SAC COUNTY, IA

Bioeconomy Development Opportunity Zone

RATING GRADE: 'A'

Date of Issue: November 25, 2024

A
High Quality

Rating Parameters:

Category	Rated Quantity	Delivered Price	BDO Zone Size
Corn Stover	**824,000 bdt/yr**	**$87-$99/bdt**	**75-mi drive distance from Sac City, IA**

BDO ZONE ASSETS

- High corn stover availability due to corn yield over 190 bushels per acre.
- Competition for corn stover is minimal.
- Sac City offers a greenfield site in an industrial park with full utility access and close proximity to major highways.

BDO ZONE LIABILITIES

- Current corn stover equipment needs upgrades or custom baling operations to meet large-scale project demands.
- Farmer participation is hindered by soil quality concerns, and past failed projects, requiring proactive engagement.
- Inclement weather can narrow the time frame for efficient bale production and collection.

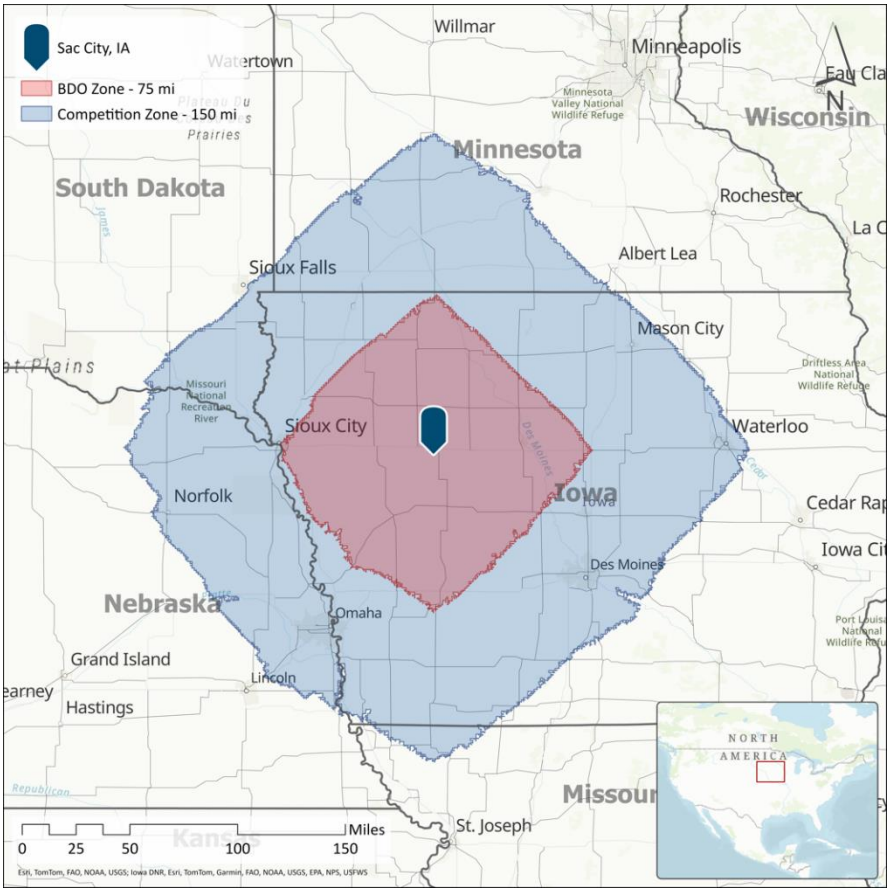
RATING GRADE

The Sac County, IA, 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. The capacity to support new biobased plant operations is considered strong. This capacity may, nevertheless, be more vulnerable to adverse weather during corn stover harvest and insufficient infrastructure to support efficient harvest, baling, and transport of corn stover.

SAC COUNTY, IA BDO ZONE



BD|BIOECONOMY DEVELOPMENT
OZ|OPPORTUNITY ZONE INITIATIVE

ANALYST NOTES

Our analysis has identified an annual availability of 824,000 bone dry tons (bdt) of corn stover within the BDO Zone, which we categorize as a low-risk supply. This quantity represents approximately 6% of the total annual stover production in the region, which amounts to 13.4 million bdt.

The rated supply accounts for competing uses of stover, including its application as a soil cover and animal bedding and feed, and standard collection efficiency achieved with current equipment. Additionally, this figure reflects adjustments for uncertainties associated with launching a large-scale stover operation in a region where stover harvesting is currently limited.

For pricing, we project that the average delivered price range for corn stover bales will be between $87 and $99 per bone dry ton. This range is what future biomass projects will likely pay to secure the necessary quantity of stover.

Additionally, we have evaluated the BDO Zone's suitability for supporting a new bio-project by analyzing various risk indicators across suppliers, competition, the supply chain, feedstock scale-up, and infrastructure. The highest risks arise from a need for industrial-scale collection and transportation capacity and the potential impact of drought. Medium risks stem from limited production scale experience, the efficiency and capacity of suppliers' equipment to scale up, and adverse weather events that impact yields and supply chains. The low risks primarily relate to the absence of large-scale competition, consistent historical production of corn stover, sustainability of supplies, no social and political backlash, and adequate physical and social infrastructure. These assessments outline the potential challenges and advantages of launching a new bio-project in the BDO Zone.

BDO ZONE ASSETS

The BDO Zone lies within one of the highest-producing corn regions in the country, with average yields of over 190 bushels per acre. This ensures that high amounts of corn stover are readily available.

Outreach to corn farmers indicated a willingness to sell corn stover provided favorable contract terms. The most common concerns were pricing and maintaining soil health by limited removal of stover from fields. With an effective measure for engaging farmers, corn stover availability will likely increase within five years.

There is currently no industrial competition for corn stover in the BDO Zone. While some stover is used locally for animal bedding and feed, this use does not significantly reduce the available supply. The primary use of corn stover remains as soil cover, with demand for this purpose projected to remain stable at approximately 50% of total production.

Although large-scale stover harvesting is limited at present, the practice is well-known within the farming community. With appropriate incentives, there is significant potential to scale up stover collection to meet future demand.

BDO ZONE LIABILITIES

The current corn stover harvesting, collection, and transportation equipment in the BDO Zone must be improved to meet the scale required for a significant initiative. Farmers would need to invest in additional equipment. Alternatively, custom baling operations could be established to fulfill the necessary supply. While some farmers already collect corn stover for animal bedding and smaller bioeconomy projects, a large-scale project presents additional logistical challenges that require further experience and coordination. This liability could be mitigated by establishing a regional coop or company responsible for harvest, baling, and transporting corn stover.

Significant yield fluctuations in the past decade have resulted from drought. Additionally, precipitation during the short window following the main grain harvest can impede stover collection and degrade its quality due to excess moisture. This liability could be mitigated by maintaining a surplus of corn stover bales from previous years to offset shortages caused by low-yielding years.

A project proponent must engage in a proactive and effective outreach program, targeting a relatively small group of interested farmers before a facility is commissioned. Building participation rates will require

establishing a solid reputation for operational success and addressing farmers' concerns to ensure sustained involvement. A project proponent should consider adding the function of harvest, baling, and transport to their business plan, relieving individual farmers of additional work during the busy harvest season. A further benefit would be the ability to closely control the quality of baled corn stover by implementing standardized methods.

Farmer participation in the BDO Zone also poses a challenge. Although farmers express willingness to consider harvesting corn stover for bioeconomy projects, changing long-established, multi-generational farming practices remains difficult. Concerns about the potential negative impact on soil quality and the recent memory of failed corn stover projects in the Midwest contribute to their hesitation.

INFRASTRUCTURE PROFILE

The 90-acre industrial site in Sac City, Iowa, offers an attractive location for new bio-industries, supported by solid infrastructure and efficient logistics. Convenient highway access enables seamless transportation of goods and materials, a critical asset for industries focused on supply chain efficiency. The site's existing utilities, including water, electricity, and potential renewable energy sources, provide a cost-effective foundation for bio-industrial operations, minimizing the need for significant initial investment and allowing businesses to focus on growth and innovation.

Sac City's lower cost of living relative to larger urban areas enhances its appeal to businesses and employees. Affordable housing supports workforce stability, making it easier to attract and retain skilled talent essential for operational success.

Overall, this 90-acre site combines well-developed infrastructure, a supportive business climate, and competitive living costs, positioning it as an ideal choice for bio-industries looking to establish or expand operations in Iowa. It should be noted that there is no direct rail access to this site. Rather, the nearest access to rail is 20 miles distant in either Storm Lake or Rockwell City.

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 drive from the center point.

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

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

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

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

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

Loaded RI scores of 4 or less are deemed very low risk; scores between 5 and 16 are deemed low risk; scores between 17 and 36 are deemed medium risk; scores

between 37 and 64 are deemed high risk; and scores of 65 and greater are deemed very high risk.

The total risk rating for the BDO Zone is the average of all Loaded RI scores and Infrastructure Indicators. The BDO Zone score for Sac County, IA, is ***21.74 out of 100, resulting in an 'A' designation.***

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

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SECTION A: RISK INDICATOR SUMMARY

