# BDO Zone Rating: **'BBB'**

**BBB**
**Good Quality**

**Rating Parameters:**

| Category | Rated Quantity | Delivered Price | BDO Zone Size |
|---|---|---|---|
| Small-Diameter Trees | 120,000 bdt/yr | $50-$55/bdt | 75-miles drive |
| Forest Residues | 16,000 bdt/yr | $50-$55/bdt | distance from |
| Sawmill Residues | 87,000 bdt/yr | $75-$117/bdt | Oroville, CA |

## BDO Zone Assets

- **223,000 bdt/yr of woody biomass available at low-risk**
- **Access to rail and seaports for potentially cost-efficient transportation of feedstocks and final products**
- **Low risk of competition due to limited commercial market for small-diameter trees**
- **Potential access to large quantities of fuel reduction and fire-damaged salvage wood**

## BDO Zone Liabilities

- **Drought and wildfire risk impacting the quality of available biomass**
- **California's absence of pulp & paper industries leads to limited small-diameter tree harvesting and artificially low prices for forest residues, sustained by wildfire mitigation grants**
- **High cost of living and tight real estate market presents challenges for attracting labor**

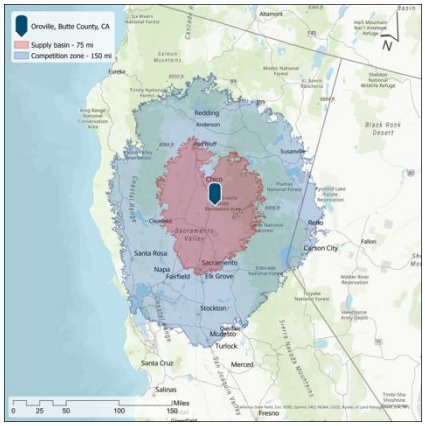
## Rating Grade

**The Butte County, CA, Biofuel Development Opportunity Zone is rated 'BBB,' or 'low-moderate' 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*).

'BBB' ratings indicate good prospective viability of Feedstock Supply and Infrastructure (FS&I), and expectations of FS&I risk are currently low in the Zone. The capacity to support new biobased plant operations is considered adequate, but adverse weather, supply chain, economic, or infrastructure conditions are more likely to impair this capacity over time.

### Butte County, CA BDO Zone




## Scoring & Rating Methodology

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

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

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

Each BDO Zone Risk Indicator is given a **Raw Risk Impact (RRI)** score which denotes the impact on a future BDO Zone project due to the Risk Indicator. RRI scores are scaled as either *very low* (2), *low* (4), *medium* (6), *high* (8), or *very*

*high* (10). Impact level scores are based on the impact level of a risk on the successful development and deployment of a BDO Zone project with no mitigation measures.

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

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

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

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

The total risk rating for the BDO Zone is the average of all Loaded RI scores. The BDO Zone score for Location is ***24.90 out of 100, resulting in a 'BBB' designation***.

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

## Analyst Notes

The BDO Zone, centered in Oroville, CA, is 8,496 square miles and encompasses all, or part, of seven counties in California. Also referred to as the Supply Zone, it extends to a 75-mile driving distance from this central point. The Zone serves as the primary biomass source for a new facility.

The Competition Zone extends to a 150-mile driving distance from the center point, covering an expansive area of 37,282 square miles. Wood-using facilities within this region may compete for biomass resources with new projects.

The wood supply in the BDO Zone will be sourced primarily from the Sierra Nevada mountains which extend from the northwest to the southeast of Oroville. This area is hilly and mountainous, at times becoming quite steep and rugged.

The land to the west of Oroville is relatively flat and part of the extensive agricultural Sacramento Valley.

Timberland ownership is split between federal and state governments, about 55%, with the 45% balance between large corporations and non-industrial private landowners.

### BDO Zone Assets

The forestry industry began in the Butte County area with lumber demand in the wake of the Gold Rush of 1849 and has continued to grow embracing professional forestry practices and sustainable management since the mid-20th century. The industry is focused on lumber production as there are no pulp & paper mills in California. In addition to managing for sawtimber, a significant effort toward reducing wildfire fuel results in small-diameter trees (also known as pulpwood) being chipped in-woods and broadcast across the landscape.

As small-diameter trees are not being harvested for commercial use, an opportunity exists for the sustainable removal of this resource. This presents an opportunity for production of engineered wood products and composites.

The U.S. Department of Energy's Billion-Ton Report indicates a standing small-diameter tree inventory of approximately 145,000 bdt/yr within the BDO Zone. We estimate that a significant portion of this inventory, about 83% or 120,000 bdt/yr, could be available for new projects at low risk, within a price range of $50/bdt to $55/bdt. The Department of Energy also estimates that forest residues, including tree branches, bottoms, and tops typically discarded during conventional logging operations, could offer approximately 47,000 bdt/yr. Small volumes are collected in the BDO Zone presently. A potential 16,000 bdt/yr of forest residues are available at low risk, within a rated price range of $50/bdt to $55/bdt.

While not considered as part of the rated quantity due to uncertainties around their quality and

accessibility, drought and wildfires have created the availability of two pools of biomass: fuel-reduction biomass and fire-damaged, or salvage, wood. This biomass can be considered an opportunity for future biomass projects as a redundant source of wood fiber in the case of supply shortages but must be tempered by its availability and possibly lower quality.

Two sawmills operate in the BDO Zone with a collective production capacity of approximately 360 million board feet of lumber per year. These mills have the potential to make available approximately 280,000 bdt of sawmill residues annually. Competition for these sawmill residues includes one engineered wood products facility, two wood pellet mills, and 10 biomass energy facilities. It is estimated that around 87,000 bdt/yr of sawmill residues could be available at low risk, with a weighted price range of $75-$117/bdt. The composition of available sawmill residues is predominantly wood chips (54%), bark/hog fuels (19%), sawdust (14%), and wood shavings (13%).

### BDO Zone Liabilities

The BDO Zone is subject to drought and wildfires. Several years of drought have increased the frequency and intensity of wildfires. The lack of a commercial market for small-diameter trees has resulted in large volumes of unharvested biomass that act as fuel for the fires. Some recent wildfires have resulted in large areas of forest being destroyed or damaged.

Oroville's cost of living index stands at 110.3, indicating expenses are about 10% higher than the U.S. average and about 26% higher than the California average. Housing options are limited, with 2.7% of properties available for rent and 1% for sale. While the city supports local businesses through dedicated programs, the elevated cost of living poses a significant risk to new ventures.

California's lack of pulp & paper facilities negates a traditional market for small-diameter trees, resulting in minimal harvests of these materials. When harvested, forest residues and small-diameter tree prices are artificially low primarily due to government wildfire mitigation grants. The abundance of low-value wood exacerbated by wildfires and climate change is likely to persist, and with subsidy reliance, there is a high risk of significant price fluctuations when these grants end.

We note that at present, harvest costs on public lands are covered by the state in the interests of wildfire reduction. While we recognize that subsidies can be withdrawn, we see strong continued pressure for the continuation of these subsidies due to climate change and severe wildfire risk in the region.

### Infrastructure Profile

Overall, the assessment of infrastructure risks, encompassing physical, logistical, social, workforce, and permitting considerations, yields a low-risk score for this site.

The infrastructure profile assessment is centered on a 43-acre site in Oroville, Butte County, California, now a vacant biomass power plant originally constructed in 1984. The site houses various structures, including boilers, chip, and fuel storage areas, offices, and the main power plant. Key features include 60 kV power, natural gas service, and a water well on site.

Transportation infrastructure includes a Union Pacific railroad spur and easy access to Interstate 65 as well as US highways 31 and 84. Deepwater Port access is available via the Port of West Sacramento (68 miles) and the Port of San Francisco (150 miles).

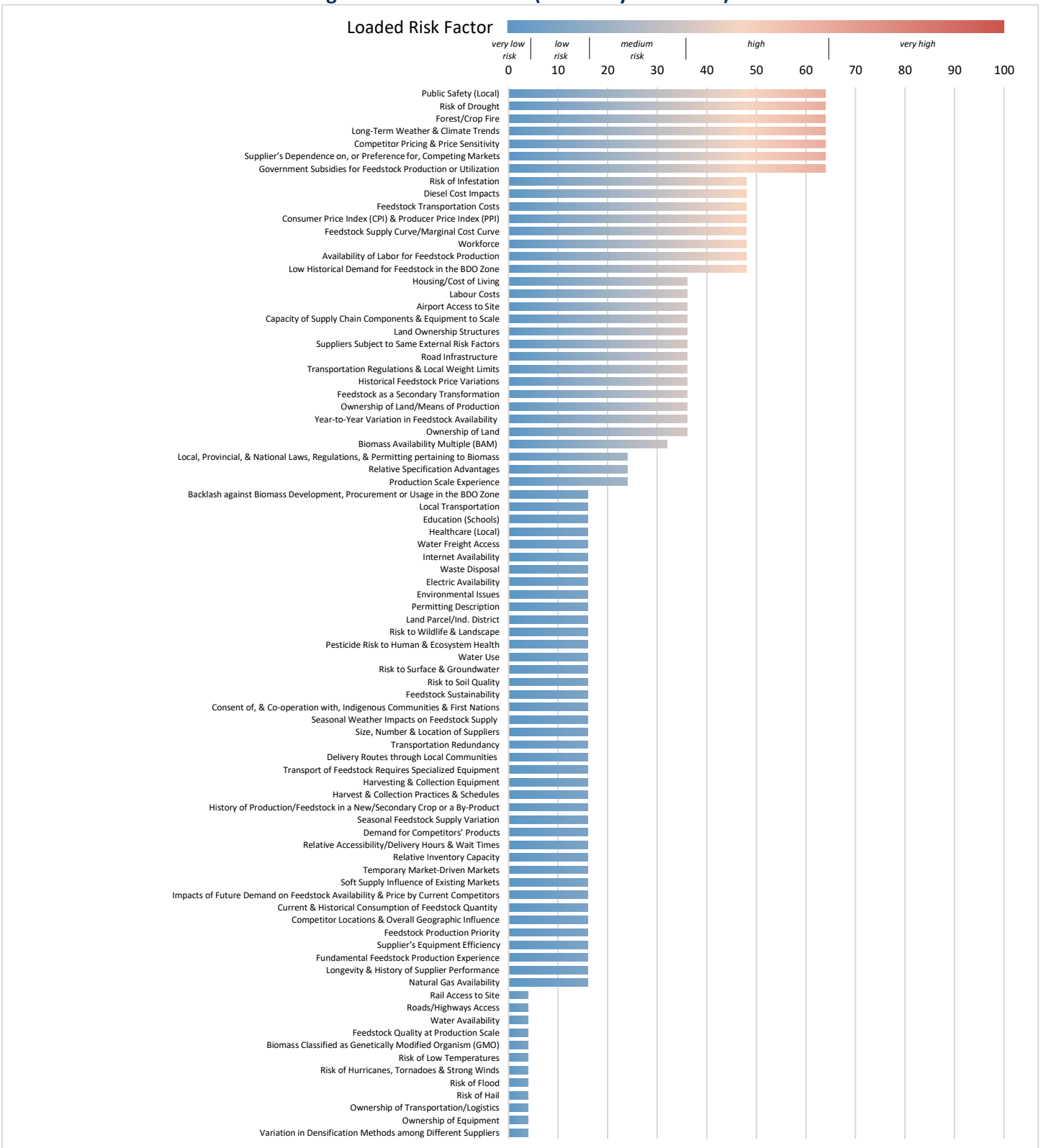
**Project Director**
Bob Kodrzycki
Project Director
Ecostrat Inc.
bob.kodrzycki@ecostrat.com

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

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

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

## Figure 1: Risk Indicators (Sorted by Risk Level)



## Table 1: Risk Indicators and Associated Scores

| | Feedstock Supply Chain Risk Indicators | Raw Risk Likelihood | Raw Risk Impact | Gross Risk Indicator | Mitigation /Notching | Loaded RI Score |
|---|---|---|---|---|---|---|
| | **Category 1.0: Supplier Risk** | | | | | |
| **1.1.1** | Longevity & History of Supplier Performance | 4 | 4 | 16 | 0 | 16 |
| **1.2.1** | Supplier's Dependence on, or Preference for, Competing Markets | 8 | 8 | 64 | 0 | 64 |
| **1.3.1** | Ownership of Land / Means of Production | 6 | 6 | 36 | 0 | 36 |
| **1.3.2** | Ownership of Equipment | 2 | 2 | 4 | 0 | 4 |
| **1.3.3** | Ownership of Transportation/Logistics | 2 | 2 | 4 | 0 | 4 |
| **1.3.4** | Feedstock as a Secondary Transformation | 6 | 6 | 36 | 0 | 36 |
| **1.4.1** | Fundamental Feedstock Production Experience | 4 | 4 | 16 | 0 | 16 |
| **1.4.2** | Production Scale Experience | 6 | 4 | 24 | 0 | 24 |
| **1.5.1** | Supplier's Equipment Efficiency | 4 | 4 | 16 | 0 | 16 |
| **1.6.1** | Feedstock Production Priority | 4 | 4 | 16 | 0 | 16 |
| | **Category 2.0: Competitor Risk** | | | | | |
| **2.1.1** | Competitor Locations and Overall Geographic Influence | 4 | 4 | 16 | 0 | 16 |
| **2.1.2** | Current and Historical Consumption of Feedstock Quantity | 4 | 4 | 16 | 0 | 16 |
| **2.1.3** | Competitor Pricing and Price Sensitivity | 8 | 8 | 64 | 0 | 64 |
| **2.1.4** | Impacts of Future Demand on Feedstock Availability and Price by Current Competitors | 4 | 4 | 16 | 0 | 16 |
| **2.1.5** | Soft Supply Influence of Existing Markets | 4 | 4 | 16 | 0 | 16 |
| **2.1.6** | Temporary Market-Driven Markets | 4 | 4 | 16 | 0 | 16 |
| **2.2.1** | Relative Inventory Capacity | 4 | 4 | 16 | 0 | 16 |
| **2.2.2** | Relative Accessibility / Delivery Hours and Wait Times | 4 | 4 | 16 | 0 | 16 |
| **2.2.3** | Relative Specification Advantages | 6 | 4 | 24 | 0 | 24 |
| **2.2.4** | Demand for Competitors' Products | 4 | 4 | 16 | 0 | 16 |
| | **Category 3.0: Supply Chain Risk** | | | | | |
| **3.1.1** | Biomass Availability Multiple (BAM) | 4 | 8 | 32 | 0 | 32 |
| **3.1.2** | Feedstock Supply Curve / Marginal Cost Curve | 6 | 8 | 48 | 0 | 48 |
| **3.1.3** | Seasonal Feedstock Supply Variation | 4 | 4 | 16 | 0 | 16 |
| **3.1.4** | Year-to-Year Variation in Feedstock Availability | 6 | 6 | 36 | 0 | 36 |
| **3.2.1** | Historical Feedstock Price Variations | 6 | 6 | 36 | 0 | 36 |
| **3.2.2** | Low Historical Demand for Feedstock in the BDO Zone | 8 | 6 | 48 | 0 | 48 |
| **3.2.3** | History of Production/Feedstock in a New/Secondary Crop or a By-Product | 4 | 4 | 16 | 0 | 16 |
| **3.3.1** | Consumer Price Index (CPI) and Producer Price Index (PPI) | 6 | 8 | 48 | 0 | 48 |
| **3.3.2** | Currency Risk | 0 | 0 | 0 | 0 | 0 |
| **3.3.3** | Border Risk | 0 | 0 | 0 | 0 | 0 |
| **3.3.4** | Temporary Externality-Driven Markets for Feedstock | 0 | 0 | 0 | 0 | 0 |
| **3.4.1** | Harvest and Collection Practices and Schedules | 4 | 4 | 16 | 0 | 16 |
| **3.4.2** | Harvesting and Collection Equipment | 4 | 4 | 16 | 0 | 16 |
| **3.4.3** | Variation in Densification Methods among Different Suppliers | 2 | 2 | 4 | 0 | 4 |
| **3.4.4** | Availability of Labor for Feedstock Production | 6 | 8 | 16 | 0 | 48 |
| **3.5.1** | Feedstock Transportation Costs | 6 | 8 | 48 | 0 | 48 |
| **3.5.2** | Diesel Cost Impacts | 6 | 8 | 48 | 0 | 48 |
| **3.5.3** | Transport of Feedstock Requires Specialized Equipment | 4 | 4 | 16 | 0 | 16 |
| **3.5.4** | Delivery Routes through Local Communities | 4 | 4 | 16 | 0 | 16 |
| **3.5.5** | Transportation Regulations and Local Weight Limits | 6 | 6 | 36 | 0 | 36 |
| **3.5.6** | Road Infrastructure | 6 | 6 | 36 | 0 | 36 |
| **3.5.7** | Transportation Redundancy | 4 | 4 | 16 | 0 | 16 |
| **3.6.1** | Size, Number, and Location of Suppliers | 4 | 4 | 16 | 0 | 16 |
| **3.6.2** | Suppliers Subject to Same External Risk Factors | 6 | 6 | 36 | 0 | 36 |
| **3.6.3** | Land Ownership Structures | 6 | 6 | 36 | 0 | 36 |
| **3.7.1** | Seasonal Weather Impacts on Feedstock Supply | 4 | 4 | 16 | 0 | 16 |
| **3.7.2** | Long-Term Weather and Climate Trends | 8 | 8 | 64 | 0 | 64 |
| **3.7.3** | Forest / Crop Fire | 8 | 8 | 64 | 0 | 64 |
| **3.7.4** | Risk of Infestation | 6 | 8 | 48 | 0 | 48 |
| **3.7.5** | Risk of Hail | 2 | 2 | 4 | 0 | 4 |
| **3.7.6** | Risk of Flood | 2 | 2 | 4 | 0 | 4 |
| **3.7.7** | Risk of Drought | 8 | 8 | 64 | 0 | 64 |
| **3.7.8** | Risk of Hurricanes, Tornadoes, and Strong Winds | 2 | 2 | 4 | 0 | 4 |
| **3.7.9** | Risk of Low Temperatures | 2 | 2 | 4 | 0 | 4 |
| **3.8.1** | Government Subsidies for Feedstock Production or Utilization | 8 | 8 | 64 | 0 | 64 |
| **3.8.2** | Local, Provincial, and National Laws, Regulations, and Permitting pertaining to Biomass | 6 | 4 | 24 | 0 | 24 |
| **3.8.3** | Backlash against Biomass Development, Procurement or Usage in the BDO Zone | 4 | 4 | 16 | 0 | 16 |
| **3.8.4** | Consent of, and Cooperation with, Indigenous Communities and First Nations | 4 | 4 | 16 | 0 | 16 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **3.8.5** | Food Security Concerns | 4 | 0 | 0 | 0 | 0 |
| **3.9.1** | Feedstock Sustainability | 4 | 4 | 16 | 0 | 16 |
| **3.9.2** | Risk to Soil Quality | 4 | 4 | 16 | 0 | 16 |
| **3.9.3** | Risk to Surface and Groundwater | 4 | 4 | 16 | 0 | 16 |
| **3.9.4** | Water Use | 4 | 4 | 16 | 0 | 16 |
| **3.9.5** | Pesticide Risk to Human and Ecosystem Health | 2 | 2 | 4 | 0 | 16 |
| **3.9.6** | Risk to Wildlife and Landscape | 4 | 4 | 16 | 0 | 16 |
| **3.9.7** | Biomass Classified as Genetically Modified Organism (GMO) | 2 | 2 | 4 | 0 | 4 |
| | **Category 4.0: Feedstock Scale-up Risk** | | | | | |
| **4.1.1** | Feedstock Quality at Production Scale | 2 | 2 | 4 | 0 | 4 |
| **4.1.2** | Capacity of Supply Chain Components and Equipment to Scale | 6 | 6 | 36 | 0 | 36 |
| | **Category 5.0: Infrastructure** | | | | | |
| **5.1.1** | Land Parcel/Ind. District | 4 | 4 | 16 | 0 | 16 |
| **5.1.2** | Ownership of Land | 6 | 6 | 36 | 0 | 36 |
| **5.1.3** | Permitting Description | 4 | 4 | 16 | 0 | 16 |
| **5.1.4** | Environmental Issues | 4 | 4 | 16 | 0 | 16 |
| **5.2.1** | Natural Gas Availability | 4 | 4 | 16 | 0 | 16 |
| **5.2.2** | Electric Availability | 4 | 4 | 16 | 0 | 16 |
| **5.2.3** | Water Availability | 2 | 2 | 4 | 0 | 4 |
| **5.2.4** | Waste Disposal | 4 | 4 | 16 | 0 | 16 |
| **5.2.5** | Internet Availability | 4 | 4 | 16 | 0 | 16 |
| **5.3.1** | Roads/Highways Access | 2 | 2 | 4 | 0 | 4 |
| **5.3.2** | Rail Access to Site | 2 | 2 | 4 | 0 | 4 |
| **5.3.3** | Airport Access to Site | 6 | 6 | 36 | 0 | 36 |
| **5.3.4** | Water Freight Access | 4 | 4 | 16 | 0 | 16 |
| **5.4.1** | Healthcare (Local) | 4 | 4 | 16 | 0 | 16 |
| **5.4.2** | Education (Schools) | 4 | 4 | 16 | 0 | 16 |
| **5.4.3** | Local Transportation | 4 | 4 | 16 | 0 | 16 |
| **5.4.4** | Public Safety (Local) | 8 | 8 | 64 | 0 | 64 |
| **5.4.5** | Housing/Cost of Living | 6 | 6 | 36 | 0 | 36 |
| **5.5.1** | Workforce | 8 | 8 | 64 | 0.25 | 48 |
| **5.5.2** | Labor Costs | 6 | 6 | 36 | 0 | 36 |
| | | | | | ***Average*** | **24.90** |




