

Fresh Cut

The Business Viability of Processing Freshly Cut Urban Wood in Baltimore City

Baltimore City Recreation and Park's Forestry Division

Humanim

USDA Forest Service

PREPARED BY QUANTIFIED VENTURES | March 17, 2019



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1.0 Executive Summary

This report explores the viability of investing in an urban wood processing center in the city of Baltimore. While the findings of this report are specific to the conditions within the city of Baltimore, the methodology and approach allow for replication in other regions of the county.

A collection of partners, including the USDA Forest Service, Humanim, the City of Baltimore's Recreation and Park's Forestry Division, and SavATree are using wood to solve social, economic, and environmental problems in some of Baltimore's most blighted neighborhoods. In pursuit of this effort, Quantified Ventures has worked for the past six months, with support from these partners, to assess the viability of investing in an urban wood mill that processes freshly cut wood from live urban trees by utility maintenance, public works, and private arborists. This source of urban wood is simply referred to as "Fresh Cut". This report explores the market creation for Fresh Cut from start to finish in order to answer the following questions:

1. Would the operation produce a positive return on investment?
2. If not, can the operation be justified on a social basis?
3. If it is justified on a social basis then how should it be supported?

Given the amount of urban tree waste in Baltimore, the experience of Camp Small's urban waste utilization program run by the Baltimore City Forestry Division on a five-acre property a few miles north of City Hall where much of Baltimore's Fresh Cut waste from public operations ends up, and the viability of urban wood businesses nationally, we believe that the proposed investment has a high potential for impact that can be linked to real financial value for the business operator and real economic value for other beneficiaries.

Based on our analysis, we conclude that Fresh Cut is a viable business model that will be profitable after 3 years and be a profitable investment overall. We chose a conservative methodology. We used high estimations of cost, conservative estimations on sales, and the more conservative liquidation valuation method. Considering these facts in conjunction with our sensitivity analysis, we feel confident about our positive return on investment assessment.

We believe that there is a potential for Fresh Cut to produce a strong social and environmental impact. By Baltimore Recreation and Park's partnering with Humanim, a Baltimore-based non-profit dedicated to improving lives, there are social returns. This operation has the ability to train and pay over a hundred individuals in Baltimore who would normally be left out of the workforce or highly likely to return to prison. By working with this underserved population, the project could save hundreds of thousands of dollars to the federal, state, and city governments. By diverting urban wood waste, the project will also sequester thousands of tons of carbon into wood products, producing environmental benefits. Lastly, this project represents a step forward in the cradle-grave approach to urban forestry: from seedling development to tree management, to wood utilization. The summary of our findings is listed in Table 1, on the following page.

Table 1. Fresh Cut Impact Summary Over 15 Years

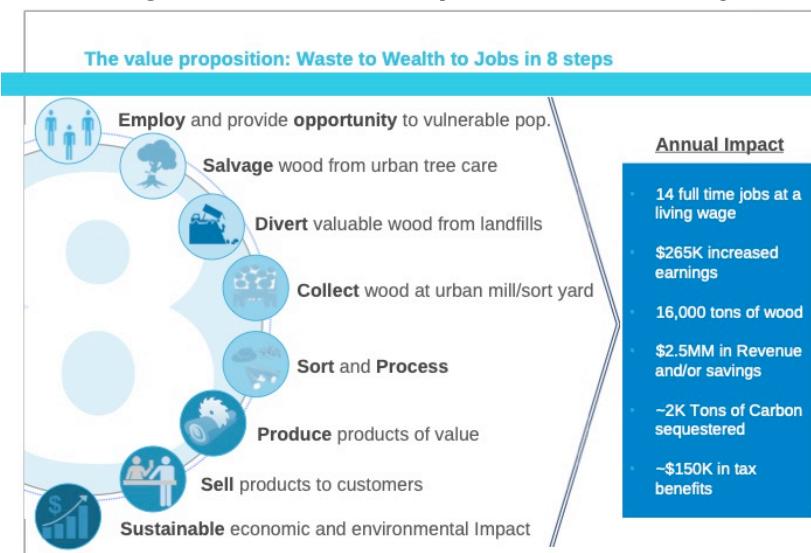
Category	Net Present Value (\$1,000s)	Notes
Investment Required	\$2,000	Equipment and working capital
Fresh Cut Operation	\$2,826	12% ROI
Baltimore City	\$524	Avoided landfill cost and increases in taxes
State of Maryland	\$1,682	Government Benefits Avoided
Federal Government	\$1,745	Government Benefits Avoided
Labor (Earnings)	\$2,991	14 jobs supported, 100+ trained
Environmental	\$863,743	28,000 tons CO2E sequestered

That said, there are financing and access to capital concerns, even with a profitable venture. It is difficult for urban wood operations to access financing and little is known about the market. The three years to profitability may make it difficult to leverage a debt investment. The social impact component may help.

The project could leverage impact investors, who want to scale impactful enterprises. The project could also leverage opportunity zones and target equity investors. Lastly, given that the enterprise will be profitable, traditional philanthropic or government partnerships could help fund the initial capital costs and allow Fresh Cut to sustainably fund its own operational expenses. In summation, we believe that the challenges in financing can be easily overcome by the financial potential of the project.

To implement the Fresh Cut operation, we offer the following next steps: gain clarity on partnerships and of scale, explore interest from various funding and financing options, and write an execution and operations plan. Lastly, Baltimore is just one city in the U.S. that experiences high levels of urban wood waste, incarceration, and unemployment. We believe there is high potential for scalability across the country, and by using the frameworks laid out here, we encourage the project team to strategically consider where best to scale and how to maximize the impact of the intervention.

Figure 1. Fresh Cut Operations Summary



2.0 Project Overview

2.1 Objective

The USDA Forest Service and Humanim contracted Quantified Ventures to explore the market for processing freshly cut trees in an urban setting. The opportunity is simply referred to herein as “Fresh Cut”. This viability study is building off of Quantified Ventures’ 2018 Pay for Success (PFS) Feasibility Assessment, which analyzed the potential to use private capital to scale up Humanim’s deconstruction practice. While the PFS Assessment’s was focused on deconstruction, the assessment shed light on Fresh Cut’s potential to be incorporated into the Baltimore urban wood market. This report draws lessons from the PFS Assessment, as well as from Camp Small, the zero waste facility run by Baltimore’s Recreation and Park’s Forestry Division.

This report assesses the feasibility of starting an urban wood process center. The report considers not only the viability from a financial standpoint, but also from social and environmental impact perspectives. A multi-partner approach to the urban wood economy can increase the substantial benefits that are already occurring, while providing a model for more sustainable management of urban wood waste that could be replicated nationally.

It should be noted that this report is not a field guide that provides directions to optimize urban wood operations. The report presents the costs and benefits associated with each phase of work, not the specific operations in each phase.

2.2 Team

The project team consisted of members from The City of Baltimore’s Recreation and Park’s Forestry Division, Humanim, Quantified Ventures, SaveATree, and the USDA Forest Service.

- **Baltimore City Recreation and Park’s Forestry Division – Camp Small**

- *Recycling Coordinator/Yard Master:* Shaun M Preston

Camp Small is the wood waste collection yard run by the Baltimore City Forestry Division. The 5-acre site is located in the Jones Falls Valley just north of Cold Spring Lane. Every day, City crews and contractors bring logs, chips, and brush to the site for processing. In early 2016, the Rec & Parks Forestry Division, in collaboration with the Baltimore Office of Sustainability, began the Camp Small Zero Waste Initiative in an effort to sort and distribute the variety of wood products at the site.

- **Humanim**

- *Vice President:* Jeff Carroll

Humanim has a 46-year history of providing workforce development and support services to individuals with barriers to employment throughout Maryland. Humanim has innovated and delivered workforce development and support services as part of a methodology to alleviate poverty to over 4,000 people a year. Through strategic risk taking and a proactive

approach, Humanim has over 40 diverse but interconnected programs and services. Whether engaging a 5-star hotel to be their community hiring arm or building our Baltimore headquarters in a disinvested community, the scope of our projects is creating economic opportunity, catalyzing self-empowerment, and simply having people's backs.¹

- **Quantified Ventures:**

- *Project Executive:* Todd Appel, Managing Director
- *Project Manager:* Seth Brown, Director
- *Project Associate:* Jason Lee, Senior Associate

Quantified Ventures advises governments, non-profit organizations, for-profit social enterprises, and impact investors who demonstrate capacity for transformative social good. Quantified Ventures provides feasibility analysis, due diligence, transaction structuring, and fundraising services for social enterprises and social impact projects in the environmental and health sectors across the United States.