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

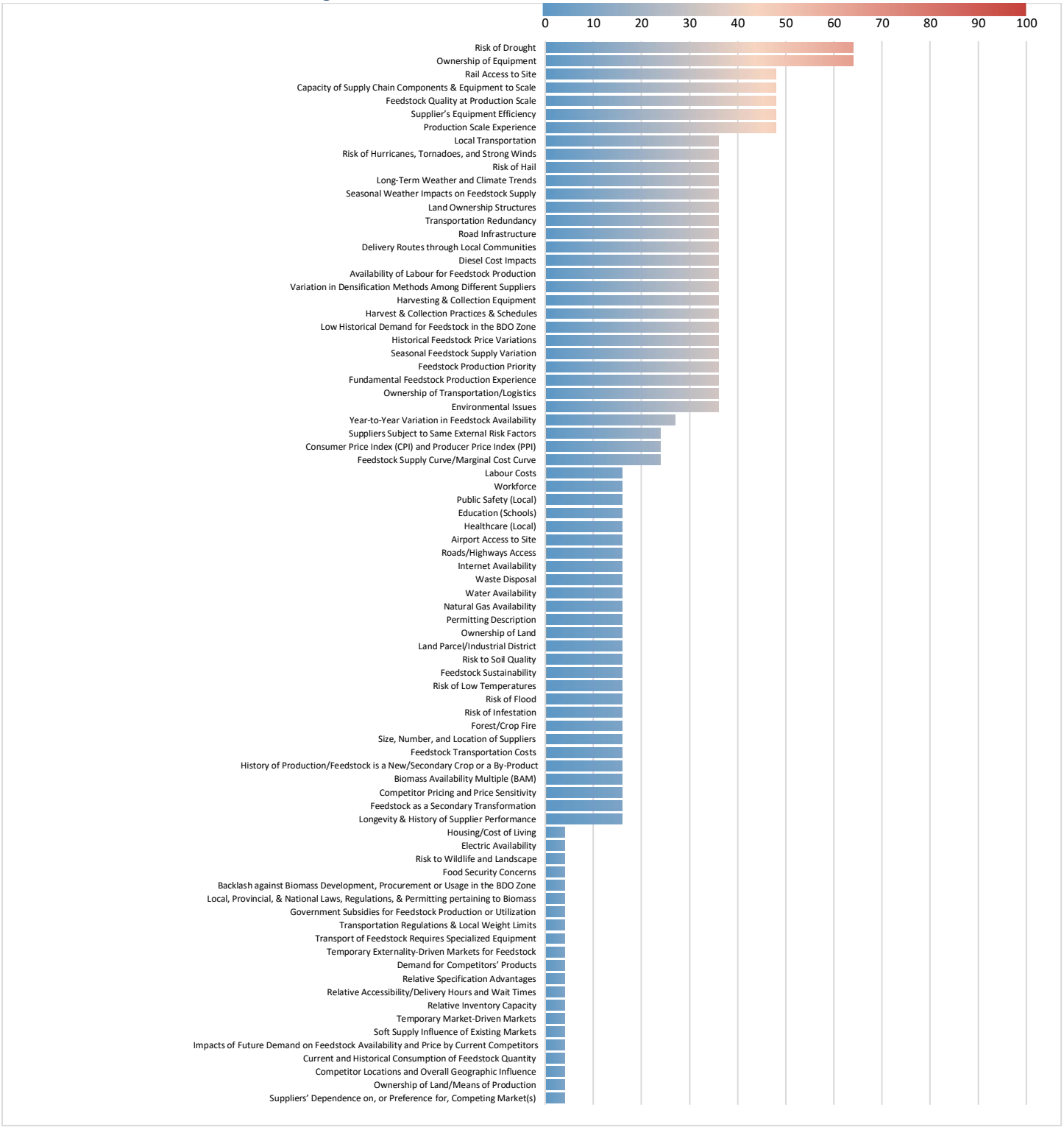


Table A-1. Risk Indicators and Associated Scores

Feedstock Supply Chain Risk Indicators	Raw Risk Likelihood	Raw Risk Impact	Gross Risk Indicator	Mitigation /Notching	Loaded RI Score
Category 1.0: Supplier Risk					
1.1 Risk Factor: Credit-Worthiness/Future Solvency of Suppliers					
1.1.1 Longevity & History of Supplier Performance	4	4	16	NN	16
1.2 Risk Factor: Conflicts of Interest/Vested Interest with Competing Market(s)					
1.2.1 Suppliers' Dependence on, or Preference for, Competing Market(s)	2	2	4	NN	4
1.3 Risk Factor: Supplier Control Over Production and Transportation					
1.3.1 Ownership of Land/Means of Production	2	2	4	NN	4
1.3.2 Ownership of Equipment	8	8	64	NN	64
1.3.3 Ownership of Transportation/Logistics	6	6	36	NN	36
1.3.4 Feedstock as a Secondary Transformation	4	4	16	NN	16
1.4 Risk Factor: Supplier Experience					
1.4.1 Fundamental Feedstock Production Experience	6	6	36	NN	36
1.4.2 Production Scale Experience	8	8	64	25%	48
1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity					
1.5.1 Supplier's Equipment Efficiency	6	8	48	NN	48
1.6 Risk Factor: Supplier Motivation					
1.6.1 Feedstock Production Priority	6	6	36	NN	36
Category 2.0: Competitor Risk					
2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets					
2.1.1 Competitor Locations and Overall Geographic Influence	2	2	4	NN	4
2.1.2 Current and Historical Consumption of Feedstock Quantity	2	2	4	NN	4
2.1.3 Competitor Pricing and Price Sensitivity	4	4	16	NN	16
2.1.4 Impacts of Future Demand on Feedstock Availability and Price by Current Competitors	2	2	4	NN	4
2.1.5 Soft Supply Influence of Existing Markets	2	2	4	NN	4
2.1.6 Temporary Market-Driven Markets	2	2	4	NN	4
2.2 Risk Factor: Specific Competitors' Competitive Advantage					
2.2.1 Relative Inventory Capacity	2	2	4	NN	4
2.2.2 Relative Accessibility/Delivery Hours and Wait Times	2	2	4	NN	4
2.2.3 Relative Specification Advantages	2	2	4	NN	4
2.2.4 Demand for Competitors' Products	2	2	4	NN	4
Category 3.0: Supply Chain Risk					
3.1 Risk Factor: Feedstock Availability					
3.1.1 Biomass Availability Multiple (BAM)	4	4	16	NN	16
3.1.2 Feedstock Supply Curve/Marginal Cost Curve	4	6	24	NN	24
3.1.3 Seasonal Feedstock Supply Variation	6	6	36	NN	36
3.1.4 Year-to-Year Variation in Feedstock Availability	6	6	36	25%	27
3.2 Risk Factor: Historical Issues					
3.2.1 Historical Feedstock Price Variations	6	6	36	NN	36
3.2.2 Low Historical Demand for Feedstock in the BDO Zone	6	6	36	NN	36
3.2.3 History of Production/Feedstock is a New/Secondary Crop or a By-Product	4	4	16	NN	16
3.3 Risk Factor: Non-Weather Based Externalities					
3.3.1 Consumer Price Index (CPI) and Producer Price Index (PPI)	6	4	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 Risk Factor: Risks Related to Feedstock Production, Harvest, and Collection					
3.4.1 Harvest & Collection Practices & Schedules	6	6	36	NN	36
3.4.2 Harvesting & Collection Equipment	6	6	36	NN	36
3.4.3 Variation in Densification Methods Among Different Suppliers	6	6	36	NN	36
3.4.4 Availability of Labor for Feedstock Production	6	6	36	NN	36
3.5 Risk Factor: Transportation					
3.5.1 Feedstock Transportation Costs	4	4	16	NN	16
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	6	6	36	NN	36
3.5.5 Transportation Regulations & Local Weight Limits	2	2	4	NN	4
3.5.6 Road Infrastructure	6	6	36	NN	36
3.5.7 Transportation Redundancy	6	6	36	NN	36

3.6 Risk Factor: Supply Chain Resiliency					
3.6.1 Size, Number, and Location of Suppliers	4	4	16	NN	16
3.6.2 Suppliers Subject to Same External Risk Factors	4	6	24	NN	24
3.6.3 Land Ownership Structures	6	6	36	NN	36
3.7 Risk Factor: Climate and Natural Risks					
3.7.1 Seasonal Weather Impacts on Feedstock Supply	6	6	36	NN	36
3.7.2 Long-Term Weather and Climate Trends	6	6	36	NN	36
3.7.3 Forest/Crop Fire	4	4	16	NN	16
3.7.4 Risk of Infestation	4	4	16	NN	16
3.7.5 Risk of Hail	6	6	36	NN	36
3.7.6 Risk of Flood	4	4	16	NN	16
3.7.7 Risk of Drought	8	8	64	NN	64
3.7.8 Risk of Hurricanes, Tornadoes, and Strong Winds	6	6	36	NN	36
3.7.9 Risk of Low Temperatures	4	4	16	NN	16
3.8 Risk Factor: Political and Social					
3.8.1 Government Subsidies for Feedstock Production or Utilization	2	2	4	NN	4
3.8.2 Local, Provincial, & National Laws, Regulations, & Permitting pertaining to Biomass	2	2	4	NN	4
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	NR	NR	NR	NR	NR
3.8.5 Food Security Concerns	2	2	4	NN	4
3.9 Risk Factor: Sustainability and Environmental Concern					
3.9.1 Feedstock Sustainability	4	4	16	NN	16
3.9.2 Risk to Soil Quality	4	4	16	NN	16
3.9.3 Risk to Surface and Groundwater	NR	NR	NR	NR	NR
3.9.4 Water Use	NR	NR	NR	NR	NR
3.9.5 Pesticide Risk to Human and Ecosystem Health	NR	NR	NR	NR	NR
3.9.6 Risk to Wildlife and Landscape	2	2	4	NN	4
3.9.7 Biomass Classified as Genetically Modified Organism (GMO)	NR	NR	NR	NR	NR
Category 4.0: Feedstock Scale-up Risk					
4.1 Risk Factor: Feedstock Scale-Up					
4.1.1 Feedstock Quality at Production Scale	8	8	64	25%	48
4.1.2 Capacity of Supply Chain Components & Equipment to Scale	6	8	48	NN	48
Category 5.0: Infrastructure					
5.1 Risk Factor: Physical Infrastructure					
5.1.1 Land Parcel/Industrial District	4	4	16	NN	16
5.1.2 Ownership of Land	4	4	16	NN	16
5.1.3 Permitting Description	4	4	16	NN	16
5.1.4 Environmental Issues	6	6	36	NN	36
5.2 Risk Factor: Utilities					
5.2.1 Natural Gas Availability	4	4	16	NN	16
5.2.2 Electric Availability	4	4	16	NN	16
5.2.3 Water Availability	4	4	16	NN	16
5.2.4 Waste Disposal	4	4	16	NN	16
5.2.5 Internet Availability	4	4	16	NN	16
5.3 Risk Factor: Transportation/Logistics					
5.3.1 Roads/Highways Access	4	4	16	NN	16
5.3.2 Rail Access to Site	6	8	48	NN	48
5.3.3 Airport Access to Site	4	4	16	NN	16
5.3.4 Water Freight Access	NR	NR	NR	NR	NR
5.4 Risk Factor: Social Infrastructure					
5.4.1 Healthcare (Local)	4	4	16	NN	16
5.4.2 Education (Schools)	4	4	16	NN	16
5.4.3 Local Transportation	6	6	36	NN	36
5.4.4 Public Safety (Local)	4	4	16	NN	16
5.4.5 Housing/Cost of Living	2	2	4	NN	4
5.5 Risk Factor: Labor					
5.5.1 Workforce	4	4	16	NN	16
5.5.2 Labor Costs	4	4	16	NN	16
				Average	**21.74**

SECTION B: BIOMASS AVAILABILITY AND PRICING

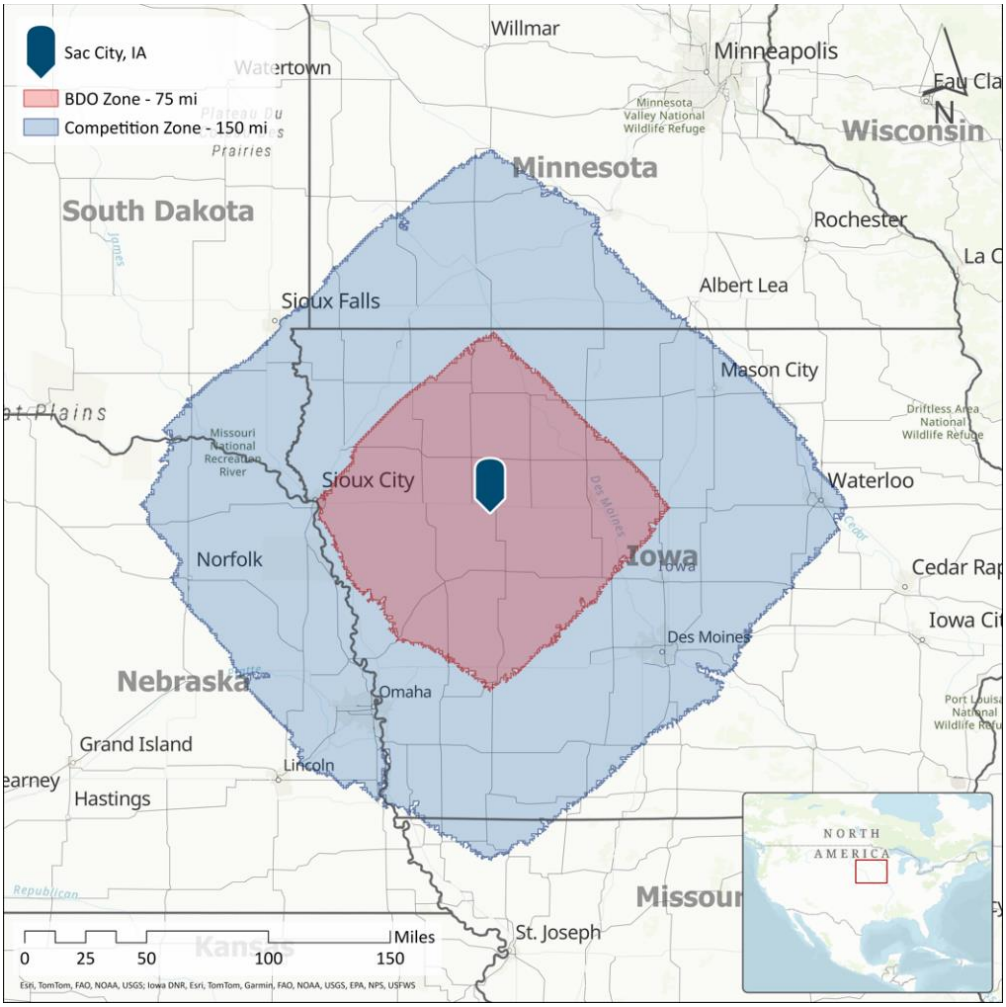
OVERVIEW

Determining corn stover availability and pricing begins with estimating total corn stover generation within the BDO Zone, defined by a 75-mile drive from Sac City, Iowa, as shown on Map B-1. This estimated quantity is then adjusted downward based on the anticipated demand within the Competition Zone, a 150-mile drive from Sac City, IA.

Additional adjustments address factors such as sustainable stover retention and harvesting efficiency. A Biomass Availability Multiple (BAM) is also applied, reducing the available quantity based on producers' participation rates, supply chain constraints, and uncertainties in the data or modeling process. The outcome is a conservative and low-risk estimate of corn stover availability tailored for a new project in Sac City.

The price range for this rated quantity is determined through outreach and detailed cost analysis within the BDO Zone. This price range reflects the expected cost a new bioeconomy project should pay to secure the rated quantity of corn stover, ensuring financial readiness and project feasibility.

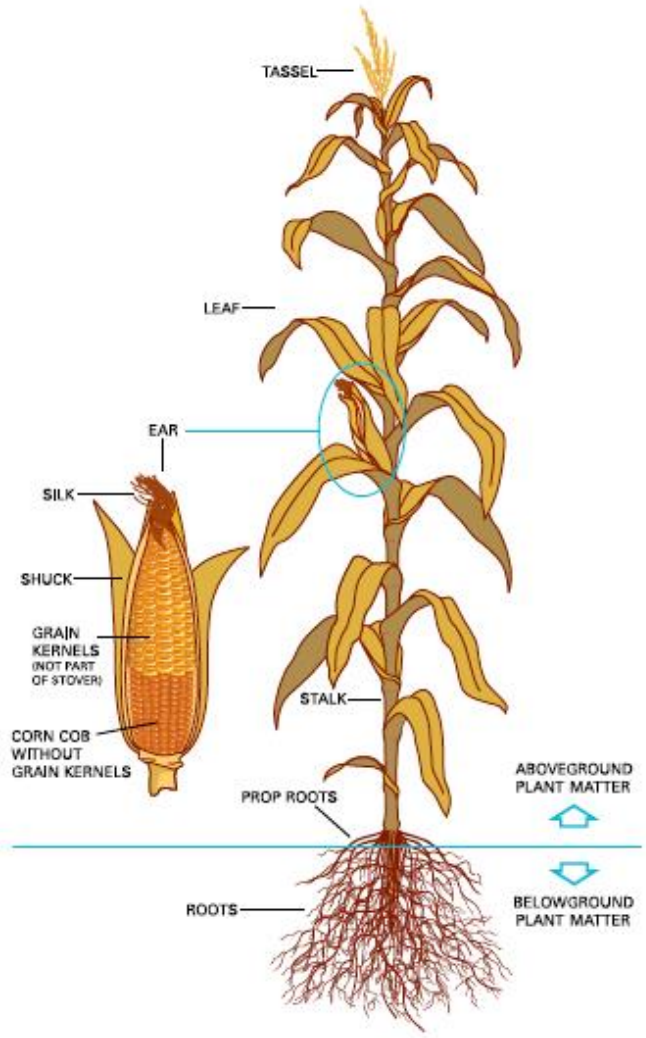
Map B-1. Map of BDO Zone and Competition Zone



EVALUATED FEEDSTOCKS

This rating evaluates the amount of corn stover available for a bioeconomy project. Corn stover consists of stalks, leaves, shuck, silk, tassel, and cobs left over after harvest (Figure B-1.)

Figure B-1. Parts of a Corn Plant[1]



To estimate the rated quantity of corn stover in the BDO Zone, we have developed a five-step methodology that accounts for factors such as competition, logistics, sustainability, farmer participation rate, and operational constraints:

(1) **Average annual corn grain production** relies on historical corn planting, harvesting, and yield data collected from the United States Department of Agriculture National Agricultural Statistics Service (USDA NASS) for the past ten years.[2]

[1] Source. Iowa State University Extension and Outreach. *Industrial Corn Stover Harvest*. Publication PM3030, March 2014.
[2] USDA/NASS. *QuickStats Ad-hoc Query Tool.* Accessed September 19, 2024. https://quickstats.nass.usda.gov/.

(2) **Average annual corn stover production** is estimated based on the average corn yield and the stover/grain ratio.

(3) **Current corn stover uses** are estimated based on outreach to local crop growers and experts and published documents. This quantity is subtracted from the total corn stover generation to determine the surplus, potentially available for other uses.

(4) **Collection Efficiency** is the ratio of stover collected to the total above-ground stover. Not all crop residues can be harvested by the baling machine. Part of that is to avoid contamination with soil by adjusting the baler pickup height. In addition, the operator's experience and the baler configuration impact the collection efficiency.

(5) **Biomass Availability Multiple (BAM)** serves as a mechanism to account for unknown risks related to the future corn stover availability in the BDO Zone by discounting the available stover estimated in Step 4. It calculates a low-risk rated quantity, providing a more conservative estimate of available corn stover.