**Butte County, CA BDO Zone Independent Review Committee (IRC)**

**DJ Gomes** - Owner, Crossfire Tree Service
**Joel White** - Owner, Earthworm Soil Factory
**Hollis Day** - Safety Director/New Business Development, Mountain F Enterprises
**Gary Warner** - Owner, Warner Enterprises
**Katie Simmons** - Deputy Administrator Officer Economic and Community Development, Butte County
**Wes Ervin** - Principal Planner, City of Oroville
**Dave Derby** - Unit Forester - Butte Unit, CalFire
**Jason Vermillion** - District Fuels Monitor, US Forest Service
**Mark Luster** - Community Relations Manager, Sierra Pacific Industries
**Madison Thomson** - Lands Manager RPF, The Chy Company
**Pete Sundahl** - Owner, Sierra Timber Services
**Pat Piatt** - Community Development Director, City of Oroville
**Brendan Pisani** - Staff, Assemblyman James Gallagher
**Doug Teeter** - Board of Supervisors, Butte County
**Hayley Stone** - Geographical Information Center, North State Planning & Development Collective
**Luis Moreno** - Assistant Director, 3Core

# APPENDIX A: BIOMASS AVAILABILITY AND PRICING

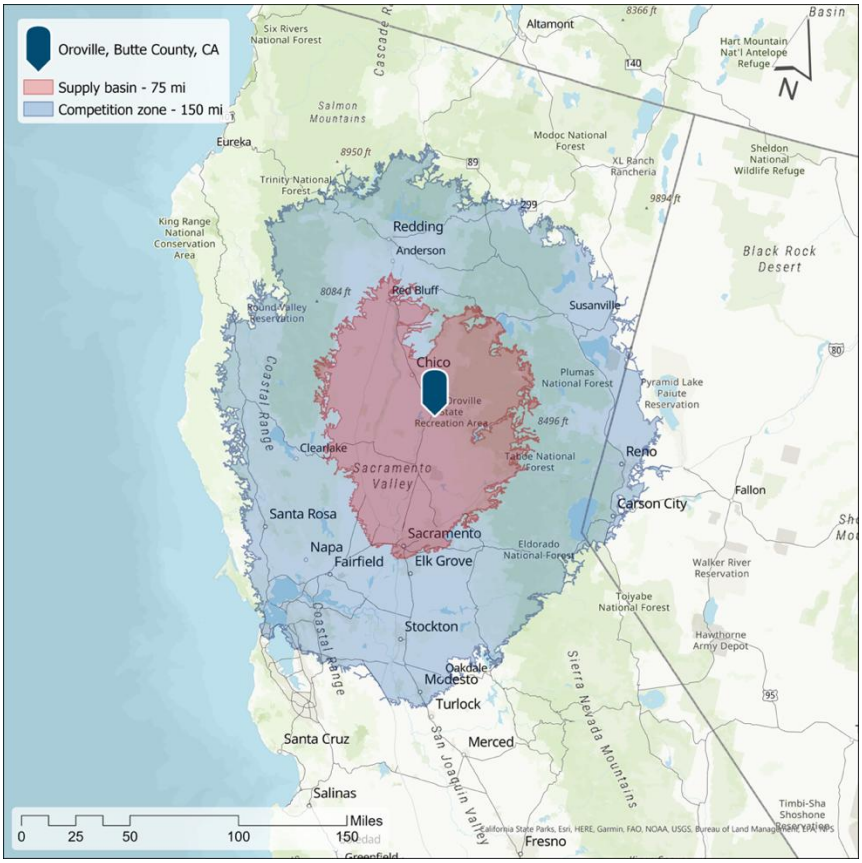
This section assesses the availability and pricing of woody biomass as feedstock for bioenergy, biofuels, and other bio-based products in Butte County, CA, as a BDO Zone region. The center point for woody biomass availability assessment is Oroville, CA.

## SUPPLY AND COMPETITION ZONES

The supply and the competition zones define the areas of interest for this BDO Zone rating (Figure A-1). The Supply Zone defines a driving distance of 75 miles from the center point of the BDO Zone. This is where biomass will most likely be sourced for a new project. The competition zone is defined as a driving distance of 150 miles from the BDO Zone center point. This is the area where competitors for biomass in the Supply Zone may be located.

The Supply Zone is 8,496 square miles and encompasses all, or part, of seven California counties. The Competition Zone expands to a total of 37,282 square miles. The detailed list of counties in the Supply Zone is shown in Appendix C, Table C-1. It is assumed that competitors for woody biomass will also use a 75-mile driving distance for procuring feedstock.

**Figure A-1: Supply and Competition Zones – Butte County CA BDO Zone**



## Woody Biomass Types in the Supply Zone

The Supply Zone is the area from which biomass will be primarily sourced for a new project. The biomass resources available in the Supply Zone can be categorized into three main types: small-diameter trees, forest residues, and sawmill residues.

Small-diameter trees typically ranging from 5 to 11 inches in diameter at breast height. In areas with a pulp & paper market, this biomass type is referred to as pulpwood. It is commonly used in the production of various wood-based products, including paper, paperboard, oriented strand board (OSB), medium-density fiberboard (MDF), and wood pellets. However, the small-diameter trees in the Supply Zone are not harvested for commercial pulp & paper operations as that industry is not present in the area. Rather, these trees are harvested through thinning operations to reduce the wildfire fuel supply. The resulting biomass is chipped and distributed across the site or used in biofuel applications. It should be noted that these trees could be harvested as roundwood (whole logs) if there was a market demand.

Forest residues encompass the by-products and residual materials resulting from forestry operations, such as timber harvesting and thinning activities. These residuals typically include items like branches, tops, stumps, bark, and other woody debris that remain on-site after a sawtimber harvest. It is important to note that forest residues do not include the roundwood or log portion of the tree, which sets them apart from whole tree chips.

Sawmill residues, on the other hand, are the by-products generated during the sawmill operations involved in converting sawlogs into finished wood products, such as lumber and engineered wood. While approximately half of the sawlogs are transformed into these finished products, the remaining portion constitutes sawmill residues, which include materials like wood chips, sawdust, shavings, and bark (often referred to as hog fuel).

It is noted that two other sources of biomass are present within the Supply Zone but are not included in the rated quantity: salvage timber and orchard woody biomass (chipped or ground trees) produced on agricultural lands. Salvage timber are standing trees that have been damaged or killed by recent wildfires. The volume of this material may be significant but was excluded from the rating to present a conservative estimate of available biomass for future biomass projects. Salvage wood end uses may be limited because of damage from the wildfires. Furthermore, it is likely that the quality of this resource will diminish rapidly over time as the bulk of these trees are either dead or severely damaged. This source of fiber could be seen as a redundant source for future biomass projects if the quality meets the feedstock quality specifications of future biomass projects.

Woody biomass is also produced in the Supply Zone from the maintenance of fruit and nut trees. While fruit and nut trees are a source of woody biomass in the area, this biomass is excluded from consideration by this rating as the supply chains involved are fundamentally different than woody biomass produced in the forest stands. Nevertheless, a significant amount of this woody biomass may be available when trees are pruned or replaced.

## Woody Biomass Demand in the Competition Zone

The Competition Zone has similar characteristics as the Supply Zone containing both timber lands from the Sierra Nevada mountains and agricultural production in the Sacramento Valley. Currently, 13 competitors actively participate in the Competition Zone, primarily competing for chipped material. These competitors operate across various sectors, including mills specializing in engineered wood products, wood pellets, and biomass energy. A detailed breakdown of these competitors, their production capacity, and wood demand can be found in Table A-1. It should be noted that there are no pulp & paper mills in the Competition Zone. Pulp & paper mills are typically very large users of biomass.

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

| Category | Number of Companies | Production Capacity | Annual Wood Demand (bdt) | Estimated Annual Wood Demand Met from the Supply Zone (bdt) |
|---|---|---|---|---|
| Engineered Wood Products | 1 | 3.5 MMCF[1] | 97,000 | 27,000 |
| Wood Pellets | 2 | 139,000 tons | 149,000 | 31,000 |
| Biomass Energy | 10 | 285 MW | 1,233,000 | 215,000 |
| Totals | 13 | | 1,479,000 | 273,000 |

- These 13 facilities have a current demand of almost 1.5 million bdt/yr of woody biomass. We estimate about 11% (156,000 bdt) of this demand is met by the suppliers in the supply zone
- Estimated wood demand takes into account the degree of overlap of supply zones for each category

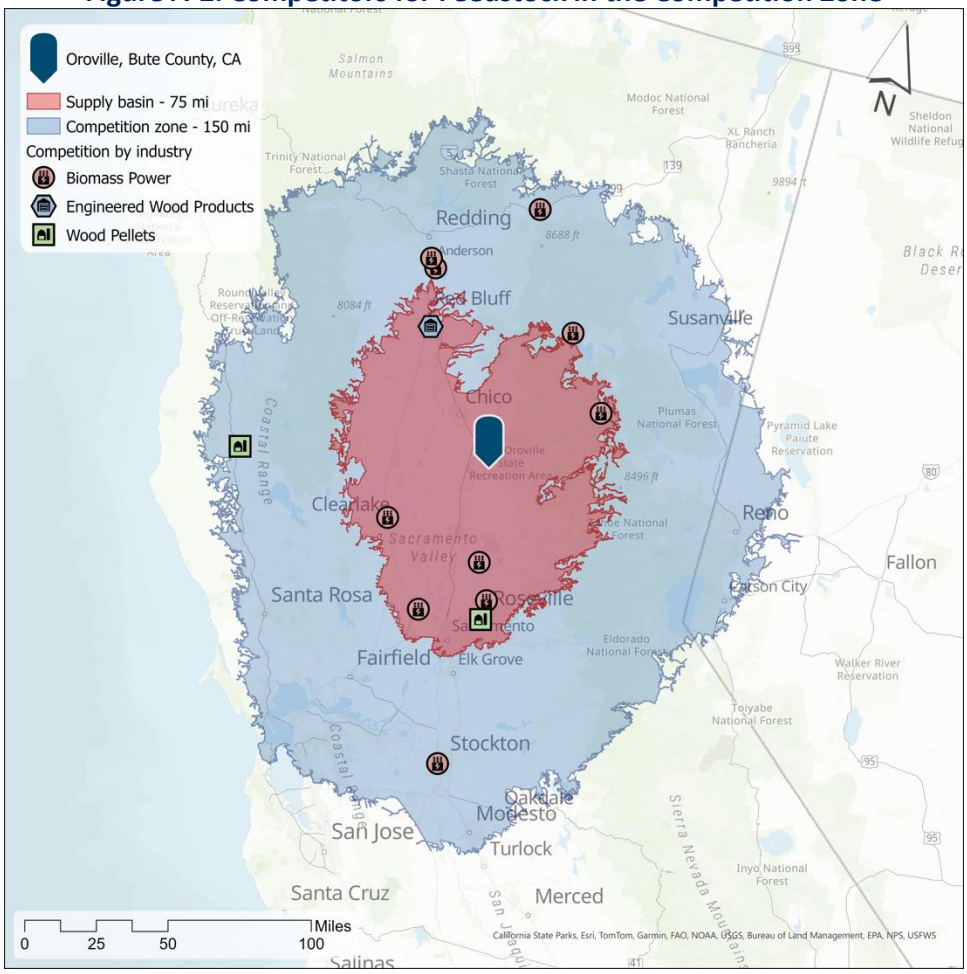
The engineered wood product mill uses a combination of sawlogs and wood chips from sawmill residues to meet their feedstock demand. The pellet mills source a combination of sawmill residues, recycled wood waste, and biomass residue from logging operations. The biomass power facilities are often co-located with sawmills and use a mix of sawmill residues and forest residues.[2]

Biomass energy plants source a significant amount of biomass from non-forestry operations including orchard wood waste, trees from the clearing of firebreaks around homes, and landscape trimmings.[3] Biomass resources in the area are 60% from the fruits and nuts industry and 40% from the forest and landscape industry.[4] Thus, the estimated wood demand for biomass energy producers from the forest operations in Table A-1 should be considered to be lower than the figure indicated.

Figure A-2 shows the geographic distribution of these competitors within the Competition Zone.

[1] MMCF stands for million cubic feet
[2] Personal Communication. Mark Luster, Sierra Pacific Industries.
[3] Ibid.
[4] 2023. Butte County Fire Safe Council Biomass Feasibility Study. Produced by the Center for Economic Development. Funded by the Butte County Fire Safe Council.

**Figure A-2. Competitors for Feedstock in the Competition Zone**




Small-diameter trees and forest residues are subject to unique market forces as a result of recent wildfires. Two pools of small-diameter trees are available as chipped in-woods biomass: thinnings and fire-damaged trees. These trees are not being harvested for pulp & paper manufacturing; rather it is removed through thinning operations. Likewise, forest residues are available as chipped in-woods material remaining after the harvest of sawtimber.

Wildfires are fueled by small-diameter trees. This biomass grows in large volumes depending on the management protocols of specific timberland tracts. Piles of forest residues also contribute to wildfire intensity. Harvesting activities of small-diameter trees and forest residues are being driven by grant funding[5] and USDA Forest Service contracts to reduce wildfire risk. Thus, these biomass resources are not harvested by market-driven forces but rather by state policy and advocacy groups. As prices are offset by grants and contracts delivered prices for this material are lower than would be expected in a market-driven economy. The market reality is that stumpage prices for small-diameter trees and forest residues are essentially zero and the delivered price is almost wholly transportation and chipping cost plus some labor.

[5] Sources of grant funding: Sierra Nevada Conservancy. https://sierranevada.ca.gov/grants/; CalFire Forest Health Grants. https://www.fire.ca.gov/what-we-do/grants/forest-health; CalFire Wildfire Prevention Grants. https://www.fire.ca.gov/what-we-do/grants/wildfire-prevention-grants; California Climate Investments Wildfire Prevention Grants Program. https://www.caclimateinvestments.ca.gov/fire-prevention-grants. Accessed Mar 5, 2024.

We note that at present, harvest costs on public lands are covered by the state in the interests of wildfire reduction. While we recognize that subsidies can be withdrawn, we see strong continued pressure for the continuation of these subsidies due to climate change and severe wildfire risk in the region.

The volume of small-diameter tree growth and removals for the years 2020 and 2021 in the Supply Zone is provided by the US Department of Agriculture Forest Service through the Forest Inventory and Analysis database.[6] Compared to other states in the US, historical data are limited for California. However, the available data for 2020 and 2021 provide an understanding of the standing inventory of living biomass in the Supply Zone.

Table A-2 shows the recent annual net growth and removals for small-diameter trees in the Supply Zone. Note that no small-diameter tree removals have been recorded, likely due to the lack of established demands from industries such as pulp and paper. These trees are currently removed through thinning operations as discussed before.

**Table A-2. Small-Diameter Tree Growth and Removals in the Supply Zone by Species Type**

| | Average Annual Net Growth by Species Type (bdt) | Average Annual Removals by Species Type (bdt) |
|---|---|---|
| Softwood Growth | 257,000 | 0 |
| Hardwood Growth | 115,000 | 0 |
| Total Small-Diameter Trees | 372,000 | 0 |

## New Projects and Expansions

Potential new competitors have been proposed for the competition zone. The types of competitors and biomass demand are provided in Table A-3. It should be noted that while the intent to build new projects has been proposed this does not indicate that construction has started. If completed, these five facilities would consume 466,000 bdt/yr of small-diameter trees and forest residues. Note that the wood demand of announced projects is not included in the woody biomass availability assessment in this rating.

**Table A-3. Proposed Competitors in the Competition Zone[7]**

| Industry | Stage | Number of Companies | Biomass Demand (bdt/yr) |
|---|---|---|---|
| Biofuel | New Facility | 1 | 66,000 |
| Renewable Natural Gas | New Facility | 2 | 30,000[8] |
| Biomass Power | New Facility | 2 | 370,000 |
| Totals | | 5 | 466,000 |

## Rated Quantities

### *Small-Diameter trees and Forest Residues*

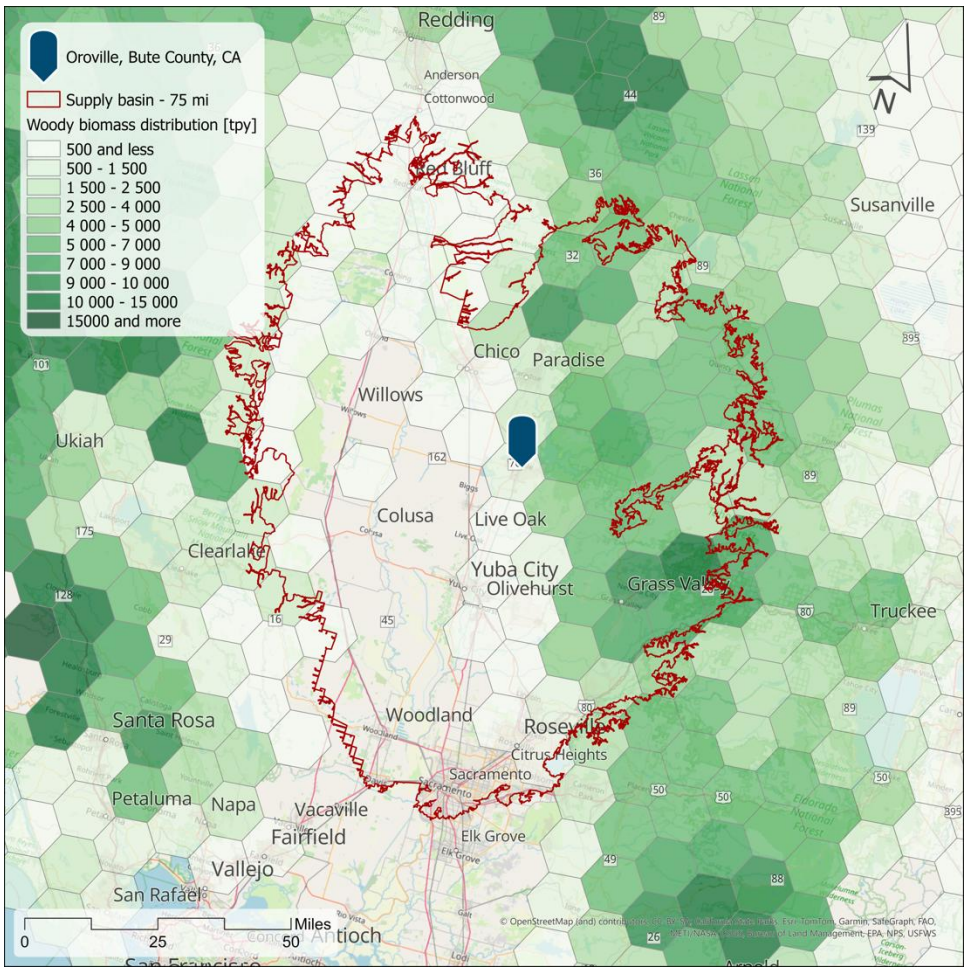
The high-level estimates of small-diameter trees and forest residue availability in the Supply Zone were sourced from the Billion-Ton Study.[9] This rating offers projections on biomass availability until 2040, grounded in assumptions regarding market and logistical conditions, as detailed in Table C-2.

