

# TWIN CITIES METRO AREA EMERALD ASH BORER WOOD WASTE STUDY

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PREPARED FOR:



PREPARED BY:



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# Executive Summary

The goal of this assessment is to provide an opportunity analysis for alternative and higher-use of wood waste for the Twin Cities metropolitan area. This report, prepared for the Partnership on Waste & Energy, seeks to effectively manage an increasing amount of Emerald Ash Borer driven waste, specifically within Hennepin, Ramsey, and Washington counties.

Current projections suggest that by 2028, a peak in ash tree removals will see more than half a million tons of wood waste processed within the Twin Cities metro area annually. At present, roughly two-thirds of wood waste is processed for use as bioenergy at District Energy's St. Paul Cogeneration facility, yet inflationary pressures, coupled with the anticipated end of a power purchase agreement in 2024, may prohibit maintaining current processing volumes. With a saturated mulch market, and less than 1% of wood waste salvaged as urban lumber, opportunities exist to seek higher impact alternative uses for wood.

With more than **400,000 tons of wood waste** flowing through the Twin Cities system, how wood biomass is managed has a significant implication for associated social, economic, and environmental impacts.

Based on more than 30 stakeholder interviews and an assessment of available wood waste data, this report outlines the following recommendations:

- **Support existing regional infrastructure including high-volume biomass energy plants and composting facilities.** St. Paul Cogeneration, Koda Energy, and SMSC Organics have the collective potential to process 365,000 tons of wood waste annually. To mitigate shocks to the wood waste system, particularly with waste volumes still rising, it is imperative to continue to enable these high-volume disposal options. Avenues to support these facilities include: extending the MDA [AGRI Bioincentive Program](#), using DNR EAB grants to subsidize ash wood use at combined heat and power plants, leasing alternative wood yards to large biomass facilities in need of capacity, and supporting state agencies in the timely issuance of required permits.
- **Expand wood utilization in lumber products via the AGRI Bioincentive Program and other policy levers.** Incentives should be positioned to enable milling operations (traditional and engineered products) and other torrefaction (e.g. biochar) or thermally-modified businesses to expand wood utilization efforts. Some examples to encourage adoption of urban lumber use are: amending and expanding the AGRI Bioincentive Program, developing new policies such as local procurement specifications, and subsidizing the use of urban lumber in place of traditional lumber.
- **Increase regulation of open burning of wood waste.** Concerns were expressed that a lack of processing capacity may result in open burning of wood as a way for tree care companies to dispose of unwanted debris. Currently, the Twin Cities metro area is exempt from burn permit reporting via the DNR statewide system. To mitigate concerns

of the growth of open burning as a disposal mechanism, it is recommended that PWE work with the DNR to improve and consolidate data collection requirements.

- **Begin programs that support small businesses.** The tree care industry is the primary source of wood waste generation in the metro area. Availability of infrastructure and equipment, coupled with operations and labor costs contribute to the companies' ability to transport, process, and determine utilization of biomass. In order to maintain the resilience of a system squeezed by shrinking margins and physical yard capacity, PWE might consider providing grants or equipment loans to avoid pushing out small players.
- **Establish additional city and/or county log collection yard with milling capacity.** The development of a centrally-located sort yard for wood waste offers the opportunity to improve aggregation and economies of scale toward log salvage and lumber production. Ramsey or Washington counties may be suited to institute a log salvage program within existing and future yard waste sites. To further determine specific commercial viability at a county or city level, an in-depth assessment is recommended.
- **Implement reporting requirements for wood waste processing and tree removals for public and private organizations managing woody biomass.** Monitoring tree loss and implementing uniform wood waste data collection practices can enable salvage efforts and inform on management strategies for utilization. It is recommended that PWE work closely with the MPCA to inform new wood waste reporting practices. Additionally, an initial assessment should be conducted to determine size, species, and condition of the removed trees to generate a clearer reflection of potential benefits.
- **Define clear roles and responsibilities at both county and state levels for agencies to play a more active role in wood waste management.** Agencies have developed various programs and resources aimed at understanding, educating, and slowing the spread of EAB in Minnesota. Yet there is no identified singular entity tasked with owning wood waste management, hindering the progress of biomass utilization efforts.
- **Improve education and grow awareness to facilitate increased secondary log use.** Education and advocacy, for both the public and tree care professionals, can be an influential factor in accelerating wood utilization. It is recommended that PWE work with the MDA and DNR to activate education campaigns for arborists to properly cut logs, and public campaigns to help catalyze market growth of urban lumber.

## Introduction

Wood waste management presents a mounting crisis within the Twin Cities Metro Area. In response to a growing volume of wood biomass – in large part resulting from Emerald Ash Borer driven tree removals – and a lack of robust disposal pathways, the Partnership on Waste and Energy for Hennepin, Washington, and Ramsey counties commissioned this analysis to understand the opportunities and barriers to current wood waste management systems.

This report seeks to address the following questions, with a focus on the 3 partner counties within the metro area:

- How much wood waste is currently being managed?
- Where is wood waste currently going for disposal, treatment, or secondary use?
- What opportunities exist to expand reuse and higher-value applications for wood biomass, over disposal?
- What policies and programs could help improve EAB wood waste management best practices moving forward?

This analysis was conducted by [Cambium Carbon](#), a public benefit corporation on a mission to enable a regenerative cycle of urban wood reuse. The company has worked with governments, NGOs, and private sector companies across the United States to develop programs, partnerships, and markets that enable wood utilization.

This project is commissioned by the [Partnership on Waste and Energy](#), an entity developed to support collaborative waste and energy management in Hennepin, Ramsey, and Washington counties.

## Quantifying EAB in MN and Twin Cities Metro Area

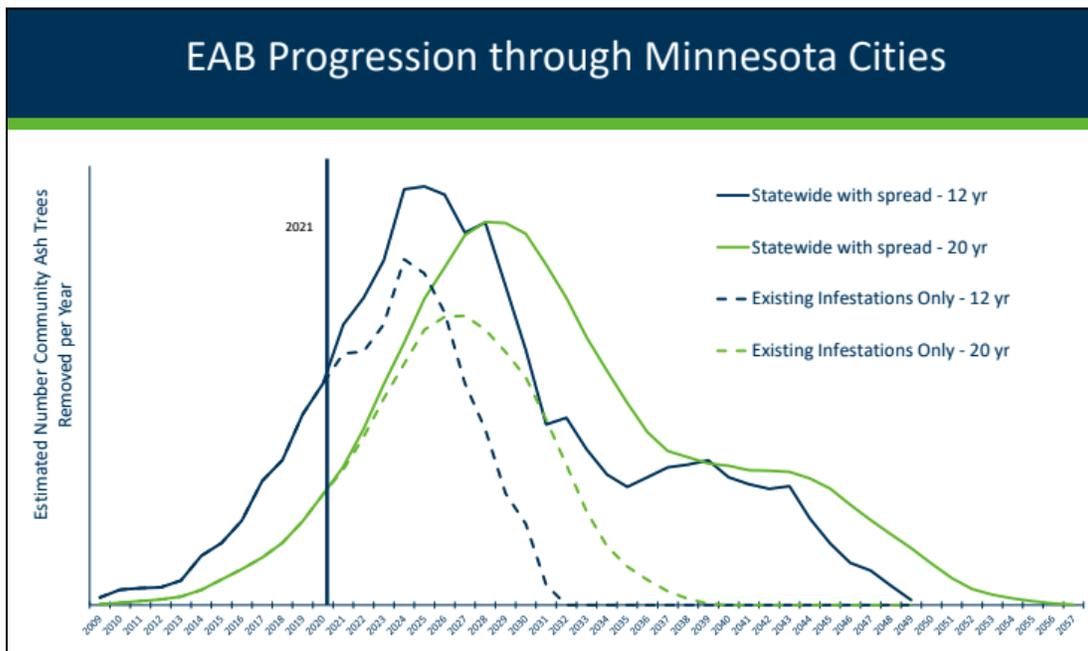
The [Emerald Ash Borer \(EAB\)](#) is an invasive beetle known to cause destruction among ash tree populations. The pest burrows inside the tree's bark, hatching larvae that feed on the cambium and phloem layers, interrupting nutrient and water exchange and ultimately killing the host tree. Since EAB's discovery in Minnesota in 2009, the pest has posed a significant threat to the [1 billion ash trees](#) in the state and prompted tree removal campaigns to mitigate the pest's spread among healthy trees, as well as the culling of standing hazards following tree decline.

State performed studies have provided a well-informed overview of the scale of EAB. When projecting spread rates in a 2019 report, the Environmental Quality Control Board estimated, under the best-case scenario, that EAB would be present in about 22 counties in 2022. Under the worst-case scenario, this estimate was 32 counties. As of the writing of this report in October 2022, according to the Minnesota Department of Agriculture (MDA) [EAB Status map](#), the pest has been found in areas of at least 35 counties.

A recent presentation, given in partnership by the MDA and University of Minnesota, estimated that we are not yet at the peak of ash trees needing removal. Methodology was driven by three main inputs:

- pre-EAB ash population estimates from a 2007 DNR survey<sup>1</sup> combined with large city tree inventories,
- estimated rate and location of spread by analysis of previous sequences, and
- the rate of EAB-induced tree removals initially modeled from a 2016 study of the impact of EAB on municipal forestry budgets.<sup>2</sup>

Under a 12-year removal model, the highest level of wood waste generation is estimated to occur between 2024 and 2025. Within a 20-year model, wood waste maximums are estimated to extend between 2028 and 2029. In review with the MDA, the 20-year model feels best fit to represent Minnesota likely due to two reasons: compared to other states, Minnesota's cold weather assists in slowing spread, and as compared to the proxy 2016 study, Minnesota has had more time for preparation. A comparison of these two scenarios for ash tree removals in Minnesota cities is outlined in **Figure 1**.



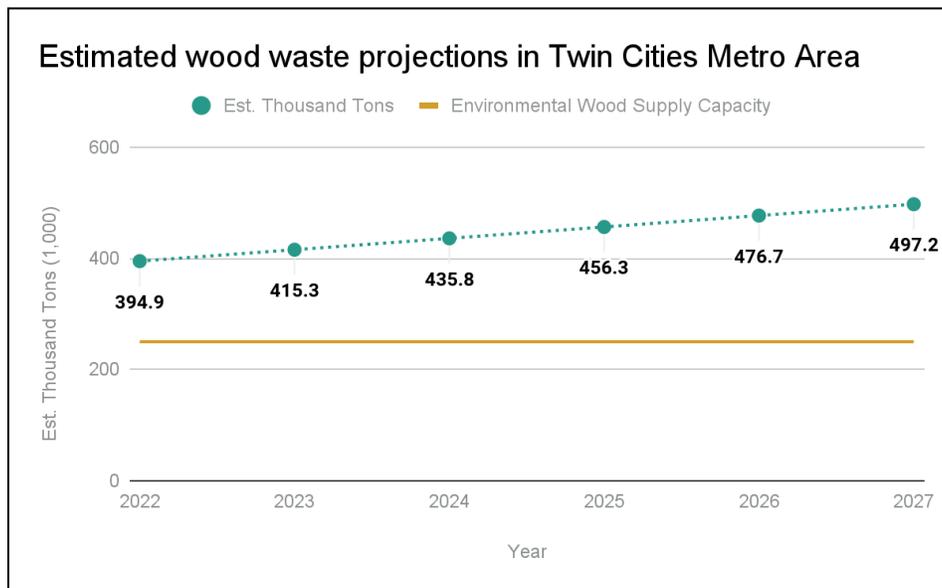
**Figure 1: EAB Progression through Minnesota Cities**  
Mark Abrahamson, Minnesota Department of Agriculture (April 2022)

Within the next couple of years, the MDA will continue to partner with a University of Minnesota entomologist to improve tree removal estimates through field work and further statistical analysis. This will allow for more accurate projections of true removals and potential wood waste tonnage, not provided in the scope of this study.