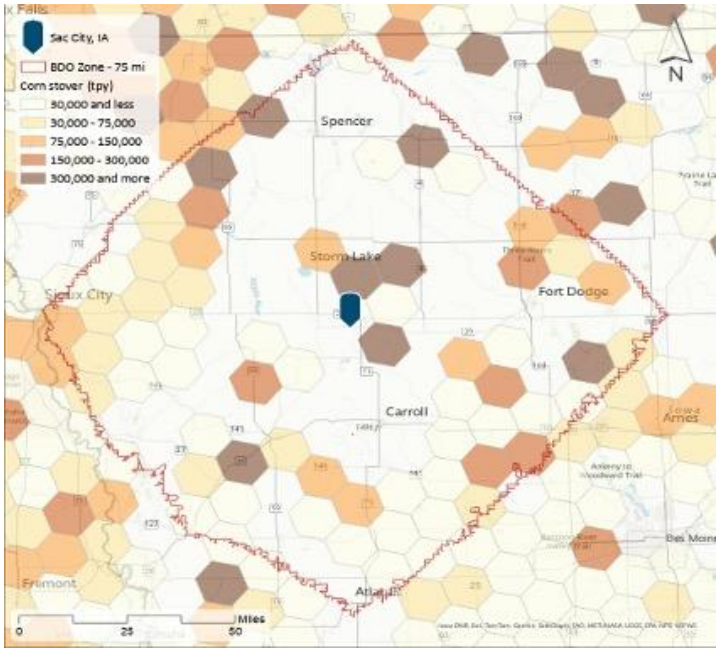
SUPPLY ANALYSIS

Average annual corn grain production

The Sac County BDO Zone, as depicted on Map B-1, is located in the western part of Iowa, with Sac City, IA, serving as the center point. This zone encompasses 32 counties, where approximately 3.2 million acres of corn are planted annually. The region consistently achieves high corn yields, ranging from 180 to 210 bushels per acre, although yield variations occur across different areas within the BDO Zone. The yield of corn stover, based on corn yield, is shown on Map B-2.

The prevalent agricultural practices in the Zone include traditional crop rotations, primarily corn-corn and corn-soybean cycles. According to data from the 2009 USDA Census, 17,040 farms were reported in the BDO Zone, covering a total area of 7.1 million acres, with an average farm size of 416 acres. This substantial agricultural base underpins the economic and production capacity of the region.

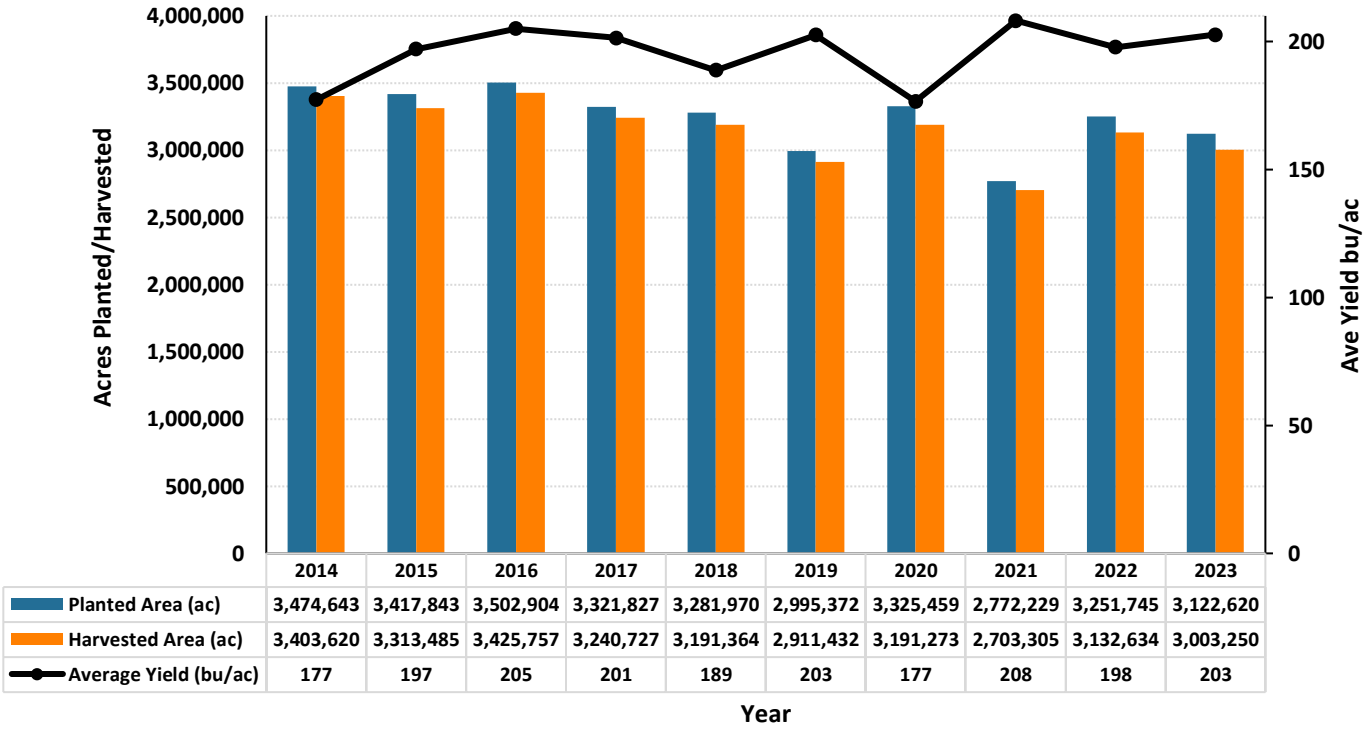
Map B-2. Map of BDO Zone – Corn Stover Yield[3]



[3] "Quick Stats - USDA - National Agricultural Statistics Service." Accessed August 20, 2024. https://www.nass.usda.gov/Quick_Stats/.

Figure B-2 shows the total corn planted area in the BDO Zone, the harvested area, and the yield per acre.

Figure B-2. Total Corn Area Planted, Harvested, and Yield per Acre



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Planted Area (ac)	3,474,643	3,417,843	3,502,904	3,321,827	3,281,970	2,995,372	3,325,459	2,772,229	3,251,745	3,122,620
Harvested Area (ac)	3,403,620	3,313,485	3,425,757	3,240,727	3,191,364	2,911,432	3,191,273	2,703,305	3,132,634	3,003,250
Average Yield (bu/ac)	177	197	205	201	189	203	177	208	198	203

- Total planted area decreased about 10% between 2014 and 2023
- The total harvested area decreased by about 12% over this period
- The average annual harvested area over this period was about 3,152,000 acres
- Low per-acre yields in 2014, 2018, and 2020 are due to drought conditions
- Aside from the three low-yielding years, corn production ranged between 189 and 208 bushels per acre
- The average grain yield over this period was 196 bu/ac, which equals about 5.47 t/ac[4]

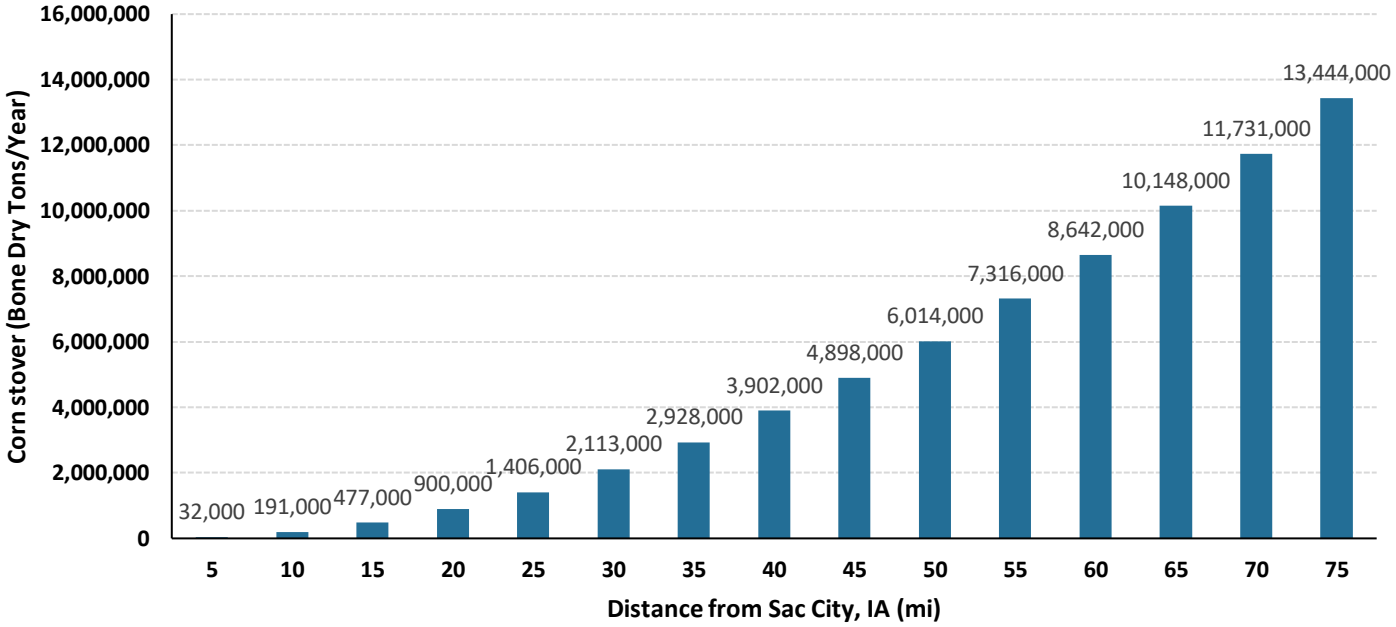
Average annual corn stover production

The average corn stover to grain ratio is 1:1,[5] meaning that one ton of stover is generated for each ton of corn harvested. Before drying, corn stover contains, on average, 22% moisture and 88% dry material.[6] After accounting for the moisture lost during drying, the average annual yield of corn stover is about 13,444,000 bdt in the BDO Zone.

[4] U.S. Grains Council. "Converting Grain Units." Accessed September 12, 2024. https://grains.org/markets-tools-data/tools/converting-grain-units/.
[5] Iowa State University Extension and Outreach. "Soil Quality." Accessed September 12, 2024. https://www.extension.iastate.edu/stover/content/soil-quality.
[6] Iowa State University Extension and Outreach. *Industrial Corn Stover Harvest*. PM 3050, March 2014.

Figure B-3 details the distribution of this corn stover at 5-mile distance increments from Sac City, IA.

Figure B-3. Estimated Corn Stover Availability by Distance from Sac City, IA



- Approximately half of the corn stover quantity is within a 55-mile drive from Sac City.

COMPETITION ANALYSIS

Current corn stover uses

There are three current competitive uses of corn stover:

- Fertilizer/Soil Cover
- Animal Feed/Livestock Bedding
- Industrial Use

Fertilizer/Soil Cover

Managing corn stover as fertilizer and soil cover involves balancing the benefits of leaving residues in the field with the challenges of excessive residues. When corn stover is left to degrade in the field, it cycles nutrients back into the soil, enhances organic matter, helps retain soil moisture, and supports beneficial microbial activity. Corn residue left over the winter also protects against soil erosion by shielding the soil from wind and rain, thereby maintaining soil quality. Conversely, excessive residues can impede soil warming during the planting season, complicate the operation of planting machinery, and increase greenhouse gas emissions from residue decay. Therefore, the optimal removal rate of corn residues is site-specific and depends on factors like crop rotation and individual soil management practices. Farmers who grow crops only tend to leave the stover on the surface or till it into the soil.

Given favorable terms, most farmers who were contacted expressed willingness to harvest and sell a portion of their corn stover.[7] The harvest methods used in the BDO Zone result in about 50% of the stover being removed. This proportion falls

[7] Outreach to local farmers. Personal communication.

within recommendations that 40 to 60% of crop residues be left in the field as ground cover to ensure soil health and sustainability.[8]

The BDO Zone ranks among the highest corn-producing areas in the US, with an average of 196 bu/ac compared to the national average of 177 bu/ac. Given the favorable corn production, we assume that removing 50% of corn stover will allow sustainable farming.

Animal Feed/Livestock Bedding

Livestock producers are generally more interested in feed products such as hay, corn silage, and wheat straw. Corn stover is mainly used to supplement animal feed products and for bedding. Farmers in the BDO Zone that raise livestock will harvest a portion of their stover and spread animal manure over the harvested area to replace nutrients lost from stover harvesting.[9]

The BDO Zone is in an area of Iowa where raising livestock is common.[10] However, outreach suggests less than 1% of corn stover production is used for feed and bedding.

Industrial Use - Current

The Verbio facility in Nevada, IA, was acquired from DuPont in 2017 and repurposed to produce renewable natural gas (RNG) from corn stover.[11] Operational since 2021, the plant uses 16 methane-digester tanks and annually consumes approximately 70,000 bdt of corn stover, sourced using their provided fleet of trucks and balers. This facility is 106 miles from Sac City, IA. The corn stover procurement radius of this facility is 50 miles. This facility is unlikely to impact corn stover use in the BDO Zone, see Table B-1.

Industrial Use – Proposed

Corn Board (Odebolt, IA) will convert corn stover into structural panels to produce shipping pallets for distribution and manufacturing centers.[12] The company anticipates a feedstock demand of 50,000 tons of corn stover annually.[13] Corn stover will be sourced from about 80 farmers in a 20-mile radius. Expected completion is in August 2025. This project is 21 miles from Sac City, IA.

New Energy Blue (Mason City, IA) is a collaboration with Dow Inc. This facility will be built to convert corn stover into ethanol and lignin.[14] This facility will use about 275,000 bdt of corn stover annually collected from about 50 farmers within a 20- to 30-mile radius.[15] The groundbreaking is expected to occur in the second half of 2024, with the facility's startup in 2026.[16] This project is 134 miles from Sac City, IA.

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[8] "Effects of Corn Stover Removal on Nutrient Management." *Bayer Crop Science*, January 30, 2024. https://www.cropscience.bayer.us/articles/bayer/effects-of-corn-stover-removal-on-nutrient-management.

[9] Outreach to local farmers. Personal communication.

[10] Iowa Farm Bureau. "Livestock and Poultry in Iowa." Published July 5, 2022. https://www.iowafarmbureau.com/Article/Livestock-and-Poultry-In-Iowa#:~:text=Northern%20Iowa%20tends%20to%20have,farms%20at%20any%20one%20time.

[11] "Verbio Nevada Biorefinery." Accessed August 22, 2024. www.verbio-north-america.com/locations/verbio-nevada-biorefinery.

[12] "Corn Board Manufacturing to Break Ground in 2023." Accessed August 15, 2024. https://www.iowafarmbureau.com/Article/Corn-Board-Manufacturing-to-break-ground-in-2023.