- **SavATree Consulting Group**

- *Director:* Mike Galvin, RCA

SavATree is committed to an environmentally sensible approach to tree and lawn services. SavATree has been providing professional landscape maintenance services throughout the Northeast, Mid-Atlantic and Mid-West regions of the United States since 1985. Their industry certified arborists add value and beauty to residential, commercial, institutional, and historic properties using environmentally sensible tree, shrub, and lawn care principles. Mike Galvin's wide-ranging expertise in arboriculture includes urban and community forestry management, state-of-the-art tree inventory and management plans, tree protection and preservation during construction, as well as tree risk management and appraisals.²

- **USDA Forest Service**

- *National Program Manager, Urban and Community Forestry, State and Private Forestry:* Lauren E.L. Marshall, PLA, ISA Cert. Arborist ®
- *Research Scientist and Baltimore Field Station Team Leader, Northern Research Station: Morgan Grove*
- *Urban Field Station Network Coordinator, Northern Research Station: Sarah Hines*

The Forest Service is a proud partner in restoring and sustaining America's community forests. The Urban & Community Forestry (UCF) Program supports forest health for all of our Nation's forests, creates jobs, contributes to vibrant regional wood economies, enhances community resilience and preserves the unique sense of place in cities and towns of all sizes. By working with our state partners to deliver information, tools and financial resources, the program supports fact-based and data-driven best practices in communities, maintaining, restoring, and improving the more than 140 million acres of community forest land across the United States.³

¹ <https://humanim.org/>

² <https://www.savatree.com/>

³ <https://www.fs.fed.us/managing-land/urban-forests/ucf>

2.3 Background

The partners listed in the previous section are using wood to solve social, economic, and environmental problems in some of Baltimore's most blighted neighborhoods. These partners consider how urban wood can be the conduit to help solve a complex landscape of social, economic, and environmental problems in Baltimore, and how can this model be replicated in other cities to:

- Support the US wood processing and manufacturing industry
- Serve as a prototype to attract much-needed private investment and economic development to communities in need
- Enable ecological restoration
- Create livelihoods and improve lives
- Serve as a model for creating a circular, self-reinforcing economy in urban areas

According to the USDA Forest Service, reclaimed wood from all dead and diseased community trees could equal nearly 4 billion board feet, or about 30% of annual hardwood consumption in the United States. Hence, there is a huge potential for positive impact. In 2010, 70.7 million tons of urban wood waste were generated in the United States, including 34.3 million tons from 'Municipal Solid Waste' (e.g., tree trimmings, durable and non-durable goods, containers, storm debris, etc.).⁴ The amount of recoverable urban wood waste varies by region, but at the turn of the 21st century, 17% of municipal waste was wood. Millions of tons of wood waste are suitable for recovery rather than being disposed in landfills, representing an enormous opportunity to realize financial and environmental efficiencies. Each year, Baltimore wastes over 78,000⁵ tons of urban wood—about 3,900 truckloads.

Reusing and repurposing urban wood waste can save money, create jobs, reduce crime and recidivism, improve ecosystems, provide green materials, supply local production and consumption campaigns, and help a city achieve its vision of a sustainable future. The USDA Forest Service Urban Wood Workbook envisions a local wood economy:

- "Where urban wood is no longer taken to the landfill or incinerated;
- Where all wood is repurposed: from compost, mulch, and wood chips for producing bioenergy, stewarding green space, maintaining playgrounds, and filtering stormwater; to lumber and slabs for furnishing homes with chairs, bookshelves, and tables, and creating interior designs for businesses and homes alike;
- Where networks of supply and demand for local wood contribute significantly to employment, to economic and community revitalization, and to the U.S. wood industry."⁶

In pursuit of that vision, the USDA Forest Service engaged Quantified Ventures for two separate, but related projects:

⁴ Falk and McKeever, 'Generation and Recovery of Solid Wood Waste in the U.S.', Biocycle, August 2012

⁵ National Renewable Energy Laboratory. 2007. Biomass potential by county.

https://services1.arcgis.com/o90r8yeUBWgKSezU/arcgis/rest/services/Biomass_Potential/FeatureServer

⁶ Galvin, Grove, Hines, Marshall: The Urban Wood Workbook: A Framework for the Baltimore Wood Project

2018 Pay for Success Feasibility:

Over eight months in 2017-2018, Quantified Ventures, with support from the USDA Forest Service, worked to assess the feasibility of Pay for Success (PFS) financing to help scale an urban wood economy in Baltimore. This economy would focus on market creation for reclaimed wood from the deconstruction of vacant houses, as well as on reclamation of vacant land for beneficial environmental and community purposes.

In examining these various aspects of the urban wood economy, Quantified Ventures found the greatest feasibility and traction for PFS to finance an intervention led by Humanim, a Baltimore-based non-profit, to deconstruct vacant homes in Baltimore and reclaim wood and other materials. The proposed mechanism would be to use a Social Impact Bond (SIB), a form of PFS financing, to scale the operations of Details Deconstruction (Details), a part of Humanim. Details is a social enterprise focused on deconstructing vacant houses through the employment of formerly incarcerated or otherwise un- or under-employed people.

The proposed intervention would produce other social and environmental outcomes as well, particularly related to workforce development opportunities targeted at a prison population in pre-release. This is the most critical time for human services support to ensure inmates are set up to succeed, find employment, and avoid going back to prison once released.

Through the PFS feasibility work, Quantified Ventures explored Camp Small, a five-acre property a few miles north of City Hall⁷ where much of Baltimore's Fresh Cut waste from public operations ends up. With the minimal staffing and equipment resources invested at Camp Small, the report highlighted several areas to increase Camp Small's impact opportunistically. It should be noted that some conditions have changed since the report. For instance, Camp Small now has a portable sawmill that increase the value of high-quality products. To provide context, the original findings are presented below:

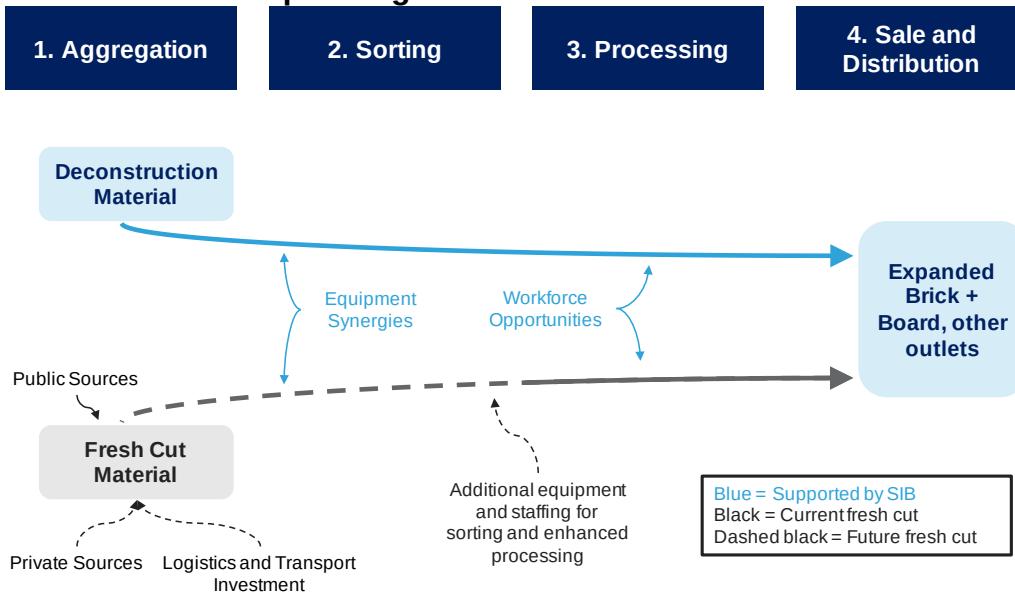
- **Processing and Sorting:** Without proper staffing and equipment, potential value is lost as the majority of the material is currently chipped or composted into low-value products regardless of the incoming material's quality. With greater capital investment, incoming materials of higher quality could yield higher value products.
- **Retail Channels:** Without a means to resell the processed "fresh cut" material to generate revenue, the City of Baltimore Department of Recreation & Parks spends as much as \$103,000 annually to remove and dispose of the material. This further exacerbates negative landfilling impacts in Baltimore.
- **Aggregation:** Currently the Camp Small facility only accepts waste from public sites and operations. Greater logistical or shipping investments, such as a logging

⁷ Silveira, Kristen "Camp Small Case Study" in Opp *et al.* 2018, *Performance Measurement in Local Sustainability Policy*

truck, would help the facility aggregate “fresh cut” material from private operations as well, particularly from utility line maintenance or the Maryland Zoo, to achieve economies of scale.

The PFS Feasibility Assessment included an illustrative model of the urban wood economy that may be supported by both deconstruction and Fresh Cut collection, sorting, and processing is presented in Figure 2 below.

Figure 2. Model for Incorporating “Fresh Cut” into the Deconstruction Process



It was this analysis that led the Forest Service to engage with Quantified Ventures on our second phase of work: a full analysis of Fresh Cut’s potential as a business venture.

Fresh Cut Viability Assessment:

Following the lessons learned from the PFS Feasibility work, Quantified Ventures was asked to explore the viability of the incorporation of Fresh Cut material into the urban wood economy. This report is the culmination of that effort. The following is a framework to evaluate the inclusion of Fresh Cut into the operations of a deconstruction business model. This analysis addressed the following questions:

- **Does the industry need some type of policy intervention?**
 - Is Fresh Cut a viable business investment?
- **If a need exists, then can it be justified on a social basis?**
 - If it is not a viable business investment, is it a viable investment for “society”?
 - That is, does the investment give a positive return on investment if the analysis incorporates societal and environmental benefits like reduction of dependence on social services, production of sustainable jobs, and positive environmental impact?

- **If it is justified on a social basis, then how should it be supported?**
 - Can a payment or transfer of benefits make the project a viable business investment?
 - If payments cannot be transferred from a single source to make the project viable, could multiple investors/payers support the project to make it a viable business investment?
 - If the project is not a viable business on its own, nor can it be justified on a social basis, then the project should not be pursued.

