

TECHNICAL MEMORANDUM

Date: September 24, 2018
To: Kinley Deller, Alex Erzen, King County Solid Waste Division
From: Phil Coughlan, Herrera; Colette Marien, C+C
Subject: Clean Wood Specification and Market Research

INTRODUCTION

In 2017, designated/certified construction and demolition (C&D) processing facilities in King County processed almost 129,000 tons of clean wood, with over 99 percent of this material processed into hog fuel and burned in industrial boilers. According to King County, over the same period, the prices paid for hog fuel dropped significantly and the number of mills accepting this material has declined; additional constraints exist for alternative uses of wood, such as compost and mulch. The combination of these factors causes considerable concern in the C&D industry as to the future of wood markets. Moreover, King County considers combustion of clean wood a single-use, low value use, and as bad to health and the environment as burning coal.¹

As a result, in 2018, the King County Solid Waste Division's LinkUp program placed added focus on supporting and developing the use of salvaged and recovered clean wood in manufactured/engineered wood products. LinkUp staff, through their consultant contract with C+C, asked Herrera to lead outreach to wood manufacturers and other relevant industry professionals to identify potential users of clean wood in manufacturing applications, identify and obtain relevant wood specifications that would support King County's Salvage Lumber Warehouse, and to research other market conditions relevant to expanding end markets available for clean wood.

This memorandum provides a summary of the outreach conducted, and conclusions and recommendations to move forward on clean wood market development activities based on the results.

METHODS

Herrera staff contacted the list of businesses shown in Appendix A, after consultation with King County staff on priorities. Priority contacts included northwest manufacturers with past activity

¹ Sound Resource Management Group LCA of clean wood waste management



using urban wood waste or who were interested in doing so (identified during previous wood outreach efforts), engineered wood product manufacturers, cross-laminated timber (CLT) manufacturers or users, paper mills, C&D processors, and others knowledgeable of local and regional wood markets. Of the 51 businesses contacted, Herrera staff interviewed 40, indicated in **red**. The remainder of the businesses were not interviewed because the calls were not returned, or the business was no longer in operation.

SUMMARY

Wood Markets / General

The consensus among interviewees is that markets for recovered urban wood are weak, with very limited immediate prospects for long-term strengthening. The combination of a decreasing number of wood biomass combustion boilers; large green and post-industrial supplies of wood from timber harvesting, sawmilling, and wood product manufacturing; large virgin chip supplies; and low natural gas prices are all contributing to the weak market. Contamination of wood waste with non-wood contaminants (e.g., metals, plastics, resin), grit, and rock is also hindering access to value-added applications and mulch. In addition, even without these issues, Washington State has relatively few remaining manufacturing facilities using wood as primary feedstock (compared with neighboring states), interjecting transportation costs as an inhibitor to market access.

Hog Fuel

While urban wood waste combustion is continuing to take place in the region (e.g., West Rock, Port Townsend Paper), many interviewees indicated that the supply of wood waste from timber harvesting, sawmilling, log yard wood waste, bark, and wood product manufacturing was displacing purchases of C&D-type wood waste. Boiler operators have significant ongoing uncertainty and concern about potential contamination from nails, paint, and wood preservatives in urban wood waste.

Some boilers have closed (e.g., GP-Toledo); a number have switched to natural gas (e.g., Carastar Industries, Enwave, Inland Empire Paper Co.); other boilers use black liquor or lignin (e.g., GP-Camas, International Paper Co, Clearwater Paper Corp, Ponderay Newsprint Co.); while others remain open but with a focus on non-contaminated clean wood (e.g., GP-Camas, Kapstone Kraft Paper), or high-quality log yard, sawmill, and chip mill residuals (e.g., Cosmos Specialty Fibers, Kapstone Kraft Paper, Roseburg Forest Products, Ponderay Newsprint Co.). At least one interviewee, McKinley Paper (formerly Nippon Paper), indicated that they intend on using urban wood waste as hog fuel once they are back up and running again.

Specifications for urban wood waste hog fuel feedstock focuses on elimination of contamination (i.e., minimum resin, engineered wood; no painted, no treated) and size (i.e., 3" minus).