County-level estimates for the years 2020, 2025, 2030, and 2040 were acquired and processed utilizing GIS software. A Supply Zone polygon, representing a 75-mile maximum transport distance, was created allowing an estimate of the woody

[6] Forest Inventory and Analysis. https://www.fs.usda.gov/research/programs/fia.
[7] Marin Dujmovic. 2024. Woody Biomass Supply Assessment, Ukiah CA. Proprietary to Ecostrat.
[8] Only one of the two proposed new projects provided wood demand data. The second project is a pilot project of new technology and thus capacity, if installed, will not be substantial.
[9] Billion-Ton Report. https://bioenergykdf.net/2016-billion-ton-report

biomass in the Supply Zone. Figure A-3 shows a representation of woody biomass distributed within a 75-mile driving distance from Oroville, CA, the center point of the BDO Zone.

**Figure A-3. Woody Biomass Distribution in the Supply Zone**




- The Supply Zone is distinguished by a transect that runs roughly northwest to southeast
- The woody biomass supply is mainly located toward the right-hand side of the Supply Zone

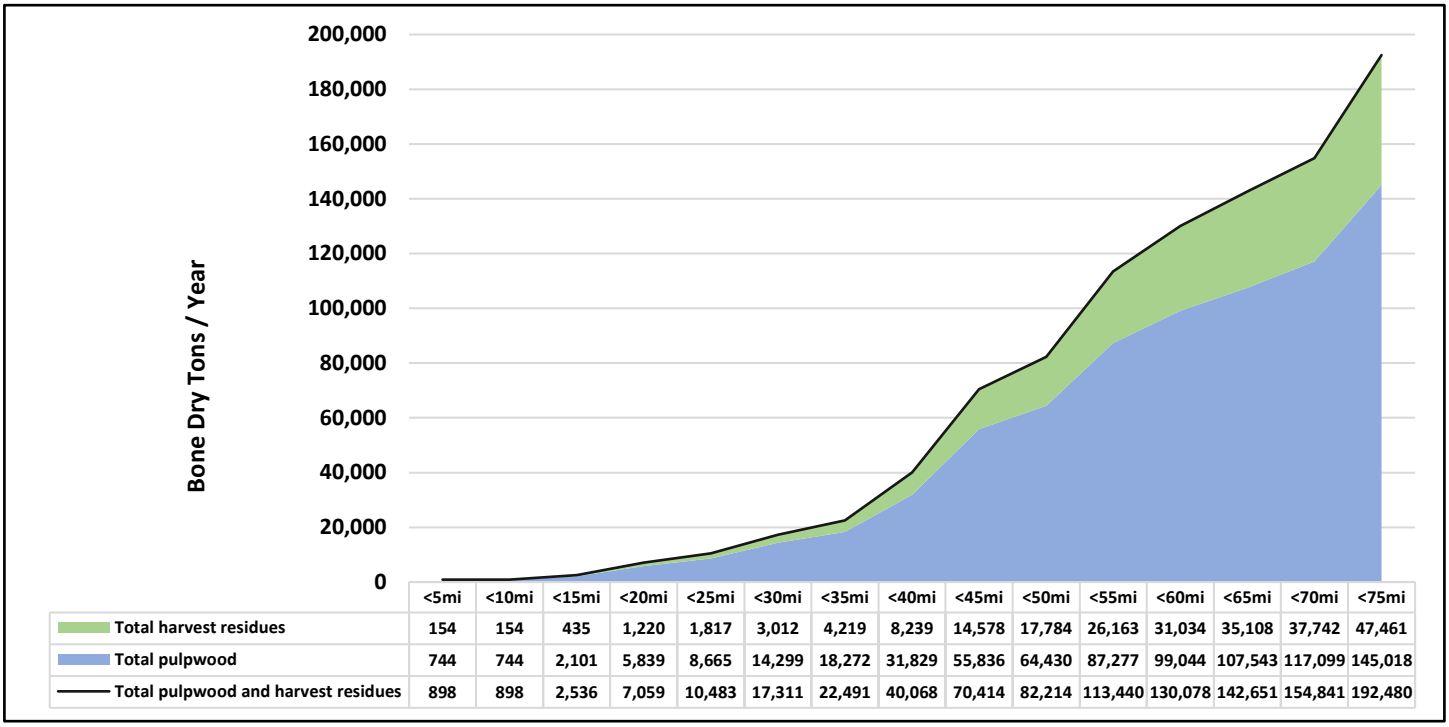
The algorithm evaluates the percentage of each county's area within the Supply Zone (percentage overlap value). These resulting values are then applied to the average annual small-diameter tree and forest residue availability for the years 2020-2040, resulting in an estimation of the total quantity available in the Supply Zone for potential newcomers. Supply curves are subsequently generated by using the Supply Zone polygon to estimate the volume of small-diameter trees and forest residue accessible in 5-mile transport distance segments, up to the maximum 75-mile transport distance.

The BDO Zone rating process, initiated from the Billion-Ton Study estimates, assesses the quantity of low-risk biomass available in the Supply Zone. It is important to note that this quantity is typically less than the total estimated availability. Various factors, including private landowner reluctance, inadequate infrastructure, labor accessibility, and adverse weather conditions during the harvest season, contribute to a reduction of available small-diameter trees and forest residues for future projects. Additionally, the assumptions used to estimate total potential biomass availability may not fully account for real-world scenarios.

Importantly to note, the small-diameter tree and forest residues availability analysis has already factored in the current competition's consumption, providing quantities that are available to the Project on top of what is already being consumed by the competitors. This is also the case for sawmill residuals, whose availability to the Project was confirmed by the direct outreach to sawmills.

Figure A-4 shows the estimated availability of small-diameter trees and forest residues in the Supply Zone through 2040.

**Figure A-4. Woody Biomass Estimated Availability by Feedstock Class and Distance from the Center Point**




| | <5mi | <10mi | <15mi | <20mi | <25mi | <30mi | <35mi | <40mi | <45mi | <50mi | <55mi | <60mi | <65mi | <70mi | <75mi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total harvest residues | 154 | 154 | 435 | 1,220 | 1,817 | 3,012 | 4,219 | 8,239 | 14,578 | 17,784 | 26,163 | 31,034 | 35,108 | 37,742 | 47,461 |
| Total pulpwood | 744 | 744 | 2,101 | 5,839 | 8,665 | 14,299 | 18,272 | 31,829 | 55,836 | 64,430 | 87,277 | 99,044 | 107,543 | 117,099 | 145,018 |
| Total pulpwood and harvest residues | 898 | 898 | 2,536 | 7,059 | 10,483 | 17,311 | 22,491 | 40,068 | 70,414 | 82,214 | 113,440 | 130,078 | 142,651 | 154,841 | 192,480 |

- The total volume of small-diameter tree and forest residues available in the BDO Zone is estimated to be about 192,000 bdt/yr
- Small-diameter trees make up about 76% of this biomass or 145,000 bdt/yr
- Harvest residues account for about 24% of the total biomass, about 47,000 bdt/yr

To address uncertainties in the assessment of woody biomass availability, the Biomass Availability Multiple (BAM) is employed as an indicator of the supply chain's resilience in the face of potential shortages or supplier issues. A higher BAM factor signifies increased uncertainty in biomass availability for a project.

Given the well-established nature of the forest products industry in the BDO Zone, a BAM factor of 1.2 is applied, reflecting a low risk of small-diameter tree availability. Another reason for the low BAM factor is the potential availability of salvage timber[10]. As discussed before, this potential biomass source is not included in the rated quantity but can be available for future biomass projects in case of supply shortages and acceptable quality and accessibility of salvage trees.

A significant amount of small-diameter trees not included in the rated volumes of biomass may also be available through fuel-reduction contracts offered by CalFire or the Forest Service. Efforts to reduce the amount of fuel available to wildfires are being carried out by harvesting all the trees under 10" in diameter on selected stands. The trees are either macerated

[10] Salvage timber are standing trees that have been damaged or killed by recent wildfires.

and spread over the site or chipped and transported out of the forest via a chip van, usually to a biomass energy, or other qualified facility.[11] The total volume of this resource is not directly available as harvesting varies from year to year depending on available funds through CalFire or the Forest Service. However, a recent study determined that an average of 12.9 bdt[12] per acre is available. An estimate from a local expert[13] suggests that between 20 to 25 bdt per acre is a more accurate figure. It should be noted that this wood resource is not included in the 2016 Billion-Ton Study estimates used in this rating as the bulk of wildfire damage occurred between 2018 and 2021.

In contrast to small-diameter trees, a higher BAM factor of 3 is assigned to forest residues, primarily because there is limited active harvesting of this resource in the area.

Table A-4 provides estimates of biomass availability for both small-diameter trees and forest residues based on the Billion-Ton Study. These figures represent the total potential availability within the Supply Zone, accounting for excess biomass beyond current and projected biomass utilization until 2040.

**Table A-4. Estimate of Average Annual and Low-risk Quantities of Small-Diameter Tree and Forest Residues through 2040**

| Biomass Type | Average Availability (bdt/yr) | BAM factor | Low-Risk Quantity after incorporating BAM factor (bdt/yr) |
|---|---|---|---|
| Small-Diameter Trees | 145,000 | 1.2 | 120,000 |
| Forest Residues | 47,000 | 3 | 16,000 |
| **Total** | **192,000** | | **136,000** |

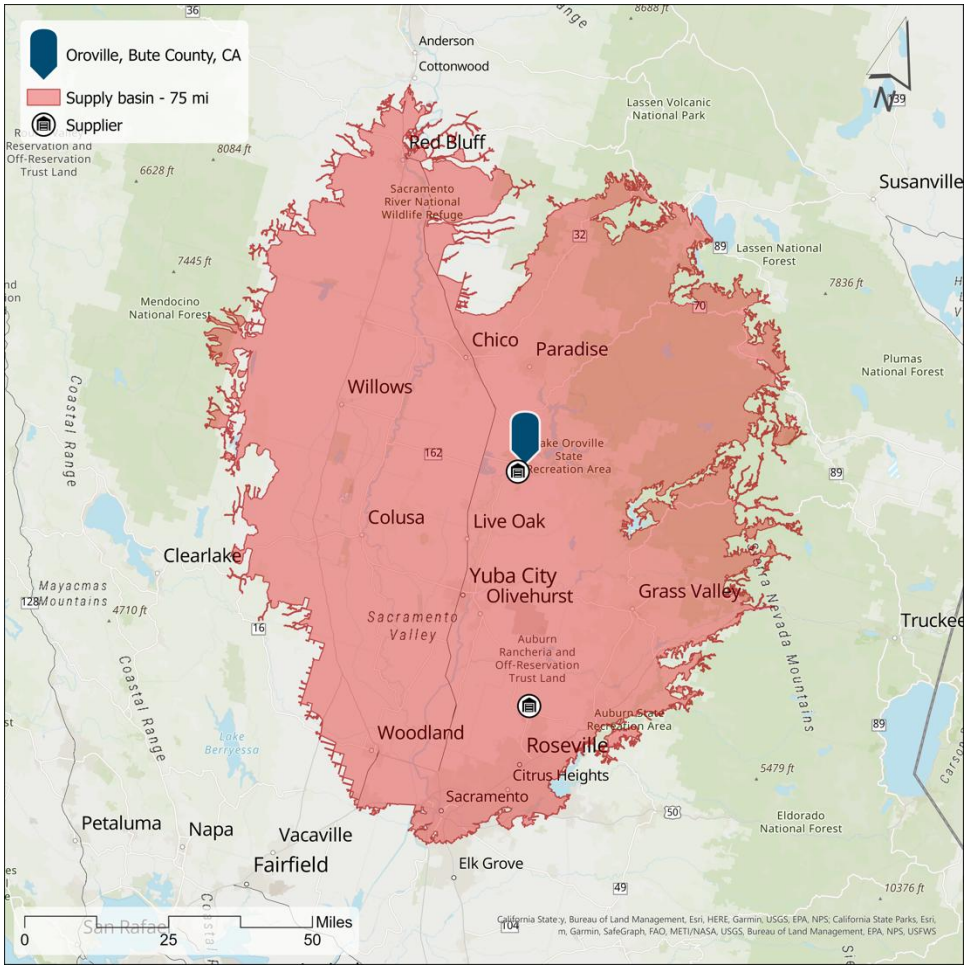
- A total of 136,000 bdt/yr of low-risk biomass is available from small-diameter trees and forest residues in the Supply Zone

### *Sawmill Residues*

Within the Supply Zone, there are two potential suppliers of sawmill residues. These mills produce lumber with a total annual capacity of 360 MMBF. Figure A-5 shows the location of these suppliers in the Supply Zone.

[11] Personal Communication. Dave Derby, Unit Forester, Butte Fire Safe Council; Eric Murphy, Supervisory Forester, US Forest Service.
[12] 2023. California Forest Biomass Pile Data Collection. Prepared for the Joint Institute for Wood Products Innovation. California Law Empowering Renewable Energy. Spatial Informatics Group. Blue Tree Analytics.
[13] Personal Communication. Jim Houtman, CalFire.

**Figure A-5. Sawmills in the Supply Zone**




The sawmills were contacted to determine the volume of sawmill residues generated and the amount available. Both sawmills produce residual chips, sawdust, shavings, and bark. Table A-5 shows the wood demand and generated quantities of these two sawmills.

**Table A-5. Sawmill Capacity and Residue Availability in the Supply Zone**

| Supplier of sawmill residues | Distance from center point (mi) | Production Capacity (MMBF/yr) | Wood Demand (bdt/yr) | Sawmill residues availability (bdt/yr) | |
|---|---|---|---|---|---|
| Sawmill 1 | 1 | 90 | 147,000 | Residual wood chips: | 0[14] |
| | | | | Sawdust: | 9,000 |
| | | | | Wood shavings: | 0[15] |
| | | | | Bark: | 0[16] |
| Sawmill 2 | 50 | 270 | 441,000 | Residual wood chips: | 144,000 |
| | | | | Sawdust: | 29,000 |
| | | | | Wood shavings: | 46,000 |
| | | | | Bark: | 42,000 |
| **Totals** | | **360** | **588,000** | | **270,000** |

While 348,000 bdt/yr of residues are generated by these mills, the entire amount available is reduced by internal use for power generation and high-value end uses. Specifically, Sawmill 1 produces chips rated as suitable for use as playground mulch. These chips are not sold as a residual material because of the high price they can demand. Neither mill indicated that long-term contracts for materials were required or currently in place.

As with small-diameter trees and forest residues, a Biomass Availability Multiple (BAM) is applied as an indicator of the uncertainty of sawmill residue availability. While there is no indication that long-term contracts limit the availability of sawmill residues there is a consideration of the transport distance involved for the majority of the material.

Figure A-2 shows the location of competitors for feedstock in relation to the center point of the BDO Zone. There are five competitors for feedstock that are closer to the majority source for sawmill residues. Four of these competitors are significantly closer. This situation creates a disadvantage for a new project as transportation costs are likely to be higher for trucking to Oroville. The likelihood that there are established relationships in place between suppliers and current buyers also contributes to increased uncertainty of obtaining sawmill residues and thus a relatively high BAM factor is justified. The BAM for wood shavings is higher than other residues because of the high price they can demand from the animal bedding market.

Table A-6 provides a breakdown of the specific volumes of sawmill residues available in the Supply Zone as well as the low-risk quantity after applying the BAM.

**Table A-6. Low-Risk Sawmill Residue Availability in the Supply Zone (bdt/yr)**

| Biomass Type | Average Annual Generation[17] | BAM | Low-Risk Quantity after incorporating BAM factor |
|---|---|---|---|
| Residual Chips | 144,000 | 3.0 | 48,000 |
| Sawdust | 38,000 | 3.0 | 13,000 |
| Shavings[18] | 46,000 | 4.0 | 12,000 |
| Hog Fuel | 42,000 | 3.0 | 14,000 |
| **Totals** | **270,000** | | **87,000** |

[14] All residual wood chips are rated for use on playgrounds and are sold at premium price. Not available as residues.
[15] All wood shavings are used internally.
[16] All bark is used internally.
[17] Volumes confirmed by outreach.
[18] Shavings are given a higher BAM factor because this resource is often bought by markets that can tolerate higher purchase prices such as animal bedding.

## Rated Pricing

Sawmill residue prices were obtained by direct outreach to the two mills in the Supply Zone. The delivered price of chipped small-diameter trees and forest residues was obtained by outreach to local experts.[19] Sawmill residue prices, delivered to Oroville, CA, are shown in Table A-7.

**Table A-7. Summary of Pricing for Woody Biomass Available in the BDO Zone**

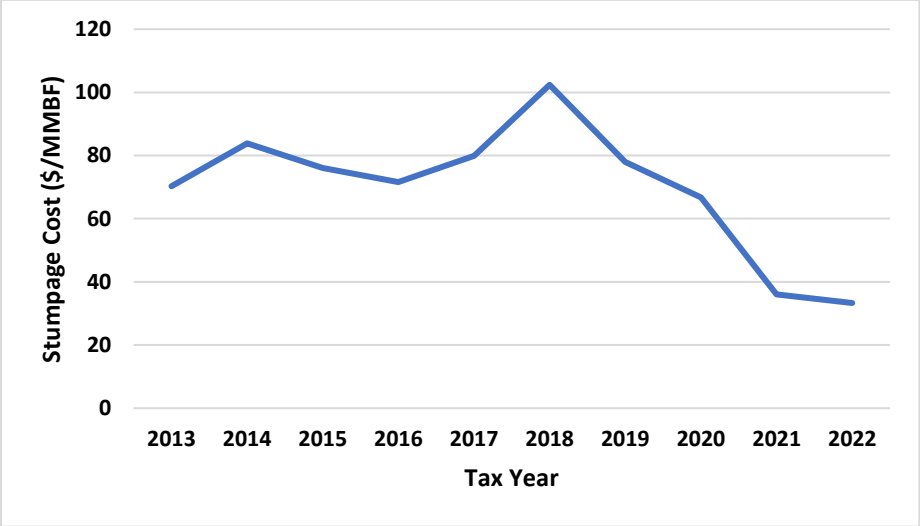
| Woody Biomass Type | Delivered Price Range ($/bdt) | Current Delivered Price ($/bdt) |
|---|---|---|
| Chipped in-woods small-diameter trees and harvest residues | 50 - 55 | 53 |
| Sawmill residual wood chips | 91 - 137[20] | 102 |
| Sawdust | 58 - 99[21] | 71 |
| Wood shavings | 70 - 112[22] | 81 |
| Bark/hog fuels | 40 - 72[23] | 50 |

The current delivered price may not represent the prices that future biomass projects need to pay to secure their biomass demand. The delivered price range accounts for the varying transportation distance to move biomass from forest stands to the center point, competition for the resource, the volatility in the stumpage fees, and the availability of grant programs to offset the cost of harvesting small-diameter trees and forest residues. Specifically, given the supplier-buyer relation factors discussed above for sawmill residues, the upper end of the delivered price range has had a 20% premium added to account for competition.

Stumpage prices in the Supply Zone have been trending downward since 2018 across all feedstock types. Historic feedstock stumpage prices in the BDO Zone for the 10 years between 2013 and 2022 were obtained from California tax records[24] for the counties in the Supply Zone (Figure A-6). These prices are based on taxable revenue from stumpage value and are not broken down by feedstock type. As discussed above, small-diameter tree stumpage can be as low as zero in fire-affected areas thus the data presented should be used to interpret trends rather than absolute values.

[19] Personal Communication. Hollis Day, Mountain F Enterprises; Gary Warner, owner Warner Enterprises; Dave Derby, CalFire.
[20] Upper value of the range reflects a 20% added premium to account for competition for sawmill residues.
[21] Ibid.
[22] Ibid.
[23] Ibid.
[24] Timber Production Figures. https://www.cdtfa.ca.gov/dataportal/dataset.htm?url=PropTaxTimberProductionStats. Accessed Feb 15, 2024.