2.4 Project Approach

This project was designed to assess the viability of pursuing an urban wood operation. The findings and recommendations pursue USDA Forest Service's long-term vision of promoting an urban wood economy, partnering with organization like Humanim, generating lasting benefits to Baltimore City, and setting an example for replication nationwide. The team worked towards and achieved the following project milestones:

- Define the scope of the project including specific processes and operations, target geography, and roles of partner organizations
- Conduct a survey of the current Urban Wood marketplace and conduct interviews with subject matter experts
- Prepare a Business Model for the Fresh Cut Industry
 - Capital Requirements
 - Land and Equipment Purchases
 - Labor Requirements
 - Material Sourcing
 - Operations
 - Material Collection & Transport
 - Sawyer Operations
 - Kiln Drying
 - Aggregation and Inventory
 - Sales and Distribution
 - Output
 - Product Offering
 - Price Point
- Analyze Evidence Base of Outcomes
- Prepare Economic Model that Evaluates:
 - Cost Savings and New Revenues
 - Other qualitative benefits
 - Mapping of Benefits to Specific Organizations
- Align on Inputs and Outputs with Stakeholders
- Conduct Sensitivity Analysis
- Present Findings and Recommendations in this Report

3.0 Business Case for Fresh Cut in Baltimore

To determine the business viability for Fresh Cut, we had to start at the very beginning. We had to determine the market supply, investment required, market demand, and labor need. To gather that information, we conducted academic and professional research and conducted interviews with urban wood professionals. We used an iterative process to gather feedback and adjust our inputs. This section follows the following outline:

- Value Proposition (Process Map)
- Costs (Equipment and Labor)
- Revenues (Production and Sales Projections)
- Cash Flow Return on Investment
- Sensitivity Analysis (Tolerance for Error)

Given the amount of urban tree waste in Baltimore, the experience of Camp Small, and the viability of urban wood businesses nationally, we believe that the proposed investment has a high potential for impact that can be linked to real financial value for the business operator and real economic value for other beneficiaries.

3.1 Value Proposition: Waste to Wealth to Jobs in 8 Steps

The USDA Forest Service's Urban Wood Handbook identified 7 key steps in the urban wood economy:

1. **Count:** Inventory and anticipate the amount of potential and actual supply of materials, and the location and types of processing and production facilities.
2. **Generate:** Divert wood considered a waste by-product and headed for landfills and utilize that wood as a material for producing wealth and well-being.
3. **Salvage:** Retaining the maximum value during the salvage process is crucial for the overall productivity of the urban wood economy.
4. **Sort:** The materials need to be sorted into piles of similar material and aggregated for processing.
5. **Process:** Raw materials have to be processed by milling, drying, chipping, or other means before it can be made into something or used. The acquisition of raw materials such as logs is referred to as primary production. Primary processing often occurs when logs are processed into primary wood products, like wood slabs, trimmings, and sawdust.
6. **Produce:** Secondary production is the process of manufacturing and assembly.
7. **Consume:** Commercial services that support production, marketing, distribution, and other aspects of getting goods to market.

This report takes a similar but slightly different lens to the urban wood value chain. This difference is attributable to the mission of Humanim and the social and environmental goals of the project partners. Through this perspective, we see urban wood as a tool to human empowerment. Therefore, we slightly modify the Urban Wood Handbook's 7 steps and include an 8th step to account for the job training and environmental benefits. These steps identified below in figure 3, on the following page.

Figure 3. Fresh Cut Operations Summary



For those interested in best practices of urban wood processing, there are many open sources available including the Urban Wood Handbook. This report is not a field or operations guide. It presents the costs associated with each phase, not the details specific to each phase of work.

3.2 Identification of Costs

3.2.1 Employment and Opportunity

The Fresh Cut operation can support 14 employees at a time, providing the basis for a living wage for those traditionally left out of the workforce. Of these employees, 4 will be full time: a yardmaster paid \$30/hour and 3 equipment operators paid \$22.50/hour. The 10 other positions will be rotational labor positions. These 10 positions will be the focus of Humanim's job training effort, explained in greater detail in Section 6. The rotational labor positions will consist of cohorts of 3-4 individuals who are likely to not be a part of the traditional workforce. Much like Humanim's Details social enterprise, these cohorts will consist of formerly incarcerated or otherwise un- or under-employed individuals. Each cohort lasts 12 months and a new cohort begins every 4th month. Rotational labor wages begin at \$12/hour but increase to \$15/hour by year 3. This meets Humanim's goal of providing a living wage for all employees.

Target Population for Rotational Labor Cohorts:

While the City of Baltimore comprises just 10.7% of the total population of Maryland, 7,795 of the 22,087 people in prison in Maryland, or 35.3%, are from Baltimore (as of 2010).⁸ This is equivalent to an incarceration rate of about 1.3%, 2.8 times greater than the national average, and 3.3 times greater than the state average. People who are formerly incarcerated often struggle to adjust once they are released, driven primarily by a lack of

⁸ http://www.justicepolicy.org/uploads/justicepolicy/documents/rightinvestment_design_2.23.15_final.pdf

employment opportunities available to them, and therefore experience high rates of recidivism and unemployment.

Studies indicate that the “pre-release” period immediately before leaving prison is one of the most critical times to set inmates up for sustained success on the outside.⁹ Humanim case managers will target this “pre-release” population – providing support, workforce development, and training services immediately before and after release – before providing employment opportunities at Fresh Cut.

The operation will employ 101 people over 10 years, brought in to the employment opportunities illustrated in Table 2. Through these workforce development services and immediate employment opportunities, recidivism and unemployment rates of the target population are expected to be lower than that of the formerly incarcerated population in Baltimore at large. These external benefits will be discussed in greater detail in Section 4.

Table 2. Employment over Time

Year	1	2	3	4	5	6	7	8	9	10	Tot.
Fresh Cut											
<u><i>Yard Master</i></u>	1	1	1	1	1	1	1	1	1	1	1
Wage:	\$30	\$31	\$31	\$32	\$32	\$33	\$33	\$34	\$35	\$35	
<u><i>Equipment Operators</i></u>	3	3	3	3	3	3	3	3	3	3	3
Wage:	\$22	\$23	\$23	\$24	\$24	\$25	\$25	\$26	\$26	\$27	
<u><i>Rotational Cohorts</i></u>	7	10	10	10	10	10	10	10	10	10	97
Wage*:	\$12	\$13	\$14	\$15	\$15	\$16	\$17	\$17	\$18	\$18	
TOTAL	11	14	101								
Direct Labor Costs (\$1,000s)*	\$265	\$441	\$459	\$478	\$500	\$515	\$530	\$546	\$557	\$570	
Indirect Costs (\$1,000s)*	\$46	\$78	\$81	\$84	\$87	\$91	\$94	\$96	\$98	\$100	
Total Labor Costs (\$1,000s)	\$311	\$519	\$540	\$562	\$587	\$606	\$624	\$642	\$655	\$670	

*Wages: Rounded for simplicity.

*Total Cost: Assumption of 160 hours a month

*Indirect Labor Costs are 15% of total labor

Key assumptions and justifications:

- **Timing of Employment:** The model assumes that the yardmaster will be hired in the first month. The equipment operators will be hired in the 3rd month, and the first cohort of rational labor will begin in the 4th month. This will allow for some “ramp up” time and for the operation to absorb the growth into full capacity.
- **Cohorts:** We assume that each cohort lasts for a full year and a new cohort begins every 4th month. While the cohorts consist of 3-4 individuals, we divide the number equally so that each cohort represents 3 and 1/3 of a person for a total of 10 rotational labor individuals a year.
- **Wages:** The wages are based on interviews with those familiar with the industry, open sources such as Indeed and Zip Recruiter, and the input of Humanim. In

⁹ <https://www.urban.org/sites/default/files/publication/32056/411767-Release-Planning-for-Successful-Reentry.PDF>

the model, wages increase by 2% annually. This is pegged to the average inflation rate since 2000. The rotational labor will have wages increase by \$0.25 every 4 months, in order to meet the goal of paying a living wage for all employees by year 3. The living wage was set as \$15 an hour (in year 0 equivalent, adjusted for inflation). Once the rotation wages met the living wage, they increase by 2% annually.

- **Hours:** Employees are assumed to work 160 hours a month. This is based off an 8-hour workday, with 240 working days a year. This assumes 104 weekend days, 10 holidays, and 10 vacation days.
- **Subsidy:** Conservatively, we have assumed that the Fresh Cut operation is responsible for bearing 100% of the cost of employment. Quantified Ventures believes that given the nature of the opportunity and the costs associated with the at risk population, this cost could be shared or subsidized with the state or local government.
- **Indirect Labor:** To account for indirect labor costs such as benefits, insurance, training, we assumed that indirect labor was 15% of total labor costs. That is, 85% of labor costs can be attributed to direct salaries and 15% is indirect costs.