Compliance with EPA Non-Hazardous Secondary Materials (NHSM) Rule

West Rock does use urban wood waste for their hog fuel boilers, as well as their own sawmill (adjacent plant) residuals. They rely on their supplier(s) meeting their quality requirements, including specifications and the EPA NHSM rule. West Rock does some inbound QA screening (no testing) and provides feedback to supplier(s). The interviewee suggested contacting Jason Sapington in Fiber Procurement at (253) 596-0291 for additional details.

Salvage / Reuse

Most interviewees that either engaged in wood reuse or knew of wood reuse activities, indicated the focus was on large and/or old-growth timbers suitable as-is for architectural treatments and custom applications. Some band-sawing or planing is done also. These wood uses are often marketed as Reclaimed FSC certified.

As is known, Portland's deconstruction ordinance is creating a substantial supply of salvaged wood, including dimensional lumber. Demand for much of the supply is still an issue. In the Puget Sound area, few organizations are focused on salvaging, processing, and retailing dimensional lumber. Several issues were raised during conversations, including collection protocols necessary to retain lumber integrity (i.e., lack of widespread use of deconstruction techniques), lack of processing and cleaning to remove contamination (i.e., nails and aggregates), and lack of scalable supply. The imbalance of cost versus value, and competition with virgin lumber prices remains an issue as well. Reuse Consulting intends on creating a warehouse space in Bellingham where salvaged and deconstructed wood can be stored and offered for retail. They would also provide deconstruction trainings.

No standard specifications for salvaged lumber were mentioned during interviews or found during research.

Engineered Wood

In general, interviewees did not know of any manufacturing facilities actively using recovered urban wood waste as product furnish. (i.e., engineered wood, particleboard, MDF, CLT, pulp, etc.) due mostly to quality and supply issues.

CLT

Cross laminated timber (CLT) was identified early in the discussion with King County staff as a potential application for recovered dimensional lumber, and some efforts have been taken to test this potential. Oregon State University (OSU) is testing salvaged lumber sourced from Portland in CLT panels and getting good strength test results.

The minimum specification for dimensional lumber for the OSU tests is Hemlock or Hem/Fir, birch, or pine; perhaps some red oak. Stud grade/framing lumber is fine. They are not paying attention to knot count and are seeking to minimize warping. The tests include planing lumber down to 1 – 1.5 inches thick. They also anticipate testing layers of salvaged lumber combined with layers of virgin lumber (e.g., 2 out of 6 ply's). Additional specifications obtained from DR Johnson for CLT components are included in Appendix B. Katerra also has a specification for their glulam product that cites species and other properties. The CLT Handbook from the Engineered Wood Association includes a specification for CLT.

Some of the potential issues with using salvaged lumber mentioned by interviewees included collection/sourcing at an appropriate scale, quality of feedstock, and grading guarantees for mechanical properties. A Washington State University (WSU) representative indicated that they do not see a technical problem using dimensional lumber in CLT, but that the logistics and costs of collection, processing, and transportation would be challenging.

Particleboard

Several manufacturing facilities were cited as having once tried using recovered urban wood waste in particleboard applications, but have since ceased doing so (e.g., Timber Products – CA, Boise Cascade – La Grande). Issues included contamination (i.e., grit, resin, color, species, plastic, aluminum [non-ferrous], composite decking); high risk for claims; and existing virgin alternatives. No Washington manufacturers are known to be using wood waste in particleboard.

Timber Products did develop a specification and intended on sending it to us. Boise La Grande's specification is 1" x 2" length, with some limits for grit.

MDF

MDF was cited by one interviewee as a potential application for urban wood waste, with the Roseburg plant in Medford (formerly owned by Sierra Pine) cited as a user, with a 1.5-inch minus, no screen specification. However, Roseburg indicated that they use only pre-consumer residuals in their Medford MDF products (and there are plenty around due to the economy).