[13] "Biomass Plant Opening in Odebolt; Will Have Crawford County Reach." Accessed August 15, 2024. https://www.denisonfreepress.com/news/biomass-plant-opening-in-odebolt-will-have-crawford-county-reach.

[14] "Dow and New Energy Blue Announce Collaboration to Develop Renewable Plastic Materials from Corn Residue." Accessed August 22, 2024. https://www.masoncity.net/newsview.aspx?nid=10211.

[15] "Announcing the Formation of New Energy Farmers LLC, a Biomass Aggregation Company." Accessed August 22, 2024. https://newenergyblue.com/nef-formation/.

[16] "New Energy Blue and ARCO/Murray Partner to Build Biomass Refineries to Produce Sustainable Fuels and Chemicals." Accessed August 22, 2024. https://www.prnewswire.com/news-releases/new-energy-blue-and-arcomurray-partner-to-build-biomass-refineries-to-produce-sustainable-fuels-and-chemicals-302178372.html.

As the proposed facilities are not yet operating, their annual consumption of stover is not included in the current availability of feedstock. The projected demand for the three identified facilities is shown in Table B-1.

Table B-1. Impact of Competitors on the BDO Zone Corn Stover Supply

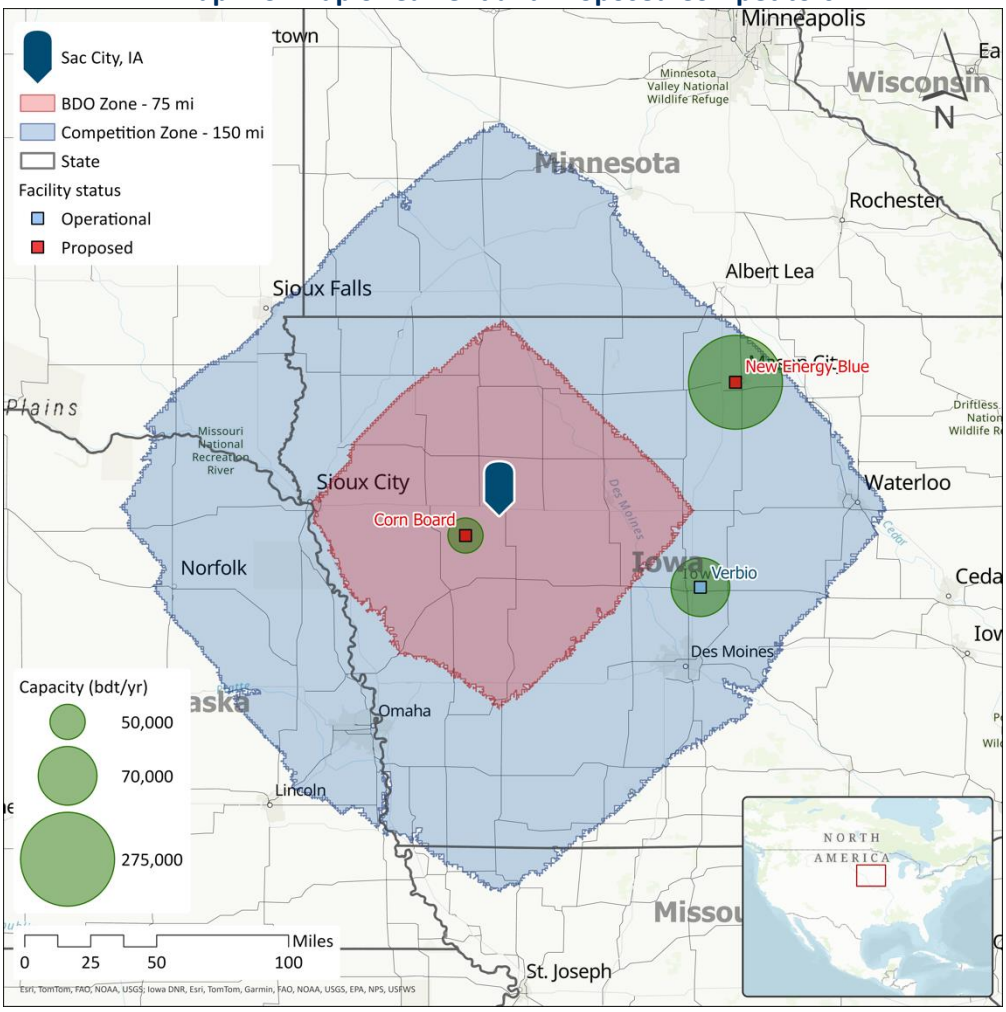
Company	Location	Status	Capacity (bdt/yr)	Distance from Sac City, IA (mi)	Stover Procurement Radius (mi)	Impact Factor	Impact (bdt/yr)
Verbio	Nevada, IA	Open	70,000	106	50	0%	0
Corn Board	Odebolt, IA	Proposed	50,000	21	20	100%	50,000
New Energy Blue	Mason City, IA	Proposed	275,000	134	30	0%	0
Totals			**395,000**				**50,000**

- Operating and proposed competitors will demand about 50,000 bdt/yr from the BDO Zone
- The impact of competitors on the BDO Zone corn stover supply is minimal, with less than 1% of the total availability

The impact of competitive demand for corn stover on a new project in Sac City, IA, is based on the feedstock supply radii of the announced projects. The closer to the BDO Zone, the higher the proportion of feedstock a competitor will source that is also available to a new project.

Current and proposed competitors for corn stover are shown on Map B-3.

Map B-3. Map of Current and Proposed Competitors



Competitive Use

The amount of available corn stover after accounting for competitive use is shown in Table B-2.

Table B-2. Production, Competitive Use, and Availability of Corn Stover

Corn Stover Parameter	Annual Amount (bdt)
Average annual production	13,444,000
Fertilizer/Soil Cover	(6,722,000)
Animal Feed/Livestock Bedding	(134,000)
Industrial Use[17]	(0)
Annual Available Corn Stover	**6,588,000**

[17] Only current demand is accounted for in this Table. Demand from proposed projects is excluded here.

The total competitive use of corn stover in the BDO Zone is about 6,856,000 bdt. After subtracting competing uses of corn stover, the annual available amount is about 6,588,000 bdt.

Collection Efficiency

In the BDO Zone, the collection of corn stover is most commonly done using a multi-pass system. The first pass runs a combine to harvest the grain, with the stover ejected out the back onto the field. After the stover has dried, the second pass involves raking into windrows, sometimes incorporating a stalk chopper. The third pass is baling, most often with a round baler. This system collects approximately 50% of the total corn stover volume. [18]

RATED QUANTITIES AND PRICING

Biomass Availability Multiple (BAM)

The rated quantity is determined by dividing the availability estimate by a Biomass Availability Multiple (BAM). The BAM is applied to account for uncertainty in underlying data, models, assumptions, corn stover supply and demand, and future operating conditions for new bio-projects. The resulting quantity is a low-risk estimate of availability for a new project.

The Biomass Availability Multiple (BAM) is a critical metric that evaluates the supply chain's resilience when estimating corn stover availability. It provides a buffer against potential risks, ensuring a reliable estimate of accessible biomass. The BAM considers several critical factors. One factor is producer participation, as the level of engagement and commitment from local farmers directly affects the available biomass. It also accounts for the capability of both project proponents and producers to scale up production in response to project demands. Historical harvesting practices and volumes also play a role in influencing both current and future supply levels. Another consideration is the reliability of the data and assumptions used in calculating the rated quantity. Finally, the BAM addresses the potential for sudden fluctuations in corn stover production and demand, which weather, market shifts, or other external factors could trigger. BAM is assigned a value between 1.5 and 4 depending on the uncertainties in the above factors.

Table B-3 shows the application of a Biomass Availability Multiple (BAM) to the estimated quantity of corn stover. A BAM value of 4.0 accounts for the various uncertainty factors that influence the availability of corn stover. This relatively high BAM value is weighted heavily toward the uncertainty of farmer participation due to the following concerns:

- Issues around soil health, as this would be a relatively new practice to be implemented on a large scale[19,20]
- Need to overcome farming practices that are ingrained into the community[21, 22]
- Farmers remember[23] a recently failed corn stover project in the Emmetsburg, IA, area

This adjusted BAM value aims to provide a more conservative and realistic estimate of available biomass to ensure the project's feasibility amid uncertainties. The calculated rated quantity, resulting from applying the BAM, is 824,000 bdt/yr, representing 6% of the total estimated corn stover production in the BDO Zone.

[18] Outreach to technical specialist. Personal communication.
[19] Outreach to local farmers. Personal communication.
[20] Outreach to academic expert. Personal communication.
[21] Local farmers without livestock either leave stover in place or till it into the soil.
[22] Outreach to technical specialist. Personal communication.
[23] Outreach to local farmer. Personal communication.

Table B-3. Calculation of Corn stover Rated Quantity *

Factor	Value
Average annual harvested area (ac)	3,152,000
Average annual grain production (bu/ac)	196
Average annual grain production (green tons)	17,236,000
Stover/Grain Ratio	1:1
Average corn stover moisture content (wet basis)	22%
Average annual corn stover production (bdt)	**13,444,000**
Competing uses	6,856,000
Average annual corn stover available after competing uses (bdt)	**6,588,000**
Collection Efficiency	50%
Available annual quantity available for removal (bdt)	**3,294,000**
BAM	4.0
Annual Rated Quantity (bdt)	**824,000**
Rated Quantity/ annual corn stover production	**6%**

* Corn stover quantities are rounded

This percentage could increase following the implementation of a project that benefits all stakeholders involved. Farmers have indicated their willingness to participate depending on the volume required and the payment rate for stover. Farmers have also preferred the new project proponents to manage corn stover harvest, baling, and transport. Additional considerations are the timing of stover collection and accounting for nutrient replacement needed due to stover removal. The success of the project and its ability to scale will depend on the project proponent's ability to generate goodwill among the farming community, pay a reasonable rate for feedstock, and demonstrate the venture's success over time.[24]

Delivered Price

The price range associated with the rated quantity is determined through outreach and market analysis. It reflects the expected price a new bio-project would have to pay to secure the rated quantity. Table B-4 indicates how the delivered price range for the rated quantity of corn stover is estimated using various cost components.

[24] Outreach to industry expert. Personal communication.

Table B-4. Farm Gate and Delivered Price Ranges

Price Component	$/bdt[25]	$/bale[26]
Chopping/Windrowing[27,28]	9.00 - 9.50	4.60 - 4.80
Baling[29]	26.80 - 29.60	13.60 - 15.00
Moving/Stacking[30]	6.40 - 6.80	3.20 - 3.40
Nutrient Replacement Value[31]	4.40 - 10.30	2.20 - 5.20
Producer Markup (20%)[32]	9.30 - 11.20	4.70 - 5.70
Calculated price at farm gate	**55.90 - 67.40**	**28.30 - 34.10**
Loading/unloading cost[33]	6.40 - 6.80	3.20 - 3.40
Av. Transportation Cost (50-mile)[34,35]	24.60	12.50
Delivered Price	**86.90 – 98.90**	**44.00 – 50.00**

In summary, the rated quantity of corn stover is estimated to be 824,000 bdt/yr (Table B-3), and the estimated rated price range is $87-$99/bdt, or $44-$50/bale (Table B-4).

OPERATIONAL CONSIDERATIONS

If a new project in Sac City used the rated quantity of corn stover, an additional 100 balers, 200 tractors,[36] and 57 trucks with 53-ft flatbed trailers[37] would be necessary.

The 2022 USDA Agricultural Census reported approximately 41,200 tractors and 2,800 balers[38] in the BDO Zone. While the above equipment requirements seem achievable under current equipment availability, a large-scale corn stover project requires addressing a short harvest window with tight quality control standards. Furthermore, the corn stover harvest must be completed simultaneously with the primary grain harvest and directly after.

[25] 22% bale moisture content assumed. Iowa State University Extension and Outreach. *Industrial Corn Stover Harvest*. PM 3050, March 2014
[26] Assumes a bale average weight (large square or round) of 1,300 lbs or 0.5 bdt
[27] Price range consists of median and average surveyed values. Price range is expressed in $/per acre and assumes 3 bales per acre.
[28] Iowa State University Extension and Outreach. *2024 Iowa Farm Custom Rate Survey*. "Ag Decision Maker." Accessed September 12, 2024. https://www.extension.iastate.edu/agdm/crops/html/a3-10.html.
[29] *Ibid*.
[30] *Ibid*.
[31] Iowa State University Extension and Outreach. *2024 Iowa Farm Custom Rate Survey. "Ag Decision Maker." IST Extension calculator. https://www.extension.iastate.edu/agdm/crops/xls/a1-70cornstoverpricer.xlsx, using default ranges: 2–4 lbs/bdt and 8–20 lbs/bdt for P and K removal rates, respectively. Also, fertilizer current rates of Urea, DAP, and Potash were used.*
[32] Outreach. Includes compensation for temporary bale storage at producers' site.
[33] Iowa State University Extension and Outreach. *2024 Iowa Farm Custom Rate Survey*. "Ag Decision Maker."
[34] Ibid.
[35] *Ibid*. Assumes $0.25/bale/loaded mile, 53 ft flatbed trailer, 39 bales/load, 22% bale moisture content. For transportation costs at 5-mile drive distance increments see Figure E-1.
[36] Assuming 3 tractors: one each for the chopper/windrower, baler, and bale collector at 10-hr day x 40 harvest days per year x 40 bales/hr (www.extension.iastate.edu/agdm/crops/pdf/a3-24.pdf)
[37] Assuming 4 trips/day for 240 days/year
[38] Values adjusted by each county area within the BDO Zone (quickstats.nass.usda.gov)

SECTION C: INFRASTRUCTURE



Industrial Acreage

PROPERTY OVERVIEW

Address:	3236 230th Street
City:	Sac City, Iowa
County:	Sac
Acres:	90 Acres
Pricing Note:	Open
Lease Available:	Yes
Topography:	Gently rolling
Zoning:	M-Industrial

SITE CONTACT

Brandy Wilson
Sac Economic & Tourism Development
108 Boyer Street
Wall Lake, Iowa 51466
P: 712-661-9713
bwilson@saccountyiowa.com

ADDITIONAL NON-RATED SITES

Infrastructure Sites Contact
Bob Buckingham
BDO Zone Infrastructure
bob@ecostrat.com

PROPERTY PROFILE

The BDO Zone center point is located 50 miles east of Sioux City, IA (Figure E-7) and is ideally situated in a heavily traveled corridor for industrial goods. Zoned for industrial use, it has most infrastructure services readily available. It is available as a 90-acre parcel (Figure E-8) or three smaller parcels (Figure E-9).

