesel Price Index Within the BDO Zone

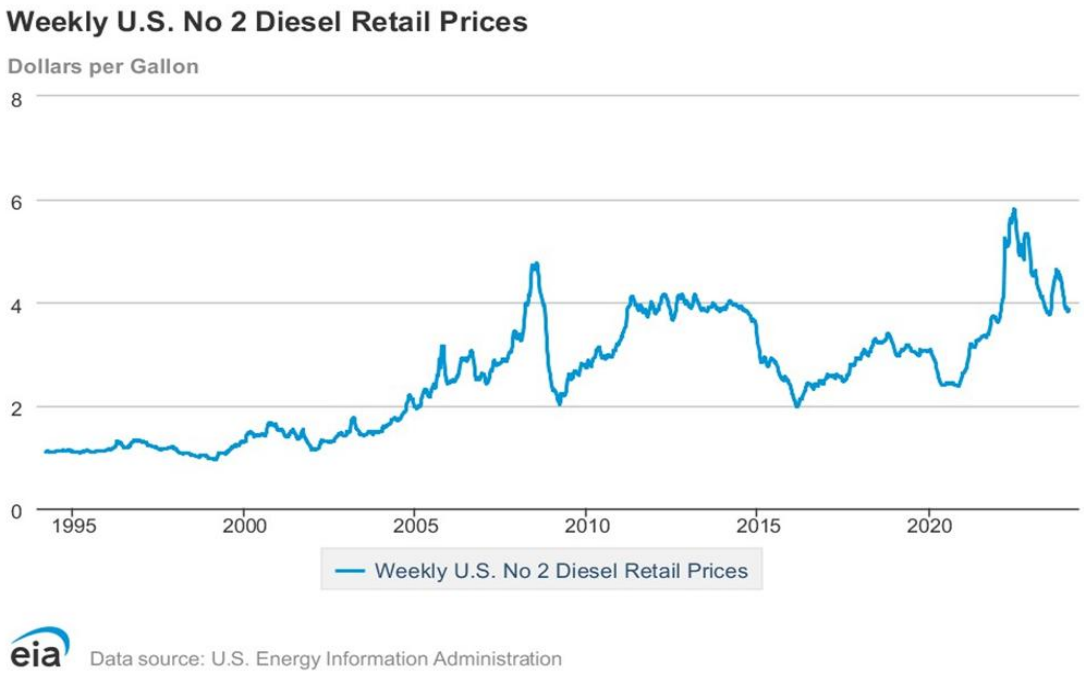
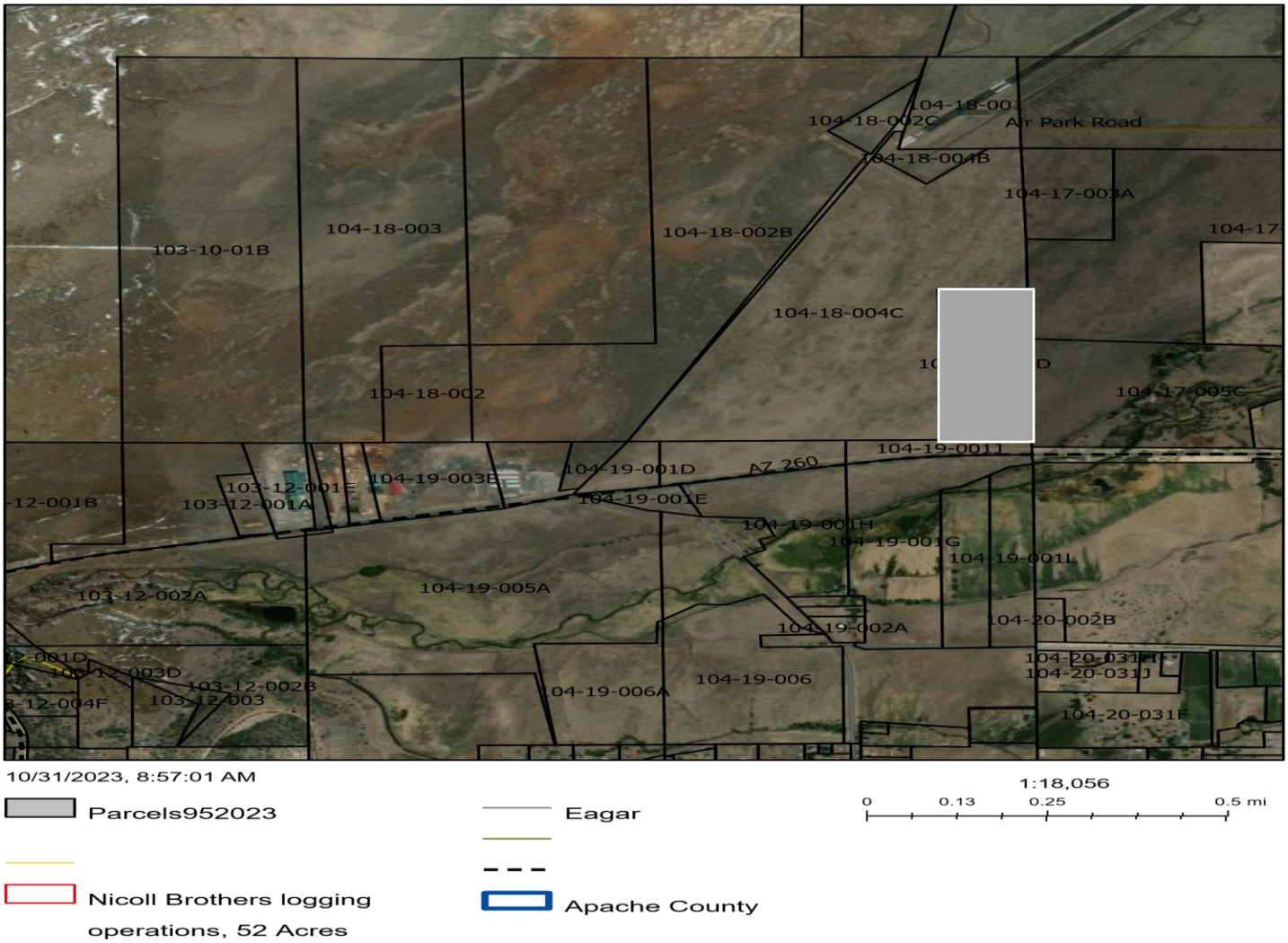