**Figure A-6. Change in Stumpage Price: 2013 – 2022[25]**




- Note that these prices include all timber types (sawtimber, small-diameter trees, poles, etc.)
- Stumpage prices in the BDO Zone in USD per MMBF[26]
- Prices rose by about 30% between 2013 and 2018, the high point over the decade examined.
- Since 2018, stumpage prices have declined 77%.

The rapid and steady decrease in stumpage prices since 2018 is attributed to the impact of drought and wildfire damage.[27] Wildfires since 2018 have damaged vast areas of timberland, resulting in dead and damaged trees.[28] There are two contributors to the recent price reduction. Large volumes of trees have been blown over, blocking roads, and need to be removed. Also, the fire-damaged timber is generally of lower quality.

As drought and wildfires are predicted to continue with climate change, it is likely that stumpage prices will continue to drop or remain very low for small-diameter tree and forest residues. As discussed above, because of funding from advocacy groups and government contracts, stumpage prices are artificially low and not driven by market forces. The market reality is that stumpage prices for small-diameter tree and forest residues are essentially zero, and the delivered price is almost wholly transportation and chipping costs plus some labor.

Transportation of woody biomass in the BDO Zone is carried out by trucking. Chipped whole trees, harvest residues and sawmill residues are transported by open bin trailers.

A recent survey determined the cost of biomass transport based on data from five resources.[29] Assumptions for this rating were that a fully loaded chip trailer carries 15 bdt and that the average haul is 60 miles with a deadhead return. The survey

[25] Timber Harvest Values. https://www.cdtfa.ca.gov/taxes-and-fees/Timber-Harvest-Values-1H-2022.pdf. Accessed Feb 15, 2024.

[26] Board feet are the quantity of timber cut and scaled. Miscellaneous products including all hardwoods, Christmas trees, fuelwood, poles and pilings, and split products are generally not measured in net board feet.

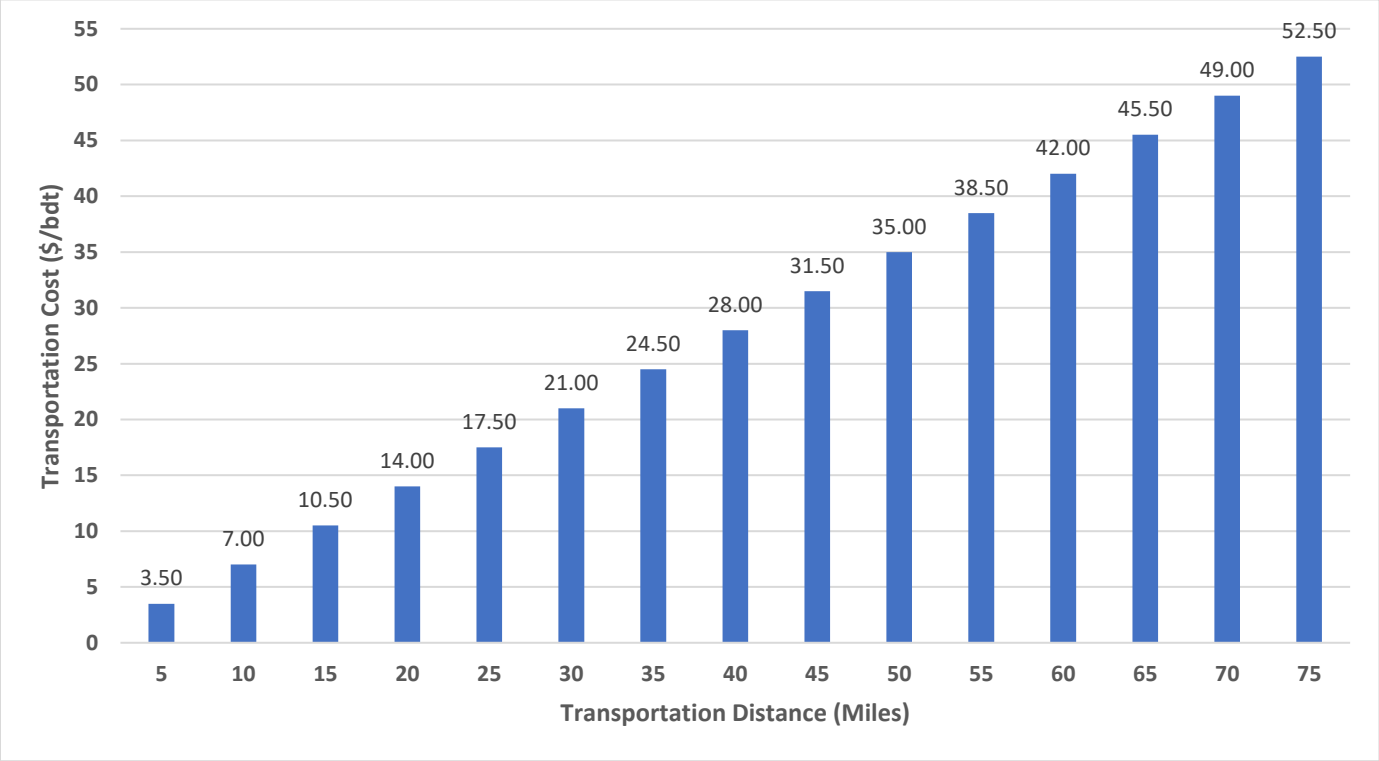
[27] Wang, Y., & Lewis, D. J. (2024). Wildfires and climate change have lowered the economic value of western US forests by altering risk expectations. *Journal of Environmental Economics and Management*, *123*, 102894.

[28] Long-Term Economic Impacts of Large Fires in California from 2018-2021: Losses and Opportunities. Mason Bruce & Girard. Natural Resource Consultants.

[29] 2023. Butte County Fire Safe Council Biomass Feasibility Study. Produced by the Center for Economic Development. Funded by the Butte County Fire Safe Council.

determined that the cost of hauling chipped biomass is about $0.35 per bdt ton-mile. Figure A-7 below shows the cost of various haul distances.

**Figure A-7. Transportation Cost Based on the Distance from the Center Point.**




- Transportation costs are directly proportional to the haulage rate per loaded mile
- A 50-mile haul, the average distance for the Supply Zone, transportation cost is $35 per bdt-mile

# APPENDIX B: RISK INDICATOR SCORING METRICS

## CATEGORY 1.0: SUPPLIER RISK

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

#### *1.1.1 Longevity & History of Supplier Performance*

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

**Risk Information:** Forestry in the BDO Zone has been practiced since the Gold Rush era, which started in 1948, brought on by the demand for timber. Lumber mills continue to operate in the area, with two lumber mills in the Supply Zone and 13 in the Competition Zone at this time. Figure C-5 shows that the number of lumber mills and their capacity have grown over the past decade. Small-diameter tree loggers have been active in the supply zone, thinning pulp-grade trees to reduce fuel for wildfires. For more detail on logging capacity, see Risk Indicator 3.6.1 Size, Number, and Location of Suppliers.

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

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

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

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

**Risk Information:** There are two suppliers in the BDO Zone that could provide sawmill residues. The supplier that can supply the majority of the biomass has five competitors that are significantly closer than Oroville putting a new project at a disadvantage when sourcing sawmill residues in the BDO Zone**.**

| | |
|---|---|
| **Raw Risk Likelihood (RRL)**<br>**The risk likelihood is deemed *high*, therefore the RRL is 8 out of 10.** | **Score**<br>**8** |
| **Raw Risk Impact (RRI)**<br>**The risk impact is deemed *high*, therefore the RRI is 8 out of 10.** | **Score**<br>**8** |

| **Gross Risk Indicator (GRI)** | **Score** |
|---|---|
| **The Gross Risk Indicator (RRL × RRI) is 64 out of 100.** | **64** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score** | **Score** |
| **The Loaded RI Score ((1-Total Notch) × GRI Score) is 64 out of 100.** | **64** |

## *1.3 Risk Factor: Supplier Control Over Production and Transportation*

### *1.3.1 Ownership of Land/Means of Production*

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

**Risk Information:** With a 75-mile driving distance of the BDO Zone center point, approximately 55% of the timberland is owned by the Federal or State government.[30] Corporate ownership of the remainder accounts for about one-third, while non-industrial ownership provides two-thirds of the land holdings.[31] While public land makes up the majority of timberlands in the Supply Zone, harvests on public land are subject to an approval process through the US Environmental Protection Agency's National Environmental Policy Act.[32] Private land makes up about 45% ownership of timberland and is the source for approximately 80% of forest products in California.[33] However, in light of the recent wildfires, some private owners are questioning whether to continue owning forestland.[34] It is not clear how this would affect accessibility to timberlands. In light of these factors and the uncertain future, this risk is rated medium.

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

[30] US Department of Energy 2016 Billion-Ton Report. https://bioenergykdf.net/2016-billion-ton-report
[31] California Forest Statistics. https://www.forestunlimited.org/resources/california-forest-statistics/. Accessed Feb 6, 2024.
[32] National Environmental Policy Act. https://www.epa.gov/nepa. Accessed March 8, 2024.
[33] Marcille, K. C., Morgan, T. A., McIver, C. P., & Christensen, G. A. (2020). California's Forest Products Industry and Timber Harvest, 2016.
[34] 2023. Long-Term Economic Impacts of Large Fires in California from 2018-2021: Losses and Opportunities. Mason, Bruce & Girad. Portland, OR.

### *1.3.2 Ownership of Equipment*

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

**Risk Information:** All loggers in California are independent contractors.[35] The majority of loggers own their own equipment.[36] If they accept jobs where additional equipment is needed for the short term, they will subcontract to other logging companies.[37] The equipment used for logging or chipping is standardized across the region and in ample supply as fuel reduction and salvage work has been widespread following recent wildfires.[38]

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

### *1.3.3 Ownership of Transportation/Logistics*

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

**Risk Information:** It is common for loggers to own their trucks. When additional trucks are needed due to the size of a particular contract, loggers will hire additional truck drivers or independent truck owner-operators as needed.[39]

| **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** |

[35] Personal Communication. Mark Luster, Sierra Pacific Industries.
[36] Personal Communication. Gary Warner, Warner Enterprises.
[37] Ibid.
[38] Personal Communication. Gary Warner, Warner Enterprises; Jim Houtman, CalFire.
[39] Personal Communication. Gary Warner, Warner Enterprises.

| **Gross Risk Indicator (GRI)**<br>**The Gross Risk Indicator (RRL × RRI) is 4 out of 100.** | **Score**<br>**4** |
|---|---|
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>**No adjustment.**<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.** | **Score**<br>**4** |

### *1.3.4 Feedstock as a Secondary Transformation*

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

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

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

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

**Risk Information:** Small-diameter trees and forest residues are currently treated as residual products. The small-diameter tree class are thinned from the timberlands as a sawtimber management practice and also to reduce the fuel source for wildfires. This biomass, along with forest residues are chipped in the woods and spread across the landscape. Thus, their production depends on the harvest of sawlogs by the lumber manufacturers.

The production of forest and sawmill residues mainly depends on the housing market, a leading indicator for the US economy. In the BDO Zone, there has been an increase in sawmill production and number of sawmills for the past decade. The link between the housing market and sawmill productivity indicates a medium risk.

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

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

### *1.4 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 sawmilling industry has been active in the area for over 200 years. With regard to handling small-diameter trees and forest residues, these resources have been handled as part of timberland management for sawtimber of reduction of wildfire fuel. Overall, the labor pool in the region has the necessary feedstock production experience.

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

#### *1.4.2 Production Scale Experience*

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

**Risk Information:** Small-diameter trees and forest residues are not being harvested at scale for commercial purposes because of a lack of markets. However, these resources are being chipped in the woods to reduce the risk of wildfires and these activities have been increasing since about 2016. Most of this material is broadcast in the forest, but in some cases the chipped material is being delivered to biomass power facilities, paid for by grants. This grant money is the limiting factor in how much material is processed and removed. Given recent efforts and the number of loggers in the area, scaling up to harvest this material is likely if given a commercial outlet.

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

### *1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity*

#### *1.5.1 Supplier's Equipment Efficiency*

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

**Risk Information:** In the BDO Zone, logging and trucking have deep roots, with a forest products industry boasting a rich 200+ year history. Suppliers in this region possess extensive expertise in the harvesting, handling, and transportation of biomass. Common operations in the region include harvest of logs as well as thinning operations involving in-woods chipping.

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

### *1.6 Risk Factor: Supplier Motivation*

#### *1.6.1 Feedstock Production Priority*

**Rationale:** When biomass feedstock is a secondary or non-core line of business, or when it is a by-product or a residual from a more valuable primary product, then suppliers may not put in sufficient effort for consistent production. Risk of

breach increases when production and/or delivery of feedstock compromises a supplier's ability to make a primary product.

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

**Risk Information:** Sawmill residues, which are secondary outputs from wood processing in sawmills, are inherently produced during the milling of timber. Conversely, forest residues result from timber and small-diameter tree harvesting (thinning) activities are typically distributed over the harvest site. Both types of residues are intrinsically generated from standard industry operations.

Due to their substantial volume, sawmill residues are particularly sought as a valuable biomass resource for the current end users. Although forest residues and small-diameter trees are rarely collected, there is a significant level of expertise in their retrieval, and the necessary machinery for their collection is readily accessible.

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

## CATEGORY 2.0: COMPETITOR RISK

### *2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets*

#### *2.1.1 Competitor Locations and Overall Geographical Influence*

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

**Risk Information:** Within the 150-mile Competition Zone from Evergreen, AL, there are 13 competitors for woody biomass feedstock. Five of these are within the 75-mile driving distance from the center point of the BDO Zone region. Of these facilities, the BDO Zone includes one wood pellet mill, one engineered wood product facility, and four biomass energy facilities. See Figure A-2 for a map showing the location of these competitors.

The combined consumption of these mills is estimated to be approximately 1.8 million bdt annually. 530,000 bdt of this demand (29%) comes from competitors within the BDO Zone itself. Regarding the total biomass demand, biomass energy accounts for 89%, wood pellets account for 8%, and Engineered Wood Products production 3% (Table A-1).

The woody feedstocks subject to this competition are small-diameter trees and sawmill residues, which are not widely collected in significant volumes within the Competition Zone.

The likelihood of this risk indicator is deemed to be low, given the small proportion of total competition coming from within the BDO Zone and the availability of underutilized small-diameter trees and forest residues.

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

### *2.1.2 Current and Historical Consumption of Feedstock Quantity*

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

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

**Risk Information: S**awmill residues are being consumed by biomass power providers and manufacturers of industrial wood pellets. Sawmill residues are available in the BDO Zone. The number of biomass power facilities has been in decline over recent years because of air quality emission issues.

There is no commercial market for small-diameter trees currently. There are no pulp & paper manufacturers in California. The bulk of small-diameter trees are being thinned in the forest and either stacked and burned or chipped and broadcast over the site. Likewise, forest residues have no commercial market at this time, and they are treated in the same manner as small-diameter trees.

Small-diameter trees and forest residues are in ample supply and this situation is likely to continue.

**Biomass supply risk is low.**

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

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

### *2.1.3 Competitor Pricing and Price Sensitivity*

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

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

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

**Risk Information:** Given that only two sawmills are in the Supply Zone and that the bulk of this biomass availability is from about 50 miles distant there is little competitive pressure to affect pricing. Although there are 13 facilities having a current demand of about 1.8 million bdt/yr of small-diameter trees and forest residues, we estimate about 15% of this demand is met by the suppliers in the supply zone.

For small-diameter trees and forest residues, the situation is quite different. There are no pulp & paper facilities in California, so the traditional market for small-diameter trees is not present. In fact, very little, if any small-diameter trees are harvested in the BDO Zone. Harvest of forest residues is also rare. However, when these materials are harvested, there is an artificially low price point of $50 to $55 per bdt, mainly delivered to biomass power generators. The low prices are due to government grants for processing this resource to reduce fuel for wildfires. One local expert estimates that the true market price of small-diameter trees should be $70 to $80 per bdt.[40]

Wildfires and climate change have contributed to a glut of low value wood, including small-diameter trees. It is likely that this trend will continue for some years.[41] As the low prices are supported by subsidies the risk likelihood and impact are deemed high as the prices can change significantly with the sunset of these grants.

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

[40] Personal Communication. Gary Warner, Owner, Warner Enterprises

[41] Wang, Y., & Lewis, D. J. (2024). Wildfires and climate change have lowered the economic value of western US forests by altering risk expectations. *Journal of Environmental Economics and Management*, *123*, 102894

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

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

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

If current markets for feedstock have been publicly signaling the potential for increased demand for feedstock (in the case of a sawmill adding a shift, or pulp mill potentially expanding into production of renewable chemicals, for example), high interest in a Supply 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. When it occurs, increased demand on feedstock may decrease availability and increase cost for new plants within the BDO Zone.

**Risk Information:** No announcements of expanded capacity were discovered for the Supply Zone.

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

### *2.1.5 Soft Supply Influence of Existing Markets*

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

**Risk Information:** It is common for landowners and forestry contractors to favor the highest bidder for their products or services. A small segment of the wood supply chain is anchored in enduring supply contracts or through vertically integrated structures, such as the dual role of sawmill operations and timberland utilization indicating the availability of

sufficient quantities for the existing end users of woody biomass. This strategic positioning is unlikely to affect availability of rated small-diameter trees for emerging projects. The prospect of securing rated small-diameter tree quantities for new initiatives remains unhampered by contractual engagements or established affiliations.

**Small-diameter trees and Forest Residues:** The market for small-diameter trees and forest residues is minimal as these resources are not being commercially harvested at this time. Rather, these resources are being thinned as a method for mitigating the intensity of wildfires. Small-diameter trees and residues are chipped in the woods and broadcast across the site.

**Sawmill Residuals:** Sawmill operators are open to establishing relationships with new buyers once existing contracts for residues expire. Outreach to sawmill operators implied that they would welcome new buyers if a competitive price were offered. However, it is likely that sawmill operators are unlikely to switch to unknown customers for long-term contracts unless the price offered was a meaningful increase.

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

### *2.1.6 Temporary Market-Driven Markets*

**Rationale:** Alternative, non-traditional, market-driven competitors for feedstock can drive feedstock demand in unusual circumstances. A BDO Zone Rating Issuer based on corn stover as a feedstock, for example, would not typically compete with higher-end animal feed markets due to quality issues. However, in times of significant hay shortage (e.g., during drought), farmers use corn stover in place of hay, driving the price of feedstock and decreasing availability for bio-projects.[42]

**Risk Information: No temporary markets were found for the woody biomass in the BDO Zone.**

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

[42] Bergtold, 2018.

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

### *2.2 Risk Factor: Specific Competitors' Competitive Advantage*

#### *2.2.1 Relative Inventory Capacity*

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

**Risk Information:** Competitors for biomass have sufficient storage space for two months of operation.[43] This risk indicator was not flagged to be a concern for future biomass projects.

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

#### *2.2.2 Relative Accessibility/Delivery Hours and Wait Times*

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

**Risk Information:** Sawmills are easily accessible for log deliveries. Wait times are normally between 20 and 30 minutes.[44]

| **Raw Risk Likelihood (RRL)** | **Score** |
|---|---|

[43] Personal Communication. Gary Warner, Owner, Warner Enterprises.
[44] *ibid*.

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

### *2.2.3 Relative Specification Advantages*

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

**Risk Information:** Specifications for available feedstock remain consistent across small-diameter trees, sawmill residues, and forest residues in the BDO Zone. Standardized techniques have been employed for decades in both biomass production methods and the processing of this biomass. The quality of the available feedstocks has been impacted in recent years by wildfires, which can lower quality or reduce supply**.**

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

### *2.2.4 Demand for Competitors' Products*

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

| |
|---|
| **Risk Information:** A moderate increase in demand for lumber is projected for the northern California region driven by population growth.[45] This will increase the supply of sawmill residues. The market for small-diameter trees and forest residues is unclear as the use of these resources is very low at this time. |
| **Raw Risk Likelihood (RRL)** **Score**<br>**The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.** **4** |
| **Raw Risk Impact (RRI)** **Score**<br>**The risk impact is deemed *low*, therefore the RRI is 4 out of 10.** **4** |
| **Gross Risk Indicator (GRI)** **Score**<br>**The Gross Risk Indicator (RRL × RRI) is 16 out of 100.** **16** |
| **Mitigation/Notching** **Notch**<br>***RRL Mitigation (Notch)*** **NN**<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** |
| **Loaded RI Score** **Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.** **16** |

## CATEGORY 3.0: SUPPLY CHAIN RISK

### *3.1 Risk Factor: Feedstock Availability*

#### *3.1.1 Biomass Availability Multiple (BAM)*

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

**Risk Information:** The likelihood of the BAM factors being incorrect is deemed low, as sources consulted for the availability of small-diameter trees, sawmill residues, and forest residues were in agreement, providing a solid foundation for biomass availability. Additional details on the BAM estimation can be found in Appendix A.