Transportation / Logistics

Nearest Highway: Highway 20
Nearest Interstate: I-35 (75 miles)
Nearest Airport: Sac City Muni (4 miles)
Rail Served: Nearby – Union Pacific
Rail Accessible: <15 miles distant
Rail Infrastructure in Place: No
Nearest Commercial Airport: Sioux City, IA, 50 miles. Airport code SUX

Electric Service

Supplier: Mid-American Energy
Ownership: Publicly Owned
Phone: 888-427-5632
Website: www.midamericanenergy.com
All Utilities Extend to Site: Yes
Nearest Substation: <1 mile
Capability: 3-Phase overhead, 12.5kv distribution lines, 69kv med voltage

Natural Gas

Supplier: Sac City Municipal Gas
Ownership: Publicly Owned
Phone: 712-662-7359
Website: www.gas@saccity.city
Size of Proposed Main: 12"
Pressure: 50 psi
Capability: Commercial and industrial volumes supported by Mid-American Energy

Water

Supplier: Sac City Municipal
Ownership: Municipal
Phone: 712-662-7692
Website: www.water@saccity.city
Size of Main: 12"
Peak Capacity: 1.000.000 gals/day
Capability: Piping for industrial volumes

Wastewater

Supplier: Sac City Municipal
Ownership: Municipal
Phone: 712-662-4915
Website: www.wastewater@saccity.city
Size of Main: 6-12"
Capability: 1,000,000 gals/day

Telecommunications

Supplier: Frontier
Ownership: Private
Phone: 833-871-4968
Website:www.frontier.comciktel.com
Platforms: Fiber, wireless
Capability: Primary wireless and fiber optics available.

SECTION D: RISK INDICATOR SCORING METRICS

CATEGORY 1.0: SUPPLIER RISK

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

1.1.1 Longevity & History of Supplier Performance

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

Risk Information: The BDO Zone is in one of the most productive corn regions in the USA, with decades of corn growing experience. Many of the farms have a history of multi-generational ownership. Although only 1% of corn stover production is currently utilized for cattle feed and bedding, corn producers in the area have supplied corn stover bales for decades. This established practice reduces the risk for potential expanded utilization of corn stover in other applications.

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

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

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

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

Risk Information: There is very little competition for corn stover. About 1% is used for cattle feed. No other significant users of corn stover were identified.

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

No adjustment.

RRI Mitigation (Notch)
No adjustment.

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

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

1.3 Risk Factor: Supplier Control Over Production and Transportation

1.3.1 Ownership of Land/Means of Production

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

Risk Information: The majority of farmland in the BDO Zone is privately owned. About 11% of farmers lease the farmland they operate.[39] Producers of corn either own their farmland or lease it directly from the landowners. Risk is very low.

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

1.3.2 Ownership of Equipment

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

Risk Information: In the BDO Zone, some producers, particularly those who also manage cattle farms, already own baling equipment. The USDA 2022 Census indicates that there are enough balers and combines currently available to meet the needs of the cattle sector. However, scaling up to meet larger project demands will necessitate significant investments in high-efficiency square balers and enhanced transportation equipment. The risk is high.

[39] United States Department of Agriculture. National Agricultural Statistics Service. Accessed August 16, 2024. https://www.nass.usda.gov/.

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

1.3.3 Ownership of Transportation/Logistics

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

Risk Information: Farmers in the region currently utilize a mix of their own trucks or engage contractors to provide transport. A new large-scale project in the BDO Zone would require an expansion of transportation infrastructure. Farmers responded that the increased capacity would most likely need to be addressed through contractors or provided by the project proponents. Farmers would be willing to make capital investments in transportation equipment if they had reason to believe that the new project would create an ongoing steady demand for stover. The risk is medium.

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

1.3.4 Feedstock as a Secondary Transformation

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

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

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

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

Risk Information: Corn stover is a by-product of corn production. The production of corn over the past decade has been stable despite some yearly variation due to weather conditions. The rated quantity of stover is about 6% of the overall production in the BDO Zone, suggesting that there is a large amount of feedstock available to make up for future down production years. The risk is deemed 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 X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

1.4 Risk Factor: Supplier Experience

1.4.1 Fundamental Feedstock Production Experience

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

Risk Information: The experience in harvesting and baling corn stover is limited to corn growers that also raise livestock. Farmers that grow grain only and wish to harvest stover tend to rely on contractors. The experience is limited in this BDO Zone, although the methods are commonly known. The risk is medium.

Raw Risk Likelihood (RRL)	**Score**

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

1.4.2 Production Scale Experience

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

Risk Information: While the production of round bales of corn stover is common in the BDO Zone, it is only practiced at a small scale to provide fodder and bedding for livestock. While the current experience can be applied to a portion of the scale needed for a new project, a significant effort would need to be implemented across a large area to efficiently deliver the feedstock needed. This risk is high.

Raw Risk Likelihood (RRL) The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed high, therefore the RRI is 8 out of 10.	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**Score** **64**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* There are companies in North America that specialize in agricultural residue harvesting and operating fleets with the necessary equipment. A project proponent could utilize these established resources to mitigate the risks and challenges associated with limited production scale experience within the BDO Zone. This strategy would help reduce operational hurdles and improve project scalability. The Total Notch (RRL Notch) X (RRI Notch) is 25%.	**Notch** **25%**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**Score** **48**

1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity

1.5.1 Supplier's Equipment Efficiency

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

Risk Information: The current baling equipment in the BDO Zone meets operational needs for livestock. Expanding for a large-scale corn stover project requires more efficient baling and transportation methods, which are unproven in this area. Investing in high-density square balers could significantly improve efficiency, potentially doubling or tripling output. However, farm labor shortages are a major concern for producers, who are hesitant to invest in these advanced machines. The lack of available labor presents a critical obstacle to upgrading the equipment necessary for the project's success. The risk is deemed medium for likelihood and high 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 X RRI) is 48 out of 100.	**48**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**48**

1.6 Risk Factor: Supplier Motivation

1.6.1 Feedstock Production Priority

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

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

Risk Information: Corn stover is a by-product of corn grain production, with grain being a much higher priority for farmers. The income from, and the demand for, grain is far greater than that of stover. Harvest and baling of corn stover must be completed within a 40-day window after corn harvest.[40] Adverse weather, or shortages of labor and/or equipment may disrupt corn stover availability. However, the relatively low rated quantity compared to the total amount of stover available reduces this risk. This risk is medium.

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

[40] Confirmed by local experts.

No adjustment.

RRI Mitigation (Notch)
No adjustment.

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

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

CATEGORY 2.0: COMPETITOR RISK

2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets

2.1.1 Competitors' Locations and Overall Geographical Influence

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

Risk Information: Current demand is limited to the use of corn stover for livestock feed and bedding. There are no competitors for stover use presently. When Corn Board starts operations, planned for 2025, their demand will be less than 1% of the total corn stover production in the BDO Zone. Risk is very low.

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

2.1.2 Current and Historical Consumption of Feedstock Quantity

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

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

Risk Information: Current and historical consumption of corn stover has been very low (Section B). Proposed future projects will not significantly affect the corn stover supply. Risk is very low.

Raw Risk Likelihood (RRL)	**Score**

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

2.1.3 Competitor Pricing and Price Sensitivity

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

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

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

Risk Information: Within the Competition Zone, there is no significant competitor capable of controlling pricing. Due to the low current demand and the large quantity of potentially available corn stover this risk is low.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed low, therefore the RRL is 4 out of 10.	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed low, therefore the RRI is 4 out of 10.	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

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

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

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

Risk Information: There are no significant competitors for corn stover within the Competition Zone. The risk is very low.

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

2.1.5 Soft Supply Influence of Existing Markets

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

Risk Information: No external influences that could impact the calculation of the rated quantity were observed or communicated. In determining the rated quantity, both the current competition and the Biomass Availability Multiple (BAM) factor were carefully considered. It is anticipated that any temporary supply shortages would not significantly affect the viability or success of future projects. This risk is very low.

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

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

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.[41]
Risk Information: There are no non-traditional or market-driven markets for corn stover that pose a threat to its long-term availability. This risk is very low.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed very low, therefore the RRL is 2 out of 10. **2**
Raw Risk Impact (RRI) **Score** The risk impact is deemed very low, therefore the RRI is 2 out of 10. **2**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL X RRI) is 4 out of 100. **4**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100. **4**

2.2 Risk Factor: Specific Competitors' Competitive Advantage

2.2.1 Relative Inventory Capacity

Rationale: The more inventory a competing biomass facility is able to store, the more competitive pressure it can exert on supply. Ability to store large inventories allows competitors to purchase inventory when the prices are low, potentially giving it an economic advantage. Additionally, the ability to store inventory during feedstock supply surpluses can enable competitors to continue to intake feedstock when the Issuer's plant (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity on the part of competing markets creates supplier loyalty and can make it more difficult for new projects to secure supply without paying a significant premium.
Risk Information: There are no significant competitors for corn stover within the Competition Zone, thus, no significant stover bale inventory is maintained. The risk is very low.
Raw Risk Likelihood (RRL) **Score**

[41] Bergtold, 2018.

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

2.2.2 Relative Accessibility/Delivery Hours and Wait Times

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

Risk Information: No existing competition for corn stover is present at this time. The announced facility in Odebolt, IA, is not expected to have significant accessibility limitations. Existing and future competitors do not have any advantages with regard to bale delivery hours. This risk is very low.

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

2.2.3 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: There are no significant local competitors at this time that have widespread influence on the specifications for corn stover. The risk is very low.

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

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

2.2.4 Demand for Competitors' Products

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

Risk Information: Although the use of corn stover for biofuels and bio-products is evolving in the Competition Zone, these proposed projects are not expected to significantly increase demand. This is particularly notable when compared to the vast amounts of corn stover produced annually in the BDO Zone, suggesting that the current and future projects will not strain the available supply. The risk is very low.

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

CATEGORY 3.0: SUPPLY CHAIN RISK

3.1 Risk Factor: Feedstock Availability

3.1.1 Biomass Availability Multiple (BAM)

Rationale: This Risk Indicator quantifies the risk that the analysts' selected Biomass Availability Multiple (BAM) value underestimates the uncertainty associated with underlying data, models, assumptions, and future operating conditions for new bio-projects. The rated quantity is estimated by dividing the amount available to new projects after accounting

for total generation and competition by a Biomass Availability Multiple (BAM). The BAM is a value between 1.5 and 5.0 that is selected based on the analyst's judgement of the level of uncertainty associated with the information used in the analysis of supply, competition, and availability, and future operating conditions. While the application of the BAM provides assurances of feedstock supply redundancy, there is risk that this methodology does not provide an accurate estimate of the amount of biomass that could be available to a new project in future years.

Risk Information: As detailed in Section B, Rated Quantity and Pricing, a Biomass Availability Multiple (BAM) value of 4.0 was chosen to account for uncertainties, including producer participation, readiness for scale-up, and the accuracy of data and models, among other factors. The resulting rated quantity of corn stover, 824,000 bone dry tons per year, represents about 6% of the total available corn stover. This calculation considers a 51% competing use, 50% equipment collection efficiency, and 20% producer participation rate. This reflects a conservative approach to estimating accessible biomass resources. The risk is deemed 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 X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

3.1.2 Feedstock Supply Curve/Marginal Cost Curve

Rationale: The greater the feasible transport distance, the more feedstock is accessible to the Issuer, but at a higher delivered cost. The feedstock supply curve, sometimes referred to as the marginal cost curve, is a function of feedstock availability over its cost, which is primarily, but not exclusively, a function of distance. The feedstock supply curve is used to determine the availability of redundant feedstock at various price points, and the cost of replacing feedstock with substitutes located at different distances.

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

Risk Information: The supply curve for corn stover shown in Figure B-3 shows total availability within 75 miles of Sac City, IA, in 5-mile segments. The graph reveals that about half of the total corn stover is available within 50- to 55-miles driving distance from the center point of the BDO Zone. While a new project will try to source feedstock from the closest sources, it is not known at this time which growers will be willing to participate. The risk likelihood is low, but the uncertainty of participation based on distance has a medium risk with regard to impact.

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

3.1.3 Seasonal Feedstock Supply Variation

Rationale: Biomass supply can present significant seasonal supply variations. Seasonal supply variations combined with limitations associated with longer-distance transportation and storage can lead to BDO Zone biomass supply imbalances[42] and can manifest in shortages and higher costs for Issuers.

Risk Information: Corn stover collection occurs after the corn harvest, typically in September and October for this BDO Zone. 80% of the grain harvest occurs within a 27-day window[43] and stover harvest will lag behind that process. This window can be shortened by rainfall as precipitation can affect the efficiency of harvesting equipment, stover quality, and ability to carry out the harvest. Figure E-6 shows the unpredictable nature of rainfall during October in the BDO Zone.

Large-scale corn stover harvesting would require well-designed logistics for harvesting, transportation, and storage. The operational constraints and weather-related risks result in a medium risk for this indicator.

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

[42] Golecha & Gan, 2016.
[43] Iowa State University Extension and Outreach. *Corn Stover Harvest Window*. PM 3051B, January 2014.

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: Corn grain and, by association, stover production in the region is high despite being affected by periodic drought (Figure B-2). Competitive use for cattle bedding is only 1%, and the rated quantity is about 6% of the total stover production. However, while availability may be reduced in drought years, growers' concerns over sustainability and soil health issues during these events may reduce supply.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* Stockpiling stover to mitigate impact during weather-impacted years can alleviate shortages. The Total Notch (RRL Notch) X (RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 27 out of 100.	**27**

3.2 Risk Factor: Historical Issues

3.2.1 Historical Feedstock Price Variations

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

Risk Information: The lack of a widespread corn stover market presents difficulty in predicting future price volatility. The current corn stover market is very small compared to supply, whereas a large corn stover user will change the market dynamics. The price of corn has not fluctuated proportionally with supply (compare Figure B-2 with Figure E-2). Rather, the price of corn appears to correlate with the global impact of COVID-19 on worldwide supply chains, the price of diesel fuel (Figure E-3), and the Producer Price Index (Figure E-4). Given that a robust supply chain for corn stover is not yet established, this risk is deemed medium.

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

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

3.2.2 Low Historical Demand for Feedstock in the BDO Zone

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

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

Risk Information: While harvest of corn stover for livestock use is common and has been practiced for decades, the scale is low compared to the requirements of a large project. The uncertainties associated with scale-up indicate a medium risk.