<sup>1</sup> [Rapid Assessment of Ash and Elm Resources in Minnesota Communities. MN DNR. 2007.](#)

<sup>2</sup> [Effects of Emerald Ash Borer on Municipal Forestry Budgets. Richard J.Hauer. Ward D.Peterson. 2016.](#)

At present, assumptions against available data offer relevant estimations of future wood waste volumes. Roughly 67% of the metro area’s waste is delivered to Pig’s Eye Recycling Center.<sup>3</sup> In order to estimate wood volume growth over the next 5 years, Cambium Carbon calculated the logarithmic growth rate of the previous six years of wood tonnage delivered to Pig’s Eye, then applied the known distribution ratio of 67%. **Figure 2** provides an overview of estimated total wood waste in 2022, with anticipated volumes through 2027.



**Figure 2:** Projection of estimated wood waste (thousand tons) in Twin Cities Metro Area

Following this growth & distribution pattern and applying to the MDA 20-year model, it is estimated that there will be over half a million tons of wood waste between 2028 to 2029, during the peak of ash tree removals. Projections highlight the need for additional wood waste management capacity within the Twin Cities metro area, as the region prepares for an increasing volume of processing needs.

Due to a lack of standardized reporting requirements, stakeholder data proved insufficient to accurately estimate the percentage of ash wood within the waste stream. Anecdotally, interviewees suggested that EAB-related waste accounts for roughly 25% of total volume.

Municipal ash tree removal plans vary across the state. The City of Minneapolis has completed removal of ash trees on publicly managed land, while the City of St. Paul plans to remove all public ash trees by 2024. However, in a survey conducted by the MDA, the majority of cities where EAB was discovered prior to 2018 still have 50% or more of their public ash trees remaining. Additionally, ash trees on private property are unaccounted for in most municipal inventory data, and fall outside of the management of government agencies; it is inferred that

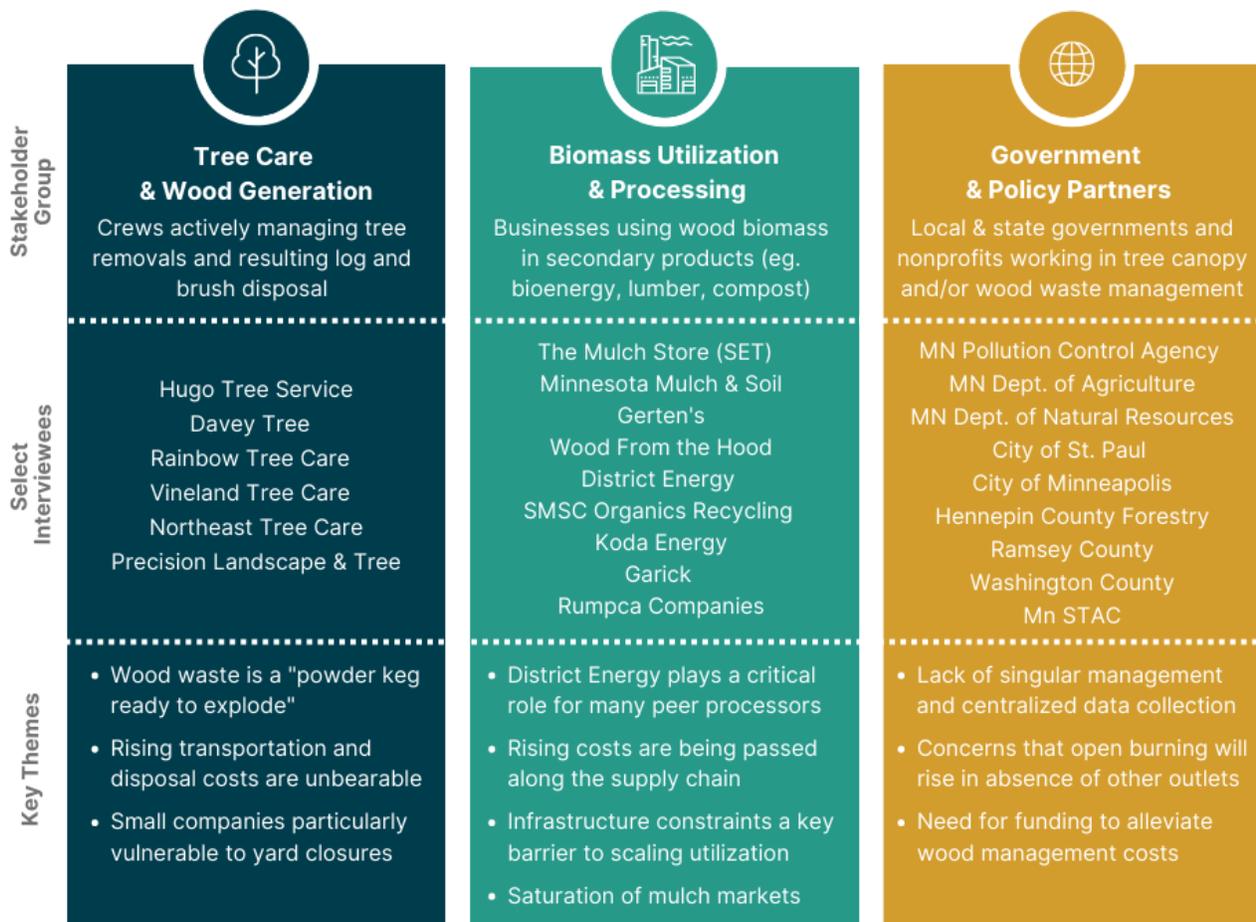
<sup>3</sup> Pigs Eye Recycling Center processes biomass for the combined-heat and power plant, St. Paul Cogeneration. For further details on District Energy St. Paul and its affiliates, refer to the [District Energy St. Paul section](#) of this report.

most have not yet been removed. Within the City of Minneapolis alone, Minneapolis Parks and Recreation Board staff estimate that there are about 30,000 private ash trees remaining, including relatively small trees down to a diameter at breast height (DBH) of 5 inches.

## Stakeholder Interviews

In order to understand current wood waste management systems in Hennepin, Washington, and Ramsey counties, Cambium Carbon conducted interviews with more than 30 individuals and organizations involved in tree care, wood biomass processing, and regulation of waste management activities. Interviewees included city and county officials, private arborists, and local businesses, identified by the Partnership on Waste & Energy or fellow interviewees as critical players in the wood management system. Our conversations aimed to understand current wood debris management practices, assess local capacity gaps, and identify opportunities for improving the beneficial utilization of biomass – particularly resulting from increased ash tree removals.

A summary of Cambium Carbon’s stakeholder interviews is provided in the figure below:



**Figure 3: Summary of Cambium Carbon Stakeholder Interviews**

The following section highlights examples of select businesses and organizations operating within each stakeholder category, in an effort to illustrate their unique role in the wood waste management system, as well as the challenges and opportunities faced in scaling secondary wood utilization.

## Tree Care & Wood Generation

Within the 7-county metro area there are roughly 440 registered tree care companies, with almost half based in Hennepin and Ramsey counties.<sup>4</sup> These companies include public and private agencies, vary in size, and have a range of capabilities in tree services. The following are a sampling of companies representative of differences in equipment, number of employees, and locations.

### Hugo Tree

[Hugo Tree](#) is a 17-person tree care company with two full-time operation crews located in the northeast corner of the metro area. The majority of their tree care is centered on condemned or hazardous trees due to their number of certified arborists and emphasis on high-skill services. Annually, Hugo Tree estimates that their tree care work produces roughly 25,000 cubic yards of tree debris. Unique to the company's operations is the ability to bring all logs and brush to their own wood yard for initial processing, prior to trucking 100% to Environmental Wood Supply<sup>5</sup> (EWS) for use as biofuel at District Energy's St. Paul Cogeneration. Harry Olsen, CFO of Hugo Tree, noted that the machine required to break wood down to a size suitable for trucking to EWS is roughly one-million dollars. Although having an in-house wood yard is in itself a luxury not accessible to many smaller tree care companies, Olsen still sees two major problems facing his and other tree care companies: disposal costs are too high to bear (e.g. equipment, labor, and fuel to haul wood), and the lack of physical capacity to dispose of wood waste legally.

### Vineland Tree Care

[Vineland Tree Care](#) employs about 40 people and services Minneapolis, St. Paul, and the surrounding suburbs. Vineland offers a variety of services to residential and commercial customers including pruning, root care, tree removals, and insect & disease management. Capabilities also extend to larger and more unique tree removals with the use of crane equipment. Annually, Vineland processes between 52,000 to 78,000 cubic yards of tree debris: typically one-third is chipped, the remainder stays in brush & logs form. Without a personal yard, roughly 70% of their waste is transferred to Environmental Wood Supply, and 30% is provided to mulching or compost organizations in south St. Paul. When possible, the company salvages logs (at most 1-2% of total volume) for Wood From the Hood, a hyper-local durable wood products manufacturer. Anecdotally, Seamus Walsh, Owner of Vineland Tree Care, noted that their volumes are sufficient to fill Wood From the Hood's annual needs within two weeks. Although a sometimes inconvenient process to salvage the logs for milling, Vineland appreciates and wants to support the salvaged wood mission.

<sup>4</sup> [Minnesota Department of Agriculture: Tree Care Registry](#)

<sup>5</sup> Environmental Wood Supply is an affiliate of District Energy St. Paul that collects and processes regional wood waste into biomass for use at St. Paul Cogeneration, a combined heat and power plant.

Like Olsen, Walsh highlighted two primary constraints for tree care companies today. Trucking fees and general transportation costs have increased, squeezing the margins that used to cover tipping fees; additionally, a strong reliance on Environmental Wood Supply as the primary offtake for wood waste. Walsh noted the difficulty in softening the shrinking capacity at Environmental Wood Supply, given that alternative uses – such as mulch – lack sufficient demand to meet the influx of supply.

### Rainbow Treecare

[Rainbow Treecare](#) employs over 200 people locally, with roughly 100 allocated to tree crews. About 70% of their services are performed for residential customers, including tree pruning, trees & stump removal, insect & disease control, as well as other forms of plant & growth management. In 2021, Rainbow generated 33,360 cubic yards of wood waste. A majority of wood debris is sent to the Mulch Store in St. Louis Park, with whom the company maintains an agreement for fixed fee disposal. Other disposal outlets include intermediary processors including Ceres, Rumpca, and Rock Hard, all of whom charge a tipping fee. Roughly 20% of wood waste is transported directly to Environmental Wood Supply.

Rainbow currently utilizes five grapple trucks, offering the ability to quickly load and haul bulky material. Over the past ten years, these trucks have allowed crews to migrate from chipping debris to being able to easily transfer wood in log and brush form.

It is estimated that a conservative 25% of Rainbow's removal work is for ash trees. Troy Mason, Director of Operations, shared that Rainbow has hit its capacity for ash tree removals, and is no longer accepting new clients. When a removal does occur, costs for the service average between \$2,000 to \$3,000. In one extreme case, where significant additional equipment including a crane were required, the client was charged almost \$32,000. Rainbow also offers annual treatment options against the Emerald Ash Borer, and currently has 77,000 trees in the metro area under protection.