Figure 4. Employment Summary



Fresh Cut can support upwards of 14 employees at a time, providing a sustainable and living wage for those traditionally left out of the workforce

Category	Number	Salary	Notes/Assumptions	Benefits
Yardmaster	1	<ul style="list-style-type: none"> \$30/hour \$58,000 annually 	<ul style="list-style-type: none"> 1 yardmaster Permanent hire 	<ul style="list-style-type: none"> 14 full time jobs at a living wage \$265K increased earnings Reduced reliance on social services
Equipment Operators	3	<ul style="list-style-type: none"> \$22.50/hour \$44,000 annually 	<ul style="list-style-type: none"> 3 equipment operators Permanent hires with licensing 	
Rotational Labor	10	<ul style="list-style-type: none"> Starting at \$12/hour Increasing to \$15/hour by year 3 \$24,000 annually 	<ul style="list-style-type: none"> 10 rotational labor positions Stay on for 12 months Rotate cohorts every quarter Get certification and follow on job opportunities Employment for those that are traditionally left out of the workforce: <ul style="list-style-type: none"> Recently incarcerated No GED Former substance abusers 	<p>Costs</p> <p>Direct:</p> <ul style="list-style-type: none"> Salaries \$265K/year <p>Indirect:</p> <ul style="list-style-type: none"> Insurance Training Inefficiencies associated with higher cost labor

3.2.2 Salvaging Wood from Baltimore

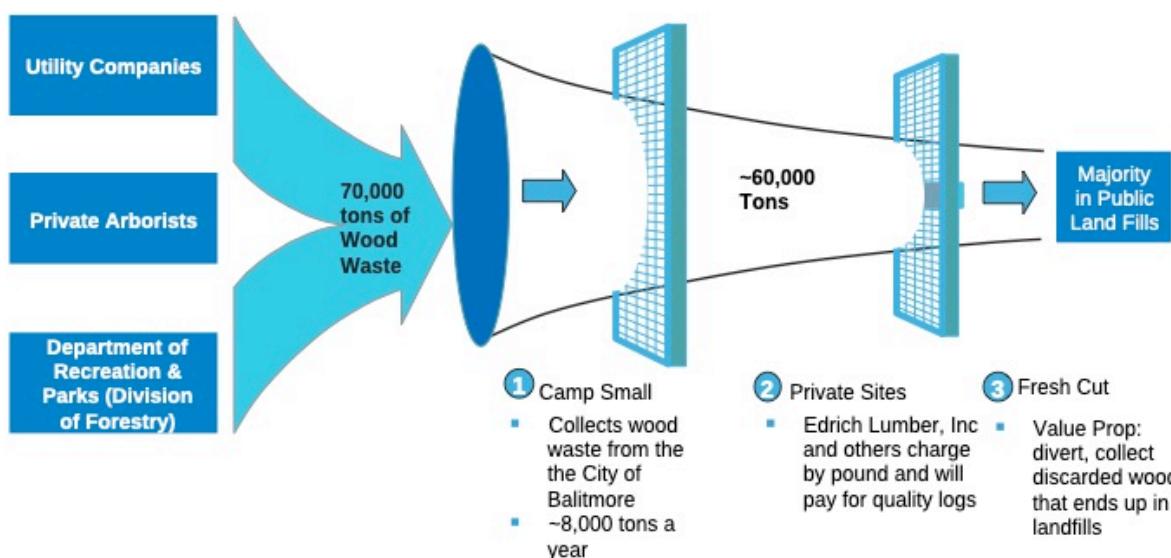
As discussed in background (Section 2.2), there is a large amount of wood waste in Baltimore. A Fresh Cut operation has a great opportunity even if it can only collect a small fraction of the 78,000 tons of wood waste produced each year. This wood waste is generated from three primary sources: utility companies, private arborists, and Baltimore City's tree care.

Currently, Baltimore City's in-house and contract tree care crews generate waste from tree care operations and bring it to Camp Small, a 5-acre site in the center of Baltimore and managed by the City's Parks and Recreation Division of Forestry. Camp Small collected roughly 8,000 tons of wood last year. This only accounts for 10% of the wood waste in the city.

The remaining 90% generated by utility companies and private arborists follow a common path of wood waste. Some arborists or utility companies may deliver and sell high value logs to a local mill. Materials that are not diverted are likely to go to a landfill. According to the Urban Wood Handbook, some landfills collect information on the volume of wood debris that they take in each year while others refuse to accept any wood debris. There are a few landfills that have a mulch or firewood operation as part of their recycling operation. Landfills charge a fee in order to accept the wood: the per ton tipping fee. The tipping fee in the City of Baltimore is \$67.50¹⁰.

Given the volume of the wood waste supply, there is plenty of opportunity to have a successful wood mill operation. As discussed in greater detail in the next section, Camp Small's existing relationships present a strong opportunity to grow partnerships and easily achieve this market capture.

Figure 5. Urban Wood Supply in Baltimore



¹⁰ <https://mde.maryland.gov/programs/LAND/RecyclingandOperationsprogram/Documents/BaltimoreCity.pdf>

3.2.3 Urban Wood as an Input

Input Sources: Drop off and Collection

Our model has two primary sources: drop off and collection. Drop-off consists of arborists, utility companies, and the government services that drop off their wood waste at the yard. Collection consists of retrieving the wood on site, and requires transportation equipment and a trained crew.

Collection Equipment Required

In order to collect wood, investment into trucks and machinery must be made. In order to be conservative, we assume high investment costs. Therefore, we select the top of the line equipment. Cheaper equipment could be purchased on the used market that could lower the initial cost of investment. For all the equipment listed, there will variable costs include fuel and maintenance.

Table 3. Urban Wood Collection Investment

Equipment (Example)	Use/Capacity	Cost	Crew	Notes
Heavy Duty Truck with Knuckleboom (International 44000 with American Hawk Crane)	Use: Hauling Logs Capacity: 20 tons	\$250,000	3	A CDL license will be required to operate the heavy duty truck.
Medium Truck with Trailer (F450 with a Big Tex Flatbed gooseneck trailer)	Use: Hauling Logs Capacity: 10 tons	\$85,000 (\$60,000 truck, \$25,000 trailer)	2	
Tractor Boom + Trailer (Wallenstein Logging Company: Timber Tallon LX 115/LT60 Log)	Use: Greater mobility in an urban environment. (e.g., driving to a backyard) Capacity: 5 tons	\$40,000	2	May not be required but would be nice to have in a dense urban setting
TOTAL		\$375,000	20 tons	

Cost of Inputs

The urban wood market is unique. In most industries, inputs have a cost. In the urban wood market, collection can be both a cost and a source of revenue.

- **Collection:** Arborists may be willing to pay others to pick up the wood on their behalf. This allows the arborists to save the time, gas, and costs associated with driving to the landfill and paying the tipping fee. As previously stated, Baltimore City has a landfill tipping fee of \$67.50 per ton¹¹. In that scenario, Fresh Cut is actually getting paid to collect the inputs of the mill (less the costs of labor and gas). On the other hand, to generate business and ensure that arborists are choosing Fresh Cut over other sources, Fresh Cut may choose to collect the wood for free or even pay for the opportunity to salvage a tree of high value. In those scenarios, collection is a cost driver.
- **Drop Off:** Since Fresh Cut is competing with a landfill that is further away, Fresh Cut could charge a tipping fee that is similar to Baltimore City's landfill rate. In this scenario, Fresh Cut would be getting paid to collect the inputs of its business model, turning the input, traditionally a cost, into a revenue source. Conversely, to ensure that Fresh Cut is not receiving only poor quality products, Fresh Cut should be willing to pay customers for high quality logs. Therefore, the source of inputs can be both a cost and revenue.

In summation, there are many different models that Fresh Cut could pursue to ensure a steady supply chain. To simplify the projections, we established an average cost to Fresh Cut of \$55 dollars per ton of wood collected. We identified this number based on our projections for the variations of quality in incoming wood under the assumption that receiving low quality wood would be a source of revenue generation and high quality wood would be a cost driver. This value is roughly 80% of the Baltimore City tipping fee, which seems appropriate and adds confidence to our assumption.

Amount Collected:

The amount of wood that can be processed is dependent on three things:

1. **Supply:** This is the amount of urban wood waste. This was discussed in detail in the previous section. The large flow of wood waste in Baltimore indicates that wood supply is not a constraint.
2. **Capability:** Fresh Cut's capability consists of the partnerships and relationships with arborists, public entities, and utility crews, and the ability to collect wood. Since we assumed high quality equipment and investment costs, equipment is not a constraint. Therefore, a constraint could be related to the relationships that lead to a high amount of drop off tonnage. That is, is Fresh Cut able to create and maintain the same type of relationships as publicly operated Camp Small? Our model assumes that Fresh Cut can receive 50% more wood than is currently received at Camp Small, or 12,000 tons. Since Camp Small is 5 acres and we are assuming Fresh Cut will operate out of a 10 acre yard, this is reasonable.
3. **Capacity:** Capacity considerations consist of acreage to store the collected wood, the number of crews, and the capacity constraints of the collection

¹¹ <https://mde.maryland.gov/programs/LAND/RecyclingandOperationsprogram/Documents/BaltimoreCity.pdf>

equipment. We assume that two crews will be able to collect 2,000 tons a year, or 4,000 tons total.

With these considerations in mind, we assume that Fresh Cut can capture 16,000 tons a year, 12,000 tons of which will be dropped off and 4,000 tons will be collected.