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

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

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

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

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

Risk Information: Corn stover bale supply chains typically require straightforward equipment needs and standard procedures.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. — **4**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. — **16**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. — **16**

3.3 Risk Factor: Non-Weather Based Externalities

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

Rationale: CPI and PPI can impact feedstock cost of harvest and collection over time. Sensitivities to worst-case scenarios should be run.
Risk Information: During 2021-2022, the national Producer Price Index (PPI) (Figure E-4) and the Midwest Consumer Price Index (CPI) (Figure 5) experienced significant spikes, driven by the COVID-19 pandemic, associated lockdowns, and disruptions in global supply chains. Since 2023, inflation trends have begun to stabilize, largely due to interest rate hikes by the Federal Reserve. Despite recent improvements in CPI and PPI figures, economic uncertainty persists. The fluctuation in these indices suggests the medium likelihood of risk with a low 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 low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 24 out of 100. — **24**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100. — **24**

3.3.2 Currency Risk

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

Risk Information: Not relevant.

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

3.3.3 Border Risk

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

Risk Information: Not relevant.

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

3.3.4 Temporary Externality-Driven Markets for Feedstock

Rationale: Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances. For example, an Issuer using corn stover as a feedstock would not typically compete with the higher-end animal feed market. However, in times of significant hay shortage (e.g., during drought), farmers may use corn stover as hay replacement, driving the price of stover feedstock and decreasing its availability for bio-projects.[44]

Risk Information: We did not identify any externality-driven markets for corn stover in this BDO Zone.

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

[44] Bergtold, 2018.

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

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

3.4.1 Harvest & Collection Practices & Schedules

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

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

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

Risk Information: Corn stover in the BDO Zone is collected using a standard practice of chopping or raking, followed by baling into round bales. The time window for this process averages about 40 days after the grain harvest, but weather, primarily rain, can shorten or lengthen this time frame. The current scale of harvest is less than one percent of the total available stover and used for livestock fodder and bedding. Implementing large-scale stover harvesting would face increased logistical challenges as competition for available equipment would put further pressure on the short time frame for harvest. This risk is medium.

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

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

3.4.2 Harvesting & Collection Equipment

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

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

Risk Information: Equipment for harvesting corn stover in the BDO Zone is well established for meeting the needs of the livestock industry. Farmers typically gather stover into windrows by raking or chopping followed by collection into round bales. The equipment is common for farmers that raise livestock but usually not owned by those cultivating grain only. The production capacity of bales required for a large-scale operation would need to be increased regardless of the desired bale type, round or square. Our outreach did not identify any farmers or custom balers in the BDO Zone producing square bales. This risk is medium.

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

3.4.3 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.[45]

Risk Information: Our outreach revealed that the vast majority of baling equipment produced round bales with a weight of about 1,300 lbs. If square bales are desired for a new user of corn stover, the required equipment would pose a significant investment by farmers, custom balers, or the project. The risk is medium.

Raw Risk Likelihood (RRL)	Score

[45] Huhnke, 2018.

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

3.4.4 Availability of Labor for Feedstock Production

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

Risk Information: Labor needed for large-scale corn stover harvest would overlap considerably with the grain harvest. Farmers have reported that the amount of labor needed for large scale harvest of stover would be limited and heavily influenced by the wages being offered. A successful corn stover harvest would require a dedicated effort to attract the necessary labor and would be most successful if carried out by contractors or the project proponent. The risk is medium.

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

3.5 Risk Factor: Transportation

3.5.1 Feedstock Transportation Costs

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

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

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

Risk Information: Figure B-3 shows that about half of the available corn stover is available within 50-55 miles from the center point. As transport cost significantly affects the total cost of delivered stover, there is a lower risk associated with shorter haul distances. Transport costs account for between 25% to 30% of total delivered cost.

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

3.5.2 Diesel Cost Impacts

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

Risk Information: Figure E-3 shows the fluctuation of diesel prices over the past decade from a low of $1.93/gal in Feb 2015 to a high of $5.66/gal in Jun 2022. Since the initial COVID-19 pandemic, prices have begun to stabilize somewhat. With the continuing COVID-19 pandemic and the possibility of carbon taxes worldwide, it is difficult to predict future prices of diesel fuel. This risk is deemed medium.

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

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

3.5.3 Transportation of Feedstock Requires Specialized Equipment

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

Risk Information: Transporting corn stover bales does not require specialized equipment. The most common methods are using flatbed trailers or straight trucks, which are universally available.

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

3.5.4 Delivery Routes through Local Communities

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

Risk Information: Transport of large quantities of agricultural goods are common within the BDO Zone. While a new large-scale user of corn stover will increase traffic, communities in this area are familiar with large seasonal increases in truck traffic coincident with the cycle of crop growth and harvesting. However, a large facility could significantly increase truck traffic in a community.

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

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

3.5.5 Transportation Regulations & Local Weight Limits

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

Risk Information: In Iowa, vehicles transporting agricultural goods are permitted to exceed the maximum allowable weight by up to 25%. Although seasonal weight restrictions are in place, they will not impact the transport of corn stover as that would occur at the same time as the main corn grain crop. Risk is very low.

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

3.5.6 Road Infrastructure

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

Risk Information: The transportation infrastructure in the BDO Zone is generally capable of supporting agricultural traffic, but there are some challenges related to road conditions. The region relies heavily on both paved and gravel roads for transporting agricultural products. However, weather-related issues can impact gravel roads, making them less reliable during periods of heavy rain or freeze-thaw cycles, which are common in rural Iowa.

Iowa's road network ranks 22nd nationally in terms of overall road conditions.[46] However, the state faces significant challenges with structurally deficient bridges, ranking 48th in the country. This is particularly relevant for the agricultural sector, as weight-restricted or deteriorating bridges could impede the flow of heavy machinery and trucks. Recent federal infrastructure funding may provide future improvements, but these changes will take time to implement.

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**

[46] "Report Drops Iowa's Road Condition Rating." *Radio Iowa.* Accessed October 14, 2024. https://www.radioiowa.com/2021/11/19/report-drops-iowas-road-condition-rating/.

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

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: Transporting the rated quantity of corn stover would require approximately 57 trucks and flatbed trailers. This estimate assumes an average haul distance of 50 miles and that each truck can complete 4 trips per day.

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

3.6 Risk Factor: Supply Chain Resiliency

3.6.1 Size, Number, and Location of Suppliers

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

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

Risk Information: There are over 17,000 farms within the BDO Zone, with an average size of about 416 acres.[47] Assuming 20% participation rate[48] there are over 3,400 farms that can contribute to the corn stover supply depending on crop rotation regimes. This large number indicates low risk.

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

3.6.2 Suppliers Subject to Same External Risk Factors

Rationale: When a single risk event can impact the feedstock production ability of all (or most) suppliers, then feedstock risk is higher and supply chain resiliency is lower. Resilience is maximized when biomass supply chains exhibit diversity in spatial location (i.e., geography), production practices and other elements of supply chain structures such that the impact of single high-risk events have varying impacts on suppliers.

Risk Information: The farms in the BDO Zone are all subject to the same weather-related impacts on yield. As stover is a by-product of corn production, situations that lower corn production, such as weather events or market situations, will also affect the stover supply. Maintaining a supply of stover as a buffer against low productivity can offset some of the associated risks. The likelihood of risk is low, with a medium impact.

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

[47] USDA/NASS. *QuickStats Ad-hoc Query Tool.* Accessed September 23, 2024. https://quickstats.nass.usda.gov/.
[48] Industry expert suggest that a reasonable initial target rate of farmer participation is 20%. With proper project management and good community outreach, this rate may grow significantly.

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

3.6.3 Land Ownership Structures

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

Risk Information: Farmland in the BDO Zone is privately owned. Approximately 11% of the operating farmland is leased.[49] Lease structures would need to be amended to allow harvest of corn stover on those lands to account for soil impacts by removal of corn stover and possibly to address terms of sale of stover. This risk is medium.

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

3.7 Risk Factor: Climate and Natural Risks

3.7.1 Seasonal Weather Impacts on Feedstock Supply

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

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

Risk Information: Yield fluctuations over the past decade can be attributed to weather events such as lower overall rainfall and an increased number of storms. This risk can be mitigated by increasing the participation rate of growers

[49] Outreach to local experts.

and by stockpiling stover. While weather events are unpredictable, the low rated quantity compared to the overall supply is partially offsetting. This risk is deemed medium.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. **6**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10. **6**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100. **36**

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: Climate change is occurring in Iowa and is expected to have an impact on agricultural productivity.[50] Specifically, precipitation and temperature increases have been occurring and are expected to continue. These factors will have an effect on flowering time, soil conditions, and infestations. However, the projected impact is unclear and may be mitigated to some degree by breeding programs and management practices. The risk is medium.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. **6**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10. **6**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100. **36**

[50] Iowa Department of Natural Resources. "Climate Change." Accessed August 30, 2024. https://www.iowadnr.gov/conservation/climate-change.

3.7.3 Forest/Crop Fire

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

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

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

Risk Information: Crop fire is not common in this region. The risk 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 X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

3.7.4 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: Corn production in the region remains largely unaffected by pest outbreaks due to effective mitigation strategies. The risk of infestation and its potential impact are minimized through regular insecticide applications, strategic crop rotations, and the use of crop insurance, ensuring stable agricultural operations. The risk 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) The Gross Risk Indicator (RRL X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.7.5 Risk of Hail

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

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

Risk Information: Hail is a common occurrence in Iowa, with several incidences a year.[51] While hail is not a direct threat to corn stover production, depending on the severity and timing, it can reduce yields. Hail is deemed a medium threat.

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

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.

[51] "Iowa Hail Maps." Accessed August 14, 2024. https://hailtrace.com/hail-maps/state/iowa.

Risk Information: The BDO Zone is not in a US Federal Emergency Management Agency (FEMA) flood zone. The risk 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 X RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

3.7.7 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: Iowa has experienced several occurrences of abnormally dry weather over the past decade, with 2021 through 2024 having this rating.[52] The risk of drought is deemed high.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10. **8**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10. **8**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 64 out of 100. **64**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**

[52] US Drought Monitor. "Historical Conditions: Iowa." Accessed August 15, 2024. https://www.drought.gov/states/iowa#historical-conditions.

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

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: The BDO Zone threat for tornados (172.71) is higher than the US national average (136.45) but lower than the Iowa average (236.74).[53] The threat is deemed medium.

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

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 average temperature in harvest season for the BDO Zone ranges between 62F and 38F.[54] This range is not a danger to corn stover. The risk is deemed low.

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

[53] "Sac County Natural Disasters and Weather Extremes." Accessed August 14, 2024. http://www.usa.com/sac-county-ia-natural-disasters-extremes.htm#google_vignette.
[54] "National Centers for Environmental Information."https://www.ncdc.noaa.gov/

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

3.8 Risk Factor: Political and Social

3.8.1 Government Subsidies for Feedstock Production or Utilization

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

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

Risk Information: No government subsidies for corn stover production were discovered. This risk is very low.

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

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

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

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

Risk Information: No regulations for the production of corn stover were reported or found. This risk is very low.

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

3.8.3 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: No backlash against use of biomass were found in our research. This risk is very low.

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

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

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

Risk Information: Not relevant.

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

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

3.8.5 Food Security Concerns

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

Risk Information: Corn stover is a by-product of the corn grain harvest. A very small amount of corn stover is used as cattle feed. This risk is very low.

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

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

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

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

Risk Information: The rated quantity of corn stover was estimated with the assumption that 50% of the stover available remains on the field to provide benefits such as nutrient retention and soil stabilization.[55] This risk is low.

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

[55] Outreach to local experts.

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

3.9.2 Risk to Soil Quality

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

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

Risk Information: Removal of corn stover is not a common practice in the BDO Zone, usually only carried out by farmers that also raise livestock. Consultation with local experts revealed that the removal of 50% of stover would not have a negative impact on soil quality.[56] In some cases, corn stover removal would have a beneficial effect with regard to reducing fungal contamination and promoting uniform germination for the crop in the following spring.

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

[56] Agricultural and biosystems engineering expert. Personal communication.

3.9.3 Risk to Surface and Groundwater

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

Risk Information: Not relevant.

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

3.9.4 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: Corn stover harvest does not affect water use. Not relevant.

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

3.9.5 Pesticide Risk to Human and Ecosystem Health

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

Risk Information: No pesticides are used in corn stover production or harvesting. This indicator is not relevant.

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

The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**NR**

3.9.6 Risk to Wildlife and Landscape

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

Risk Information: Corn stover production leverages existing agricultural land and does not require an expansion of cropland areas, thereby not altering the overall landscape or impacting landscape-level wildlife conservation strategies, such as prairie strips.[57]

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

3.9.7 Biomass Classified as Genetically Modified Organism (GMO)

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

Risk Information: Not applicable to corn stover.

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

[57] Iowa State University. "What are Prairie Strips?" Accessed August 27, 2024. https://www.nrem.iastate.edu/research/STRIPS/content/what-are-prairie-strips.

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: For a new corn stover project, maintaining high-quality standards throughout the harvesting, baling, transportation, and storage stages is critical. Key attributes such as moisture content, soil contamination, and bale size/bulk density must be carefully monitored and controlled. The current practice of supplying round bales for cattle bedding, which follows minimal quality standards, will likely be insufficient for new projects. The risk is deemed high.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**64**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* To ensure corn stover meets the quality specifications, the biomass project developers can work closely with crop growers and custom harvest groups to establish Best Harvest Practices that aim for minimizing soil contamination and controlling moisture content during the harvest and storage operations. This risk is notched at 25% The Total Notch (RRL Notch) X (RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**48**

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: While the current use of round balers is sufficient for livestock applications, a large-scale project will likely prefer the higher density and improved transportation characteristics of square bales. Likewise, the number of balers available is not adequate for a large-scale stover harvest. A new project would require a significant capital investment in baling equipment and training to ensure proper harvest efficiency. This risk is medium for likelihood and high 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 X RRI) is 48 out of 100.	**48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 48 out of 100.	**Score** **48**

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Industrial District

Risk Information: The 90-acre greenfield parcel near Sac City, Iowa, is situated along State Highway 20, a primary east/west transportation thoroughfare. Currently zoned industrial with no building restrictions, the parcel can be subdivided into three parcels (See Section E) or acquired in whole. The gently rolling terrain, available infrastructure and pro-business community further enhance its attractiveness. This represents a low risk to developers seeking a buildable site within the BDO Zone.

This site is identified and highlighted with maps in Section E (Figures 5.1.1a, 5.1.1b, and 5.1.1c). This represents a low risk to developers seeking a buildable site within the BDO Zone.