As with other tree care companies, Rainbow cited two large barriers in their continued operations: increase in trucking costs and capacity for wood waste drop-off. In an effort to mitigate impact on their business due to wood yard closures, their team has acquired a parking lot to use as a temporary site for holding excess log and brush.

## Biomass Utilization & Processing

### Bioenergy

#### District Energy St. Paul

The cornerstone of wood utilization in the Twin Cities are District Energy affiliates St. Paul Cogeneration (SPC) and Environmental Wood Supply (EWS). District Energy St. Paul (District Energy) is a nonprofit utility that provides district heating and cooling services to downtown St.

Paul and its neighboring West Side community. Since 2003 SPC has utilized a combined heat and power system fueled by regional wood waste, with heat sold to District Energy, and electricity to Xcel Energy. Environmental Wood Supply (EWS) was created in an effort to streamline collection and processing of regional wood waste into biomass fuel for SPC.

For two decades, these District Energy affiliates have been the single largest volume processor and user of wood biomass in the Twin Cities metro area. As a result, EWS and SPC continue to play a critical role in enabling low-cost management of logs and brush from the tree care industry, as well as other local wood waste streams. District Energy's subsidiary [Ever-Green Energy](#) is contracted to operate and manage the biomass-fired combined heat and power (CHP) plant that uses roughly 67% of the metro area's wood waste<sup>6</sup>. The plant utilizes around 260,000 tons of woody biomass annually as its primary fuel source, to produce approximately 25 megawatts of electricity and up to 55 megawatts of heat.

Wood waste arrives at Pig's Eye Wood Recycling Center – owned by the City of Saint Paul, and operated on contract by EWS – for biomass processing. Pig's Eye has long been a site for collecting and processing of tree waste, and played a critical role in storage of tree waste during the area's Dutch Elm Disease epidemic. The site accepts regional wood waste in the form of chips, mulch, brush, and logs, from sources including: forest maintenance work, EAB compromised tree removals, storm damage, land development, and clean residues from other wood processors. Private and public agencies of varying size utilize Pig's Eye for wood waste off-take, where in turn it can be processed into biomass fuel and brought to SPC for energy production. See **Figure 4** for a diagram that describes the plant's wood waste flow.

[Xcel Energy](#), a national public utility based in Minnesota, holds a power purchase agreement with SPC for renewable electricity. A recent extension of the power purchase agreement through December 31, 2024 together with thermal energy sales to District Energy presents an interim funding solution to cover operational fees and processing.<sup>7</sup>

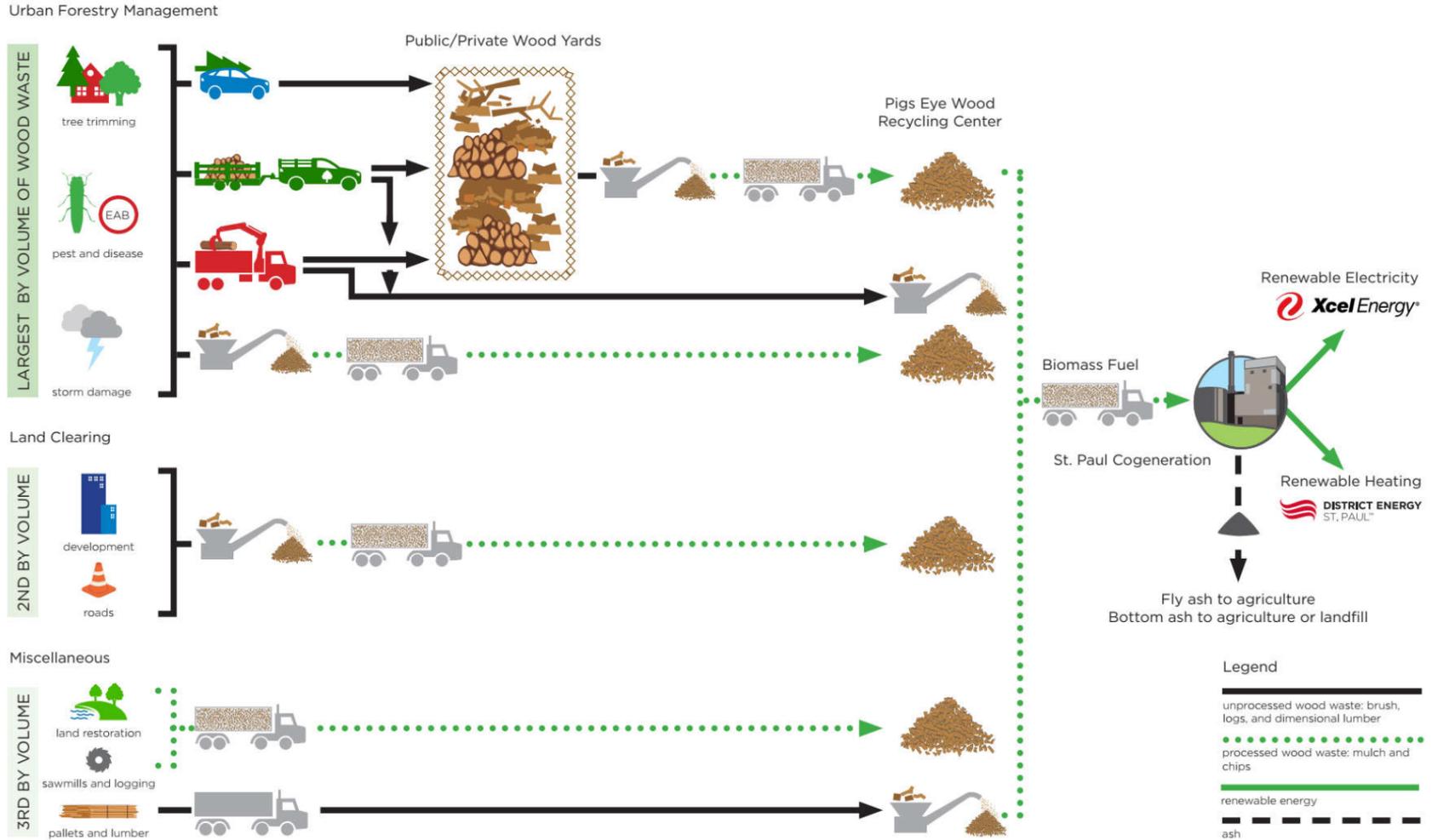
Yet without further continuance of the power purchase agreement, costs may prove prohibitive for EWS to maintain current wood processing volumes. Ken Smith, President and CEO of Ever-Green Energy and District Energy St. Paul, estimates that given current inflationary pressures on operating costs and in order to compete with other sources of power – including wind and solar – a subsidy of up to \$30/ton may be required to continue processing wood waste into bioenergy at present scale.

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<sup>6</sup>To determine the percentages of final wood waste distribution across the Metro Area, data were aggregated from over 30 MPCA Compost Facility Annual Reports, 15 stakeholder interviews, and 2 datasets provided from private organizations. Given the small sample set and lack of standardized reporting for wood waste management, this is viewed as a general estimate.

<sup>7</sup> Recent approval for extension from the State legislature occurred in 2021, as part of the revised Subdivision 5 of the [216B.2424 Biomass Power Mandate](#).

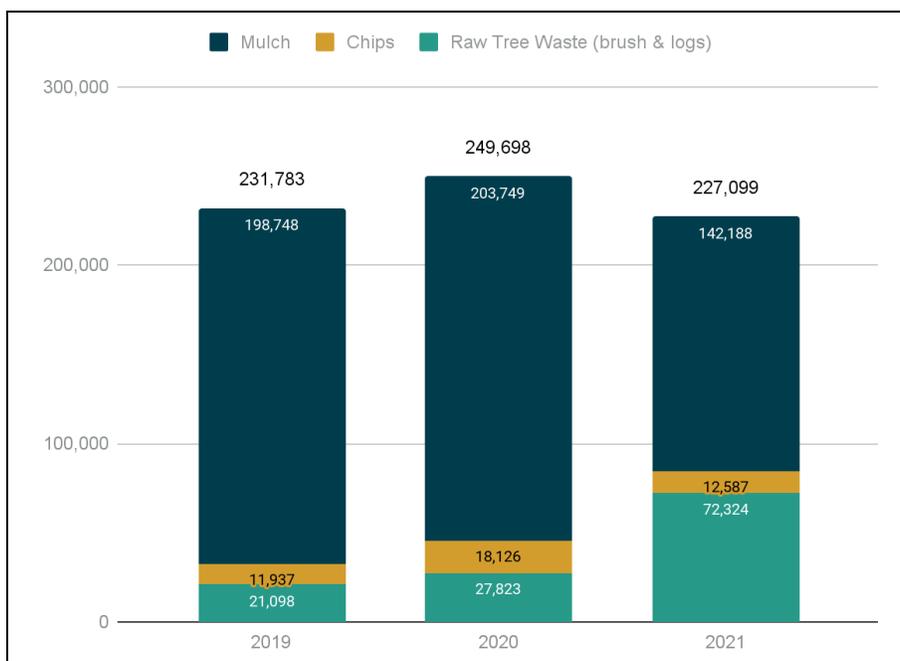
## WOOD WASTE FLOW DIAGRAM ST. PAUL COGENERATION



**Figure 4: Wood Waste Flow Diagram St. Paul Cogeneration**  
District Energy St. Paul, Ever-Green Energy (sourced September 2022)

While Environmental Wood Supply has managed the Pig's Eye collection site for almost 20-years, via an agreement with the City of St. Paul, it is unclear what would happen to the yard should SPC cease operations after 2024 and EWS fail to extend its contract with the city beyond 2024.<sup>8</sup> The City has received some complaints from community members, given the site's location on City park land.

Between 2019 to 2021, a majority of the wood waste processed by Environmental Wood Supply was mulch or chips (see **Figure 5**). This percentage decreased by 20% in 2021, with over 70,000 tons of logs & brush processed. While EAB tree removals have still not peaked, EWS expects it will process similar logs & brush numbers in 2022.



*Note: 2021 was a drought year. Drier wood resulted in a higher BTU content of biomass fuel than in 2019 & 2020*

**Figure 5: Estimated composition of wood waste at EWS**  
Environmental Wood Supply (sourced September 2022)

Although EWS and SPC remain the largest wood processors in the region, physical capacity remains an ongoing issue. During the summer of 2022, an influx in volumes of tree waste led to multiple weeks of yard closures. EWS estimates that without these closures, the Pig's Eye site would have received roughly 100,000 total tons of brush & logs in 2022, a 30,000 ton increase in the total volume of raw tree waste (compared to 2021 totals) had there been space at Pig's Eye to safely store it.

According to self-reported vendor data, EWS has experienced a year-over-year uptick of EAB related waste within its brush and log inflows. Estimates show a margin of error between 5-10%,

<sup>8</sup> Environmental Wood Supply's current contract extends through June 2023; City of St. Paul staff anticipate its renewal through December 31, 2024 – the last date of the power-purchase agreement

with staff observations noting that some EAB related waste is missed in the self-reports from vendors dropping off material at Pig's Eye.