Paper

Paper manufacturers use wood fiber for pulp. However, none of the paper manufacturers interviewed indicated they used urban wood waste in paper manufacturing, instead relying on virgin fiber from sawmills or whole logs, often with specific species, moisture, color, or chemical property requirements (e.g., Cosmos Fiber, West Rock, Port Townsend Paper, Georgia Pacific, Inland Empire Paper Co., International Paper Co., North Pacific Paper Corp (NORPAC), Ponderay Newsprint Co., Kapstone Kraft Paper, Clearwater Paper Corp).

Some interviewees identified the use of recovered paper fiber in their manufacturing processes, including old corrugated cardboard (OCC), old newspapers (ONP), de-inked office paper, hard pack (Asian OCC), and books (e.g., Caraustar Industries, McKinley Paper (formerly Nippon Paper), Sonoco, Monarch Composites). Other interviewees indicated that they had discussed or tried and halted the use of recovered fiber in their pulping processes due to contamination, or material or process inconsistencies (e.g., Sonoco, Inland Empire Paper Co., Kapstone Kraft Paper, West Rock).

Some interviewees were willing to discuss the use of recovered wood fiber in the future (e.g., Georgia Pacific, Ponderay Newsprint Co., West Rock, Monarch Composites).

Other Uses

Other active or potential uses of urban wood waste cited by interviewees include architectural panels, erosion control products, and other confidential developments. While King County has received some inquiries about biochar, no interviewees mentioned it.

DETAILS

Firm/Location	Discussion
Alpine Recycling/Cascade Recycling, Tacoma, WA	Referenced from the BLOCK Project. But, they receive mixed loads, process material. All wood is ground for hog fuel.
Bear Creek Lumber, Winthrop, WA	Sell recycled Doug-Fir structural timbers; reclaimed redwood, western red cedar salvaged from barns, warehouses in western US and Canada. Try to source as close as possible to reduce shipping. Sell as-is or re-saw for specific uses; Ad-hoc no specification. Market for salvaged lumber: some inquiries, no ongoing re-seller relationships.
Boise Cascade – La Grande, La Grande, OR	Use wood waste in boilers - mostly log yard wood waste, bark; buy some other sources. Wood in feedstock - ground logs. Buy some from reman plants for particleboard, ground pallets, planer trimmings. Do use in particleboard, meet some requirements for size. Spec. is 1" x 2" length, with some specs for grit. Would need sample, though lots of it is ground for hog fuel. Will send spec.
Caraustar Industries, Tacoma, WA	Product is 100% recycled OCC; boiler is 100% gas.
Cedarbrook Lumber Company, Aitkin, MN	Out of Business
Clearwater Paper Corp, Lewiston, ID	Will take only clean wood (no dust, nails, rocks, etc.). No demolition. Use no recovered wood in boilers - only recovered lignins or black liquor.
Cosmos Specialty Fibers, Cosmopolis, WA	Thinks they use some urban wood as hog fuel at Camas mill, though nails are a problem. They have a great source of hog fuel from saw mill and chip mill residuals that is high quality. Would not consider use of recovered wood fiber or paper products because they are closely focused