However, it is crucial to acknowledge that assumptions regarding future biomass supply and demands are inherent in the BAM factors. Unforeseen supply and market factors, such as the emergence of new competitors, weather events, and shifts in economic conditions, can exert a high level of impact on these assumptions and consequently influence biomass availability. Continuous monitoring and adaptation to dynamic external factors are essential to maintaining the accuracy and reliability of BAM estimations.

| |
|---|
| **Raw Risk Likelihood (RRL)** **Score**<br>**The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.** **4** |
| **Raw Risk Impact (RRI)** **Score**<br>**The risk impact is deemed *high*, therefore the RRI is 8 out of 10.** **8** |

[45] Population Growth in Northern California. https://www.businessinsider.com/california-population-growth-central-valley-bay-area-housing-affordability-exodus-2023-11#:~:text=The%20state%20is%20projecting%20that,current%20population%20of%20about%20780%2C000. Accessed Feb 14, 2024.

| **Gross Risk Indicator (GRI)** | **Score** |
|---|---|
| **The Gross Risk Indicator (RRL × RRI) is 32 out of 100.** | **32** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score** | **Score** |
| **The Loaded RI Score ((1-Total Notch) × GRI Score) is 32 out of 100.** | **32** |

### *3.1.2 Feedstock Supply Curve/Marginal Cost Curve*

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

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

**Risk Information:** The supply patterns for small-diameter trees, forest residues, and sawmill residues exhibit distinct characteristics. For small-diameter trees and forest residues, biomass availability increases with distance from the center point (Figure A-4 In contrast, sawmill residues are only accessible from two sawmills in the Supply Zone, resulting in a stair-step availability pattern, as illustrated in Figure A-6.

Specifically, within a 55-mile driving distance the availability of feedstock:

- 60% of the total available small-diameter trees (87,000 of 145,000 bdt).
- 55% of the total available forest residues (26,000 of 47,000 bdt).
- 4% of the total generated sawmill residues (9,700 of 270,000 bdt).

Within 40 miles, slightly more than half the limit of the Supply Zone, feedstock availability is:

- 22% of the total available small-diameter trees (32,000 of 145,000 bdt).
- 17% of the total available forest residues (8,200 of 47,000 bdt).
- 100% of the total available sawmill residues (270,000 bdt).

The low availability of feedstock close to the center point increases the risk likelihood to medium. The impact on transportation costs, specifically fuel, is high.

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

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

### *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[46] and can manifest in shortages and higher costs for Issuers.

**Risk Information:** Seasonal access is not a limitation to harvesting feedstock. There are times when timberlands at higher elevations cannot be accessed because of snow, but there are enough accessible tracts available.

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

### *3.1.4 Year-to-Year Variation in Feedstock Availability*

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

**Risk Information:** Year to year variation in feedstock availability can be limited by wildfires during times of outbreak. Between 2016 and 2021 approximately 35% of the timberland in the Supply Zone, about 624,000 acres, were damaged by fire.[47]

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

[46] Golecha & Gan 2016.
[47] Long-Term Economic Impacts of Large Fires in California from 2018-2021: Losses and Opportunities. Mason Bruce & Girard. Natural Resource Consultants.

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

## *3.2 Risk Factor: Historical Issues*

### *3.2.1 Historical Feedstock Price Variations*

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

**Risk Information:** Historic feedstock prices in the BDO Zone for the 10-year period between 2013 and 2022 were examined[48] (Figure A-6). These prices are based on taxable revenue from stumpage value and are not broken down by feedstock type. Stumpage prices rose by about 30% between 2013 and 2018, the highest point over the decade examined. Since 2018, stumpage prices have fallen steadily through 2022. The 2022 value is about one-third of the 2018 value. Drivers of this trend have been attributed to lower timber value brought on by drought and wildfire damage.[49] Local experts have indicated that stumpage price for small-diameter trees and forest residue is often zero because of the glut of available wood and state subsidies that pay for stumpage and harvesting costs.[50] As drought and wildfires are predicted to continue with climate change it is likely that stumpage prices will continue to drop, or remain low, for small-diameter trees and forest residues.

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

[48] Timber Production Figures. https://www.cdtfa.ca.gov/dataportal/dataset.htm?url=PropTaxTimberProductionStats. Accessed Feb 15, 2024.
[49] Wang, Y., & Lewis, D. J. (2024). Wildfires and climate change have lowered the economic value of western US forests by altering risk expectations. *Journal of Environmental Economics and Management*, *123*, 102894.
[50] Personal Communication. Hollis Day, Mountain F Enterprises; Gary Warner, Warner Enterprises.

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

### *3.2.2 Low Historical Demand for Feedstock in the BDO Zone*

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

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

**Risk Information:** The lumber industry has been practiced in the BDO Zone for decades, and the supply chains for timber and sawmill residues are well established. Small-diameter trees and forest residues have not been harvested in large quantities because industries with large demand for these resources, such as pulp & paper, are not present. However, a small amount of this biomass resource has been processed for several years by in-woods chipping to reduce available biomass for wildfires and to produce electricity and power. This situation deems the risk likelihood to be high.

Some demand for this resource has been created by state grants and Forest Service contracts to reduce fire risk and supply biomass to power and energy generators. Thus, the risk impact is deemed medium.

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

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

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

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

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

**Risk Information:** The history of the forest products industry in the region dates back to the mid-1800s to the time of the Gold Rush when the lumber industry was established. However, use of the small-diameter trees and forest residues have been minimal due to the lack of large facilities such as pulp & paper companies in the supply zone.

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

## *3.3 Risk Factor: Non-Weather Based Externalities*

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

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

**Risk Information:** General economic trends exert a significant impact on delivered feedstock prices. Key indicators such as the Producer Price Index (PPI) and Consumer Price Index (CPI) serve as effective tools for monitoring associated costs in biomass logistics operations. These costs encompass fuel, labor, equipment parts, and administration.

Figure C-6 depicts the change in the CPI over the past four years for the US West Region, revealing a notable increase in inflation from November 2020 to June 2022, followed by a subsequent decline until the present.

The relationship between diesel prices (Figure C-7) and the CPI trend from 2020 to 2023 underscores a robust correlation between fuel prices and broader economic trends. Furthermore, the delivered small-diameter tree price closely mirrors the CPI, emphasizing the interconnected nature of economic indicators and the costs associated with biomass harvesting and delivery.

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

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

### *3.3.2 Currency Risk*

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

**Risk Information:** Currency risk is not relevant to this BDO Zone.

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

### *3.3.3 Border Risk*

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

**Risk Information:** Border risk is not relevant to this BDO Zone.

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

| **Loaded RI Score** | **Score** |
|---|---|
| **The Loaded RI Score ((1-Total Notch) × GRI Score) is not rated.** | **NR** |

### *3.3.4 Temporary Externality-Driven Markets for Feedstock*

**Rationale:** Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances. For example, an Issuer using corn stover as a feedstock would not typically compete with the higher-end animal feed market. However, in times of significant hay shortage (e.g., during drought), farmers may use corn stover as hay replacement, driving the price of stover feedstock and decreasing its availability for bio-projects.[51]

**Risk Information:** Not relevant to this BDO Zone.

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

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

### *3.4.1 Harvest & Collection Practices & Schedules*

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

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

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

**Risk Information:** The harvesting and collection practices of biomass in the BDO Zone are standard practices employed in other regions of the US.

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

[51] Bergtold, 2018.

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

### *3.4.2 Harvesting & Collection Equipment*

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

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

**Risk Information:** The equipment used for harvesting and collection of biomass in the BDO Zone is standard for the region. Typical crew will consist of two feller-bunchers, one skidder, and one chipper.

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

### *3.4.3 Variation in Densification Methods Among Different Suppliers*

**Rationale:** The shape and density of the unit in which feedstock is supplied can impact feedstock cost and quality. Standard feedstock densification modes for biomass consist of round or square bales, pellets, cubes, chips, or grindings. The size of wood fiber processed in a grinder is less homogenous than if a chipper is used.

Bales of different densities can absorb moisture at different rates. In certain cases, round bales have been viewed as problematic due to their uneven moisture content distribution.[52]

[52] Huhnke, 2018.

| |
|---|
| **Risk Information:** The underutilized woody biomass resources in the BDO Zone have been produced and used by the existing wood processing facilities and the same feedstock can be used by future biomass projects. |
| **Raw Risk Likelihood (RRL)** — **Score** |
| **The risk likelihood is deemed *very low*, therefore the RRL is 2 out of 10.** — **2** |
| **Raw Risk Impact (RRI)** — **Score** |
| **The risk impact is deemed *very low*, therefore the RRI is 2 out of 10.** — **2** |
| **Gross Risk Indicator (GRI)** — **Score** |
| **The Gross Risk Indicator (RRL × RRI) is 4 out of 100.** — **4** |
| **Mitigation/Notching** — **Notch** |
| ***RRL Mitigation (Notch)*** — **NN**<br>No adjustment. |
| ***RRI Mitigation (Notch)***<br>No adjustment. |
| **The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** |
| **Loaded RI Score** — **Score** |
| **The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.** — **4** |

### *3.4.4 Availability of Labor for Feedstock Production*

| |
|---|
| **Rationale:** Skilled labor shortages can be difficult to remedy in the short-term. Availability of suitable labor in an area can impact the ability to procure sufficient feedstock quantities on required schedules. Labor risks are higher where supply chains are not yet active; or for Issuer's for whom large feedstock requirements, or development of new (or expanded) supply chains, demand significant additions to the local labor force. |
| **Risk Information:** A typical harvesting crew comprises three to five personnel to produce a minimum of about 55 truckloads per week.[53] Each truckload carries about 15 bone dry tons (bdt) of wood, and the number of logging trucks required depends on the distance to the mill, with an average haul distance of 30 miles.[54]<br><br>For a new biomass facility sourcing small-diameter trees and forest residues in the BDO Zone, operating at the rated volume of 136,000 bdt per year, additional logging crews, truck drivers, logging equipment, and trucks are needed.[55] Based on productivity statistics above for the BDO Zone, this would necessitate an additional three logging crews (comprising nine to twelve personnel) and 8 logging truck drivers.<br><br>Several local experts[56] have noted difficulty in hiring loggers and log truck drivers due to shortages and that attracting people for these positions is linked directly to pay scales. Given the modest number of loggers and truck drivers needed this risk likelihood is deemed medium. Given the direct link to harvesting and delivery of biomass with labor availability, risk impact is deemed high. |
| **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** |

[53] Personal Communication. Gary Warner, Owner, Warner Enterprises.
[54] *Ibid*.
[55] Note that volume and transport of sawmill residues are not included in this estimate.
[56] Personal Communication. Mark Luster, Sierra Pacific Inc; Haley Stone, California State University, Chico; Dave Derby, CalFire.

| | |
|---|---|
| **The Gross Risk Indicator (RRL × RRI) is 16 out of 100.** | **16** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100.** | **Score**<br>**48** |

### *3.5 Risk Factor: Transportation*

#### *3.5.1 Feedstock Transportation Costs*

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

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

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

**Risk Information:** The majority of the available biomass for each of the feedstock types is available at relatively long distance (50- to 75-miles) from the center point. The low availability of feedstock close to the center point increases risk likelihood to medium. The impact on transportation costs, specifically fuel, is high.

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

#### *3.5.2 Diesel Cost Impacts*

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

**Risk Information:** Diesel fuel serves as a critical component throughout all stages of biomass logistics, powering tree harvesting equipment and logging trucks. The volatility in diesel prices directly impacts the delivered cost of biomass. Research indicates that for every $2.00 increase in diesel prices, there is a corresponding rise of approximately $2.43 per green ton of logs.[57] Escalations in fuel costs are typically passed on to the end user of biomass, either through the implementation of fuel surcharges or the inclusion of escalators in contractual agreements. This ensures that the economic impact of fuel price fluctuations is reflected in the overall cost structure of biomass delivery.

Diesel fuel price in the California has generally tracked upward for the past decade (Figure C-7) with a low point of $2.34 per gallon in February 2016 and a high of $6.87 in June 2022.[58] These price fluctuations closely parallel the changes in national average price of diesel but are higher in California. Changes in diesel prices could have a significant effect on the delivered cost of biomass.

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

### *3.5.3 Transportation of Feedstock Requires Specialized Equipment*

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

**Risk Information:** The methods for transporting small-diameter trees and forest residues are already widespread through the BDO Zone. No special equipment is required.

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

[57] Reflections on the current state of fuel prices in logging and transport. https://bellwetherfp.com/reflections-on-the-current-state-of-fuel-prices-in-logging-and-transport/
[58] US Energy Information Administration. https://www.eia.gov/. Accessed Feb 6, 2024.

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

### *3.5.4 Delivery Routes through Local Communities*

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

**Risk Information:** Forestry and biomass are of economic significance to the community, major opposition to these operations is unlikely. Additionally, trucking professionals are knowledgeable about potential nuisance areas and have received training to avoid them, further contributing to the smooth functioning of biomass transportation in the region.

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

### *3.5.5 Transportation Regulations & Local Weight Limits*

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

**Risk Information:** With existing weight limits log trucks and chip vans can haul about 15 bdt per load which is in line with most other states in the US (total GVW of 80,000 lb). The California Air Resources Board[59] implements restrictions on air emissions that can prevent operation of older vehicles in some areas of the BDO Zone. Also, the Climate Change

[59] California Air Resources Board. https://ww2.arb.ca.gov/resources/documents/laws-and-regulations. Accessed Feb 14, 2024.

| |
|---|
| regulations in California can make transportation operations less economical for small-scale logging companies who own trucks. |
| **Raw Risk Likelihood (RRL)** **Score**<br>**The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.** **6** |
| **Raw Risk Impact (RRI)** **Score**<br>**The risk impact is deemed *medium*, therefore the RRI is 6 out of 10.** **6** |
| **Gross Risk Indicator (GRI)** **Score**<br>**The Gross Risk Indicator (RRL × RRI) is 36 out of 100.** **36** |
| **Mitigation/Notching** **Notch**<br>***RRL Mitigation (Notch)*** **NN**<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** |
| **Loaded RI Score** **Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.** **36** |

### *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:** Access to timberlands is good for fuel reduction but tight curve radii on about 40% of these roads limits the type and size of trailers that can negotiate these roads. While removal of short logs is not limiting, use of longer trailers or vans typically used to transport biomass chips is limited.[60] |
| **Raw Risk Likelihood (RRL)** **Score**<br>**The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.** **6** |
| **Raw Risk Impact (RRI)** **Score**<br>**The risk impact is deemed *medium*, therefore the RRI is 6 out of 10.** **6** |
| **Gross Risk Indicator (GRI)** **Score**<br>**The Gross Risk Indicator (RRL × RRI) is 36 out of 100.** **36** |
| **Mitigation/Notching** **Notch**<br>***RRL Mitigation (Notch)*** **NN**<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** |
| **Loaded RI Score** **Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.** **36** |

[60] Personal Communication. Dave Derby, Unit Forester, Butte Fire Safe Council; Eric Murphy, Supervisory Forester, US Forest Service.

### *3.5.7 Transportation Redundancy*

**Rationale:** Transport equipment redundancy is important for dealing with seasonally variable feedstock supplies as well as the risk of equipment breakdowns.

**Risk Information:** To meet the demands of a new biomass facility in the BDO Zone sourcing the total rated volume of 223,000 an additional 15 truck drivers would be needed to complete 60 hauls per day. The existing trucking resources are adequate to meet this demand.[61]

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

## *3.6 Risk Factor: Supply Chain Resiliency*

### *3.6.1 Size, Number, and Location of Suppliers*

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

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

**Risk Information:** In the Supply Zone, there are two major sawmills. Both mills have residuals available. Outreach did not reveal that long-term contracts were necessary.

The trade organization Associated California Loggers provides certification and training for its Prologger status. There are 153 Prologgers operating in California currently.[62] In Butte County, Shasta Junior College has a workforce development training program just for logging operations. CalFire maintains a list of at least 140 logging companies that are available to provide bids on harvesting and processing jobs.[63]

[61] These labor estimates include harvesting small-diameter trees and forest residues along with transport of small-diameter trees, forest residues, and sawmill residues.
[62] Associated California Loggers. https://californialoggers.com/services/prologger-certification-and-training/prologger-list/. Accessed Feb 14, 2024.
[63] Personal Communication. Jim Houtman, Butte County Fire Safe Council.

| | |
|---|---|
| **Raw Risk Likelihood (RRL)**<br>**The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.** | **Score**<br>**4** |
| **Raw Risk Impact (RRI)**<br>**The risk impact is deemed *low*, therefore the RRI is 4 out of 10.** | **Score**<br>**4** |
| **Gross Risk Indicator (GRI)**<br>**The Gross Risk Indicator (RRL × RRI) is 16 out of 100.** | **Score**<br>**16** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.** | **Score**<br>**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 timber market is primary driven by lumber production in this area. Sawmill production over the past decade (Figure C-5) roughly parallels housing starts in the western region (Figure C-8). Thus, external economic factors that affect housing can also affect the supply of sawmill residues in this area.

Small-diameter trees are not subject to the same external risk factors as there are no pulp & paper facilities in the region. Likewise, fire-damaged timber is also available. New projects that can use these two wood classes can enjoy an ample supply of biomass.

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

### *3.6.3 Land Ownership Structures*

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

**Risk Information:** About 40% of California forestland is privately owned with the remainder publicly owned. Of the privately owned timberland, one-third is owned by timber companies and two-thirds by families, individuals, and tribes.[64] High levels of government ownership can represent a risk to projects as government regulations can limit harvesting biomass.

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

## *3.7 Risk Factor: Climate and Natural Risks*

### *3.7.1 Seasonal Weather Impacts on Feedstock Supply*

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

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

**Risk Information:** Seasonal variation has minimal effect on feedstock harvesting. Snow can limit operations at higher elevations and wet weather can limit harvest on poorly drained sites. Snow and wet site issues are avoided by harvesting accessible areas.

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

[64] Focus on forestlands in California. https://www.climatehubs.usda.gov/hubs/california/topic/focus-forestlands-california#:~:text=California%20has%2033%20million%20acres,remaining%2040%25%20is%20privately%20owned. Accessed Dec 22, 2023.

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

### *3.7.2 Long-Term Weather and Climate Trends*

**Rationale:** In certain BDO Zones, climatic trends and significant potential changes to future weather patterns can create feedstock risk.

**Risk Information:** A 2021 Climate Change Vulnerability Assessment[65] provides a qualitative analysis of how climate change may impact Butte County throughout the twenty-first century. Out of the 71 populations and assets Butte County analyzed, 50 are highly vulnerable to at least one hazard condition. Wildfires are responsible for the highest vulnerability scores, followed by severe storms, severe wind, and extreme heat. Conifer forests were deemed among the most vulnerable ecosystems. The Bureau of Land Management is addressing the effect of climate change on forests by making adjustments in reforestation protocols to encourage increased genetic diversity and more hearty species.

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

[65] Butte County Climate Change Vulnerability Assessment. https://bof.fire.ca.gov/media/1fyfaxs2/rpc-2-b-v-butte-county-climate-change-vulnerability-assessment-supplemental-_ada.pdf. Accessed Dec 21, 2023.

### *3.7.3 Forest/Crop Fire*

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

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

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

**Risk Information:** According to CalFire,[66] Oroville has a major risk of wildfire over the next 30 years. This is based on the level of risk the properties face rather than the proportion of properties with risk**.**

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

### *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:** Bark and wood-boring beetles' threat to California forests has risen in recent years due to prolonged drought and wildfires. These insects can infect weakened trees causing damage or death. Such infestations can significantly impact the rated quantity.

| **Raw Risk Likelihood (RRL)** | **Score** |
|---|---|

[66] California Department of Forestry and Fire Protection. https://www.fire.ca.gov/. Accessed Jan 31, 2024.