*\*Through Sept-2022. Jump can be attributed to the wood yard being closed to log & brush, and the requirement for EWS to still receive all EAB related activities from the City of St. Paul.*

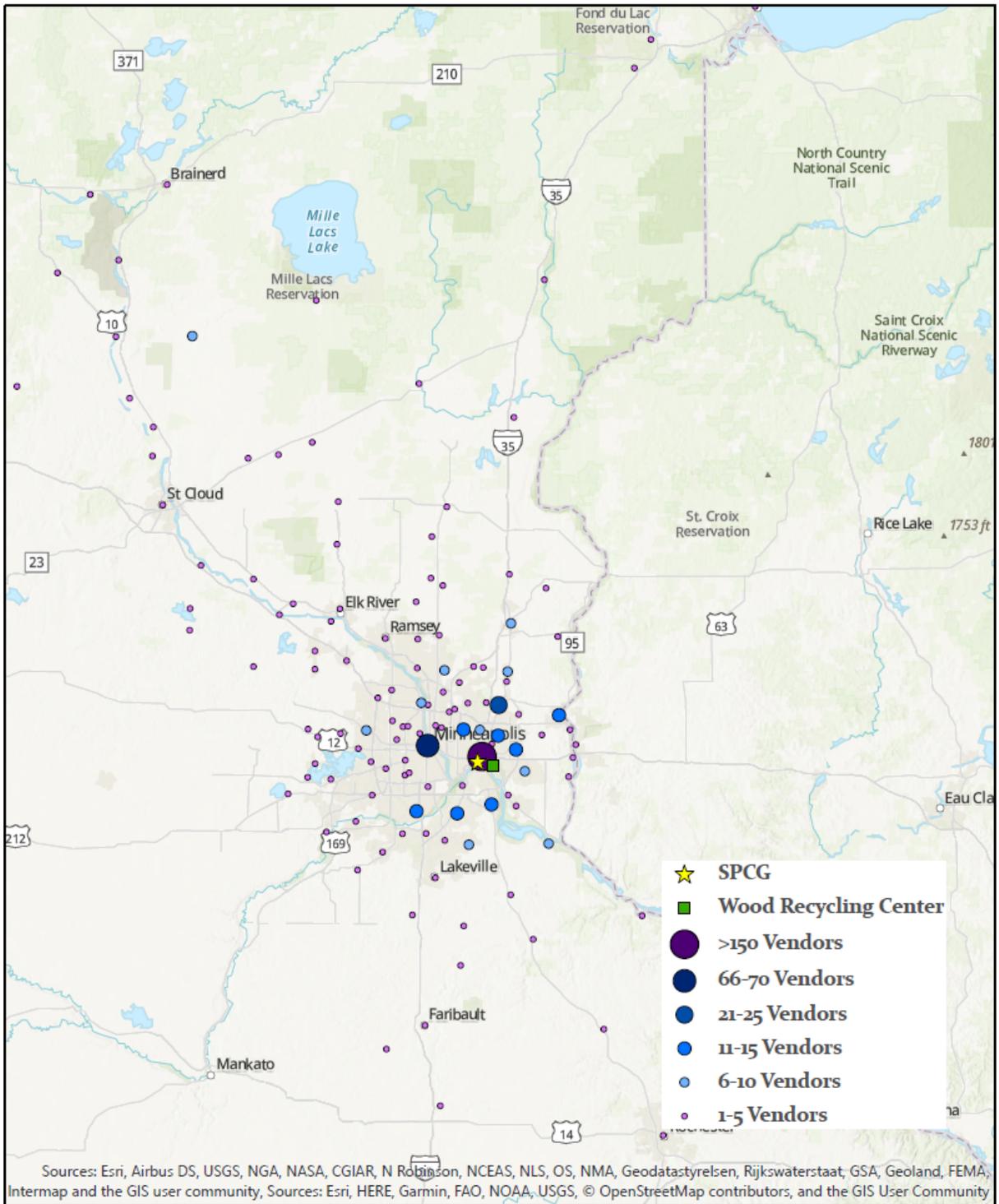
**Figure 6: EAB Related Brush & Logs at Pig's Eye Wood Yard**  
Environmental Wood Supply (sourced September 2022)

Not included are ground and chipped materials received at the wood yard, which can be as much as three-quarters of total volume. Because processed material is a mix of species, it is impossible to know the EAB-related material present in the waste stream.

Although over two-thirds of waste received comes from the 7-county metro area, the St. Paul Cogeneration plant has also become an outlet for wood waste outside the region. Between 2019 to 2021, District Energy processed biomass from over 200 private vendors, across almost 20 counties. The map in **Figure 7** shows the wide reach of its service area.<sup>9</sup>

While District Energy and its affiliates undoubtedly play a primary role in regional wood utilization, it is unclear how to finance ongoing operations at their current scale beyond termination of the power purchase agreement. Additional funding streams – whether through government subsidy or via the institution of tipping fees – will be essential to maintaining this critical piece of the wood waste management system.

<sup>9</sup>Analysis of data provided by District Energy, sourced September 2022



**Figure 7: Private Vendors Served by Environmental Wood Supply (Pig's Eye Wood Yard)**  
 Environmental Wood Supply (sourced September 2022)

## Koda Energy

The [Koda Energy](#) combined heat and power plant opened in late May 2009 as a partnership between Rahr Corporation and the Shakopee Mdewakanton Sioux Community generating electricity and thermal energy for the southwestern part of the metro area. Operational and infrastructure investments in the last decade have enhanced feedstock options (i.e. inclusion of urban tree trimmings in 2013), yet the facility's strict size and moisture specifications for biofuel have proven a limitation in capacity to process regional wood waste. As of January 2021, the plant transitioned ownership and operation to Rahr Corporation, the world's largest single-site producer of malted barley – since then, steps have been taken to increase Koda's role as an outlet for green woody biomass.

At Koda, byproducts from malting and food processing, along with raw materials like wood chips, grain dust, chaff, and other plant seed material are used to generate electricity and thermal energy. To maintain 100% output, Koda can process about 186,000 tons of dry biomass (~10% moisture content) annually, equivalent to roughly 250,000 green tons if burning only woody biofuels. Currently, Koda is utilizing about 80,000 tons of oat hulls in year 1 of a 3 year contract with General Mills and up to 50,000 tons of wood-related biofuels annually.<sup>10</sup> Dried wood chips trucked from Brainerd in Crow Wing County make up the majority of wood-related biofuels, with a small quantity of recycled pallet and crate materials.

The distance to transport woody biomass from Brainerd to Shakopee is over 130 miles – a long distance for regularly used biofuel. Yet this feedstock qualifies under the Minnesota Department of Agriculture's [AGRI Bioincentive Program](#), which offers payment for production of advanced biofuels.<sup>11</sup> For [biomass thermal energy](#), producers will be reimbursed at a rate of \$5.00 per MMBtu of production, after qualifying thermal loads have been switched from fossil fuel sources. Under the Biomass Thermal Energy Production Incentive Program, state payments are capped at 30,000 MMBtu annually: Koda reaches this threshold within the state's first fiscal quarter. Upon qualification, a producer maintains 10 years of eligibility. For Koda, their last claim will be in 2027.

At present, Koda has the capacity to absorb an additional 60,000 dry tons of wood waste per year – equivalent to roughly 80,000 green tons of wood waste – while still maintaining stable purchase volumes from existing suppliers. However, due to a lack of onsite infrastructure to process and store material, Koda has strict specifications for delivery. All deliveries of processed wood fuel must be less than three-quarters inch in size and less than or equal to 10% moisture content: these requirements can prove unattainable for small tree care operations.

Within the period of this study, emissions modeling for proposed installation of a wood chip dryer at the facility has begun, with the goal to permit, construct, and commission by December 2023. With the dryer in place, Koda will be able to directly receive and utilize three-quarter inch green

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<sup>10</sup> Interview with Stacy Cook, September 2022

<sup>11</sup> See the [AGRI Bioincentive Program](#) of this report for further analysis.

wood chips, dramatically opening up supplier options. Stacy Cook, VP of Sustainability at Rahr Corporation & President at Koda Energy, expressed that the “intent of this project is to ensure that [Koda] is an able partner with the ability to reduce the waste material burden on the region”.

Owning and operating a wood yard for raw brush and logs is under consideration. The goal would be to find a location within 5 miles of Shakopee, wherein waste does not need to be delivered pre-processed. Highlighted as a project in the pre-planning stages, the wood yard would likely be developed after dryer installation.

Koda Energy, as the only other local biomass energy plant, has the potential to provide a significant capacity increase for wood waste management in the metro area. Through capital investments in equipment, Koda can support diversification of waste offtake for chipped material. Additional infrastructure investments in capacity building – such as a yard that accepts raw brush and logs – would be critical to processing more wood waste material.

## **Mulch & Compost**

Specialized Environmental Technologies, Inc. (SET) & The Mulch Store

Established in 2000, [Specialized Environmental Technologies, Inc. \(SET\)](#) hosts the largest organics composting operation in the Twin Cities metro area. SET owns and operates four yard waste processing and retail outlets, and processes over 25,000 tons of Source Separated Organic Material annually. In addition, the company is one of the largest processors of yard waste, accepting over 80,000 tons of yard, brush, and biomass waste each year. These organic materials are composted and turned into soil amendments and blends used for the horticultural, organic farming, infrastructure and other industries around the state.

Between 2020 and 2022, SET has seen an increase in incoming wood waste of roughly 10%, which is assumed to be driven by ash tree removals. Dropping off any yard waste, wood waste, soil & sod at SET requires a fee: currently \$15/cubic yard for brush & logs and \$9/cubic yard for wood chips. As expressed by other stakeholders, SET anticipates that tipping fees will increase from the cost of fuel and other inflationary pressures. Roughly 80% of this wood waste is transferred to Environmental Wood Supply, and the other 20% is used within SET’s retail arm, The Mulch Store, as compost or mulch.

Although SET views its wood waste as a “side business” to their source separated organics, they recognize their role as a major processor and continue to search for other outlets in need of chipped materials, due to saturation in the mulch market. One less common use they have seen is the application of wood chips by construction and energy crews to keep the ground warm in cold months. The company has also expressed interest in the use of biochar products, but has been hesitant to explore further due to the expense of production and lack of secure offtake partners. SET still suggests that a best case scenario for their operations would be in the form of a subsidy, to allow Environmental Wood Supply to process woody biomass for energy.

## SMSC Organics Recycling Facility

Opened in 2011, [SMSC Organics Recycling Facility](#), is owned and operated by the Shakopee Mdewakanton Sioux Community (SMSC). The operation recycles organic material from residential, commercial, and municipal customers that is then processed into natural fertilizer, compost, or mulch. Between 2019 and 2021, SMSC Organics Recycling Facility averaged about 23,000 tons of wood waste annually; 2022 volumes are anticipated to reach 27,000 tons. Roughly 80% to 90% of SMSC's wood comes from municipal sites, where it is ground onsite before being hauled to the facility for processing. Any additional material, not transported to SMSC for feedstock, is taken directly to Environmental Wood Supply, and not reported as "received" in annual reports. All chipped wood is mixed, making it difficult to know the species makeup. EAB infestation concerns are mitigated when the material goes through a high-temperature composting process.

With a new facility expansion targeted for the end of 2023, SMSC's goal is to grow capacity to process roughly 37,000 tons of wood waste annually, a 10,000 ton increase from present capacity. Although the expansion offers the opportunity to scale higher-use utilization, SMSC awaits the permitting from the Minnesota Pollution and Control Agency (MPCA) before it can be operational.

## Alternative Wood Processing

### Biochar

One emerging opportunity for utilizing urban tree biomass is in the production of biochar, a carbon-rich charcoal derived from pyrolysis of organic material in a low-oxygen environment. Biochar has been proven to [sequester carbon](#) as well as improve soil and plant health when reincorporated into landscapes; as a result, its production from wood waste is considered an opportunity for [carbon offsetting](#) as well as the derivation of a value-added product with benefits to soil health.