Firm/Location	Discussion
	on controlling species and chemical properties because of their process and products (high brightness, etc.). He suggested some of the other mills that focused on lower-end products where species and color were not as important (i.e., brownboard, corrugating medium, hand towels, toilet paper) such as Port Townsend, West Rock (Tacoma) and Kapstone (Longview). He did say that at this point, these mills could also source de-inked office paper to pulp for cheap.
D.R. Johnson Lumber Co, Riddle, OR	Spec for CLT components obtained from website.
Enwave Seattle (formerly Seattle Steam), Seattle, WA	Mostly gas at this point, due to pricing, though boiler(s) still set up to allow use of wood.
Forest Concepts, Auburn, WA	Conduct research and development of size reduction technologies for processing feedstocks to meet needs of users, including biofuel, bio-energy. They do not use post-consumer urban wood. They do have a licensee that uses scrap veneer from virgin manufacturing (Rainier Veneer) for Woodstraw, one of their products. They typically use wood chips, which are plentiful and cheap (not paper-grade; 1.5 - 2-inch chip). They have not done research on getting required chips or fiber lengths out of lumber (salvaged or new).
Forterra, Tacoma, WA	Producers they are working with have not actively considered or worked with recovered lumber - no reliable supply and issues ensuring glues adhere to certain types of materials. They do have a list of manufacturers - one coming on line in the next quarter; one in Spokane and one in Colville: Kattera and Vagaun Timber. Will provide contacts. Brian Hatfield - Department of Commerce is looking at biomass and biofuel. Also, other researchers at UW and WSU they can provide - looking at demand mostly.
Georgia Pacific – Camas, Camas, WA	Mill uncertain about continued use of hog fuel - boiler closed in Toledo; Use slash or sawmill residual, not urban wood; GP has not used recovered wood fiber in products; use virgin fiber from sawmills or whole logs in production of paper products; May be willing to discuss use of recovered fiber - some mills were trying in the past (outside GP). Camas mill may still use hog fuel (urban wood waste) rather than natural gas. Will send spec. - 3" minus - no contamination; no treated. Only a couple loads of hog fuel per day, will send.
Inland Empire Paper Co, Spokane, WA	All fresh wood chips (saw mill residuals) as furnish or recovered newsprint. Stopped using recovered wood in pulp 7-8 years ago. All boilers combust only gas.
International Paper Co, Springfield, OR	Use only chips or mill residuals in the pulping process; use only liquor in the boilers
Kapstone Kraft Paper, Longview, WA	Only use recovered wood for hog fuel - with 60-65% bark, with remainder saw dust and sawmill waste; some local urban wood waste suppliers. Hog fuel use is lowest in summer and highest in winter. No waste wood used as product furnish. They looked at the potential to use waste wood in the product about 6 months ago. Spec included Clean dimensional lumber

Firm/Location	Discussion
	from new construction residual, no OSB, PB, etc. NO DEMO. Major issue was metal contamination. Grit and rock were also issues, but not as risky as metals. Overall quantity would have been only at 1-2%. They were willing to provide payment, as well as some premium for the additional processing. Tabled due to high risk.
Katerra, Spokane, WA	Katerra does not have plans to use salvaged lumber or recovered dimensional lumber in their product. They are building the Spokane plant for high volume and the use of salvaged lumber would be too risky. They have interest in this area, but the issue is that the quality of the feedstock could not be guaranteed. They do have specs for their "lam-stock" that cites species and other properties. A difficulty in using the salvaged lumber would be to get a grader to stand behind the mechanical properties of the lumber without knowing the species or vice versa. Forterra had identified Katerra as a new CLT manufacturer coming on line in Spokane. To their knowledge, they have not considered salvaged lumber for component wood.
Lautenbach Recycling, Mt Vernon, WA	Nobody is doing re-use for dimensional lumber back into the marketplace. Collection problems and cost versus value for reuse are issues, as is availability, contamination from metals and aggregates. Does not know of other manufacturing uses for recovered wood. Overall wood market is bleak, with decreasing outlets for cogeneration and large supplies from virgin lumber manufacturing, timber harvesting, chip supplies due to booming building. Not much going on in mulch market either due to engineered wood and resin contamination. Need a summit of interested parties to brain-storm solutions. Troy is willing to participate and communicate about this.
McKinley Paper (formerly Nippon Paper), Port Angeles, WA	Use urban wood as hog fuel for steam and power. Their manufacturing process was not suitable for wood waste fiber feedstock, because of species and moisture content. Needed green chips (hemlock) as Nippon. Now, as McKinley Paper (purchased in April 2017), they will be a 100% recycled content paper mill, sourcing recovered paper fiber (de-inked office paper, newsprint, etc.) (good news!)
Monarch Composites, Tacoma, WA	No longer Klip Biotechnologies. Rely on recycled pulp fiber from paper. Purchase locally and elsewhere. Indicated now much easier to source recycled pulp fiber. Could use recycled pulp fiber from wood if available. No spec available.
North Pacific Paper Corp (NORPAC), Longview, WA	Use only chips or mill residuals. Get steam from Nippon, so no boilers on site (and no use of hog fuel). They ship some wood waste offsite.
Oregon DEQ, Salem, OR	Not much in the way of non-energy uses. ODEQ gave grant to Metropolitan Contractor Improvement Partnership (MCIP - Valerie Carey) - Associated with City of Roses [valerie@cityofrosesdisposal.com]) to work on valued added uses for wood. Also finishing up report for City of Portland on environmental impact of deconstruction ordinance. Tough problem with contamination - nails. Residential Building code allows use of reclaimed wood but needs good QC. Collection and supply scale is also