Quality:

The quality of wood that is received drives the type of product and the price point for the product. We conservatively assume that the vast majority will be average and low quality inputs, with only a very small percentage being high quality. These numbers were derived from the current incoming wood supply at Camp Small and calibrated with subject matter experts.

- **High Quality:** 3%
- **Average Quality:** 60%
- **Low Quality:** 37%

Table 4. Urban Wood Sourcing

	Municipal operations	Utilities	Other
Source of material	Currently the source of materials coming into Camp Small are from the City Forestry tree maintenance crews and contract crews, Park's maintenance crews, and pruning's from tree care partners	Materials from surrounding utilities such as BG&E that arise due to line maintenance or expansion of transmission grids	There is an opportunity to source trees from private sources (e.g. disposal of wood chips, leaves, and manure from the Maryland Zoo) and private arborists
Quality of material	Unprocessed logs, wood chips, and unprocessed brush are of low value. Rec and parks does not currently have the capacities for sorting and processing all of these materials into higher value products	Usually higher quality material from this source	Quality varies depending on source
Total volume of material	No less than 8K tons	n/a	n/a
Potential cost savings and Revenues	\$103k annual cost avoidance for material removal. One-time \$150k for savings and sale of screened compost. 75k annual for sale of logs and chips.	n/a	Private Arborists: Tipp Fee avoidance and landfill trip time costs Zoo: \$141,800 per year for the City ¹²

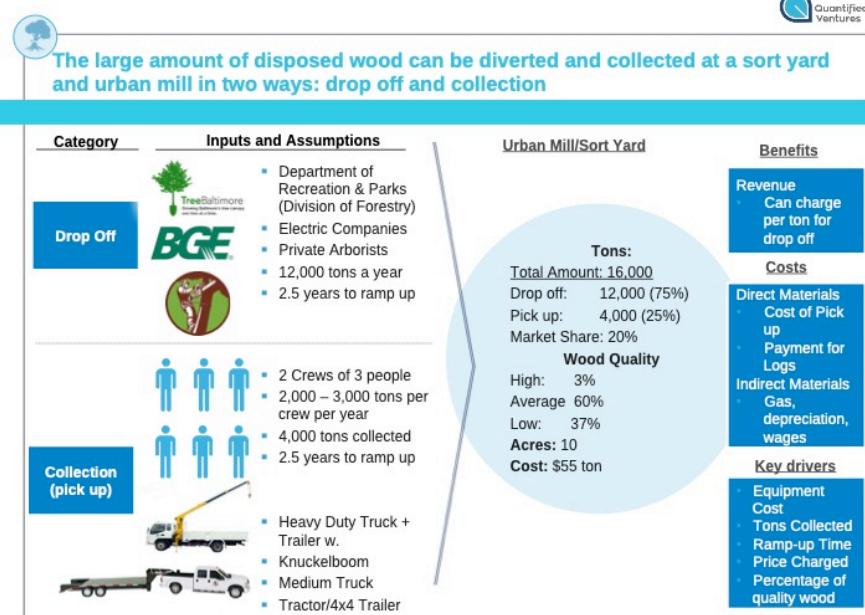
¹² This number is an estimation that includes \$56,400 in tipping fees for 1,200 tons of leaves at BRESCO, \$80,000 average for wood grinding and removal at Camp Small, and \$5,400 in fuel and labor costs for hauling 2,340 tons of manure from the Maryland Zoo to Quarantine Road Landfill.

Source: Camp Small grant and enhancement proposals and interview conducted

Key assumptions and justifications:

- **Input Cost:** \$55 dollars a ton. This is a cost to the Fresh Cut operation as there is a cost to receiving urban wood. The reason that landfills charge a tip fee is to cover their expenses. That is, there is a cost to receiving urban wood no matter what is charged to the drop off or collection customer. The \$55 is roughly 80% of the tipping fee for Baltimore City's landfill. This accounts for the fact that Fresh Cut will have to pay for high quality logs and will charge for lesser quality wood.
- **Market Capture:** We assume that Fresh Cut can capture twice the current annual amount of Camp Small, or 16,000 tons. This is conservative given that Camp Small is capturing only 10% of the market without engaging in wood collection.
- **Acreage:** We assume a 10 acre lot, which can hold the 16,000 tons a year.
- **Drop Off Amount:** We assume the amount of wood at Fresh Cut will consist of 75% from Drop Off and 25% from Collection. We came to this conclusion because Camp Small is already receiving 8,000 tons a year (50% of our estimated total) without partnering with private arborists or utility companies. That partnership could easily increase Drop Off by 50% to 12,000 tons per year.
- **Collection Amount:** We assume that 2 crews collecting 2,000 tons per crew per year for a total of 4,000 tons per year. This number was conservative based off an assessment from Mike Galvin from SavAtree that crews can collect upwards of 3,000 tons per year.
- **Ramp up:** We assume it takes 6 months of operation prior to receiving any urban wood and it takes 2 years to grow to full capacity. The growth to full capacity was calculated using a compound annual growth rate (CAGR). After 2.5 years, the yard is receiving 16,000 tons a year. Following the 2.5 year mark, we assume a 2% increase in wood collection and drop off a year from “learning by doing” and increasing awareness. The 6-month delay and slow start are conservative assumptions.

Figure 6. Urban Wood Sourcing



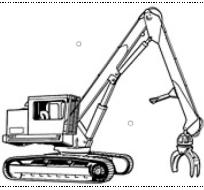
3.2.4 Sorting

As the Urban Wood Handbook states, “You can’t sell it if you don’t sort it”¹³. Once the wood is collected at the yard it needs to be sorted into the following categories:

- Logs
- Limbs
- Brush
- Compost
- Wood Chips and Mulch

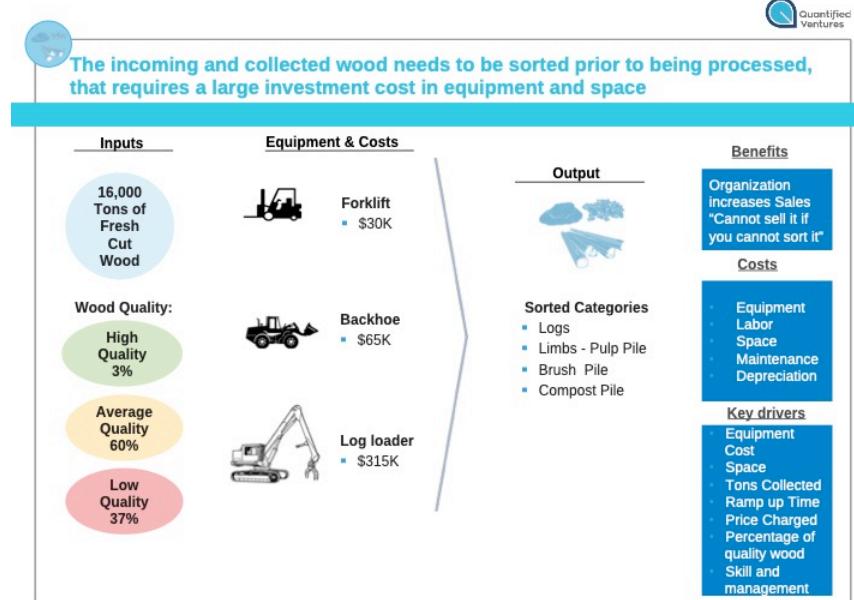
This requires equipment that can pick up and move the urban wood around the yard.

Table 5. Urban Wood Sorting Equipment Investment

Equipment (Example)	Use/Capacity	Cost	Crew
Forklift (Daewoo Propane 5K)		2 tons	\$30,000
Backhoe (Terex TLB840R)		10 Tons	\$65,000
Log Loader (DEERE 2656G)		10 Tons	\$315,000
TOTAL		10 tons	\$410,000

¹³ Galvin, Grove, Hines, Marshall: The Urban Wood Workbook: A Framework for the Baltimore Wood Project

Figure 6. Urban Wood Sorting Summary



3.2.5 Production and Processing

The next phase is processing the wood. This consists of taking the raw urban wood materials into something that is marketable either as an input for secondary manufacturing or as a stand alone product. The chart below indicates the equipment that is required for processing, and the following sections indicate which products can be processed using said equipment.

Table 6. Urban Wood Processing Equipment Investment

Equipment	Use/Capacity	Cost	Crew	Notes
Horizontal Grinder (Vermeer HG6000TX)	Helps to maintain a consistent processing rate for a variety of raw materials, from whole pallets to wood chips to slab wood creating higher valued products	\$705,000	1	Horizontal grinders tend to have a more complex feeding mechanism, which can make maintenance more challenging
Portable Sawmill (Woodmizer LT 70)	Live Edge and processing lumber Slabs 36" log diameter, 20'2" log length, and production up to 940 bf/hr.	\$105,000	2	Fully-loaded portable sawmill.

Industrial Sawmill (Woodmizer WM1000)	Live Edge Slabs Capacity center cut of 67" 1050 bf/hr	\$105,000	3	Uses thin-kerf narrow band blades that measure 2" to 3" wide.
Firewood Splitter (Woodmizer FS500)	Firewood, 3 cords/hr.	\$35,000	1	42 tons of force, 3-way wedge, log lift, and production up to
Biochar Pyrolysis	Biochar	\$100,00*	1	
TOTAL		\$1,050,000	3	10 tons

*Biochar unit specifications are a representative placeholder as no individual unit has been selected

Product Offering:

The types of products that an urban mill can offer is dependent upon the equipment purchased and the quality of the incoming wood. With Fresh Cut's current equipment purchase assumptions, Fresh Cut will have the ability to produce: Live Edge Slabs, Dimensional Lumber, Firewood, BioChar, Chips, Compost, and Log 2nds and 3rds. If more equipment is purchased, Fresh Cut could produce Pellets and Pallets.