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

5.1.2 Ownership of Land

Risk Information: The industrial site is managed by the Sac Economic and Tourism Development Authority (see Section C), providing streamlined, consistent control over land transactions. This centralized approach minimizes complications, allowing businesses to secure property more easily and reliably. For new and developing industries, this arrangement simplifies negotiations and offers a clear framework for land acquisition, supporting a more efficient setup process within the park.

Raw Risk Likelihood (RRL)	**Score**

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

5.1.3 Permitting Description

Risk Information: In Sac County, the permitting process is generally straightforward, with most air, water, and operational (non-hazardous) permits taking an average of 60-90 days. The town's administration is accessible and offers clear guidance on securing permits, particularly for new businesses.

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

5.1.4 Environmental Issues

Risk Information: The 90-acre parcel in Sac County, Iowa, was previously used as farmland and is surrounded by agricultural land, which reduces the likelihood of significant environmental concerns. While a visual review of the site has been conducted, a formal Phase I Environmental Site Assessment (ESA) has not yet verified the absence of contaminants or other environmental risks from past use.

Sac County is designated as an air attainment area, complying with the EPA's National Ambient Air Quality Standards. This classification reflects generally acceptable air quality, with minimal regulatory restrictions for local industries. Although local livestock operations, typical in agricultural regions, can temporarily impact air quality, particularly on

low-wind days due to emissions like ammonia and methane, these factors do not affect the county's attainment status. This air quality context is advantageous for new industries, as regulatory concerns are minimal.

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

5.2 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: The 90-acre industrial parcel in Sac County benefits from proximity to a natural gas pipeline, located within a mile along Highway 20. This 6-inch distribution line, serviced by Sac County Municipal Gas, provides an accessible energy source for new industries. For larger gas consumers, it is advisable to consult with the City to confirm available capacity to meet specific operational demands.

As of July 2024, the industrial natural gas price in Sac County stands at $4.97[58] per thousand cubic feet (Mcf), aligning within 10% of the U.S. national average. This consistency with national trends over the past five years offers cost stability, making natural gas an economically viable option for industrial operations in the area.

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

[58] U.S. Energy Information Administration. "Natural Gas." Accessed October 21, 2024. https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_sia_m.htm.

5.2.2 Electric Availability

Risk Information: The 90-acre industrial site in Sac County is serviced by MidAmerican Energy, offering both medium and high-voltage, 3-phase electricity capacity, a crucial asset for industrial operations. Medium voltage (25 kV) transmission lines run along the north side of the parcel, along US Highway 20, allowing for efficient connection. However, additional distribution lines would need to be extended to individual parcels within the site.

The majority of Iowa's electric power is produced through wind energy, with the state being a national leader in wind power generation, currently providing over 50% of its electricity from wind turbines; this has surpassed coal as the primary source of electricity in Iowa, making it the dominant source of power generation in the state.

As a reference, Iowa's average residential electricity rate is 14¢ per kWh,[59] approximately 26% below the national average of 19¢ per kWh. This reflects Iowa's favorable, renewable energy costs, which benefit both residential users and industries looking to reduce operational expenses.

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

5.2.3 Water Availability

Risk Information: The City of Sac City oversees water delivery infrastructure for the 90-acre industrial site, managing pipelines, treatment ponds, and pumping systems. The site benefits from 6-inch water mains, complemented by nearby agricultural canals, which contribute to its strong infrastructure readiness for industrial use. Although Iowa experienced full drought relief by May 2024, recent dry conditions, including the driest September on record, have reintroduced some areas of moderate drought.

Iowa's drinking water primarily comes from public water systems and private wells, ensuring reliable sources for both industrial and residential needs. This established water infrastructure positions Sac City well for supporting new industrial operations, though ongoing monitoring of drought conditions will be key to maintaining long-term water reliability.

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**

[59] "Cost of Electricity in Iowa." *Energysage.* Accessed October 21, 2024. https://www.energysage.com/local-data/electricity-cost/ia/.

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

5.2.4 Waste Disposal

Risk Information: The fact that Sac City's municipal wastewater system is owned and operated by the city reduces the risk factor for waste removal. This local control ensures that the system can be more responsive to the needs of industries. The 90-acre industrial site has wastewater infrastructure within 1 mile, requiring municipal construction to a new site.

The landfill in Sac City is 6 miles from the industrial site. It is managed by Sac County and operates during daylight hours. Hazardous waste disposal requires advanced approval.

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

5.2.5 Internet Availability

Risk Information: The Sac City area offers 8 providers of both internet and TV services. One of the primary carriers is Frontier Communications, offering wireless and fiber internet with speeds up to 5G. These providers offer competitive rates and plans for both residential and industrial customers. There is low risk of this being an issue for new businesses.

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

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: Sac City, Iowa, benefits from its strategic location on major roadways, enhancing its accessibility for transportation and logistics. US Highway 20 is a key east-west route that runs through Sac County and alongside the industrial parcel and connects Sac City to larger regional hubs. It provides direct access to cities like Sioux City to the west and Dubuque to the east, making it a crucial corridor for freight and passenger traffic. State Highway 39 runs north-south and intersects with US Highway 20 in Sac City. Interestingly, Sac city is located equidistant (about 70 miles) from Interstates in all four directions (I-35, I-29, I-80, and I 90).

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

5.3.2 Rail Access

Risk Information: Given the lack of direct rail access to the 90-acre industrial site in Sac City, attracting industries that rely heavily on rail logistics might be challenging. However, the proximity to rail services in nearby towns like Storm Lake (20 miles to the north) and Rockwell City (20 miles to the east). could mitigate this issue to some extent.

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

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

5.3.3 Airport Access

Risk Information: The Sac City Municipal Airport, located 2.5 miles south of the city's central business district, serves as a convenient hub for small business jets, offering a 4,100-foot concrete main runway. Its elevation is 1,250 feet. For larger-scale passenger and air freight services, the nearest commercial airport is in Sioux City, 75 miles west of Sac City. This situation provides Sac City with essential aviation infrastructure, balancing local business needs with access to broader commercial air services.

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

5.3.4 Water Freight Access

Risk Information: This item is not rated for Sac County, IA.

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

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: Sac County has local healthcare facilities, including Sac City's Loring Hospital, which offers a range of services from emergency care to outpatient treatments. There are also six specialty clinics and smaller health centers throughout the county. For more specialized medical care, residents may need to travel to larger nearby cities, such as Sioux City (75 miles) or Storm Lake (20 miles). These cities offer a broader range of specialist services and advanced medical facilities. This availability of healthcare options in the area is critical to attract new industries and employees and poses a low risk.

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

5.4.2 Education (Schools)

Risk Information: Sac County is served by several school districts, including the Sac City Community School District and the East Sac County Community School District, with 820 students enrolled in 2024. These districts provide education from kindergarten through high school.

While Sac County itself does not have a large college or university, nearby cities like Sioux City (75 miles) and Storm Lake (20 miles) host institutions such as Morningside University and Buena Vista University. These institutions offer a range of vocational, undergraduate, and graduate programs. Central Community College, located in Fort Dodge (about 45 miles away), provides vocational training and associate degree programs, which can be advantageous for residents seeking career advancement or specialized skills.

Overall, while Sac County offers essential primary and secondary education, the presence of nearby higher education institutions and vocational training centers supports both the local workforce and the appeal of the area to new residents.

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

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

5.4.3 Local Transportation

Risk Information: Sac City lacks a public transit system, but the region does have some limited service. Community transportation options may include occasional van or shuttle services provided by local organizations. There are taxis and contract vehicles available for hire. Approximately 19 miles from Sac City, Rockwell City has Calhoun County Transportation that provides some regional transit services, although they may be infrequent. For employees needing regular public transportation, the absence of a comprehensive local system means they might need to rely on regional services or consider private transportation solutions like ridesharing or carpooling arrangements.

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

5.4.4 Public Safety (Local)

Risk Information: Located in Sac County, Iowa, Sac City is a small town with a relatively low crime rate compared to the rest of the United States. The violent crime rate in Sac City is 11.5,[60] significantly lower than the national average of 22.7. Additionally, the property crime rate in Sac City is 20.4,[61] also lower than the national average of 35.4. This indicates that the town has a relatively low rate of theft, burglary, and other property-related crimes.

Overall, Sac City is a peaceful and safe place to live, with a strong community and low crime rates, making it an ideal setting for families and individuals seeking a tranquil lifestyle.

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

[60] "Sac City, IA Crime." *Bestplaces.* Accessed October 21, 2024. https://www.bestplaces.net/crime/city/ia/sac_city.
[61] Ibid.

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

5.4.5 Housing/Cost of Living

Risk Information: Sac City, Iowa, gets a BestPlaces Cost of Living score of 72.9,[62] which means the total cost of housing, food, childcare, transportation, healthcare, taxes, and other necessities is 27.1% lower than the US average and 9.0% higher than the average for Iowa.

A typical home costs $113,500,[63] which is 66% less expensive than the national average of $338,100 and 42% less expensive than the average Iowa home, at $194,900.[64] Renting a two-bedroom unit in Sac City costs $810 per month, which is 43% cheaper than the national average of $1,430 and 15% cheaper than the state average of $930.[65] There is available housing in Sac City and the surrounding areas.

These factors indicate that Sac City is a cost-effective option for homebuyers and renters alike as they look to relocate to the area.

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

[62] "Sac County, IA Overview." *Realtor.com.* Accessed October 21, 2024. https://www.realtor.com/realestateandhomes-search/Sac-County_IA/overview.
[63] "Sac County, IA Housing." *Realtor.com.* Accessed October 21, 2024. https://www.realtor.com/realestateandhomes-search/Sac-County_IA/housing.
[64] Ibid.
[65] Ibid.

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

5.5 Risk Factor: Labor

5.5.1 Workforce

Risk Information: The workforce in Sac County consists of 2,200[66] and generally reflects a mix of educational backgrounds. While it may not have the high levels of educational attainment found in larger urban areas, many workers have vocational training or college degrees. Local educational institutions and community colleges contribute to skill development in the region. Sac County's unemployment rate has historically been low compared to national averages, reflecting a stable job market. As of recent data, the rate is typically in the range of 2-4%,[67] indicating a relatively healthy employment environment. Rates may vary with economic conditions and seasonal factors.

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

5.5.2 Labor Costs

Risk Information: Sac County's labor costs are relatively low compared to larger metropolitan areas. This can make it an attractive location for businesses looking to manage expenses effectively while still accessing a dedicated workforce.

As of 2024, Iowa's minimum wage is $7.25 per hour,[68] which is the federal minimum wage. This rate applies throughout the state, including Sac County. The average salary in Sac County varies by industry and occupation. Generally, wages tend to be lower compared to urban areas, reflecting the overall cost of living. For many roles, the average salary might be around $40,000 to $50,000[69] annually, though this can differ based on specific job types and qualifications.

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

[66] U.S. Department of Labor. *U.S. Department of Labor: Home.* Accessed October 21, 2024. https://www.dol.gov.
[67] "Sac County, USA." *DataUSA.* Accessed October 21, 2024. https://datausa.io/profile/geo/sac-county-ia.
[68] U.S. Department of Labor. "State Minimum Wage Laws." Accessed October 21, 2024. https://www.dol.gov/agencies/whd/minimum-wage/state.
[69] "Sac County, USA." *DataUSA.* Accessed October 21, 2024. https://datausa.io/profile/geo/sac-county-ia.

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

SECTION E: ADDITIONAL FIGURES

Figure E-1 Corn Stover Transportation Cost by Distance from Sac City, IA[70]

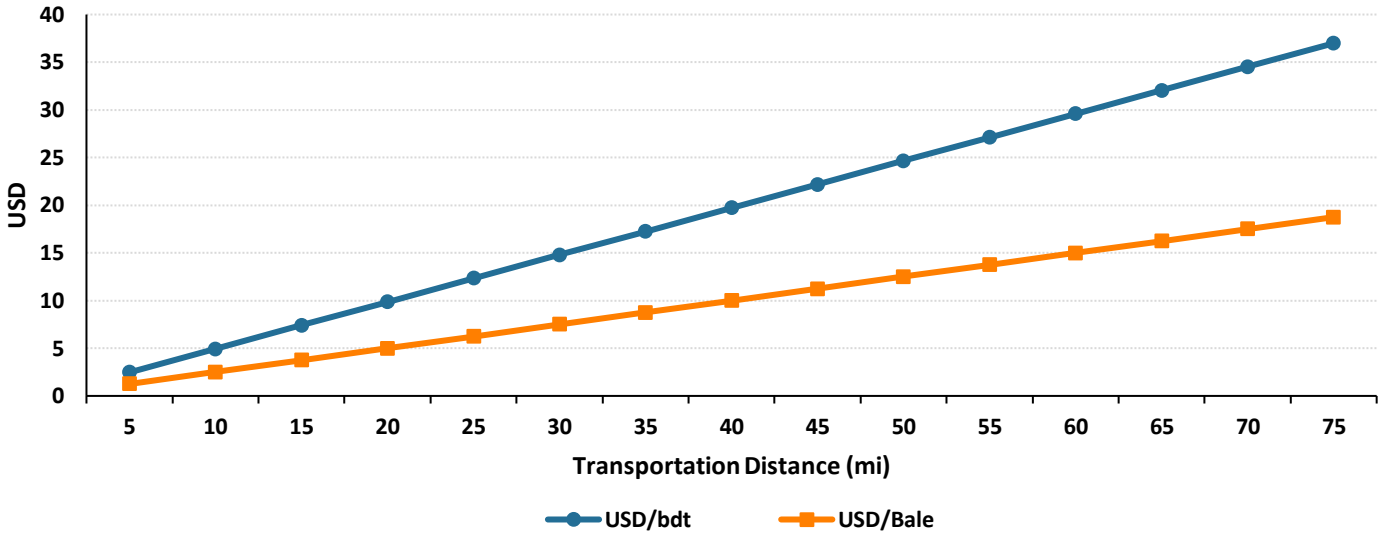
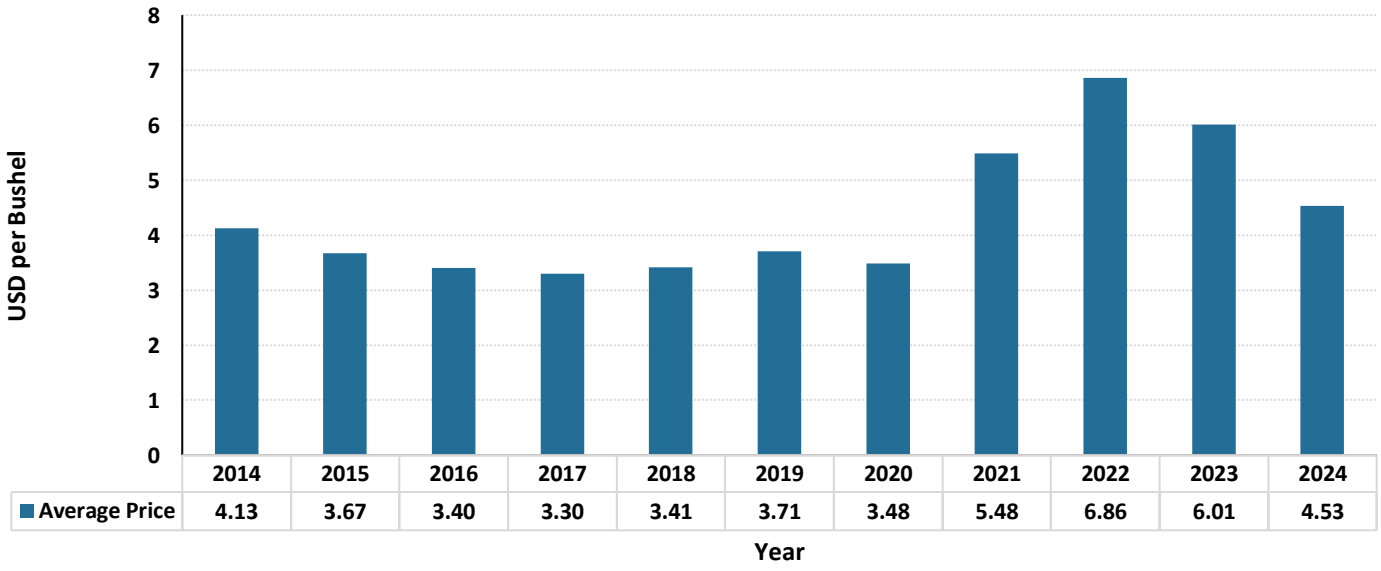