Firm/Location	Discussion
	an issue. Reclaimed Northwest is depot for all deconstruction wood coming out of Portland - lots of supply. Need additional demand.
Oregon Pallet, Salem, OR	Market for biomass has dried up. OP used to supply Pope and Talbot (BCC St Helens (PCA now) – Jeff Walton; pulp market was the old driver - only folks using recovered fiber was Port Townsend Paper; supplied by a range of suppliers; OP has called all biomass boilers, but with no success. 12 tpd - unsuccessful acquiring new outlets; GP Camas has a 60,000 tpy for cogeneration but shut down volume due to black liquor credit. OP has talked to every chip buyer around - nothing. They are currently stockpiling wood, trying to clean out resin-based product. Boilers relying on green and sawdust. Urban wood is challenging. Need driver that incentives use of recovered wood, such as a certification or standard for quality that is printed on the product label. Existing relationships are driving outlets for urban supply. No higher value applications using recovered wood to their knowledge. They feel the industry needs innovation, like Trex™. Pulp prices low. Only other potential is MDF (1.5-inch minus, no screen – Roseburg/Sierra Pine in Medford for example) and pulp. Need to work with paper supplier to take be able to take wood.
Pasquier Panel Products / Plywood Components, Inc., Sumner, WA	They are a saw mill. Sells sawdust and fall down as hog fuel. Take away for free, as long as contaminants are low, including resins.
Ponderay Newsprint Co., Usk, WA	Ponderay uses virgin wood fiber to produce new newsprint. Typically use chips and chipped whole logs as furnish; though their machinery has compatibility to use ONP and magazines. This is not active presently. Their biomass boiler uses sludge from their own process, and a very small amount of wood, which is also sourced from plant residuals and other sawmills. Specification is for process is clean sawdust, no bark.
Portland State University, Portland, OR	Did not address engineered wood or other manufacturing applications as part of their "summit." She reached out to colleagues working with CLT development and they were not interested in considering salvaged lumber for CLT.
Rainier Wood Recyclers, Covington, WA	GT team visited Rainier Wood Recyclers and determined that their markets were mostly or exclusively hog fuel or mulch, and no value-added market opportunities (i.e., engineered wood, pulp, CLT, particleboard, etc.) were currently being accessed. RWR did indicate they had sold wood in the past for use in particleboard furniture, though it was unclear if this was one-time, or if future potential exists. Follow-up needed.
ReCor Express, Seattle, WA	Worked with OSU for testing - CLT came out with higher specs than virgin - possibly because of dryness of wood - stronger panel. Sourcing was from Oregon - due to de-construction. Laurie Schimleck (OSU) - Seattle needs deconstruction protocols similar to Portland. Saw Rainier and Recovery 1 and can get some good lumber, but deconstruction is better to. Minimum spec for dimension lumber is Hemlock or Hem/Fir, Birch, or Pine. Perhaps some red oak. Stud grade/framing is fine. Looking to ascertain standardized limit for grit content. Not paying attention to knot count. Minimize warping. Planing down to an inch to inch and a half thick. Will look at some panels. Done later in the summer. Talking to professor in