Product offering and pricing can be the hardest to estimate for many reasons. First, there is variation in input quality that will drive the proportions of product mix. Second, even with predictability of inputs, the product offerings are difficult to predict because it can be a user's choice. That is, one input could be made into multiple products at the user's discretion. Third, pricing may vary with species of the input wood for the exact same product. Projecting a species mix with confidence would increase the accuracy of the projections, but that is difficult. Fourth, there are variations in product pricing units. Firewood is sold in cords. Dimensional lumber is sold in board feet. Compost and chips are sold by the ton. To make matters more complicated, the incoming wood is measured in tons. Fifth, many wood products are commodities that are affected by a fluctuating market rate price.

This report is dependent upon projections. Instead of ensuring 100% confidence in the product mix, it is important to highlight a guiding principle. Our goal is to answer the question "Can Fresh Cut offer a product mix that, on average, sells at a certain price per ton?" Therefore, in order to account for the uncertainty and variability, it is easiest to group the products into categories of similar price points. For Example, Fresh Cut may produce more of firewood and less of high-quality chips as predicted but using the categories, Fresh Cut can say "what value we are getting out of average quality inputs".

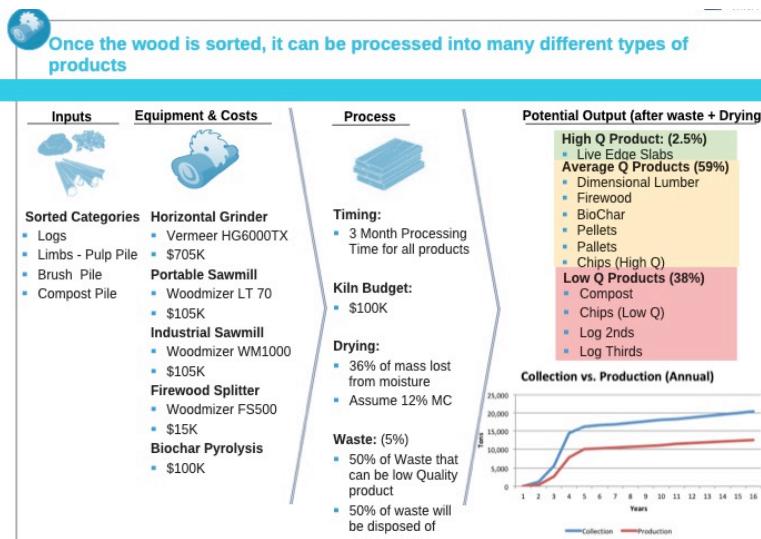
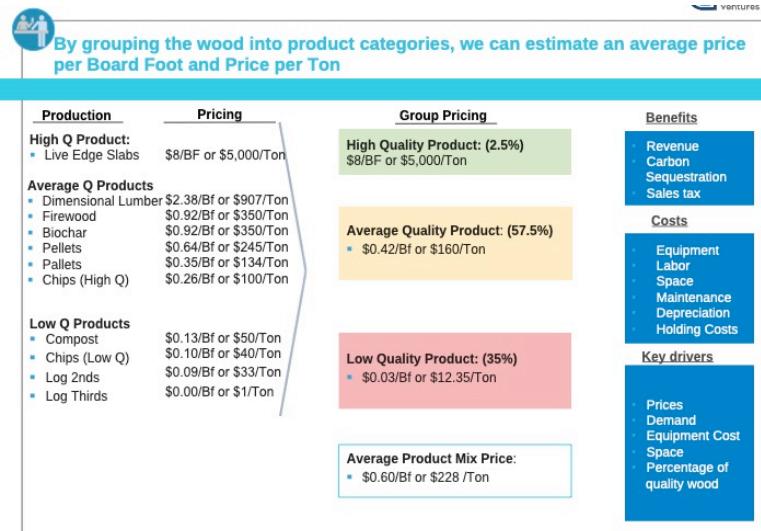
Table 7. Urban Wood Product Grouping and Pricing

Grouping	Product	Assumed Percentage Output	Price (Per BF)	Price (Per Ton)
High Quality (> \$1000/ton)	Slabs	2.5%	\$8	\$5,030
Average Quality (\$100/ton-\$1000/ton)	Dimensional Lumber	2.5%	\$2.38	\$907
	Firewood	15%	\$0.92	\$350
	Biochar	15%	\$0.92	\$350
	Pellets	2.5%	\$0.64	\$245
	Pallets	12.5%	\$0.35	\$134
	Chips (High Quality)	10%	\$0.26	\$100
Average Quality Price		59%	\$0.42	\$160
Low Quality (<\$100/ton)	Compost	10%	\$0.13	\$50
	Chips (Low Quality)	10%	\$0.10	\$40
	Log 2nds	10%	\$0.09	\$33
	Log 3rds	5%	\$0.00	\$1
Low Quality Price		35%	\$0.03	\$12.35
Waste		5%	-\$0.18	-\$67.50
Total Product mix		100%	\$0.6	\$228.42

Key assumptions and justifications:

- **Timing:** 3 months processing time for all products. Some products will have no processing time (chips and logs seconds and thirds). Some products may have longer processing times (compost, dimensional lumber).
- **Kiln Budget:** We allocated \$100,000 for a Kiln Budget. We assumed that Fresh Cut would build 4 kilns. Kiln drying lumber is a simple, cost effective method to increase profits by selling dried lumber.
- **Drying:** 36% of mass lost from moisture content. This is an important because we are using tons as our input and need to adjust for a change in mass.
- **Moisture Content:** 12% of products mass is water.
- **Waste:** 5% of waste during production. 50% of the waste is assumed to be able to be captured into low quality product such as compost. The other 50% will be disposed of at a cost of the Baltimore City tipping fee. This is extremely conservative for modeling purposes, as the stated goal is to have “100% of the waste captured”

Figures 7 and 8. Urban Wood Product Summary



3.2.6 Miscellaneous Costs

Sections 3.2.1-3.2.5 identified the major drivers of cost. This section discusses the smaller but also impactful costs.

- **Land and Buildings:**

- **Acreage:** 10 acres for subsidized rent of \$650 an acre. This is significant for a few reasons. First, if we assume the land is not purchased, it does not require an upfront investment, nor is it an asset on the balance sheet. Second, the implementation of Fresh Cut may leverage the existing infrastructure on Camp Small.
- **Office:** We assume a jobsite construction office that can be purchased for \$22,500 dollars.
- **Electricity:** We have included the purchase of one 80 kW Generator which we priced at \$15,000 for a Generac 80KW propane/natural gas generator. This was taken from a similar firm in Texas. While we use a “real world” example, given the mission of the project, we recommend a

greener solution with less wattage. Off grid 10KW electric solar units with batteries cost a similar amount. Since a large driver of electricity will be driven by the Kiln design, including humidifiers. The \$100,000 for the Kilns can be shared with the \$15,000 budget electricity production. Lastly, this is conservative as there is potential that the site could be connected to the grid.

- **General:**
 - **Selling, General, and Administrative Expense (SG&A):** 7.2% of direct labor costs would be attributable to SG&A. This value was derived from the 10K fillings from publicly traded timber firms.
 - **Cash Reserves/Working Capital:** 5% of initial investment and 5% of total expenses each year.
- **Indirect Costs:**
 - **Indirect Materials:** 9% of total material cost is projected to be indirect materials. This is comprised of adhesives, equipment maintenance, energy, fuel, packaging, and other costs. The 9% was based on an analysis of comparable companies and previous analysis of a Cross Laminated Timber (CLT) manufacturing facility. This is conservative as this Fresh Cut operations will not have the expensive adhesives used in the CLT facility.
 - **“Learning by doing” / Training Inefficiencies:** For the first month of any new rotational labor cohort we added half of the cohort’s salary under the assumption that they might be 50% less productive as they have to get trained on the equipment by shadowing others.
 - **Depreciation of Assets:** We used the Modified Accelerated Cost Recovery System on all assets that are purchased.
- **Inventory Holding Costs:**
 - **Storage:** We allocated \$8,500 for the purchase of 23 Storage Racks. Each Storage rack costs \$375 and can hold 18,600 pounds. The purchase of 23 racks was based off the maximum inventory assumption of 20% of production (223 tons) held as inventory.

3.2.7 Costs of Goods Sold Over Time

Costs of goods sold (COGS) is the direct costs attributed to the production of goods sold. This is distinct from goods produced. That is, inventory costs for goods produced but not sold have to be accounted for. It is fruitful to determine the average cost of production and compare it to the sale price of the firm. As Chart 1 shows, the average direct cost of production drops steadily as more and more wood is collected and products are produced. The firm approaches the capacity of 16,000 tons capacity by year 2.5. This is because the direct labor costs are now spread out over more products.