Over the past decade, the City of Minneapolis has been analyzing opportunities to produce biochar from local wood biomass. A [recent grant](#) from Bloomberg Philanthropies will help enable the city to pilot a pyrolysis unit that will process up to 10,000 tons (initially 6,000-8,000) of green wood into biochar annually. Although these volumes are small compared to the region's total available wood biomass, the pilot may prove a first step in developing larger markets and processing capacity necessary to scale biochar production as a piece of the regional wood utilization puzzle.

### Modular Mobile Technologies

One concern vocalized by tree care companies and government stakeholders with respect to the growing strain on regional wood waste management systems was the fear that lack of

cost-effective disposal pathways or storage sites would result in open burning of biomass. Logs, brush, and chips present a bulky waste stream – with commensurately high transportation and disposal costs – creating an incentive to reduce biomass volumes close to the point of waste generation. One potential strategy for onsite management of wood waste is the deployment of mobile wood processing technologies, which can be moved to various locations depending on dynamic needs. An overview of various mobile and modular systems can be found [here](#), compiled and maintained by Martin Twer, Biomass Program Director of the Watershed Center.

### Lumber Products

[Wood From the Hood](#) is a hyper-local supplier of reclaimed urban wood from the Twin Cities. Transforming fallen trees into dimensional lumber, slabs, tables, and other artisanal wood products, Wood From the Hood processes roughly 100 tons of tree waste annually, with ash trees comprising 70% of that waste – placing their operations the highest in utilization on the tree waste management hierarchy<sup>12</sup>. A recent grant from the Partnership on Waste & Energy of \$24,000 is intended to help increase the company's processing capacity to over 600 tons annually<sup>13</sup>. At present, a majority of logs are sourced from the City of Minneapolis, rather than private arborists. When a tree is earmarked for removal, Wood From the Hood will have an opportunity to evaluate and mark the log for salvage, then hiring a tree care contractor to haul the material.

With logs sourced from an urban environment, the milling process requires an additional step of metal detection. Despite Wood from the Hood's efforts to avoid contaminant metal, blades are frequently damaged by embedded objects, increasing cost and slowing processing<sup>14</sup>. This type of metal contamination – in addition to the heterogeneity of species and a lack of uniform growth patterns – is often cited by traditional sawmills as a barrier to utilizing urban lumber. Similar to traditional drying processes, it takes Wood From the Hood about two years to turn a salvaged log into a ready product. Lead time requires ample space for long-term storage and the ability to adapt quickly to different design concepts.

Wood From the Hood is deeply rooted in its community and the storytelling aspect of each reclaimed wood product. Yet to scale this hyper-local model and put wood to its highest use, an efficient supply chain network requires development. Rick Siewart, co-founder of Wood From the Hood, cited two potential developments to enable greater wood salvage. First, by pruning trees to enable longer stems, arborists can help create saw logs of a minimum 6.5 feet before branching, making more trees potentially eligible for milling at end of life. Second, by creating procurement specifications to require a minimum percentage of local or reclaimed wood use, cities and local businesses could help develop the market to catalyze greater wood salvage.

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<sup>12</sup> See page 11 of the EQB Report from 2019, Emerald Ash Borer in Minnesota.

<sup>13</sup> [Partnership on Waste & Energy Board Minutes. May 26, 2022.](#)

<sup>14</sup> [Creating Natural Edge Wood Slabs from Reclaimed Urban Trees. Wood From the Hood. June 2022.](#)

## Thermally Modified Wood

[Arbor Wood Co.](#), established in partnership with the University of Minnesota's [Natural Resources Research Institute](#) (NRRRI), is a producer of thermally modified wood. Thermal modification is a controlled pyrolysis process through which wood is heated in the absence of oxygen, then reconditioned with steam to a moisture content of 4 to 6%. In this environment, the cellular composition of the wood is altered, resulting in a more stable wood product that is naturally decay resistant and can be used in a variety of indoor and outdoor applications, including siding, decking, trim, and other millwork. Thermal modification allows for lower quality wood to be utilized, including species with traditionally lower secondary value.

Arbor Wood Co. has been growing quickly, and cited a need for ash in its products, along with other local species.<sup>15</sup> The company holds more than \$10 million worth of pending contracts<sup>16</sup> and aims to process 2 million board feet annually (roughly 11,000 tons), within 5 years. A thermal modification kiln in Grand Rapids, roughly 75 miles from their headquarters in Duluth, is scheduled to be operational by the end of 2022. Without full scale milling capabilities, rough sawn lumber is expected to be purchased for thermal modification and finishing.

Thermal modification by Arbor Wood Co. presents one opportunity to increase high-value utilization of ash logs from the Twin Cities metro area. Next steps would require further testing on urban logs for viability, as well as a more detailed assessment of potential program and marketplace development.

## Government & Policy Partners

State, county, and municipal government agencies, including third party policy partners have played integral roles in understanding, educating, and slowing the spread of EAB in Minnesota. In the absence of a singular entity tasked with owning wood waste management, agencies have developed various programs and resources aimed at addressing components of solution development.

### Minnesota Department of Agriculture (MDA)

The MDA hosts the [Emerald Ash Borer Program](#) and has assumed the responsibility of tracking the spread of the invasive pest, in partnership with the University of Minnesota. The agency manages all quarantine and regulatory information, a list of ash tree removal sites, and administers compliance agreements for transportation of wood to non-quarantine zones. The MDA has played a critical role in early education about EAB, as well as providing resources for homeowners and natural resource professionals.

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<sup>15</sup> [Arbor Wood uses thermal modification for more durable products. Business North. December 2021.](#)

<sup>16</sup> [Thermally modified wood fines upscale markets in the US. June Brennan, NRRRI Marketing & Communications. March 2022.](#)

Separately, the MDA manages the [Agricultural Growth, Research, and Innovation \(AGRI\) Program](#) to support the advancement of Minnesota’s agricultural and renewable energy industries<sup>17</sup>. One critical component of this is the Bioincentive Program. Initiated in 2015, the program encourages commercial-scale production of advanced biofuels, renewable chemicals, and biomass thermal energy. Koda Energy, is one example of a private party participating in the biomass thermal energy component of the incentive program<sup>18</sup>.

### Minnesota Pollution Control Agency (MPCA)

The MPCA holds a few central roles when considering the management of wood waste in the Twin Cities: facilitating the annual report for [SCORE](#) (Select Committee on Recycling and the Environment), preparing the [Metropolitan Solid Waste Management Policy Plan](#), and permitting [compost facilities](#) and other organic drop-off sites.

Funded by tax revenues on solid waste management services, MPCA’s SCORE program acts as a funding mechanism for counties to implement recycling programs and other solid waste management plans. About 20% of solid waste funding for counties comes from SCORE with distribution proportional to population. In addition, the MPCA is the state agency responsible for summarizing waste management efforts across Minnesota including costs, waste reduction activities, and material collection.

The MPCA is the best positioned agency to understand the amount of wood waste materials within the state due to their solid waste annual reporting requirements and ownership over SCORE reporting. However, regulations do not currently require wood yards to hold permits, exempting them from reporting to the MPCA in the same manner as other compost, recycling, and solid waste sites. MPCA is currently considering implementation of wood waste reporting requirements via SCORE reporting at the county level, or solid-waste structure permits (for private and public organizations). Prior to adoption, there will be a public comment period available. A key piece to managing wood waste in the future will be the facilitation of centralized data collection and reporting.

Every six years the MPCA prepares a Metropolitan Solid Waste Management Policy Plan. The over 300 page document describes regional objectives and strategies for solid waste management, while setting goals for waste reduction, recycling, and organics recovery, including related sustainable material management practices. Counties within the seven-county metro area select strategies from the plan for implementation. The 2022 plan is estimated to be published in January 2023. For the first time counties will be required to have a plan for managing wood waste through three main objectives: flattening the waste curve, supporting existing end markets, and identifying future end markets that don’t exist today.

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<sup>17</sup> See the [AGRI Bioincentive Program](#) of this report for further analysis.

<sup>18</sup> See the [Koda Energy section](#) of this report for further details on participation.

## Minnesota Department of Natural Resources (DNR)

The Minnesota DNR has had a rich history of providing a variety of support to forest products and related industries in the state<sup>19</sup>. Today, their most prominent roles related to wood waste management include: grant administration for communities managing EAB infested trees, regulation of burn permits, facilitation of a timber utilization & marketing program, and participation in the nationwide [USFS Forest Inventory and Analysis \(FIA\)](#) program.

The DNR received \$2.4 million dollars of state funding for ash management, removal, planting, and treatment to be distributed to local units of government through [EAB grants](#). Two members of DNR staff interviewed for this report expressed concern that their work is not far enough reaching to show true waste management impact. Beyond this program, concerns exist around the reduction of general grant funding and how to support communities at scale without the proper resources.

The DNR is also responsible for issuing burn permits within the state, depending on the requesting county. Several counties, including the entire seven-county metro area fall outside of the regulation of the DNR and are tracked and managed separately.<sup>20</sup> For this reason, measuring the volume and materials burned is difficult to track.

For decades, the DNR's [Utilization and Marketing Program](#) has been active in promoting Minnesota's wood-based economy. The program's "Mill Maps" and directory for "Primary Forest Products Producers" help connect traditional industry partners and grow the wood market. Additional resources include technical skills and marketing guides for beginners in wood products manufacturing. Although there was once a robust program for the Twin Cities and urban wood utilization at large, over the past 12 years the team has declined from 5 to 2 staff, and now struggles to maintain past service offerings.

Statewide tree inventories have always been a key function of the DNR; nationally, Minnesota's FIA inventory is one of the most robust state databases. A partnership with FIA has also resulted in an annual report analyzing Minnesota's forest resources and timber industrial use trends. The City of Minneapolis has additionally begun conducting analysis of its canopy as part of the Urban FIA program, with anticipation of data being available within the next year. These resources provide critical data management tools to understand current tree canopies, while working with forestry experts to improve existing wood utilization markets and identify new opportunities.

## County Partners

At the local level, ownership of tree maintenance on public landscape varies between city and county. Municipalities with forestry or parks staff often manage this work, or contract with a private company (as in St. Paul and Minneapolis).

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<sup>19</sup> [Using Industrial Urban Clusters to Build an Urban Wood Utilization Program. Dovetail Partners, Inc. June 30, 2010.](#)

<sup>20</sup> [MN DNR Burning Permits.](#)

Ramsey County operates seven total residential yard waste facility sites, of which four accept raw brush and logs. Of the three Partnership on Waste and Energy counties, Ramsey provides the most comprehensive county-facilitated yard waste collection system. All wood waste received at the residential drop sites is processed on-site by a third-party, with a majority hauled to Environmental Wood Supply. A small amount of mulch is left behind for public use. In instances when a private contractor is completing removal work for Ramsey County, the company is asked to use the county sites to drop commercial tree waste, to avoid the added-cost of tipping fees at other private yards.

Washington County owns one yard waste facility in Hugo that opened a few years ago. OTI, a private wood and yard waste processor, operates the yard as a transfer facility, chipping logs and brush on site before transporting processed material to Environmental Wood Supply. The site in Hugo is interim through 2023; a combined hazardous and yard waste facility with greater capacity is being developed in Forest Lake. Given that Forest Lake is on the northern edge of the County, Washington is working to identify an additional centrally-located yard.

In contrast, Hennepin County does not operate any yard waste drop-off sites, rather directs residents to use local private yards or city-operated sites. According to Hennepin County's Forester, Hennepin's 45 cities manage their yard-waste collection independently. To operate a county owned yard site would require Commissioner approval to take consequent steps to acquire land and staff appropriately.