Firm/Location	Discussion
	Australia about carbon offset called carbon blocking which accounts for multiple reuses using RFID tags. Perhaps going to test layers of PC and then layers of virgin (say 2 out of 6 ply's). Collection at scale is the issue to overcome. Portland currently has a surplus. Talked to Katterra about using Spokane Plant for manufacturing.
Recovery 1, Tacoma, WA	Hog fuel is the only game in town. Does not know of anybody using wood in valued-added applications. Even hog fuel value has dropped precipitously in the last 2 years; not how much you will get per ton, but can you even move it!
Reuse Consulting, Bellingham, WA	Does not know of, or supply, wood manufacturers with recovered wood. Focused mainly on deconstruction of timbers for specific buyers and does some dimensional lumber. Intends on creating a warehouse space in Bellingham where salvaged and deconstructed wood can be stored and offered for retail. Would also provide trainings for others on deconstruction.
Rhine Reclaimed Wood, Tacoma, WA	Only uses old timbers - usually old growth from commercial sources. Too time consuming to bother with dimensional lumber. Mostly supply to custom builders as-is but do some band sawing. Reclaimed FSC certified is applied if applicable and adds to sales potential. Could submit pictures of material to website info page to determine if it can be used.
Roseburg Forest Products, Roseburg, OR	Sierra Pine particleboard plant in California that previously tried to use wood waste is not in operation any longer. At the time, they used urban wood waste when mill residuals were in low supply. Most of Roseburg's PB plants (e.g., Dillard) and MDF plants (e.g., Medford, formerly owned by Sierra Pine) use only pre-consumer residuals in their products (and there are plenty around due to the economy). Use of post-consumer wood is too risky, contaminated. Hog fuel is the same story. Plenty of available mill residuals available, including internal residuals. They are working on new products that could use raw wood from a wider variety of sources, and they will keep us informed of their supply needs.
Sonoco, Sumner, WA	Does not use urban wood for hog fuel. Using recovered wood fiber has been discussed but does not think it would break down. They source OCC, newsprint, hard pack (Asian OCC), books as feedstock. They have also unsuccessfully tried wheat straw; no others.
The Engineered Wood Association, Tacoma, WA	2018: CLT Handbook downloaded
Timber Products (formerly Sierra Pine), Medford OR	Particleboard mill/plant in Medford OR, formerly owned by Sierra Pine. Medford does not use PC wood - not able to handle contaminants. California mill has used post-consumer wood but struggled with supplier's ability to keep it clean enough: CA mill started using urban wood in 2009, had extensive program using 2500 dry tons per month; installed urban wood cleaning system to remove grit contamination; ran until 2015 when they stopped the program in favor of using beetle-kill whole logs. Urban wood included dimensional lumber, pallets, truss plant fall down, some plywood and OSB. Best was pallets and wood ends (lots of pallets in CA Central Valley due to growers). Tried to avoid PB and MDF due to resin

Firm/Location	Discussion
	incompatibility. Had no luck with concrete forms, C&D, fencing - problems with color, species, grit, dirt. Also struggled with getting out soft contaminants (e.g., plastic, aluminum [non-ferrous], Trex decking). Fair amount of loss in cleaning system, rocks, grits (some loads as high as 10%, which then necessitated disposal). The program worked but was a high maintenance endeavor; including turnover in the personnel on the collection side added to inconsistencies. Did develop a Specification Sometimes depends on supply. Grit, rock are problems. High Risk for claims. Technology to clean wood not robust enough to meet specification of board. Quality requirement is tough. Paying \$45 per <i>bone dry ton</i> (bdt). Does not know of others that are using it. Lots of sawdust and shavings available. Best use is hog fuel. Used to work for GreenLeaf Power, who used hog fuel successfully in Connecticut. State was instrumental in issuing permit but required urban wood to be used. Had protocol for how clean the wood needed to be.
West Coast Forest Products, Inc., Arlington, WA	No longer in business
West Rock Tacoma Kraft, Tacoma, WA	West Rock sources wood for pulping from sawmills from BC to Northern California and does not use urban wood waste fiber in their pulping process. They tried to use urban wood in the past, but they had problems with kiln-dried wood and need the moisture content of green wood. Their willingness to use urban wood depends on the economics of sourcing it and configuring their process to use it; currently the price of chips does not support that. West Rock does use urban wood waste for their hog fuel boilers, as well as their own sawmill (adjacent plant) residuals. They rely on their supplier(s) meeting all requirements, including specifications and EPA NHSM rule. They do some inbound QA screening (no testing) and provide feedback to supplier(s). He suggested I contact Jason Sapington in Fiber Procurement at (253) 596-0291.
Windfall Lumber, Olympia, WA	They do have a technical spec and know of others (Potentially) that do. Need to get me in touch with their buyers.
Washington State University, Pullman, WA	Biofuel markets are very hard - low gas prices. Washington State has very few wood mills taking wood as primary feedstock. Clean white wood may get higher prices; Oregon has mills but its transport costs may be prohibitive. Urban wood is dry and already in industrial areas, but perceptions. California - Sierra Pine is possibly running a particle board mill mostly on wood waste. We (WA) do not have the infrastructure to accept mill residuals. Sawmills can't even sell their waste. Particleboard mill going into Michigan but new development like that is few and far between. BUT, does not see a technical problem using dimension lumber in CLT - just a matter of logistics. Wood needs to be in good shape - got a market for it. But has to compete with virgin wood prices. CLT has to get up running first. If gas prices go up, perhaps look at biofuel options for wood.