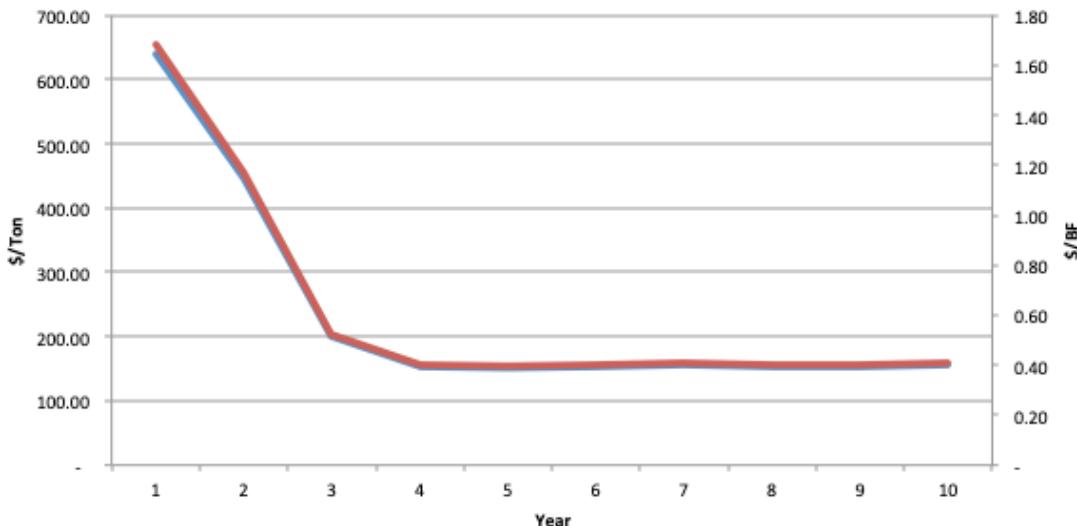
Table 8. Cost of Goods Sold Over Time

YEAR	1	2	3	4	5	6	7	8	9	10
Average Direct Cost of Production (\$/Tons)	640.66	448.03	200.41	153.07	151.38	153.30	155.23	154.08	153.13	155.18

Average Direct Cost of Production (\$/BF)	1.68	1.17	0.53	0.40	0.40	0.40	0.41	0.40	0.40	0.41
Book Value of Inventories on First of Year	(1,052)	(9,265)	(28,866)	(40,930)	(42,581)	(44,299)	(46,086)	(47,945)	(49,879)	(51,891)
Direct Labor Cost	22,122	36,811	38,328	39,852	41,382	42,919	44,402	45,523	46,426	47,348
Direct Materials Expenses	5,810	26,198	68,778	79,431	82,636	85,969	89,437	93,045	96,799	100,703
Direct Equipment Depreciation	19,727	27,280	16,449	10,386	6,793	6,226	5,718	2,723	-	-
Book Value of Inventories on Dec. 31	(1,475)	(10,207)	(30,820)	(41,064)	(42,720)	(44,444)	(46,236)	(48,102)	(50,042)	(52,061)
COGs	45,133	70,818	63,869	47,676	45,509	46,371	47,235	45,245	43,304	44,099

Chart 1. Average Direct Cost of Production

Average Direct Cost of Production



3.3 Identification of Revenues

3.3.1 Potential Consumers and End Uses

Table 9. End Uses Summary

Type of product	Value of material (range / unit)	Potential end uses / users for product
Logs	“Firsts” – Priced based on market report (Appalachian hardwood center) “Seconds” – \$0.30 per board foot → greatest opportunity to maximize value with high end users such as Room and Board	“Firsts” – lumber yards, whiskey barrels, flooring, wall cladding “Seconds” also known as “character wood” – furniture (interest from Room & Board) “Thirds” – Mulch, pulp, or biofuel

	"Thirds" – bulk of production (80-90%) – \$1 per truck load (buyer needs to load and haul)	
Firewood	\$60-\$225 per cord (4 ft. x 4 ft. x 8 ft.) ¹⁴	Saw mills, artists, landscapers and residents, home owners, businesses, restaurants.
Chips	1-20 yards at \$10/yard If in bulk, 25 cents per yard With better separation, can double value \$10-\$20/yard For landscape \$25/yard	DPW, DOT, City Schools for landscaping, horticulture, city garden paths, etc.
Pellets	\$245 per ton ¹⁵	Fuel for power generation, commercial or residential heating, and cooking
Wood pallets	\$0.5 to \$4 each ¹⁶	Local manufacturers, furniture companies
Compost	\$30 dollars per cubic yard or \$50 per ton ¹⁷	Compost is in high demand by gardeners and landscapers throughout Baltimore City: The Office of Sustainability runs two programs that will have compost needs in the immediate future – The Growing Green Initiative and the Homegrown Baltimore Land Lease Initiative
Biochar	Market is still in development so large variation in pricing. \$200-2000 a ton. ¹⁸ Recommended to sell at \$485 a ton. Noted that the greatest yield for biochar is 30% (proportion of biomass dry weight) ¹⁹	Soil amendments, produce, orchards, retail plotting soil, soil remediation, water filtration, poultry farm pollution reduction, animal bedding
Slabs / cross-cut slabs	\$6-20 per board foot	Furniture Architecture

3.3.2 Projected Production, Inventory, and Sales

Putting everything together shows a 10-year production and sales growth is shown in figure 9, below.

¹⁴ <http://www.woodheat.org/cord-wood.html>

¹⁵ <https://www.pellet.org/wpac-news/global-pellet-market-outlook-in-2017>

¹⁶ <https://moneypantry.com/recycle-wood-pallets-for-money/>

¹⁷ http://www.waste360.com/mag/waste_growing_compost_profits

¹⁸ <https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/16584/BushellMPFinal.pdf?sequence=2>

¹⁹ https://ag.umass.edu/sites/ag.umass.edu/files/reports/timmons_-_biochar_report_10-16-17.pdf

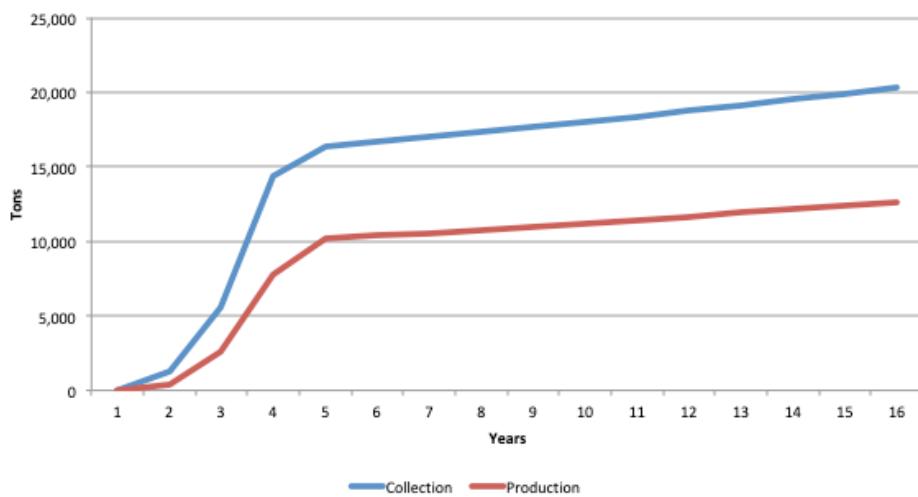
Figure 9. 10 Year Production Estimations