Figure C-6. Industrial site in Springerville / Eagar, AZ, for new bio-economy development

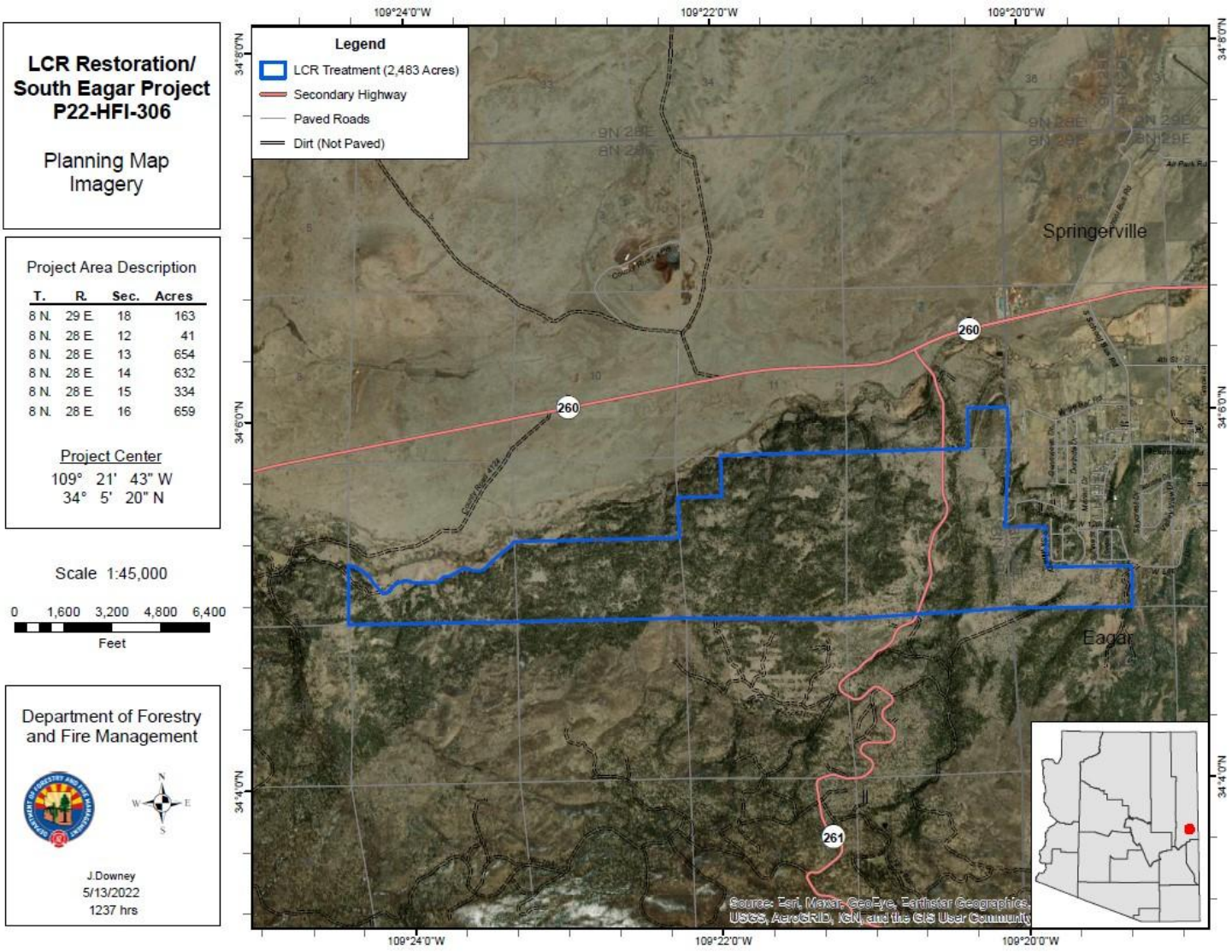


- This 30-acre parcel is zoned for commercial/industrial development
- Owned by the Udall Family Trust – They are very pro-development and would like to promote this site
- Power and water lines run adjacent to the property – it is currently undeveloped
- Arizona Highway 260 provides direct access to the parcel

Figure C-7. Location of industrial site in Springerville / Eagar, AZ



Figure C-8. An additional 2,500 acres of pinyon-juniper to be masticated just south of Springerville in 2024-25



The terrain in this area prohibits grinders and semi-trucks from hauling the material. The PJ will be removed by mastication (see Appendix A Fig. A-10) and spread over the area.

APPENDIX D: LEGAL DISCLAIMER

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