CONCLUSIONS

Based on the results of the interviews, the following conclusions are clear:

- Current market conditions (i.e., lower prices and large supply of virgin residuals) are not favorable for the use of urban wood waste as a hog fuel feedstock, though numerous suppliers and users are maintaining existing relationships. The cyclical nature of that market may provide future opportunities when timber harvesting, sawmilling, and wood product manufacturing decline; natural gas prices increase; or some combination of all those factors.
- Contamination in urban wood waste feedstock (e.g., grit, dirt, metal, plastics) and the resulting risk to manufacturing processes and/or product quality is a major factor in the low use of recovered urban wood in value-added manufacturing (i.e., engineered wood, pulp and paper, etc.).

Current market conditions (i.e., timber harvesting, large supply of virgin wood chips at good prices) are also tempering the use of urban wood waste in non-hog fuel uses. Manufacturing engineered wood or paper with urban wood waste was more of a focus a decade ago but now few if any facilities are actively using recovered urban wood in their processes; few market incentives exist for manufacturers to take on the additional effort, and up-front cost, of overcoming the perceived and real risks.

- Most technical specifications used for sourcing wood (i.e., logs, chips, sawdust, lumber) for manufacturing rely on species, moisture content, and/or visual characteristics; or rely on meeting the strength characteristics of the final product. See Appendix B.
- Few users of hog fuel use a published technical specification, relying instead on published guidance for avoidance of contaminants (i.e., grit, dirt, metal, plastics), paint, and preservative treatments, among others; and indicating types of wood accepted. See Appendix B.
- According to the few interviewees contacted with responsibility for doing so, compliance with the EPA's Non-Hazardous Secondary Materials (NHSM) Rule generally falls on the feedstock supplier, with reinforcement from the boiler plant's usual load acceptance procedures. No special procedures or equipment were identified.

Additional follow-up is needed:

- To obtain urban wood waste or product specifications, or additional insight from contacts mentioned during interviews, including from West Rock Tacoma Kraft, Boise Cascade – La Grande, Vagaun Timber, Georgia Pacific – Camas, Kapstone Kraft Paper, Rainier Wood Recyclers, State of Connecticut, Timber Products Co., and Windfall Lumber.

RECOMMENDATIONS

Despite current market conditions and existing barriers, continued efforts by King County can influence, shape, and develop the market for recovered urban wood. A focused and sustained effort, in partnership with private businesses, at addressing barriers (i.e., business, financial, technical, operational, logistical, and communications) all along the value chain from collection through processing, manufacturing and sales, can add to the region's capacity to use wood waste in non-hog-fuel applications.

Recommendations for King County's initial next steps include:

- Conducting follow-up identified above for additional information about market opportunities and practices.
- Continuing to provide support and education around salvage and deconstruction practices as an alternative to traditional demolition.
 - o Possible methods to consider: Sponsor and deliver in partnership with reuse stores, builders, architects, developers, contractors, including commercial and professional workshops, demonstration projects, webinars, etc.
- Prioritizing development of a salvaged lumber warehouse as an important vehicle to move clean wood out of the waste stream, away from hog fuel, and into reuse. A salvaged lumber warehouse may also add to the ability for manufacturers to experiment with clean feedstock for manufactured wood products.
 - o Possible methods to consider: Sponsor, provide in-kind donations, seek partnerships with property owners, recycling businesses, reuse stores.
- Bringing together stakeholders to discuss issues around the low value and lack of use of urban wood waste in product manufacturing and to identify potential solutions and actions, with a focus on supply chain, technical, financial, and legal aspects of market development.