For commercial operations within all three counties, tree care companies are required to utilize privately owned yards, such as Environmental Wood Supply, SET, and Rumpca Companies.

Although county-level tracking of solid waste data currently exists through the annual SCORE report, wood waste is not a required material to track, and consequently is not measured. Where counties run their own yard-waste sites, annual compost facility reporting requires data collection for brush and log materials received and transferred. In both instances, data is reported to MPCA. During stakeholder interviews, one major theme surfaced: a preference for State guidance regarding wood waste planning.

#### Minnesota Shade Tree Advisory Committee (MnSTAC)

The [Minnesota Shade Tree Advisory Committee \(MnSTAC\)](#) is a volunteer organization that has acted as an advisory and advocacy group for the state of Minnesota regarding the best ways to "preserve, protect, expand, and improve Minnesota's urban and community forests". As of 2015, the committee has been working diligently to bring awareness to EAB and encourage a comprehensive statewide strategy. More specifically, MnSTAC's goal is to try to use treatment to preserve at least 20% of community trees. Karen Zumach, current President of MnSTAC, noted that while more than \$15 million has been granted to communities for inventory, removal, and replanting, funds have not been commensurately allocated for pesticidal treatment or wood waste utilization. Overall, Zumach views preserving District Energy's St. Paul Cogeneration as the only option in the short-term to manage Minnesota's high volume of wood waste. For the

longer-term, she notes that ownership by an agency at the state level is critical for monitoring and incentivizing alternative markets.

### Great Plains Institute

The [Great Plains Institute](#) (GPI) is a nonprofit, nonpartisan organization working to find strategies that focus on economy-wide decarbonization in major emitting sectors. Through research, consensus-building, and advocacy much of their work has been focused on transforming the energy system via electrification and low carbon fuels.

The Bioeconomy Coalition of Minnesota, a partnership facilitated by GPI, supported a recent project to identify emerging markets for wood. Themes from the resulting [white paper](#) included:

- Reinforce viable existing markets, including investments in further development
- Identify markets for wood residuals, underutilized species, and bug-kill wood
- Explore new technologies including engineered wood construction materials, wood pellets for heating and electricity generation, and other forms of biofuels and biobased chemicals
- Fully fund the Bioincentive Program, considering a “low carbon fuel policy to create incentives for wood-based biofuel production”
- Expand the role forest product industries can play in enhancing the natural environment

Brendan Jordan, co-author of the white paper and Vice President of Transportation and Fuels at GPI, noted that there is still too much wood biomass in the metro area to lose District Energy as a resource. While other unconventional woody biomass utilization options exist – such as sustainable aviation fuel – research and development in these areas is still policy and funding dependent. In consideration of ash wood specifically, he recommended thermal modification efforts for lumber products or biochar, which both offer small yet growing markets. Jordan’s best case scenario for wood waste management would be developing a supply chain that offers the most carbon removal benefit through high-value products, but is concerned that the collective political will to solve the problem is missing.

## Wood Waste Flows

In an effort to map the material flow of wood waste in the Twin Cities metro, data were collected via stakeholder interviews, MPCA Compost Facility Annual Reports, and private businesses. Based on available information, **Figure 8** outlines an approximated Sankey diagram of wood waste inputs and outputs in the region, with a focus on Hennepin, Washington, and Ramsey counties. A summary of data sources is provided below:

- **Stakeholder interview data** – 8 total organizations shared estimated wood processing volumes verbally, including Koda Energy, anticipated biochar production from the City of Minneapolis, Wood From the Hood, Rumpca Companies, and four mid-to-large tree care

companies (Hugo Tree Service, Vineland Tree Care, Precision Landscape & Tree, and Davey Tree).

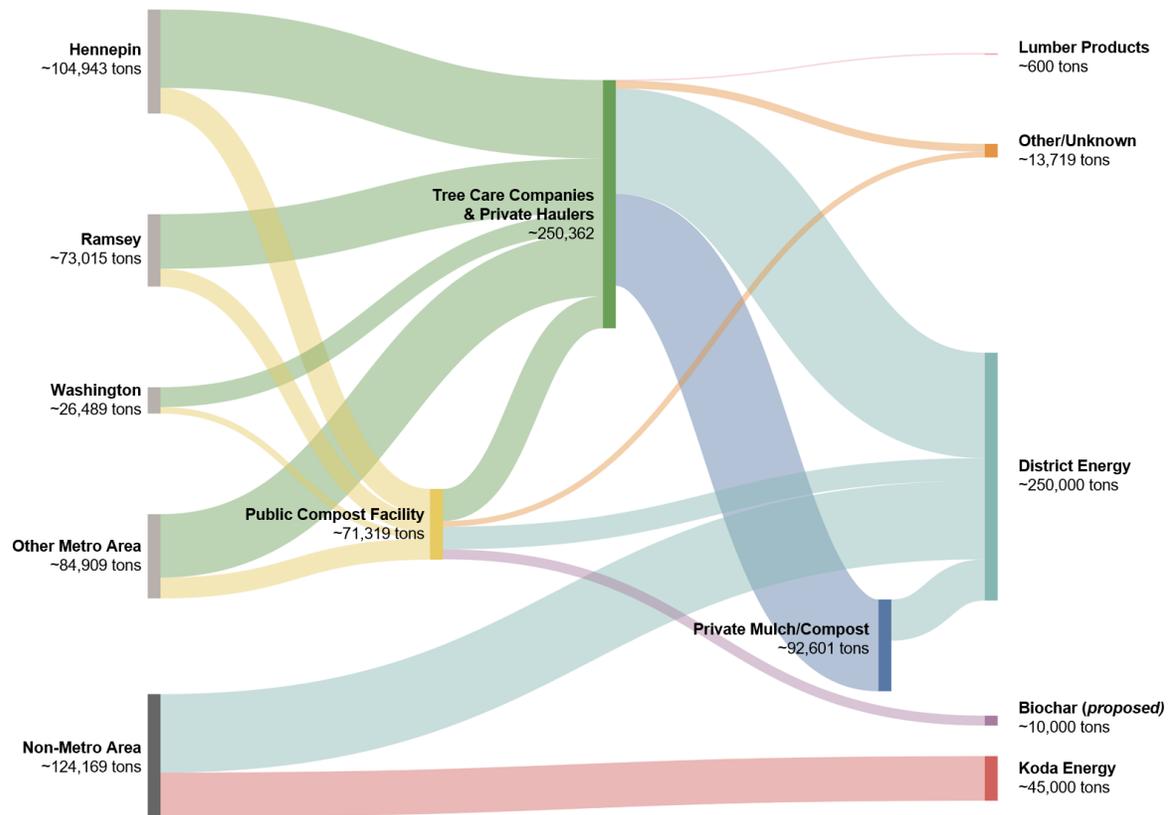
- **Analysis of stakeholder provided data** – 2 organizations sent physical copies of data. District Energy shared the data previously reviewed and Rainbow Treecare shared exact volume reports for 2021.
- **MPCA Compost Facility Annual Reports** – Annual reports of 35 composting facilities found on [MPCA's composting facility locator map](#) within or adjacent to the border of the 7-county metro area were requested from the MPCA for 2019 to 2021. In total, only 28 facilities had at least one annual report from the requested years. Only 22 of the 35 had all three annual reports between 2019-2021. In total, 70% of the requested data were available or reported to MPCA for inclusion.

Given a lack of standardized reporting requirements for wood waste management – particularly among tree care companies and non-reporting private utilizers – this small sample size was used to understand potential ratios of material transfer. In order to more accurately gauge the various pathways from wood waste generation sources through end biomass utilization, a detailed waste audit should be completed to better understand the scope of material managed by non-reporting agencies and further validate assumptions made within this report.

Data from District Energy were the most robust, and therefore used as the foundational volume assumption (roughly 250,000 tons/year processed for bioenergy). The applicable percentages of other organizations, based upon the sources listed above, were applied against the District Energy volume to provide tonnage estimates found in the Sankey. Unaccounted for in this model is the unknown amount of waste illegally dumped or open-burned. See **Figure 8** on the following page. For a detailed review of methodology and assumptions see the [Appendix](#).

The Sankey diagram serves to highlight a few observations about the current wood waste management system in and around the Twin Cities:

- There is a strong reliance on District Energy as a final outlet for wood biomass, even among intermediary compost facilities.
- Tree care companies are the primary source of regional wood waste generation; as a result, their decisions regarding disposal are critical to shaping where wood is processed and ultimately how biomass is utilized.
- There are roughly 125,000 tons of wood waste generated annually outside of the metro area and transferred for processing within it (including at Koda Energy).
- There is significant growth potential to increase the flow of wood waste into product applications such as lumber and biochar.



**Figure 8: Twin Cities Wood Waste Flow Sankey Diagram (Illustrative Only)**

## Evaluating Wood Utilization Strategies

With more than 400,000 tons of wood waste flowing through the Twin Cities system, how wood biomass is managed has a significant implication for associated social, economic, and environmental impacts. Given the rising costs of wood waste disposal through historical channels such as bioenergy and mulch, there is increasing interest in finding opportunities to process wood into value-added products such as lumber and biochar. Yet to date, a lack of infrastructure capacity and end market development have constrained diversion of wood waste into these supply chains. When evaluating various products applications from regional wood waste, the following priorities may be considered:

### Cost of implementation:

A critical determinant of end wood utilization pathways is the cost to develop new programs or infrastructure to move more material through a processing. Costs for value-added wood product fabrication range from procurement of equipment to labor costs. Deployment of localized modular Air Burner equipment ranges from [\\$52,000 to \\$870,000](#) depending on technology and electric and thermal energy generation capabilities.

While upfront capital investments may present a hurdle to expanding wood utilization pathways, rising tipping fees for disposal of wood at large-scale biomass processing facilities also presents a significant cost burden. Based on projected wood waste volumes within PWE counties, **Table 1** estimates various scenarios of disposal costs across Hennepin, Washington, and Ramsey counties, if all county wood required payment of a tipping fee. Different cost thresholds were based on interviewed processing facilities' current or anticipated per ton fees.

	2021	2022	2023	2024
<b>Estimated wood volume (tons)</b>	213,013	224,673	236,327	247,976
<b>\$ per ton</b>	<b>Estimated cost of disposal</b>			
<b>\$25</b> (SMSC)	\$5,325,337	\$5,616,833	\$5,908,186	\$6,199,394
<b>\$30</b> (EWS - projected)	\$6,390,404	\$6,740,200	\$7,089,823	\$7,439,273
<b>\$54</b> (SET)	\$11,502,728	\$12,132,360	\$12,761,681	\$13,390,691
<b>\$72</b> (Gertens)	\$15,264,546	\$16,100,091	\$16,935,223	\$17,769,943
<b>Average</b>	<b>\$9,620,754</b>	<b>\$10,147,371</b>	<b>\$10,673,728</b>	<b>\$11,199,825</b>

**Table 1:** Cost scenarios for paid disposal of wood waste in Hennepin, Washington, and Ramsey

Average estimated costs highlight that the utilization of free disposal via Environmental Wood Supply has had a tremendous impact on alleviating the cost burden of wood waste management in this tri-county area. In the future, the institution of tipping fees for the bulk of wood waste management will have a significant impact on public and private wood waste management costs, as well as intermediary tree care companies.

### Potential economic value:

The potential to recoup costs from wood biomass is a critical factor in considering wood utilization strategies. The utilization of wood for lumber production (via traditional milling or thermal modification) can yield upward of \$1,000 per salvaged ton of wood, with significantly greater potential for development of a skilled local workforce. By contrast, mulch and biomass energy present a relatively low-value but high-volume offtake pathway. In the middle, biochar may offer a high-value utilization strategy (with additional carbon offsetting revenue potential), yet end markets for application in soil remediation and agricultural projects remain nascent and unproven.