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

### *3.7.5 Risk of Hail*

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

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

**Risk Information:** Hail is rare in the BDO Zone and does not significantly impact woody biomass feedstock or supply chains.

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

### *3.7.6 Risk of Flood*

| |
|---|
| **Rationale:** Floods can cause catastrophic disruption and delay in feedstock supply. Where there is high risk of flood and thus negative impact to feedstock supply, the BDO Zone rating should account for this risk. |
| **Risk Information:** The Oroville site is deemed by the US Federal Emergency Management Agency (FEMA) to be in Zone X, Area of Minimal Flooding Hazard. |

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

### *3.7.7 Risk of Drought*

| |
|---|
| **Rationale:** Droughts can cause significant disruptions to feedstock supplies across entire BDO Zones for extended periods of time, especially in case of agricultural residues and energy crops. Parts of Western Canada are experiencing more frequent and severe droughts, and scientists expect drought to affect new areas across Canada going forward.<br><br>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:** Continued dry weather throughout California has led to extreme drought conditions in Butte County and the North State. Butte County Office of Emergency Management, in response to the drought proclamation is in Monitor Status in support of both long- and short-term actions addressing drought in the community. As dry conditions continue throughout California and Butte County, conservation of water for all purposes is increasingly important. The State Water Project allocation is currently 5% and irrigation districts in the county have received a 50% cut-back to their water supplies. Drought conditions slow the growth rates of woody biomass and increase the likelihood of wildfire. |

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

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

### *3.7.8 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:** Oroville has a Minimal Wind Factor, which means there is a very low likelihood that hurricane, tornado, or severe storm winds will impact this area.[67]

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

### *3.7.9 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.

[67] Risk Factor. https://riskfactor.com/city/oroville-ca/654386_fsid/wind. Accessed Dec 21, 2023.

| |
|---|
| **Risk Information:** In Oroville, the summers are hot, arid, and mostly clear and the winters are cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from *40°F* to *95°F* and is rarely below *32°F* or above *103°F*. This temperature range is not a risk to forest species. |
| **Raw Risk Likelihood (RRL)** **Score**<br>**The risk likelihood is deemed *very low*, therefore the RRL is 2 out of 10.** **2** |
| **Raw Risk Impact (RRI)** **Score**<br>**The risk impact is deemed *very low*, therefore the RRI is 2 out of 10.** **2** |
| **Gross Risk Indicator (GRI)** **Score**<br>**The Gross Risk Indicator (RRL × RRI) is 4 out of 100.** **4** |
| **Mitigation/Notching** **Notch**<br>***RRL Mitigation (Notch)*** **NN**<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** |
| **Loaded RI Score** **Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.** **4** |

## *3.8 Risk Factor: Political and Social*

### *3.8.1 Government Subsidies for Feedstock Production or Utilization*

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

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

| |
|---|
| **Risk Information:** Harvest of small-diameter trees and forest residues is being driven by grant funding,[68] state funding,[69] and USDA Forest Service contracts to reduce the amount of fuel available for wildfires. Thus, small-diameter trees and forest residues are not harvested by market-driven forces but rather by state policy and advocacy groups. As prices for small-diameter trees and forest residues are offset by grants and contracts, delivered prices for this material are lower than would be expected in a market-driven economy. It is unknown how long these programs will be in place, indicating a high risk for this risk indicator. |
| **Raw Risk Likelihood (RRL)** **Score**<br>**The risk likelihood is deemed *high*, therefore the RRL is 8 out of 10.** **8** |
| **Raw Risk Impact (RRI)** **Score**<br>**The risk impact is deemed *high*, therefore the RRI is 8 out of 10.** **8** |
| **Gross Risk Indicator (GRI)** **Score**<br>**The Gross Risk Indicator (RRL × RRI) is 64 out of 100.** **64** |

[68] Sources of grant funding: Sierra Nevada Conservancy. https://sierranevada.ca.gov/grants/; CalFire Forest Health Grants. https://www.fire.ca.gov/what-we-do/grants/forest-health; CalFire Wildfire Prevention Grants. https://www.fire.ca.gov/what-we-do/grants/wildfire-prevention-grants; California Climate Investments Wildfire Prevention Grants Program. https://www.caclimateinvestments.ca.gov/fire-prevention-grants. Accessed Mar 5, 2024.

[69] Governor signs wildfire package. https://www.gov.ca.gov/2021/04/13/governor-newsom-signs-landmark-536-million-wildfire-package-accelerating-projects-to-protect-high-risk-communities/. Accessed Mar 20, 2024.

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

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

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

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

**Risk Information:** The California Forest Practice Act sets forth the rules and guidelines for all timber harvesting activities on private lands within the state, including Butte County. CalFire's Forest Practice Division oversees the enforcement and compliance with these regulations for private timberland owners in the Butte Unit. This division ensures that timber harvesting operations are conducted in a manner that protects water, wildlife, fisheries, and soils.

California has policies that can positively impact the utilization of woody biomass including the Renewables Portfolio Standard[70] (RPS) linked to energy generation and the Low Carbon Fuels Standard[71] (LCFS) which addresses lowering carbon content of transportation fuels. These policies impact the utilization of biomass for bioenergy and biofuel production and the sunset of these policies can negatively impact the use of biomass. Among these two policies, RPS has encouraged the use of woody biomass for power generation. This policy is expected to expire in 2030 as the cost of electricity from other alternative renewable such as solar and wind energy have become competitive with fossil fuels.

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

[70] Renewables Portfolio Standard – RPS. https://www.energy.ca.gov/programs-and-topics/programs/renewables-portfolio-standard. Accessed Feb 9, 2024.
[71] Low Carbon Fuels Standard. https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard#:~:text=The%20Low%20Carbon%20Fuel%20Standard,and%20achieve%20air%20quality%20benefits. Accessed Feb 9, 2024.

| **Mitigation/Notching** | **Notch** |
|---|---|
| ***RRL Mitigation (Notch)***<br>No adjustment.<br><br>***RRI Mitigation (Notch)***<br>No adjustment.<br><br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **NN** |
| **Loaded RI Score** | **Score** |
| **The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.** | **24** |

### *3.8.3 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:** Overall, support of biomass projects in California is strong despite a recent petition[72] and an article[73] pushing back against the use of biomass to produce energy and wood pellets, citing carbon and particulate matter emissions. Two of the proposed pellet projects are near the Competition Zone (Lassen and Tuolumne Counties). The trend toward biomass use is strong in California, especially for carbon reduction and fire suppression. Any change in current policy is likely to take several years to resolve. If policy changed in favor of the recent complaints, it would likely only impact particular technologies for the conversion of biomass to energy and not the most recently developed technologies for the conversion of biomass to liquid fuel of hydrogen.

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

[72] 50 Groups Petition to End California's Dirty Biomass Loophole. https://biologicaldiversity.org/w/news/press-releases/50-groups-petition-to-end-californias-dirty-biomass-loophole-2023-06-20/. Accessed Dec 22, 2023.
[73] Golden State Natural Resources' Biomass Boondoggle. https://www.nrdc.org/bio/rita-frost/golden-state-natural-resources-biomass-boondoggle. Accessed Dec 22, 2023.

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

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

**Risk Information:** There are five local Native American tribes in the area. These tribes are involved in planning and monitoring forest health, ecological restoration, and wildlife safety through the Butte County Collaborative Group.[74] Some Native American tribes are active in forest operations.

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

### *3.8.5 Food Security Concerns*

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

**Risk Information:** Food security is not relevant to this BDO Zone as none of the biomass sources are food crops and do not cause land-use changes.

| | |
|---|---|
| **Raw Risk Likelihood (RRL)**<br>**The risk likelihood is deemed *not relevant*, therefore the RRL is not rated.** | **Score**<br>**NR** |
| **Raw Risk Impact (RRI)**<br>**The risk impact is deemed *not relevant*, therefore the RRI is not rated.** | **Score**<br>**NR** |
| **Gross Risk Indicator (GRI)**<br>**The Gross Risk Indicator (RRL × RRI) is NR out of 100.** | **Score**<br>**NR** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment. | **Notch**<br>**NN** |

[74] Butte County Collaborative Group. https://butte-county-collaborative-group-bcrcd.hub.arcgis.com/

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

## *3.9 Risk Factor: Sustainability and Environmental Concern*

### *3.9.1 Feedstock Sustainability*

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

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

**Risk Information:** In California, under current law, if trees are to be harvested for commercial purposes, a Registered Professional Forester must prepare a Timber Harvest Plan for review and approval by state agencies. The Timber Harvest Plan is the functional equivalent of an Environmental Impact Report covering many aspects of forest health including: soil, water, fire, fish, wildlife, Native American impact, forestry practices, and public resources.[75]

The timberlands of the largest private landowner, Sierra Pacific Industries land is certified for sustainability under the Sustainable Forestry Initiative (SFI)[76,77] and they encourage other private landowners to participate in this program.[78] Public timberlands are not certified for sustainability. Rather, harvests on public land are subject to an approval process through the US Environmental Protection Agency's National Environmental Policy Act.[79]

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

[75] Timber Harvest Plans in California. www.wildcalifornia.org/_files/ugd/64096f_b2aa0aa2387547ce9bfee9b032282b5a.pdf?index=true. Accessed Dec 22, 2023.
[76] Personal Communication. Mark Luster. Sierra Pacific Industries.
[77] Sustainable Forestry Initiative. https://forests.org/. Accessed March 6, 2024.
[78] Sierra Pacific Industries. Sustainability. https://www.spi-ind.com/OurForests/SustainableForestInitiative. Accessed March 6, 2024.
[79] National Environmental Policy Act. https://www.epa.gov/nepa. Accessed March 8, 2024.

### *3.9.2 Risk to Soil Quality*

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

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

**Risk Information:** See risk indicator 3.9.1 Feedstock Sustainability where this risk is addressed.

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

### *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:** See risk indicator 3.9.1 Feedstock Sustainability where this risk is addressed.

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

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

### *3.9.4 Water Use*

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

**Risk Information:** See risk indicator 3.9.1 Feedstock Sustainability where this risk is addressed.

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

### *3.9.5 Pesticide Risk to Human and Ecosystem Health*

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

**Risk Information:** Pesticides can be used to control insects in agriculture. For tree species, pesticides are mostly used in fruit and nut operations. Pesticides are rarely used in timber production. The use of pesticides is regulated by the Forest Health Protection staff of the USDA Forest Service**.** The land area treated with pesticides is typically very small. On an annual basis, total pesticide use represents approximately one-tenth of one percent of the total forest and rangeland area within the National Forest lands in California.[80]

| **Raw Risk Likelihood (RRL)** | **Score** |
|---|---|

[80] USDA Forest Service. Pesticide-Use Management & Coordination. https://www.fs.usda.gov/detail/r5/forest-grasslandhealth/?cid=fsbdev3_046692#:~:text=The%20land%20area%20treated%20with,National%20Forest%20lands%20in%20California. Accessed Dec 22, 2023.

| | |
|---|---|
| **The risk likelihood is deemed *very low*, therefore the RRL is 2 out of 10.** | **2** |
| **Raw Risk Impact (RRI)**<br>**The risk impact is deemed *very low*, therefore the RRI is 2 out of 10.** | **Score**<br>**2** |
| **Gross Risk Indicator (GRI)**<br>**The Gross Risk Indicator (RRL × RRI) is 4 out of 100.** | **Score**<br>**4** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.** | **Score**<br>**16** |

### *3.9.6 Risk to Wildlife and Landscape*

| | |
|---|---|
| **Rationale:** Biomass production and supply chain operations with negative impacts on wildlife and landscape are at a greater long-term risk of encountering project setbacks and disruptions. | |
| **Risk Information:** See risk indicator 3.9.1 Feedstock Sustainability where this risk is addressed. | |
| **Raw Risk Likelihood (RRL)**<br>**The risk likelihood is deemed *low*, therefore the RRL is 4 out of 10.** | **Score**<br>**4** |
| **Raw Risk Impact (RRI)**<br>**The risk impact is deemed *low*, therefore the RRI is 4 out of 10.** | **Score**<br>**4** |
| **Gross Risk Indicator (GRI)**<br>**The Gross Risk Indicator (RRL × RRI) is 16 out of 100.** | **Score**<br>**16** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.** | **Score**<br>**16** |

### *3.9.7 Biomass Classified as Genetically Modified Organism (GMO)*

| | |
|---|---|
| **Rationale:** There are various risks associated with GMOs such as migration or dispersion across the landscape, which can generate community backlash and create supply chain risk. GMOs can also be heavily regulated. If planning to grow or procure GMO feedstocks, especially purpose-grown energy crops, it is important to understand the risks. | |
| **Risk Information:** There are no GMO trees grown in California forestlands. | |
| **Raw Risk Likelihood (RRL)**<br>**The risk likelihood is deemed *very low*, therefore the RRL is 2 out of 10.** | **Score**<br>**2** |
| **Raw Risk Impact (RRI)**<br>**The risk impact is deemed *very low*, therefore the RRI is 2 out of 10.** | **Score**<br>**2** |

| | |
|---|---|
| **Gross Risk Indicator (GRI)**<br>**The Gross Risk Indicator (RRL × RRI) is 4 out of 100.** | **Score**<br>**4** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.** | **Score**<br>**4** |

## CATEGORY 4.0 FEEDSTOCK SCALE-UP RISK

### *4.1 Risk Factor: Feedstock Scale-Up*

#### *4.1.1 Feedstock Quality at Production Scale*

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

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

**Risk Information:** The BDO Zone has a long-established and well-organized system for the production, harvesting, transport, and processing of sawmill residues as well as chipping small-diameter trees and forest residues. The quality of these materials in not limiting for most biobased projects. These biomass resources have been used by biomass power facilities for many years in the competition zone.

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

#### *4.1.2 Capacity of Supply Chain Components & Equipment to Scale*

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

| |
|---|
| **Risk Information:** Harvesting and chipping capacity of small-diameter trees and forest residues has been increasing in recent years as an effort to reduce the amount of wildfire fuel in the timberlands. These efforts have been funded by grants as commercial outlets for this biomass are limited at the time. Given that the number of bidders for chipping operations has increased in recent years[81] it is likely that scale-up for commercial demand could take place over a reasonable time period. The current supply chain capacity, in particular harvesting and collection of small-diameter trees and forest residues cannot handle the rated quantity. |
| **Raw Risk Likelihood (RRL)** — **Score** |
| **The risk likelihood is deemed *medium*, therefore the RRL is 6 out of 10.** — **6** |
| **Raw Risk Impact (RRI)** — **Score** |
| **The risk impact is deemed *medium*, therefore the RRI is 6 out of 10.** — **6** |
| **Gross Risk Indicator (GRI)** — **Score** |
| **The Gross Risk Indicator (RRL × RRI) is 36 out of 100.** — **36** |
| **Mitigation/Notching** — **Notch** |
| ***RRL Mitigation (Notch)*** — **NN**<br>No adjustment.<br><br>***RRI Mitigation (Notch)***<br>No adjustment.<br><br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** |
| **Loaded RI Score** — **Score** |
| **The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.** — **36** |

## CATEGORY 5.0: INFRASTRUCTURE RISKS

### *5.1 Risk Factor: Physical Infrastructure*

#### *5.1.1 Land Parcel/Ind. District*

**Risk Information:** The land parcel is located in Oroville, CA, the county seat of Butte County, CA. The selected site, shown in Figure C-9, is approximately 43 acres zoned Intensive Industrial (M-2). Formerly a biomass power plant constructed in 1984, now partially leased for forest debris processing and agricultural activities. The site has 29 structures. The facility, constructed as a power plant, consists of administration buildings, electrical and mechanical shops, a trailer depot for spare parts and waste oil storage, control buildings, the turbine and generator building, the electrostatic-precipitator and cooling tower structures, and a fire suppression house. The site is a Federal Qualified Opportunity Zone.

The parcel is bordered on the north boundary is the Oroville Yard and Sewerage Commission, a wastewater treatment plant. To the east is a Sierra Pacific Industries sawmill. On the south is a railroad spur and Sierra Silica Resources, a sand and gravel supplier. An empty parcel is located to the west of the site. Highway 70 Industrial Park, one of Northern California's largest, is less than one mile away to the southwest.

The industrial nature of the local region and onsite facilities deem this site 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** |

[81] Personal Communication. Eric Murphy, Supervisory Forester, US Forest Service.

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

### *5.1.2 Ownership of Land*

**Risk Information:** The Oroville site is owned by Butte Renewable Energy Inc., a private company dedicated to renewable and sustainable energy development. Acquisition of a site for a new project would be through a lease agreement. As no purchase option is currently available the risk is deemed to be medium.

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

### *5.1.3 Permitting Description*

**Risk Information:** Biomass projects are subject to various federal, state, and local regulations for industrial facilities, specific to electrical generation. The California Energy Commission (CEC) regulates the siting of thermal power plants larger than 50MW, including biomass plants. For biomass projects below 50MW, the California Waste Management Board advises on, and reviews, all applications. The permits for these smaller projects are managed by the Butte County Planning Division. The Butte County Air Quality Management District oversees the permit process for air quality, a process that generally takes 30 to 60 days. Overall, there is an established permitting process for biomass power projects that can be extended to other biomass conversion technologies thus low risk.

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

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

### *5.1.4 Environmental Issues*

**Risk Information:** Oroville, CA, is within Butte County, and the air quality in this county is monitored by the Butte County Air Quality Management District. The two main pollutants of concern in this area are fine particulate matter (PM2.5) and Ozone (O3), where PM2.5 is typically a problem in the winter and Ozone in the summer. The Oroville site is deemed by FEMA to be in Zone X, Area of Minimal Flooding Hazard and given a low risk rating.

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

## *5.2 Risk Factor: Utilities*

### *5.2.1 Natural Gas Availability*

**Risk Information:** A natural gas pipeline borders the property on the western side. See Figure C-9. Additionally, less than one mile away, the Highway 70 Industrial Park is served by a four-inch, high-pressure gas main.[82] The level of available service deems this risk to be low.

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

[82] Highway 70 Industrial Park. https://www.facebook.com/hwy70industrialpark/about_details. Accessed Mar 11, 2024.

| **Gross Risk Indicator (GRI)** | **Score** |
|---|---|
| **The Gross Risk Indicator (RRL × RRI) is 4 out of 100.** | **16** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score** | **Score** |
| **The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.** | **16** |

### *5.2.2 Electric Availability*

**Risk Information:** The site is serviced by a 60kV Pacific Gas & Electric power tap. The line is currently energized but is listed for removal as the site is idle. An interconnection agreement would be needed by the current, or new, owner with Pacific Gas & Electric to re-energize the plant. See Figure C-9. Given that there is electric service to the site, low risk is warranted.

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

### *5.2.3 Water Availability*

**Risk Information:** A municipal water connection is on site as well as a fire hydrant. This capacity can serve a large industrial operation. The parcel is also bordered on the north boundary is the Oroville Yard and Sewerage Commission, a wastewater treatment plant.

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

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

### *5.2.4 Waste Disposal*

**Risk Information:** A sewer connection is on site and the regional wastewater treatment plant borders the property to the north. Located in Oroville, the Recology Butte Colusa Counties Transfer Station hosts a household hazardous waste facility, a public recycling drop-off center, a green waste drop-off center, and a construction and demolition sorting facility. There are also several companies in Oroville that handle industrial waste. A low risk rating is awarded based on the available waste options.

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

### *5.2.5 Internet Availability*

**Risk Information:** Oroville is served by several internet service providers including cable, satellite, and 5G options that can provide the necessary Internet and IT required for residence and the industry. The risk is deemed low.

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

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

### *5.3 Risk Factor: Transportation/Logistics*

#### *5.3.1 Road/Highway Access*

**Risk Information:** The site is less than one mile from Highway 70, (Northern California's designated north-south highway). Highway 70 makes transportation to most Northern California cities easily accessible and also provides a direct link to California's major freeways Access to Interstate 5, California's north-south freeway, is 53 miles from the site. Oroville is 65 miles away from Sacramento via Highway 70. San Francisco is 150 miles distant via Highway 99 and I-80. Reno, NV, is a 139-mile drive via Highway 20 and I-80. See Figure C-10. The easy access to major highways imparts very low risk for this site.