Recommendations for King County's longer-term actions include:

- Providing facilitation and advocacy for creating higher value urban wood waste in reuse and fiber markets
 - o Possible methods to consider: Focused efforts on a smaller number of willing private businesses that can utilize a larger volume of wood waste supply; issuance of a Request for Information (RFI) for innovative non-hog-fuel applications for waste wood.

- Advocating for recycled lumber grade standards reflective of a technical understanding of recycled wood's characteristics (Including advantages and defects).
 - o Possible methods to consider: Sponsor, provide in-kind donations, seek partnerships with engineered wood specification standards organizations, USDA Forest Service.
- Providing business, financial, technical, operational, logistical, and marketing support to start-up and existing businesses through LinkUp, GreenTools, or other contract mechanism for the identification, development, and implementation of manufacturing applications that use urban wood waste. Support services could include:
 - o Strategic planning and project development
 - o Sourcing materials
 - o Facility development
 - o Identification of financing opportunities
 - o Use of emerging technologies and best practices
 - o Evaluation and performance testing of recycled-content products
 - o Performance testing of processing equipment, including testing and refining recycled wood size reduction and cleaning technologies, given the concern for contaminants in manufacturing feedstocks
 - o Assessment of the characteristics and engineering performance of recycled material through experimental and analytical testing, including testing recycled lumber and timber for structural integrity in the presence of typical defects
 - o One-on-one marketing consultation
 - o Communications and media assistance
 - o Training for effective marketing techniques.

APPENDIX A

List of Companies Contacted

1. Alpine Recycling/Cascade Recycling
2. Bear Creek Lumber
3. Boise Cascade – La Grande
4. Caraustar Industries
5. Cedarbrook Lumber Company
6. Clearwater Paper Corp
7. Cosmos Specialty Fibers
8. D.R. Johnson Lumber Co
9. Enwave Seattle (formerly Seattle Steam)
10. Eugene MDF & Duraflake
11. Forest Concepts
12. Forterra
13. Georgia Pacific - Camas
14. Globe Machine Manufacturing
15. Graham Construction
16. Inland Empire Paper Co
17. International Paper Co
18. Kapstone Kraft Paper
19. Kattera
20. Lautenbach recycling
21. McKinley Paper (formerly Nippon Paper)
22. Meyers-Wells
23. Monarch Composites
24. Nippon Dynawave Packaging Co
25. North Pacific Paper Corp (NORPAC)
26. Oregon DEQ
27. Oregon Pallet
28. Pasquier Panel Products / Plywood Components, Inc.
29. PCA (Boise Paper) - Wallula
30. Ponderay Newsprint Co
31. Port Townsend Paper Corporation
32. Portland State University
33. Premier Forest Products
34. Rainier Wood Recyclers
35. ReCor Express
36. Recovery 1
37. Reuse Consulting
38. Rhine Reclaimed Wood
39. Roseburg Forest Products
40. Sierra Pacific
41. Sonoco
42. The BLOCK Project
43. The Engineered Wood Association
44. Timber Products (formerly Sierra Pine)
45. Timber Products Co.
46. Unity Homes
47. West Coast Forest Products, Inc.
48. West Rock Mill
49. Weyerhaeuser
50. Windfall Lumber
51. WSU

Businesses interviewed by Herrera staff are indicated in red.

APPENDIX B

Specifications and Standards

- ANSI/APA PRG 320-2018: Standard for Performance-Rated Cross-Laminated Timber, February 2018
- ANSI/APA PRG 320-2012: Standard for Performance-Rated Cross-Laminated Timber, October 2012
- ANSI/AWC NDS-2015: American Wood Council National Design Specification for Wood Construction, 2015
- APA Product Report-L314 (PR-L314): Structurlam CrossLam, April 2018
- CrossLam® CLT Technical Design Guide, v4.0 – USA, 2018
- CLT Handbook, US Edition, FPInnovations and AWC, SP-529E, 2013
- Particleboard environmental product declaration (EPD), AWC and Canadian Wood Council, November 2013

Contact King County Solid Waste Division for the above specifications and standards.