### Environmental impact:

Because roughly 50% of a tree's biomass is carbon, pathways such as decomposition (mulching, compost) or open burning without efficient heat or energy capture contribute to the

formation of harmful greenhouse gasses. Per unit of heat or electricity, wood biomass creates greater greenhouse gas emissions than fossil fuels.<sup>21</sup> When a single atom of carbon binds with two heavier oxygen atoms to create a molecule of CO<sub>2</sub>, the resulting carbon dioxide weighs 3.67 times the amount of its carbon content. As a result, the sequestration of carbon in stable wood products such as biochar and lumber can have a significant impact on reducing total greenhouse gas emission formation. A ton of biochar with 85% carbon content is estimated to sequester 2.18 tons CO<sub>2</sub>e after 100 years. Similarly, a single board foot of salvaged ash wood sequesters an average 4.92 lbs of CO<sub>2</sub>.<sup>22</sup>

Another consideration in maximizing the carbon benefit of wood utilization systems is collocation of wood processing to source brush and log generation. While factors such as zoning restrictions and infrastructure availability may constrain options, locating processing as closely as possible to anticipated tree removals and utilizing low-carbon vehicles for hauling biomass can help increase total carbon benefit.

### Capacity potential:

Finally, the total capacity for material uptake is another key criterion in evaluating investment in various wood utilization strategies. Mulch and biomass energy present high-volume uses of wood biomass across a spectrum of quality, species, and sizes. By contrast, thermal modification is limited by expensive kiln equipment (ranging from \$1-3 million per unit) as well as the fraction of high-quality, millable logs within the wood waste stream. Some processing technologies (such as Koda Energy's combined heat and power plant, or various biochar production units) may require specific preparation of wood feedstock, including standardized shredding and drying of material that may limit total use.

## AGRI Bioincentive Program

At present, the best avenue to incentivize highest and best uses for removed ash trees and wood waste at large is the Agricultural Growth, Research, and Innovation (AGRI) Bioincentive Program managed by the MDA. Initiated in 2015, the Legislature appropriated funds for incentive payments for production of advanced biofuel, renewable chemicals, and biomass thermal energy. In 2016, the program expanded to include incentive payments for the production of siding, which were then rescinded in 2017. As of 2021, the Legislature reinstated siding appropriations and added a new program to incentivize commercial scale production of oriented strand board (OSB).

Funding is determined at the biennium. Every fiscal year, should funding be depleted, distribution occurs on a pro-rata basis. Annual appropriation amounts are shown in **Table 2**. Funding for 2024-2025 is not yet determined. No funds are appropriated for the OSB production incentive until fiscal year 2025.

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<sup>21</sup> [Laganière et al. 2017](#). "Range and Uncertainties in Estimating Delays in Greenhouse Gas Mitigation Potential of Forest Bioenergy Sourced from Canadian Forests." *Global Change Biology Bioenergy* 9 (2): 358–69.

<sup>22</sup> Average of Green, Black, and White ash species. From [Dovetail Partners, 2018](#).

Biennium	Year 1	Year 2
2016-2017	\$500,000	\$1,500,000
2018-2019	\$1,500,000	\$1,500,000
2020-2021	\$2,500,000	\$2,500,000
2022-2023	\$4,500,000	\$4,500,000

**Table 2: AGRI Bioincentive Program Appropriations**  
MDA Minnesota Incentive Programs Annual Report (Amended March 2022)

Each of the five production types have specified requirements for minimum production levels and standards for sourcing the biomass feedstock. Qualifying facilities can receive payments for up to ten years, with programs scheduled to end in 2035. Annual maximum reimbursements per production type and individual facility vary. See **Table 3** and **Table 4**.

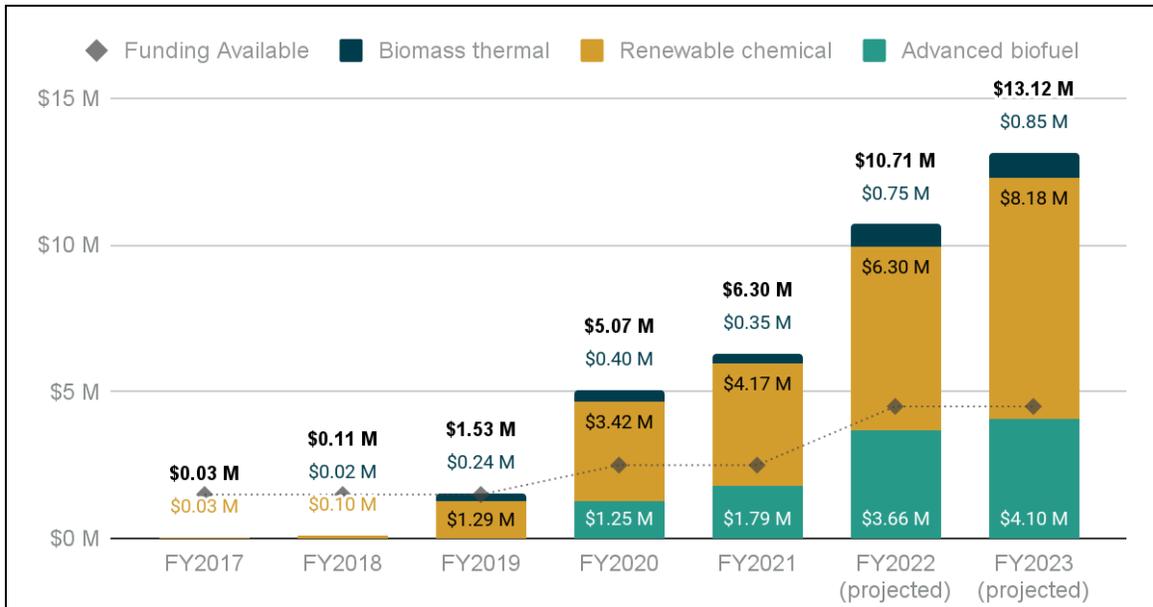
Production type	Maximum per production type	Low rate	High rate	Compensation at low rate	Compensation at high rate
Advanced biofuel	17,100,000 MMBtu	\$1.053	\$2.1053	\$18,006,300	\$36,006,630
Renewable chemical	599,999,999 pounds	\$0.03	\$0.06	\$18,000,000	\$36,000,000
Biomass thermal	150,000 MMBtu	\$5.00	\$5.00	\$750,000	\$750,000
Siding production	400,000,000 square feet	\$7.50	\$7.50	\$3,000,000	\$3,000,000
OSB production	400,000,000 square feet	\$7.50	\$7.50	\$3,000,000	\$3,000,000

**Table 3: AGRI Bioincentive Program Maximum Production Type Reimbursements per Year**  
MDA Minnesota Incentive Programs Annual Report (Amended March 2022)

Production type	Maximum per facility	Low rate	High rate	Compensation at low rate	Compensation at high rate
Advanced biofuel	2,850,000 MMBtu	\$1.053	\$2.1053	\$3,001,050	\$6,000,105
Renewable chemical	99,999,999 pounds	\$0.03	\$0.06	\$3,000,000	\$6,000,000
Biomass thermal	30,000 MMBtu	\$5.00	\$5.00	\$150,000	\$150,000
Siding production	400,000,000 square feet	\$7.50	\$7.50	\$3,000,000	\$3,000,000
OSB production	400,000,000 square feet	\$7.50	\$7.50	\$3,000,000	\$3,000,000

**Table 4: AGRI Bioincentive Program Maximum Facility Reimbursement per Year**  
MDA Minnesota Incentive Programs Annual Report (Amended March 2022)

Claims have been made across all six fiscal years of the incentive programs, with fiscal year 2019 being the first year claims were higher than funding. In FY20 and FY21, claims exceeded the total funding available by roughly \$2.6 million and \$3.8 million respectively. It is projected that claims will be approximately \$10.7 million in FY22 and \$13.1 million in FY23. See **Figure 9**.



**Figure 9: AGRI Bioincentive Program Claims**

MDA Minnesota Incentive Programs Annual Report (Amended March 2022)

In review of all claims submitted FY17 through FY21, biomass thermal energy only makes up 7.6% of total claims<sup>23</sup>, likely due to the production type having the least appropriated funds. Koda Energy, a facility that submits claims each year, reaches the maximum reimbursement within the first quarter. Under the current eligibility criteria, due to production of biomass thermal energy prior to July 1, 2015, St. Paul Cogeneration does not qualify for reimbursements. Furthermore, the current maximum incentive would cover less than 2% of St. Paul Cogeneration’s projected future funding needs,<sup>24</sup> even if the facility was eligible. Lobbying for a shift in allocation funds and/or an increase in funding for the biomass thermal energy category, along with an expansion to subsidize existing facilities, could play a significant role in keeping combined heat and power plants online as a major wood processor in the coming years.

The Bioincentive Program is a mechanism through which markets for value-added wood products can grow. Yet no claims have been made to date for the siding production incentive and there has been no expressed interest from producers when developing projections for FY22 and FY23. No further data for the OSB incentive has been collected, as it is scheduled to start in 2025. It is recommended that the program undertake an evaluation of interest in the siding incentive and further explore where market demand may be better met.

<sup>23</sup> See Table 5 within the [Minnesota Incentive Programs Annual Report, Amended March 2022](#).

<sup>24</sup> Assumes a \$32.50/ton tipping fee upon expiration of the PPA with Xcel Energy, processing 250,000 tons/year.

# Recommendations for Wood Waste Management

Based on stakeholder interviews and analysis of existing wood utilization data in the Twin Cities metro area, the following recommendations are offered toward increasing effective management of the growing region's wood waste stream:

## Support existing regional infrastructure including high-volume biomass energy plants and composting facilities.

A heavy reliance on Environmental Wood Supply and St. Paul Cogeneration has left the wood waste management system vulnerable to shocks including price increases and closures of the Pig's Eye Yard. Without EWS's processing capacity, it is impossible to absorb current material volumes through other existing offtake channels. Following initial interviews, Ken Smith noted that inflationary pressures and market conditions will necessitate both a new power purchase agreement and a subsidy of approximately \$30/ton will be required for EWS to maintain current wood processing volumes. In the absence of further continuance of SPC's power purchase with Xcel Energy, Smith does not see a path forward to continue operations. Implementation of a tipping fee to cover inflationary pressures and operating expenses passes the funding burden to tree care companies, already pressed with rising fuel and labor costs. One avenue to enable continued low-cost disposal of Emerald Ash Borer-driven wood waste, is to extend the MDA AGRI Bioincentive program or DNR EAB grants to subsidize utilization of ash wood in combined heat and power plants.

Koda Energy, as the only other local biomass energy plant, has the potential to provide a significant capacity increase for wood waste management in the metro area. It is recommended that the PWE counties and state agencies work with tree care companies to increase awareness of Koda Energy as a potential alternative disposal site, once the wood dryer is operational. With the proper equipment to grind and dry inbound wood to specifications usable by Koda Energy, the facility could pivot toward use of metro area wood waste as fuel for bioenergy and heat production. The City of Minneapolis or its surrounding counties might also consider leasing a public site to a private wood processor, such as Koda Energy, to enable expanded processing of raw brush and logs in future.

SMSC Organics aims to complete a new facility expansion by the end of 2023, with the ability to process an additional 10,000 tons of wood waste annually. It is recommended that the MPCA work closely with SMSC Organics to provide guidance and timely issuance of the required permits needed to ensure a fully operational facility.