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

#### *5.3.2 Rail Access*

**Risk Information:** The property is bordered on the south by a rail spur. A main Union Pacific line (Class I railroad) is about half a mile away. The Union Pacific line provides direct access to Sacramento to the south, a major junction, and Eugene, OR, and Portland, OR to the north. The Sacramento junction provides direct access to San Francisco and other deep-water ports in California as well as eastern destinations. Passenger train service was discontinued in 1970. See Figure C-9. Rail adjacent to the site indicates very low risk.

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

| | |
|---|---|
| **Gross Risk Indicator (GRI)**<br>**The Gross Risk Indicator (RRL × RRI) is 4 out of 100.** | **Score**<br>**4** |
| **Mitigation/Notching**<br>***RRL Mitigation (Notch)***<br>No adjustment.<br>***RRI Mitigation (Notch)***<br>No adjustment.<br>**The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).** | **Notch**<br>**NN** |
| **Loaded RI Score**<br>**The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.** | **Score**<br>**4** |

### *5.3.3 Airport Access*

**Risk Information:** Oroville Municipal Airport, a regional airport is 4.5 miles from the site and accommodates private and charter flights. The closest commercial airports include Sacramento International, 60 miles south, and San Francisco International, a three-hour drive. See Figure C-10. Major airport access between 50 and 100 miles designates a medium risk.

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

### *5.3.4 Water Freight Access*

**Risk Information:** The Port of West Sacramento is 68 miles from Oroville. It is a non-container port specializing in bulk cargo The Port of West Sacramento is an inland deep-water port with access to the Pacific Ocean via the Sacramento River Deep Water Ship Channel. The Port of San Francisco is 150 miles away and provides bulk, neo-bulk, break-bulk, and intermodal container capabilities. The Port of San Francisco has rail service via Union Pacific and the San Francisco Bay Railroad. See Figure C-10. As water freight access is not adjacent to the site, a low risk is awarded.

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

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

## *5.4 Risk Factor: Social Infrastructure*

### *5.4.1 Healthcare (Local)*

**Risk Information:** The Oroville Hospital is a 153-bed facility offering state-of-the-art medical services and is 4 miles from the site. Oroville also offers a range of additional healthcare facilities including: assisted living, urgent care clinics, and specialty care offices. Emergency services include Police and Fire Departments as well as an emergency operations plan and an evacuation plan. The Police Department has 20 uniformed officers. The close access to a hospital and the presence of a police force indicates low risk.

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

### *5.4.2 Education (Schools)*

**Risk Information:** Butte County has 14 school districts with 91 public schools and 18 charter schools.[83] The average class size is 22.7 students, which is lower than the statewide average of 25.4 students.[84] The closest public higher education options include California State University (22 miles from Oroville), Yuba College (26 miles away), and Butte College (an 11-mile drive). The University of California, Davis, is 80 miles away. Chico State was ranked as one of the top schools for "Accredited Online Bachelor's Degree Programs" by BestColleges.com in 2016. Chico State ranked 5th among Master's

[83] Butte County https://www.buttecounty.net/. Accessed Mar 11, 2024.
[84] Ibid.

level public universities in the western United States in the 2013 edition of "America's Best Colleges" from U.S. News and World Report. The proximity of educational facilities is a low risk.

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

### *5.4.3 Local Transportation*

**Risk Information:** Butte Regional Transit "B-Line" serves most residents in the Greater Oroville area, making bus transportation easy and reliable. The system operates seven days a week. Greyhound Bus Lines is also available to and from the City of Oroville. Two taxi services are based in Oroville. Uber and Lyft are also available. Access to public transit indicates low risk for local transportation.

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

### *5.4.4 Public Safety (Local)*

**Risk Information:** Emergency services include Police (20 uniformed officers) and Fire Departments as well as an emergency operations plan and an evacuation plan. Oroville, CA, has a much higher rate of both violent and property crime than the national average. Violent crime in Oroville is 30.8, which is significantly higher than the US average of 22.7. Similarly, property crime in Oroville is 95 compared to the US average of 35.4. This suggests that there are elevated

levels of criminal activity in the area and that residents should take extra precautions when it comes to safety and security.[85] As the crime rate is higher than the national average, a high risk is assessed.

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

### *5.4.5 Housing/Cost of Living*

**Risk Information:** Oroville, California gets a BestPlaces Cost of Living index of 110.3,[86] which means the total cost of housing, food, child care, transportation, health care, taxes, and other necessities is 10.3 percent higher than the U.S. average but 26.4 percent lower than the average for California. Renters make up 48.2% of the Oroville population, and 2.7% of houses and apartments in Oroville, are available to rent. About 1% of vacant homes are for sale. The City of Oroville has established programs and activities designed to enhance the local economy by providing financial and technical assistance to qualified new and existing businesses. The Business Assistance and Housing Development Department staff administers programs and activities are designed to provide assistance to business owners or potential business owners located or locating in the City of Oroville. The cost of living is above the national average but lower than the California average and is deemed medium risk to new businesses.

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

[85] Best Places. https://www.bestplaces.net/crime/city/california/oroville. Accessed Dec 21, 2023.
[86] Best Places. https://www.bestplaces.net/cost_of_living/city/california/oroville. Accessed Dec 21, 2023.

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

## *5.5 Risk Factor: Labor*

### *5.5.1 Workforce*

**Risk Information:** The unemployment rate in Oroville, CA, as of Dec 2023 was 7.5%.[87] This is higher than the Jan 2024 unemployment rate in Butte County (5.7%),[88] California (5.2%),[89] and the Feb 2024 USA rate (3.9%). There are some opportunities for workforce training. Butte College has a program called "The Training Place"[90] that offers a number of courses and job-specific training. Another opportunity for training exists through the Butte County Career Technical Education program.[91]

Despite such programs, the shortage of logging truck drivers (a nationwide challenge) has already begun impacting supply chains, posing a risk to biomass deliveries. Discussions with local experts[92] suggest that this shortage is directly linked to pay scales. While not as severe as the driver shortage, a shortage of logging crews has been identified locally, which can impact productivity. Logger training is available through the Associated California Loggers.[93]

This risk is deemed high as the local supply chains are being impacted.

| **Raw Risk Likelihood (RRL)** | **Score** |
|---|---|
| **The risk likelihood is deemed *high*, therefore the RRL is 8 out of 10.** | **8** |
| **Raw Risk Impact (RRI)** | **Score** |
| **The risk impact is deemed *high*, therefore the RRI is 8 out of 10.** | **8** |
| **Gross Risk Indicator (GRI)** | **Score** |
| **The Gross Risk Indicator (RRL × RRI) is 64 out of 100.** | **64** |
| **Mitigation/Notching** | **Notch** |
| ***RRL Mitigation (Notch)*** | **25%** |
| Workforce training programs are available. Recommend notching at 25%. | |
| ***RRI Mitigation (Notch)*** | |
| No adjustment. | |
| **The Total Notch (RRL Notch × RRI Notch) is 25%.** | |
| **Loaded RI Score** | **Score** |
| **The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100.** | **48** |

[87] Best Places. https://www.bestplaces.net/economy/city/california/oroville. Accessed Dec 15, 2024.
[88] EDD Labor Market Information Division. https://labormarketinfo.edd.ca.gov/. Accessed Mar 11, 2024.
[89] US Bureau of Labor Statistics. https://www.bls.gov/. Accessed Mar 11, 2024.
[90] Butte College, The Training Place. https://www.butte.edu/thetrainingplace/. Accessed Feb 6, 2024.
[91] Butte County CTE. https://cte.bcoe.org/. Accessed Feb 6, 2024.
[92] Personal Communication. Mark Luster, Sierra Pacific Inc; Haley Stone, California State University, Chico; Dave Derby, CaleFire.
[93] Associate California Loggers. https://californialoggers.com/. Accessed Feb 6, 2024.

### *5.5.2 Labor Costs*

**Risk Information:** Minimum wage is $16.00/h in California while the average wage is $23.90/h in Oroville, CA.[94] This compares to the federal minimum wage of $7.25/h.[95] This risk is deemed medium as the local minimum wage is above the national average.

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

[94] ZipRecruiter. https://www.ziprecruiter.com/Salaries/-in-Oroville,CA. Accessed Mar 11, 2024.
[95] https://www.usa.gov/minimum-wage#:~:text=The%20federal%20minimum%20wage%20is,at%20least%20%247.25%20per%20hour. Accessed Mar 11, 2024.

# APPENDIX C: TABLES AND FIGURES

## SUPPLY ZONE INFORMATION

**Table C-1. Counties in Supply Zone with Percent Overlap**

| County | Percent in Supply Zone | County | Percent in Supply Zone |
|---|---|---|---|
| Sutter | 100% | Placer | 38% |
| Butte | 99% | Tehama | 33% |
| Yuba | 95% | Plumas | 33% |
| Glenn | 71% | Sacramento | 27% |
| Colusa | 69% | Sierra | 21% |
| Nevada | 59% | El Dorado | 1% |
| Yolo | 44% | Solano | 0.2% |

## BIOMASS SUPPLY SUPPLEMENTAL INFORMATION

**Table C-2. Billion-Ton Report Assumptions and Parameters Included in the Analysis**

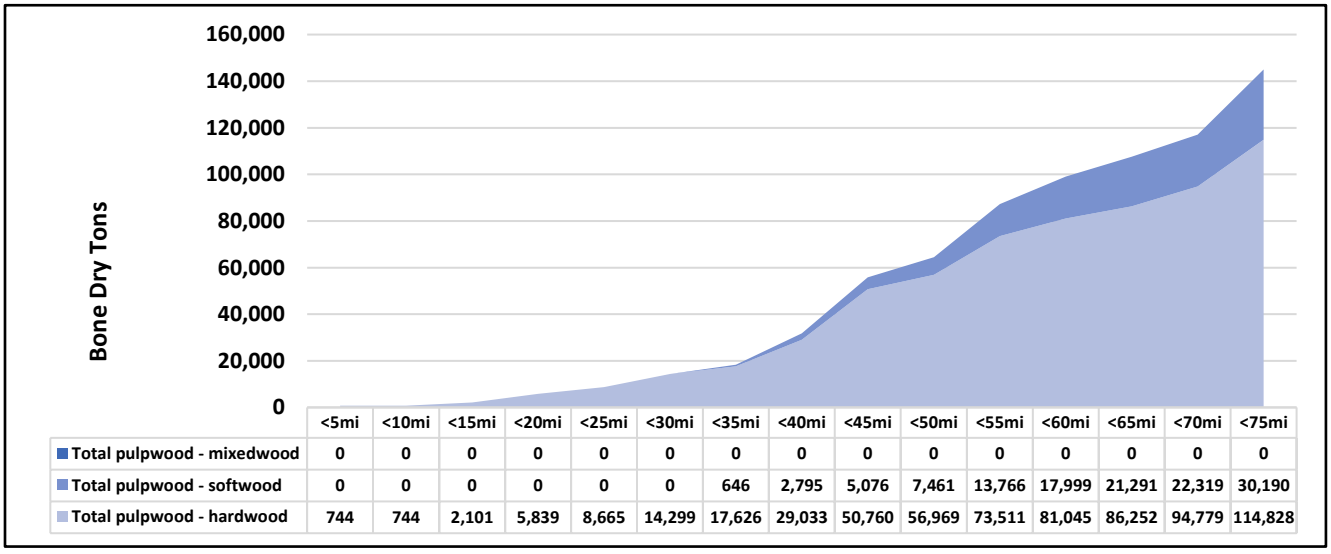
| **Bioenergy – Knowledge Discovery Framework, US Department of Energy Billion-Ton Report – 2016 Vol. 1 Data Download Tool[96]** | | |
|---|---|---|
| **Data retrieval** | | County level<br>Year 2020, 2025, 2030, 2040 |
| **Data presented as** | | Bone dry tons per year (bdt/yr)[97]<br>Average of the five retrieved years (2020, 2025, 2030, 2040) |
| **Resource Category** | **Forestry** | All biomass resources modeled on forestlands with commercial timber, i.e., forest residues and small-diameter trees. |
| **Demand for feedstock** | | Based on 2016 data |
| **Scenario** | **Medium housing, medium energy demands** | **1.)** Growth in housing starts returns to long-term average by 2025. The long-term average of housing starts from 1959 through 2011 is slightly less than 1.1 million housing starts per year.<br>**2.)** Growth in wood biomass demand for energy increases by 86% by 2040. Actual wood biomass production in 2010 was 58.2 million dry tons for all scenarios.<br>**3.)** New plantation management intensity in the South – Based on current FIA pine plantation growth rate. Current average FIA growth rate on pine plantations across the South (all owners, all ages) is approximately 108 cubic feet/acre per year (1.6 dry ton/acre per year). Increasing management intensity by 50% only on new plantations results in an increase in the average South-wide growth rate over time up to 140 cubic feet/ac per year in 2040 (2.1 dry tons/acre per year). |
| **Biomass price** | Specified biomass price after harvest cost as applicable but before transportation costs, in 2014 dollars per dry ton equivalent. *If these prices are used within the rating, they will include inflation rates and newest transportation costs.* | |
| **Resources** | Hardwood, lowland forest residues, Hardwood, lowland whole trees, Hardwood, upland forest residues, Hardwood, upland whole trees, Mixedwood forest residues, Mixedwood whole trees, | |

[96] US Department of Energy 2016 Billion-Ton Report. https://bioenergykdf.net/2016-billion-ton-report
[97] Dry tons (0% moisture content) were converted to green tons using a moisture content assumption of 50% for pulpwood, 35% for forest residues.

| | | |
|---|---|---|
| | Softwood, natural forest residues, Softwood, natural whole trees, Softwood, planted forest residues, Softwood, planted whole trees – logging resides = harvest/forest residues; whole trees = only small diameter trees = pulpwood. | |
| **Class** | **RSDF** | Residues, forestry (i.e., forest residues) |
| | **TREE** | Small-diameter trees |
| **Section** | **PFRS** | Primary forestland resources including forest residues (i.e., Class RSDF) and small-diameter trees (i.e., class TREE). |
| **Diameter class** | **2** | Timberland trees with diameter at breast height 5-11 inches. |
| **Operation Type** | **Clear Cut** | Clearcut harvest of small-diameter trees or production of forest residues. |
| | **Thinning** | Thinning harvest of small-diameter trees or production of forest residues. |
| **Supply Class** | **LE40** | Timberland resources harvested from slopes less than or equal to 40 degrees. |

Small-diameter tree availability by species and distance is shown in Figure C-1.

**Figure C-1. Small-Diameter Trees Estimated Availability by Species Group and Distance from Center Point**

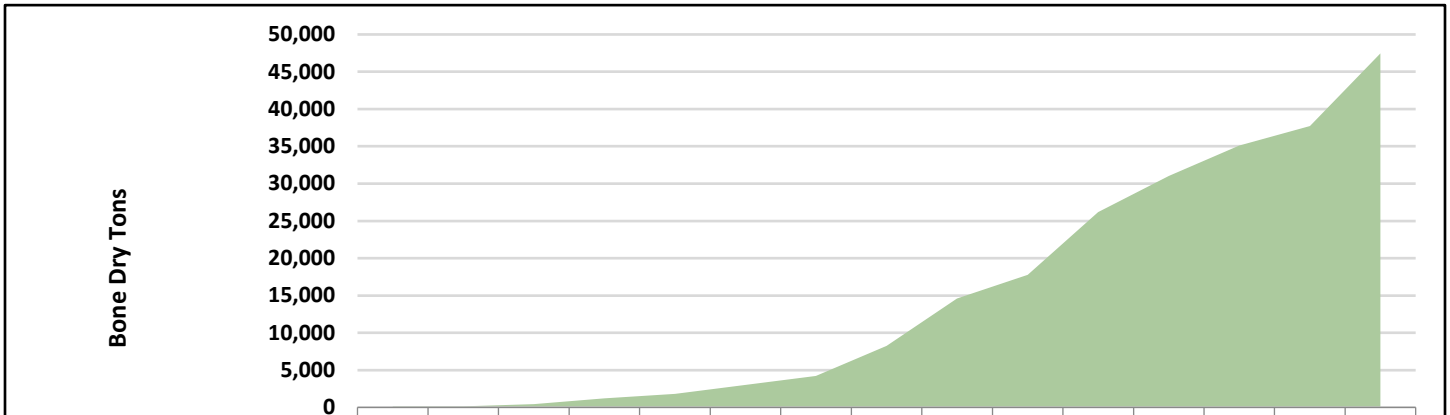



| | <5mi | <10mi | <15mi | <20mi | <25mi | <30mi | <35mi | <40mi | <45mi | <50mi | <55mi | <60mi | <65mi | <70mi | <75mi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total pulpwood - mixedwood | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total pulpwood - softwood | 0 | 0 | 0 | 0 | 0 | 0 | 646 | 2,795 | 5,076 | 7,461 | 13,766 | 17,999 | 21,291 | 22,319 | 30,190 |
| Total pulpwood - hardwood | 744 | 744 | 2,101 | 5,839 | 8,665 | 14,299 | 17,626 | 29,033 | 50,760 | 56,969 | 73,511 | 81,045 | 86,252 | 94,779 | 114,828 |

- Hardwood makes up the majority of available biomass, about 97% of the total.
- Softwood species are available only in the outer half of the Supply Zone.

Forest residue availability by species and distance is shown in Figure C-2.

**Figure C-2. Harvest Residues Estimated Availability by Species Group and Distance from Center Point**

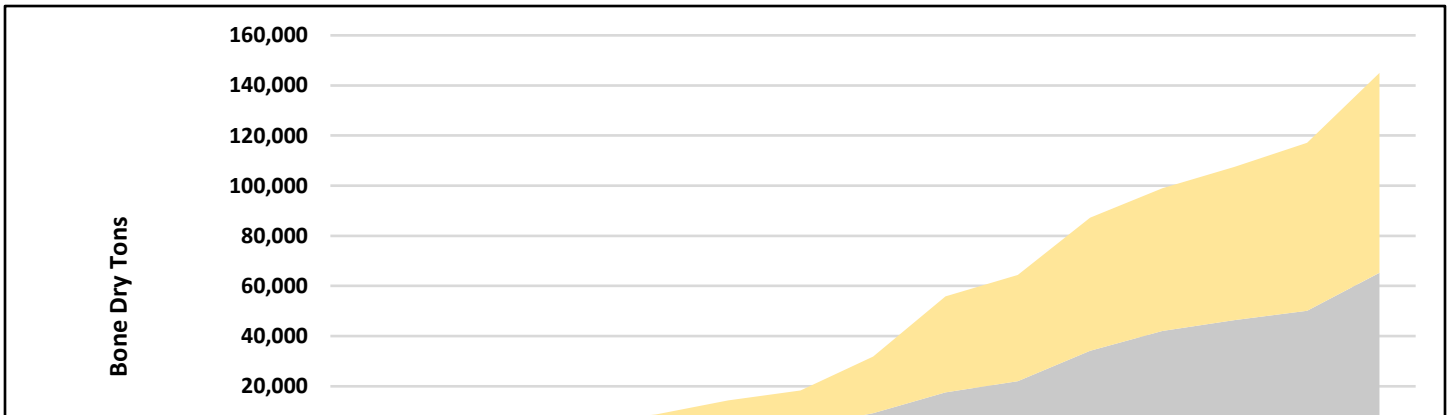



| | <5mi | <10mi | <15mi | <20mi | <25mi | <30mi | <35mi | <40mi | <45mi | <50mi | <55mi | <60mi | <65mi | <70mi | <75mi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Harvest residues - mixedwood | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total harvest residues - softwood | 154 | 154 | 435 | 1,220 | 1,817 | 3,012 | 4,219 | 8,239 | 14,578 | 17,784 | 26,163 | 31,034 | 35,108 | 37,742 | 47,461 |
| Total harvest residues - hardwood | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

- Harvest residues are only available from softwood species.

The availability of small-diameter trees and forest residues in private vs public lands and by species are shown in Figures C-3 and C-4 respectively.