Figure E-2. Historical Iowa Corn Prices – USD per Bushel[71]



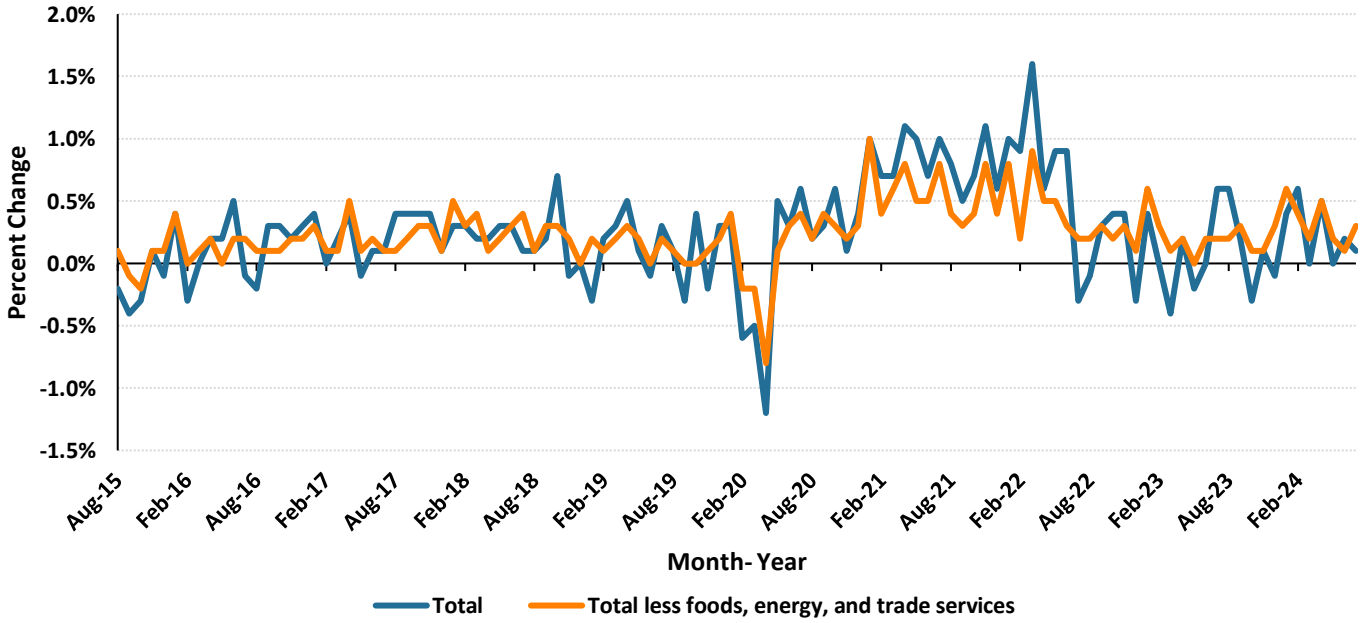
[70] Iowa State University Extension and Outreach. *2024 Iowa Farm Custom Rate Survey*. "Ag Decision Maker." Accessed September 12, 2024. https://www.extension.iastate.edu/agdm/crops/html/a3-10.html.

[71] United States Department of Agriculture. National Agricultural Statistics Service. *Iowa Cash Corn Prices*. https://www.extension.iastate.edu/agdm/crops/pdf/a2-11.pdf.

Figure E-3. Monthly Midwest Diesel Price[72]



Figure E-4. Producer Price Index[73]



[72] U.S. Energy Information Administration. Accessed August 13, 2024. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2DXL0_PTE_R20_DPG&f=M.
[73] U.S. Bureau of Labor Statistics. "Producer Price Index - Midwest." Accessed August 13, 2024. https://www.bls.gov/charts/producer-price-index/final-demand-1-month-percent-change.htm#.

Figure E-5. Consumer Price Index Percent Change - Midwest[74]

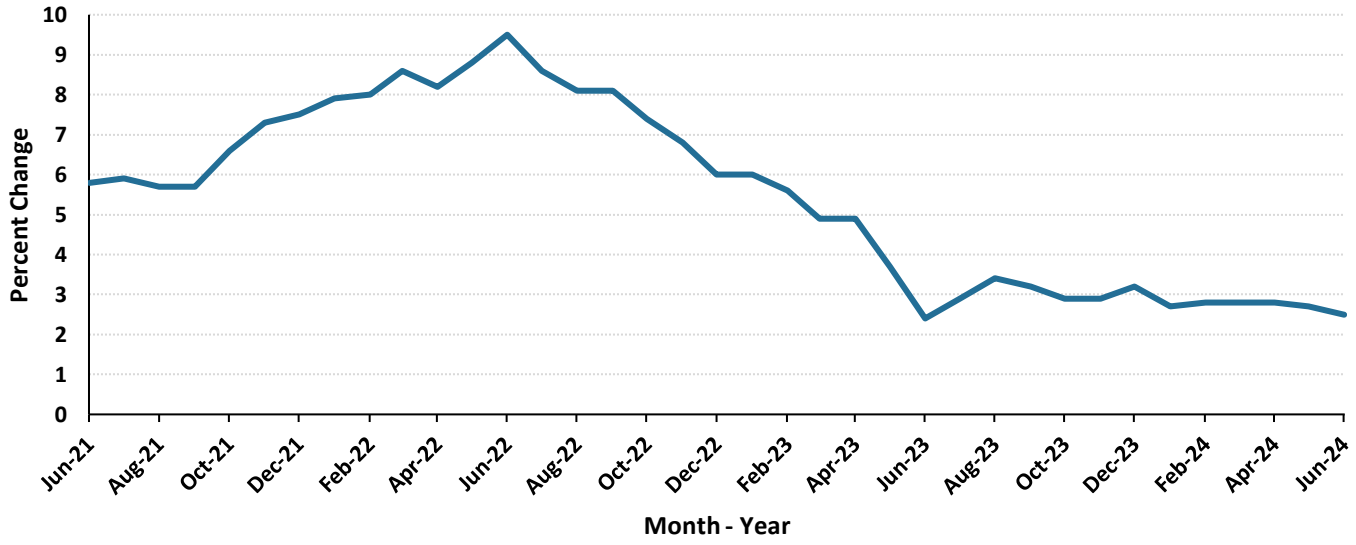
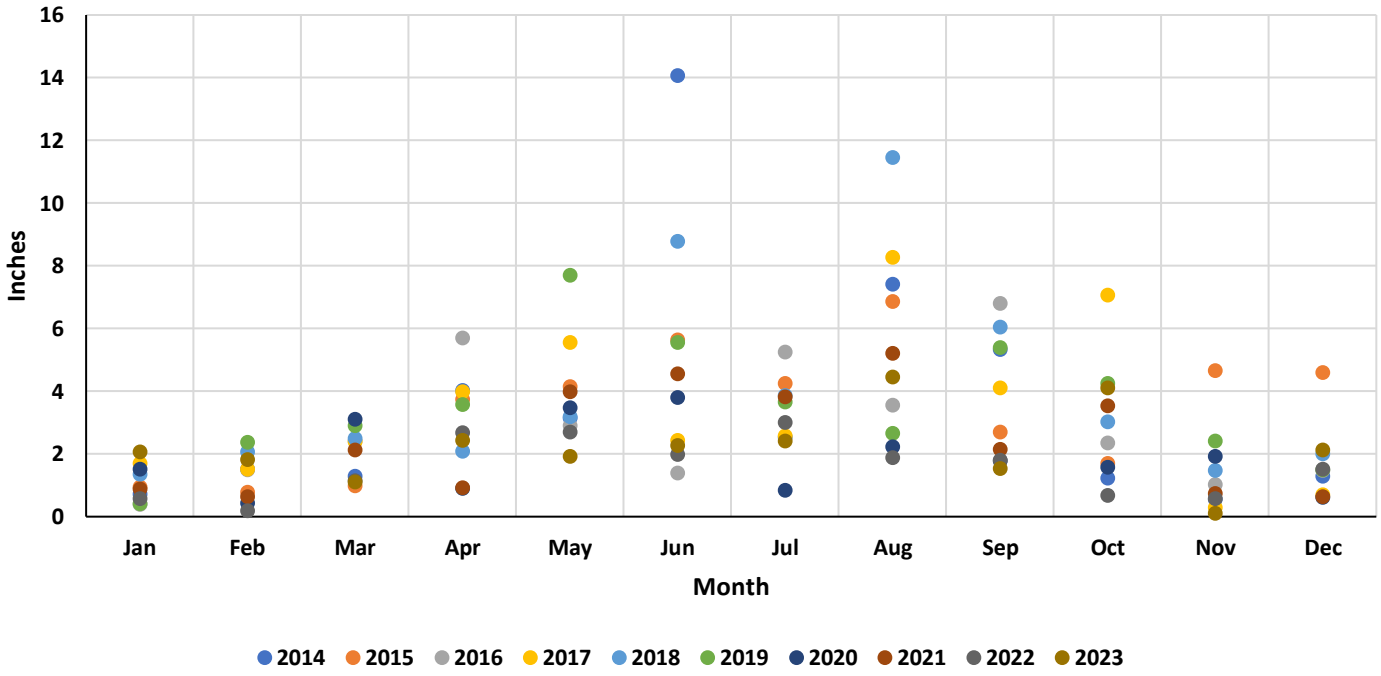


Figure E-6. Monthly Rainfall in Sac City, IA: 2014 - 2023[75]



[74] U.S. Bureau of Labor Statistics. "Consumer Price Index, Midwest Region – July 2024." Accessed August 13, 2024. https://www.bls.gov/regions/mountain-plains/news-release/consumerpriceindex_midwest.htm.
[75] Iowa State University. "Iowa Environmental Mesonet." Accessed August 13, 2024. https://mesonet.agron.iastate.edu/rainfall/.

Figure E-7. Location of Industrial Site – Sac City, Iowa

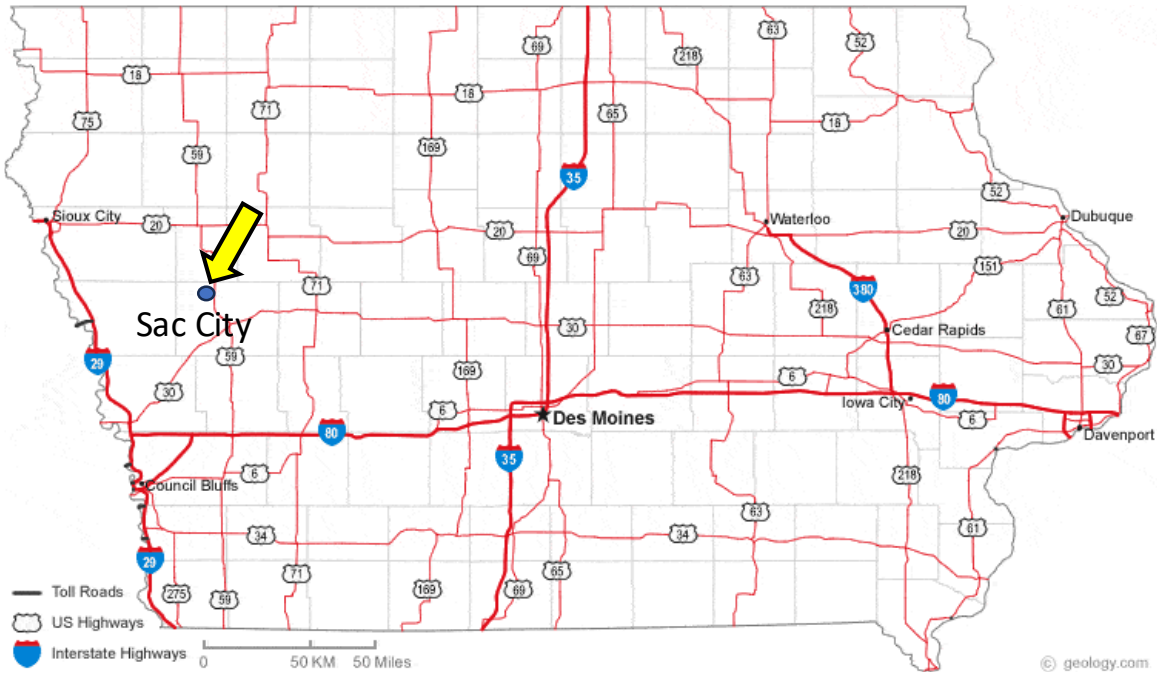


Figure E-8. 90-Acre Industrial Parcel NE of Sac City, Iowa



Figure E-9. Industrial Site – Parcel divisions – All or Part



SECTION F: LEGAL DISCLAIMER

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