## Expand wood utilization in lumber products via the AGRI Bioincentive Program and other policy levers.

To use wood to its highest and best use will require activating existing primary processors to absorb salvageable urban logs at scale. With mulch markets already saturated, incentives should be positioned to enable milling operations (traditional and engineered products) and other torrefaction (e.g. biochar) or thermally-modified businesses. This includes subsidies that

encourage substituting traditional lumber with urban lumber and supporting capital investments such as sawmills, kilns, or increased space.

The AGRI Bioincentive Program has highlighted the willingness of large-scale commercial businesses to participate in the advancement of regional biofuel production. In 2016, the program expanded to include production of building siding; in 2021, oriented strand board (OSB) was added as an additional wood product eligible for incentive payments. The Bioincentive Program presents an existing mechanism for growing markets for targeted value-added wood products. Through this avenue, the Minnesota Legislature can help encourage growth of underutilized supply chains for processing EAB-driven wood waste, such as biochar and lumber production.

At present, with claims higher than funding, opportunities exist to not only fully fund the program but also expand awareness in an effort to support alternative uses for wood waste. Marketing the new OSB incentive will be critical for incentivizing higher volume offtake options. Given that the siding production incentive has thus far not seen claims made to date, it is recommended that the program explore why underlying outreach efforts or incentive values have been insufficient to garner interest, and further identify where new incentives might better drive local market demand.

Arbor Wood Co. is pioneering thermal modification in the state, with expectations of a kiln operational in Grand Rapids at the end of 2022. The company's goal is to scale to processing 2 million board feet annually within the next 5 years. Root River Hardwoods, which processes roughly 4.5 million board feet per year, has a kiln facility about 115 miles southeast towards Rochester. About 40 miles southwest in Jordan, Siewek Lumber processes roughly 620,000 board feet per year. All 3 companies use traditional lumber practices, processing a combined 40,000 tons of lumber annually. Encouraging existing private businesses like these to adopt urban wood as an input in their supply chains can help divert waste toward higher value use.

Ultimately, creating procurement specifications to require a minimum percentage of local or reclaimed wood use, offering subsidies to transition to urban lumber, and developing large-scale incentives programs (like AGRI's), can develop the market to catalyze greater wood utilization.

### **Increase regulation of open burning of wood waste.**

Several stakeholders interviewed expressed concern that a lack of processing capacity for the growing wood waste stream would result in the open burning of wood as a cheap means for tree care companies to dispose of unwanted debris. Given the wood smoke's [hazardous effects](#) on air quality – including particulate and toxic chemical pollution – as well as the formation of carbon dioxide, open burning should be strictly mitigated to reduce both human and environmental harm.

At present all 3 PWE counties fall outside of the DNR's burn permitting system, leaving permits to the discretion of individual counties and making it difficult to track regional trends. While burn permit applications have trended upward in recent years, the current system does not track or cap total volumes of material, providing an incomplete picture of how much wood waste ends up

burned. In order to mitigate concerns of rising open burning of wood waste, it is recommended that PWE and the DNR work to institute improved reporting requirements to collect data and regulate open burning for Hennepin, Washington, and Ramsey counties.

### **Begin programs that support small businesses.**

The tree care industry supports local workforce development and acts as a critical public partner during emergency response situations (e.g. major storms). As the primary source of wood waste generation, availability of infrastructure and equipment, coupled with operations and labor costs contribute to the companies' ability to transport, process, and determine utilization of biomass. Yet margins are being squeezed for the industry and with shrinking capacity of wood yards, small tree care companies are further constrained by their lack of equipment to pre-process raw logs and brush.

In order to maintain the resilience of the tree care system and avoid pushing out small processors, PWE might consider providing grants or equipment loans to help small businesses maintain and expand operations. Support for capital infrastructure investments such as chippers or portable sawmills could help encourage better wood processing systems. Similarly, subsidies for transportation costs related to EAB wood waste management can support current operational inefficiencies that deter tree care companies from finding alternative outlets.

### **Establish additional city and/or county log collection yard with milling capacity.**

Aggregation and triage of the variable wood waste stream can support supply chain consistency and economies of scale needed by processors. Additionally, by developing sorting yards for wood waste, an individual city or county can provide oversight for higher-use processing of quality logs, before material is chipped and transported. While models for municipally-operated and private sector log yards exist, a public-private partnership model may be best suited to build upon the existing yard waste facilities in Ramsey and Washington counties and include availability for commercial use.

A log salvage program could feasibly run through an existing yard waste facility in Ramsey or Washington counties. Washington County presents a unique opportunity, given its ongoing active search for an additional combined hazardous and yard waste site: an expanded scope to consider land and resource allocation toward milling operations could increase high-value utilization on the new site. Ramsey County has several existing yard waste sites and is more centrally located within the metro area, presenting an option to earmark at least one of those sites for a commercially viable log yard.

Different lumber yard program models offer variable benefits including revenue creation, workforce development, and reduction of transport emissions related to moving heavy biomass. It is recommended that a specific county or city be identified to conduct an in-depth assessment regarding feasibility of such a program within a specific jurisdiction.

## Implement reporting requirements for wood waste processing and tree removals for public and private organizations managing woody biomass.

At present, no centralized reporting mechanism exists to aggregate wood waste data or track tree removals on private or public lands. Although the MPCA requires annual solid waste reporting, woody biomass will not be a necessary material to report until implementation of the next Metropolitan Solid Waste Management Policy Plan in 2023. Regardless of the reporting policy implemented – be that via self-reporting by counties in SCORE reports or facilitated through waste facility permitting – it is essential for county partners to fully adopt the new requirements.

Improving collection of tree loss/wood waste data can enable wood salvage efforts, as well as inform on management strategies for utilization. It is recommended to **complete an assessment to determine quality and quantity of material collected at current wood yards** to understand marketability for higher-use. Specifically, recording size, species, and conditions of removed trees can generate a clearer reflection of potential economic value capture. In instances where counties or municipalities use outside contractors to complete removals, requiring reports on wood waste volumes and composition could be made requirements of contract fulfillment.

Diverse supply capability within the Twin Cities from wood waste is still unknown. An in-depth study to test and process wood materials – in both chipped and raw form – should be conducted to attract existing private processors, as well as show viability for new markets. Together, Wood From the Hood's lumber use and burgeoning biochar processing technology would only assume 2.5% of future offtake; working to attract existing higher-volume businesses can support a more rapid on-ramp for utilization.

## Define clear roles and responsibilities at both county and state levels for agencies to play a more active role in wood waste management.

Many of the systems and initiatives previously in place, described in a 2010 study<sup>25</sup> as “well prepared for EAB,” have not met expectations in managing wood waste. A champion agency at the state-level is necessary to drive high-level program, policy, and data-reporting requirements. Complementary roles from peer agencies will further support development of a robust program. Via discussions with stakeholders, an understanding of ideal agency roles and responsibilities is delineated below:

- Minnesota Pollution Control Agency – manage data of wood waste flows, prepare recommendations for local solid waste management
- Minnesota Department of Agriculture – anticipate tree removal volumes due to pest tracking, maintain quarantine zone compliance
- Minnesota Department of Natural Resources – rebuild urban wood utilization & marketing team to actively engage and identify burgeoning wood markets, administer community grants for continued EAB management

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<sup>25</sup> [Using Industrial Urban Clusters to Build an Urban Wood Utilization Program. Dovetail Partners, Inc. June 30, 2010.](#)

- Counties – prepare for and adopt updated solid waste management plans including wood waste, act as good stewards in data collection efforts

Codifying these roles is the first step to maintaining accountability and ensuring continued progress of EAB regulation. The 2019 EAB report prepared for the Environmental Quality Control Board, and the subsequent [2020 Recommended Actions](#), are examples of successful interagency collaboration. Creation of a centralized system for wood waste reporting – utilized cooperatively across state government agencies – will be critical to successful management of this mounting waste stream.

### **Improve education and grow awareness to facilitate increased secondary log use.**

Across Cambium Carbon’s national market research, wood product buyers have demonstrated an overwhelmingly positive response to the local and environmental impact of salvaged wood. Education and advocacy – for both the public at large and tree care professionals – can be an influential factor in accelerating urban wood utilization. With the reduction of staff within the DNR’s Timber & Utilization Marketing Program, the PWE counties are tasked to take a more prominent role in promoting higher wood use in the metro area.

Educating arborists and tree care crews to cut quality logs to millable lengths can play a critical role in encouraging higher-use products. Supplemental opportunities exist for PWE counties to work with their municipalities to adopt pruning practices to enable longer stems, better suited for urban lumber use at end of life. Readily available, the Tree Care Registry hosted by the MDA offers an initial platform for outreach and establishing statewide best practices.

## **Next Steps for PWE**

- Work with Legislature and MDA to include an incentive for the use of ash wood waste in the AGRI Bioincentive Program, particularly related to biomass thermal energy
- Develop incentive programs with the MN DNR to encourage small wood-based businesses to utilize urban lumber
- Meet with all key state agencies to clearly delineate roles & responsibilities among the state and within counties
- Review and provide feedback on MPCA’s proposed requirements for wood waste data reporting during the available public comment period
- Implement contractual requirements for public tree removals that include reporting of size, species, and condition
- Complete an in-depth assessment for a specific county or city-owned wood yard with milling capacity to better determine scale & feasibility
- Activate education campaigns with MDA and MN DNR to train arborists and other tree care professionals on how to cut quality logs to millable lengths

# Appendix

## Item A: Sankey Methodology & Percentage Allocations

### Assumptions:

- 250,000.00 tons processed by DE (per DE data analysis and general average)
  - 68.30% from Metro Area of DE total (per DE analysis)
  - 36.30% from Hennepin County of total Metro Area of DE total (per DE analysis)
  - 25.20% from Ramsey County of total Metro Area of DE total (per DE analysis)
  - 9.20% from Washington County of total Metro Area of DE total (per DE analysis)
  - 29.30% from Other Metro Area of total Metro Area of DE total (per DE data analysis)
  - 31.70% from Non-Metro Area (per DE data analysis)
- 45,000.00 tons processed by Koda (Non-Metro Area per Koda Energy)
  - 600 tons processed by Wood From the Hood (scaling goals)
- 10,000.00 tons processed as Biochar (Jim Doten, City of Minneapolis)
  - 84% Tree Care from Metro Area (assumed from aggregated data)
  - 16% Tree Care from Public Compost Facility in Metro Area (assumed from aggregated data)

### Percentages of Utilization Type to Transfer (% Row Totals from aggregated data)

	Remains onsite	District Energy	Other/Unknown	TOTAL
<b>Bioenergy</b>	100.00%	0.00%	0.00%	<b>100.00%</b>
<b>Private Mulch/Compost</b>	55.10%	44.90%	0.00%	<b>100.00%</b>
<b>Public Compost Facility</b>	1.30%	78.80%	19.90%	<b>100.00%</b>
<b>Tree Care</b>	27.20%	67.70%	5.10%	<b>100.00%</b>
<b>Lumber Products</b>	100.00%	0.00%	0.00%	<b>100.00%</b>

### Percentages of Utilization Types within Transfers (% Column Totals from aggregated data)

	Remains onsite	District Energy	Other/Unknown
<b>Bioenergy</b>	67.00%	0.00%	0.00%
<b>Private Mulch/Compost</b>	17.80%	24.30%	0.00%
<b>Public Compost Facility</b>	0.10%	13.40%	42.10%
<b>Tree Care</b>	15.00%	62.30%	57.90%
<b>Lumber Products</b>	0.10%	0.00%	0.00%
<b>TOTAL</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>