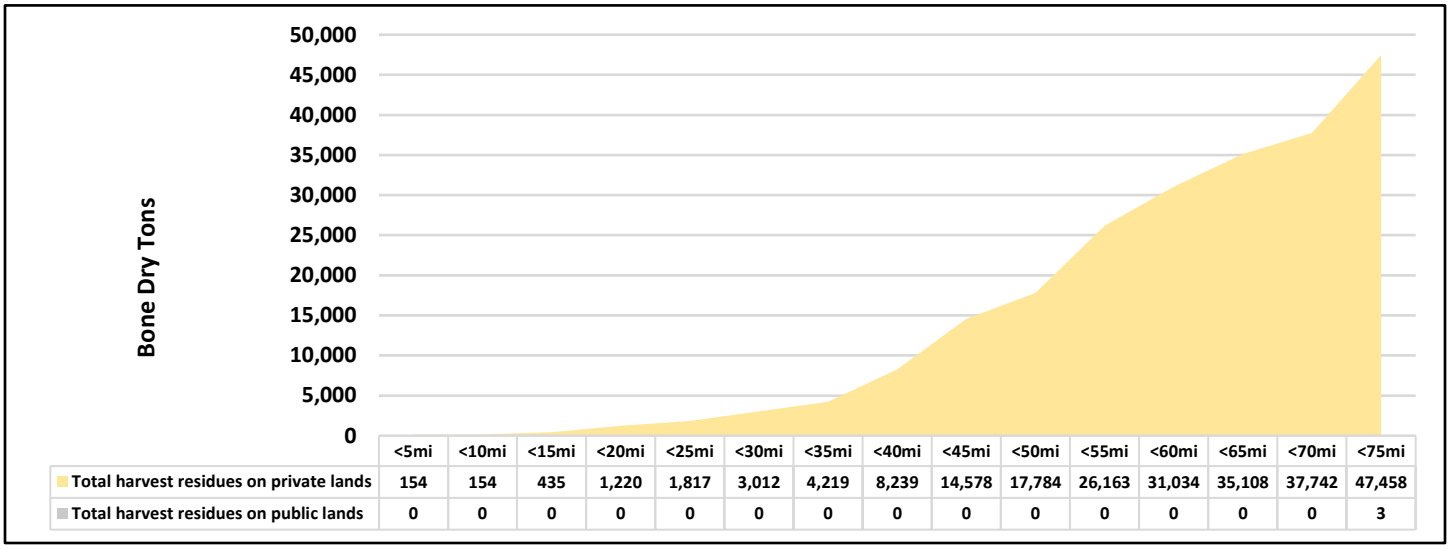
**Figure C-3. Small-Diameter Trees Estimated Availability by Ownership Type and Distance from Center Point**




| | <5mi | <10mi | <15mi | <20mi | <25mi | <30mi | <35mi | <40mi | <45mi | <50mi | <55mi | <60mi | <65mi | <70mi | <75mi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total pulpwood on private lands | 558 | 558 | 1,576 | 4,642 | 7,030 | 11,899 | 14,782 | 22,559 | 38,286 | 42,475 | 53,107 | 57,028 | 61,109 | 67,012 | 79,792 |
| Total pulpwood on public lands | 186 | 186 | 525 | 1,197 | 1,636 | 2,400 | 3,490 | 9,270 | 17,550 | 21,955 | 34,170 | 42,016 | 46,434 | 50,087 | 65,226 |

- Small-diameter trees available from public lands is about 79,800 bdt/yr, about 55% of the total.
- Small-diameter trees available from private lands is about 65,200 bdt/yr, about 45% of the total.
- About half of the available small-diameter trees is available within 55 miles of the BDO Zone center point.

**Figure C-4. Harvest Residues Estimated Availability by Ownership Type and Distance from Center Point**




| | <5mi | <10mi | <15mi | <20mi | <25mi | <30mi | <35mi | <40mi | <45mi | <50mi | <55mi | <60mi | <65mi | <70mi | <75mi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total harvest residues on private lands | 154 | 154 | 435 | 1,220 | 1,817 | 3,012 | 4,219 | 8,239 | 14,578 | 17,784 | 26,163 | 31,034 | 35,108 | 37,742 | 47,458 |
| Total harvest residues on public lands | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |

- Harvest residues are only available on private lands.

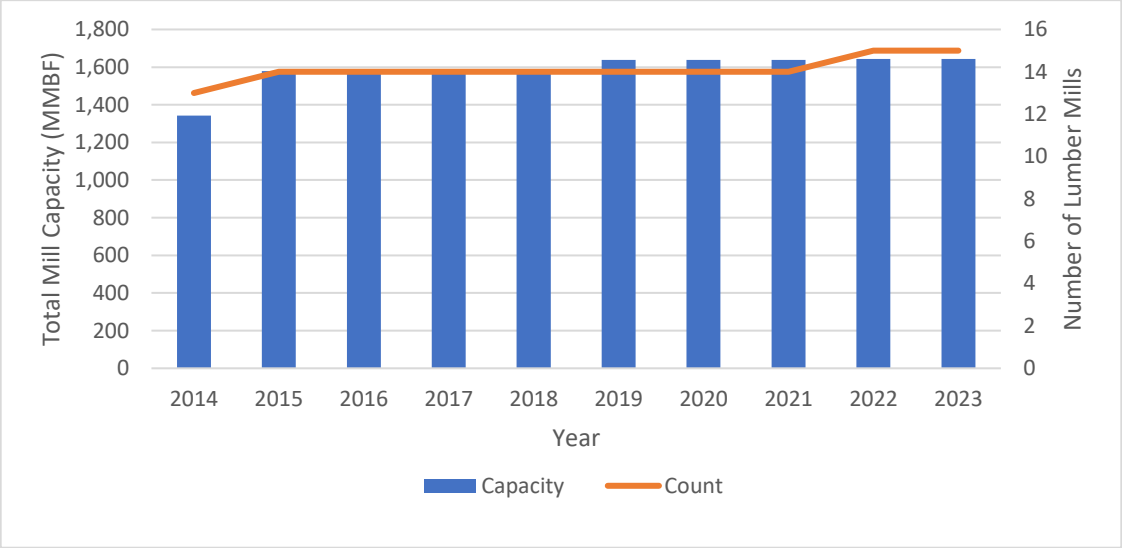
The overall sustainability of timber growth is indicated by Table C-3, showing growth and removals for all wood, including small-diameter trees and sawtimber. These data allow measurement of the growth-to-drain ratio, an indicator of harvesting sustainability, and represents the proportion of wood growth each year compared to harvest removals. The average growth-to-drain for the Supply Zone averages 3.03 for this time period. This means that about three times the amount of wood that was harvested was added to the forest through growth. A high ratio of 3 is a positive indicator of sustainability.

**Table C-3. Total Average Annual Net Growth and Average Harvest Removals**

| | Average Annual Net Growth by Species Type (bdt) |
|---|---|
| Total Growth | 1,754,000 |
| Total Removals Growth | 579,000 |
| Growth-to-Drain Ratio | 3.03 |

Given the small number of sawmills in the Supply Zone, there may be an interest in expanding the acquisition of sawmill residues into the Competition Zone. Figure C-5 shows the relationship between the number of sawmills in the Competition Zone and total capacity and suggests a robust sawmilling industry.

**Figure C-5. Lumber Mill Capacity in Competition Zone 2014 – 2024[98]**

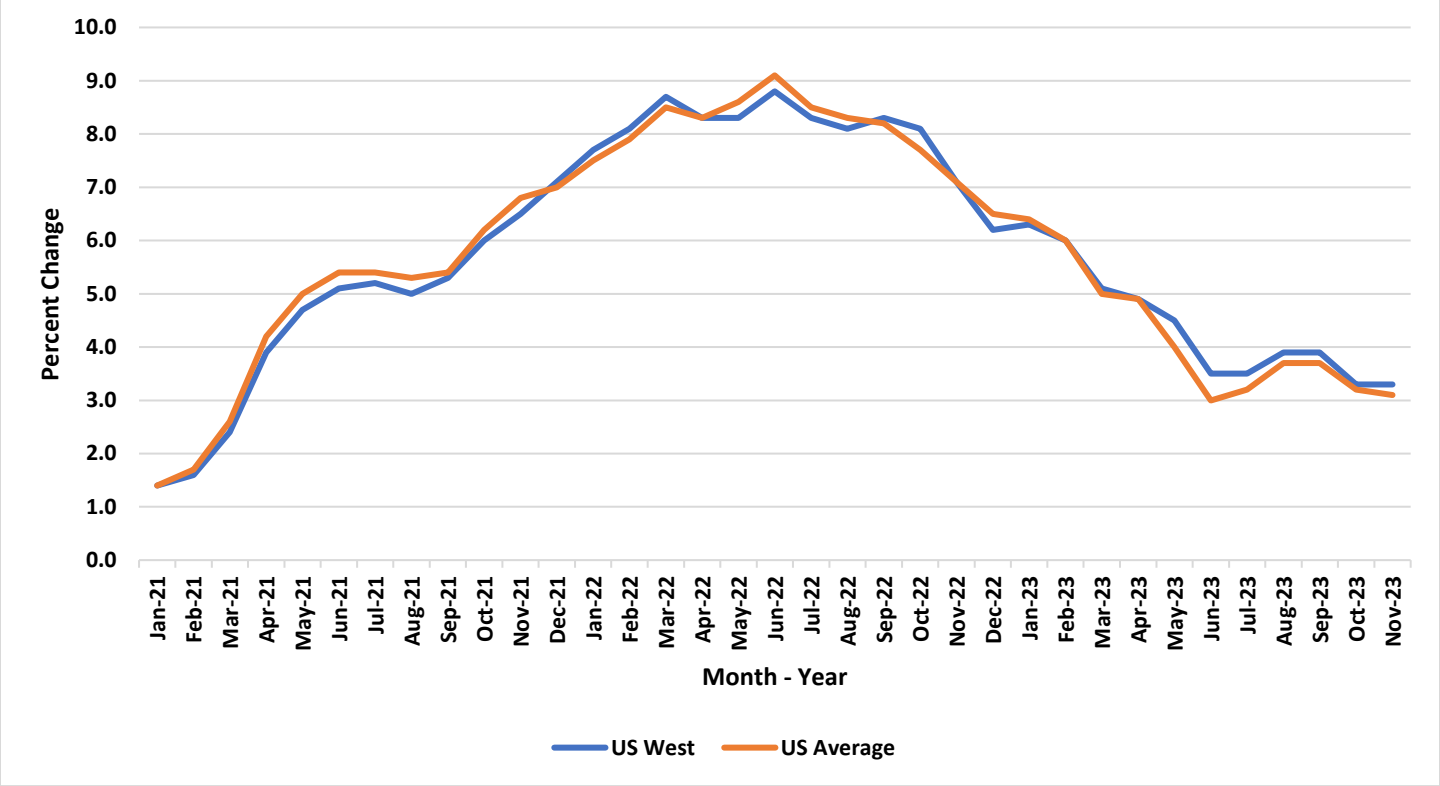



- As the Supply Zone contains only two sawmills with 75 miles, supply of sawmill residues could be increased if the acceptable drive distance for feedstock is increased.
- Lumber production in the Competition Zone increase from about 1,300 MMBF to 1,600 MMBF between 2014 and 2023.
- The number of sawmills increased from 13 to 15 over this period.

[98] FORISK Mill-Database-Excel-Full-Q4-2023.

The change in Consumer Price Index for the west region and US national average is shown in Figure C-6.

**Figure C-6. Percent Change in Consumer Price Index: US West Region vs US National Average[99]**

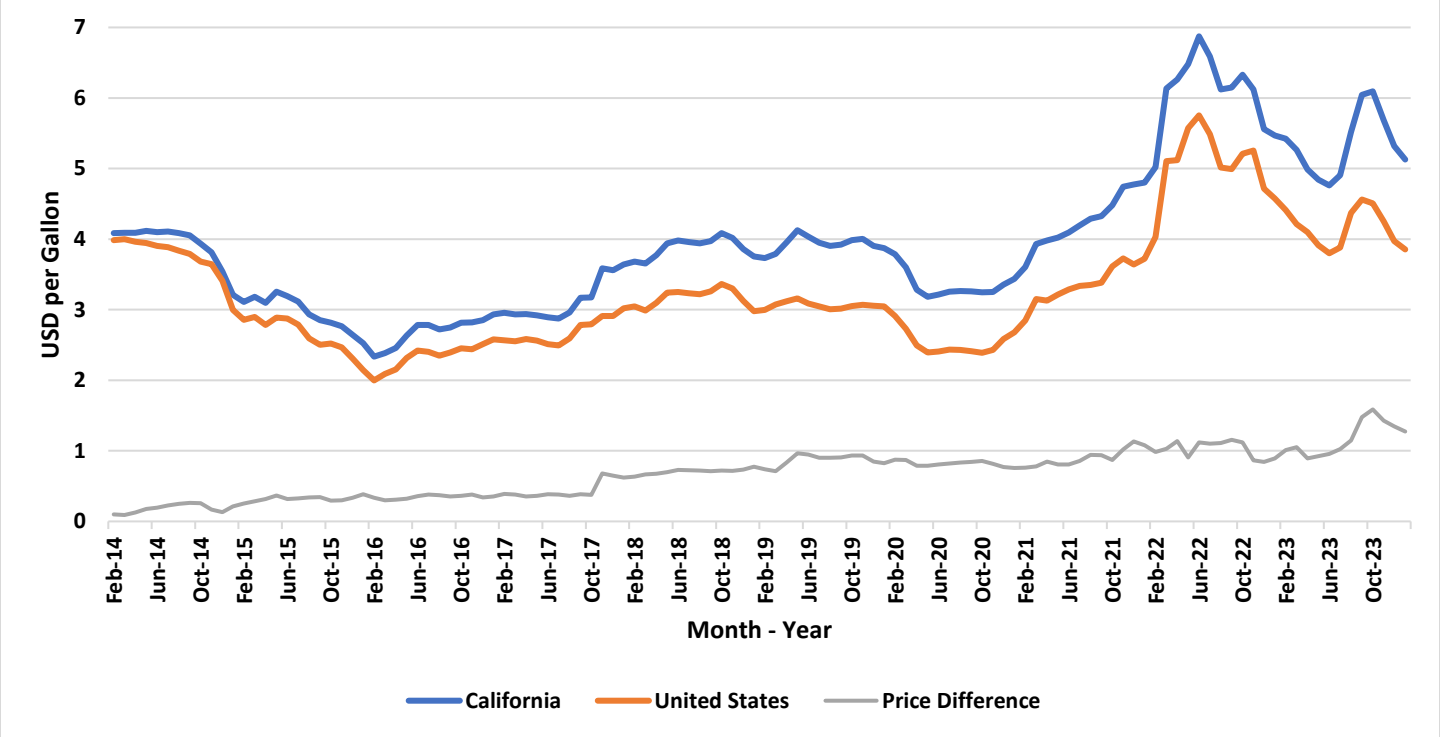



- The later months of 2023 show a notable decrease in the Year-over-Year change percentages for both the West and the US averages, with decreases ranging from around -42% to -59%.
- This suggests a significant deceleration in inflation rates as compared to the same months in the previous year.
- Year-over-Year changes for the West Region and the National Average are relatively close, indicating that inflation trends in the West are somewhat in line with the national trends

[99] US Bureau of Labor Statistics. https://www.bls.gov/regions/west/news-release/consumerpriceindex_west.htm. Accessed Dec 26, 2023.

A comparison of historical pricing for diesel fuel in California vs. the US national average is shown in Figure C-7.

**Figure C-7. 10-Year Historical Diesel Prices: California vs US National Average[100]**

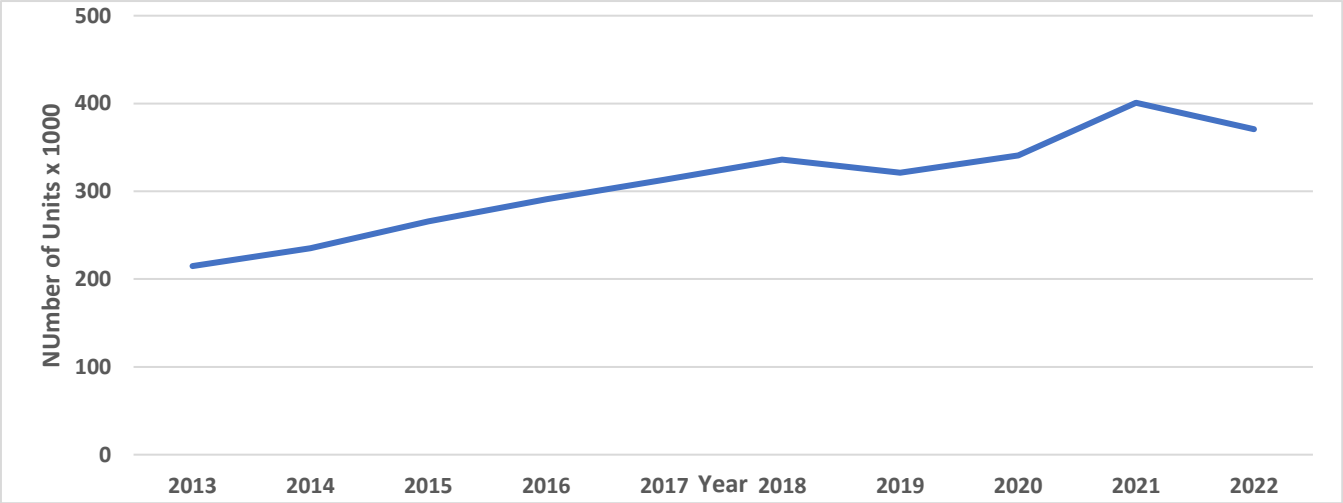



- The general trend of California diesel prices follows the pattern of the US national average.
- California diesel prices are higher than the US national average with the difference in price trending upward.

Housing starts are a measure of new residential construction, and are considered a key economic indicator. Data showing housing stars in the western region of the US between 2013 to 2022 are shown in Figure C-8.

[100] US Energy Information Administration. https://www.eia.gov/. Accessed Feb 6, 2024.

**Figure C-8. Housing Starts US West 2013 - 2022[101]**




- Housing starts in the US West have grown steadily between 2013 and 2022.

An aerial photo of the Center Point is shown in Figure C-9.

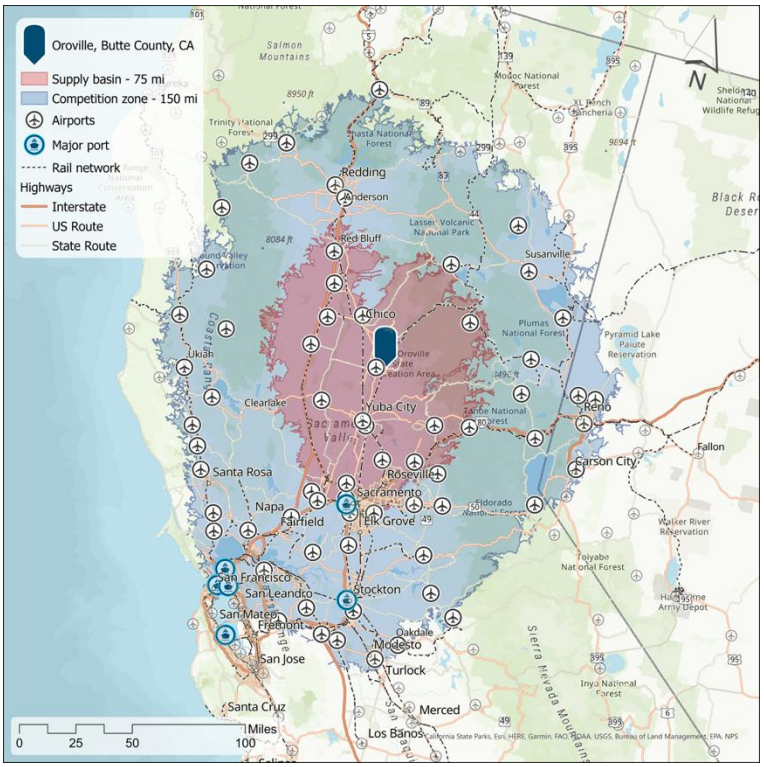
**Figure C-9. Oroville Biomass Facility Concept Map**




[101] US Census. Housing Starts US West. https://www.census.gov/construction/nrc/historical_data/index.html. Accessed Jan 16, 2024.

Figure C-10 shows various infrastructure in the Supply Zone and Competition Zone including: Airports, major water ports, rail, and highways.

**Figure C-10. BDO Zone Transportation Infrastructure Map**



# APPENDIX D: LEGAL DISCLAIMER

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

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

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