Production Steps and Summary														
A. Wood Collection		% of Total	1	2	3	4	5	6	7	8	9	10		
1 Pick Up		25%	258	1,401	3,737	4,097	4,186	4,277	4,369	4,464	4,561	4,660		
2 Drop Off		75%	773	4,203	11,212	12,291	12,557	12,830	13,108	13,392	13,682	13,979		
3 Incoming Tons Collected		100%	1,031	5,604	14,949	16,388	16,743	17,106	17,477	17,856	18,243	18,639		
4 High Value Incoming		3%	27	147	393	431	441	450	460	470	480	490		
5 Average Value Incoming		61%	624	3,392	9,048	9,919	10,134	10,354	10,578	10,808	11,042	11,281		
6 Low Value Incoming		37%	380	2,065	5,507	6,038	6,169	6,302	6,439	6,579	6,721	6,867		
B. Waste from processing		% of Green Mass Lost to Waste	1	2	3	4	5	6	7	8	9	10		
1 High Value		5%	1	7	20	22	22	23	23	23	24	25		
2 Average Value		5%	31	170	452	496	507	518	529	540	552	564		
3 Low Value		5%	19	103	275	302	308	315	322	329	336	343		
4 Less Reprocessed Waste			(26)	(140)	(374)	(410)	(419)	(428)	(437)	(446)	(456)	(466)		
5 Total Waste		5%	26	140	374	410	419	428	437	446	456	466		
C. Green Wood into Kiln		Less Waste	1	2	3	4	5	6	7	8	9	10		
1 High Value			26	140	374	410	419	428	437	446	456	466		
2 Average Value			593	3,222	8,595	9,423	9,627	9,836	10,049	10,267	10,490	10,717		
3 Low Value			361	1,961	5,232	5,736	5,860	5,987	6,117	6,250	6,385	6,524		
4 Total in Kiln			979	5,324	14,201	15,568	15,906	16,251	16,603	16,963	17,331	17,707		
D. Time in Kiln and Drying Loss		% Loss of Green Mass	1	2	3	4	5	6	7	8	9	10		
1 High Value		36%	4	38	118	146	149	153	156	159	163	166		
2 Average Value		36%	91	866	2,714	3,361	3,434	3,509	3,585	3,662	3,742	3,823		
3 Low Value		36%	59	565	1,770	2,192	2,240	2,288	2,338	2,389	2,440	2,493		
4 Total Mass lost in Kiln			154	1,469	4,601	5,700	5,823	5,949	6,078	6,210	6,345	6,482		
E. Production (Tons)		Months in Kiln	1	2	3	4	5	6	7	8	9	10		
1 High Value Products (post Kiln)		3.00	7	67	211	262	267	273	279	285	291	297		
2 Average Value Products (post Kiln)		3.00	163	1,550	4,856	6,015	6,146	6,279	6,415	6,554	6,696	6,841		
3 Low Value Products		3.00	106	1,011	3,167	3,923	4,008	4,095	4,184	4,274	4,367	4,462		
6 Total Production			276	2,629	8,235	10,200	10,421	10,647	10,878	11,113	11,354	11,601		
F. Sales Volume (Tons)		% Sold	1	2	3	4	5	6	7	8	9	10		
1 High Value Products		80%	7	66	209	261	267	273	279	285	291	297		
2 Average Value Products		80%	151	1,522	4,803	6,013	6,144	6,277	6,413	6,552	6,694	6,839		
3 Low Value Products		80%	98	993	3,132	3,922	4,007	4,094	4,182	4,273	4,366	4,460		
4 Total Sales Volume			256	2,581	8,144	10,196	10,417	10,643	10,874	11,110	11,351	11,597		
G. Sales Revenue (\$)		Price Point in Year 0	1	2	3	4	5	6	7	8	9	10		
1 High Value Products		\$5,030.1	33,021	339,461	1,094,942	1,399,994	1,461,305	1,525,293	1,592,074	1,661,770	1,734,508	1,810,420		
2 Average Value Products		\$160.6	24,244	249,233	803,909	1,027,879	1,072,894	1,119,874	1,168,905	1,220,077	1,273,481	1,329,215		
3 Low Value Products		\$12.4	1,216	12,502	40,325	51,560	53,818	56,174	58,634	61,201	63,879	66,675		
4 Total Sales Revenue			58,481	601,196	1,939,176	2,479,433	2,588,017	2,701,342	2,819,614	2,943,048	3,071,868	3,206,311		
H. Waste Disposal Cost		Price Point in Year 0	1 Cost of Waste Disposal	-\$67.5	(1.739)	(9.646)	(26.289)	(29.440)	(30.730)	(32.075)	(33.479)	(34.945)	(36.475)	(38.071)

Figure 9, above, is graphically represented in Charts 2, 3, and 4.

Chart 2. Production Growth (Tons)

Collection vs. Production (Annual)



Production Growth

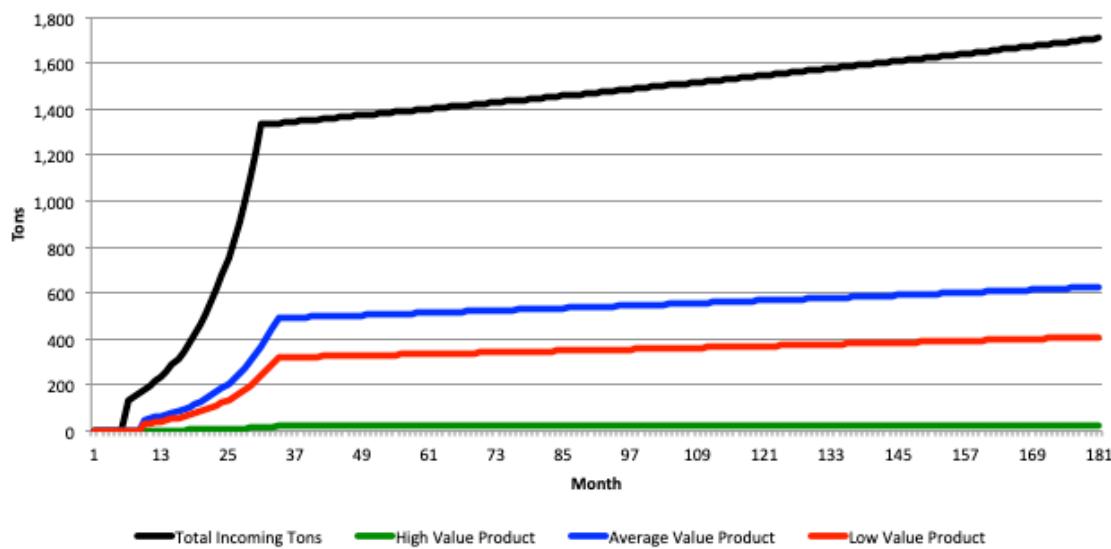
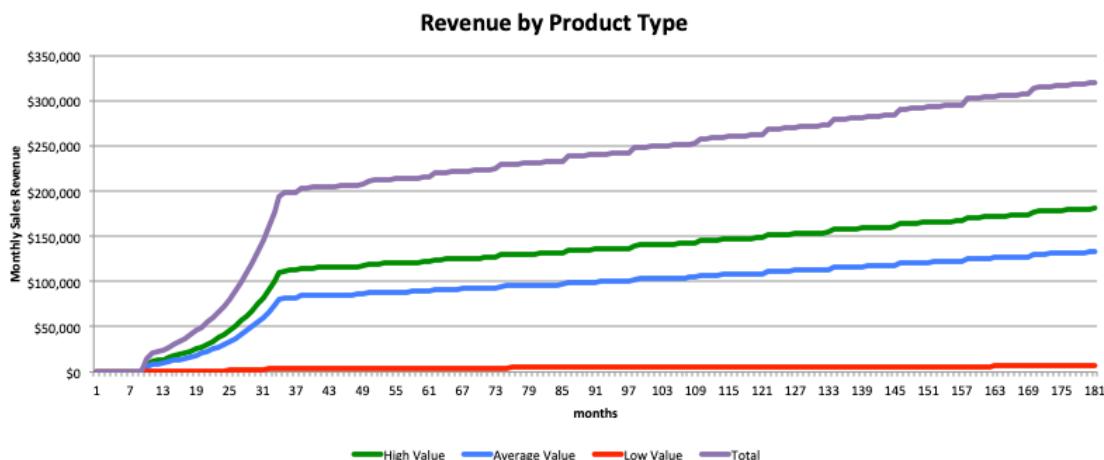


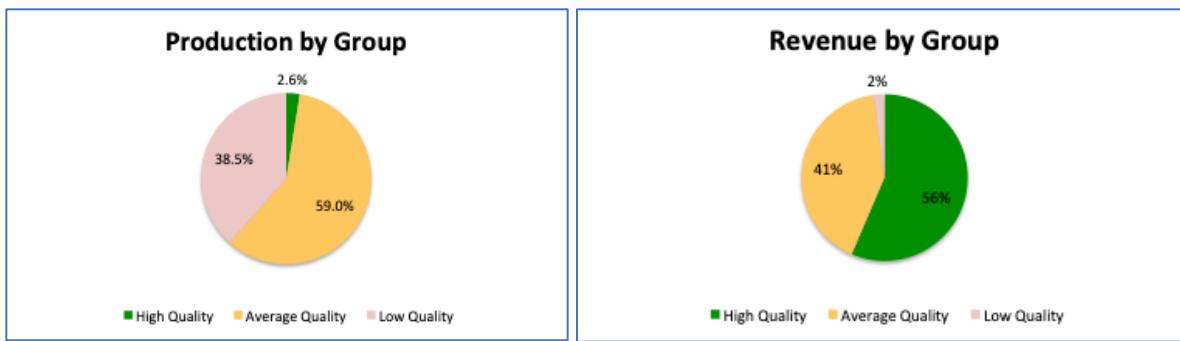
Chart 2, above, shows that after accounting for the decline in mass from drying and waste during production, there is a difference between the amount of wood that is collected versus the amount of wood that can be produced and sold. Chart 3, above, highlights this scenario. Charts 2 and 3 also highlights the 3 month kiln time: the production curve is slightly to the “right” of the collection curve on the graph.

Chart 4. Revenue Projections by Type



As shown in Chart 4, above and Charts 5 and 6, below, although high quality products are the smallest amount of production (2.6%), they make up over 50% of the revenue. This is because the high quality products are much more expensive than the rest of the product offerings. Therefore, the best thing to do is to balance the zero waste initiative with ensuring that high quality wood is coming into the production pipeline.

Chart 5 and 6. Production and Revenue by Type



3.4 Financial Cash Flow Model

We used a 15-year liquidation model, which calculates net present value of the enterprise assuming it stops production after 15 years and sells all of its assets. This is a conservative model as compared to other enterprise valuation methods such as the Discounted Cash Flow with Terminal Value method or a Multiple Valuation method.

Chart 7 shows the undiscounted cash in versus cash out. The sharp “peak” in year 15 is attributed the liquidation method. In that year all assets are liquidated and sold off, therefore there is a spike in the revenue in that year. (All subsequent Charts will have similar “peaks”.) It is considered conservative because the spike is a lesser amount than the value that would be produced if Fresh Cut operated into perpetuity. In month 31, the cash in becomes greater than the cash out (green line is above the red line). This indicates the firm is quickly operating at a profit once it is at scale.

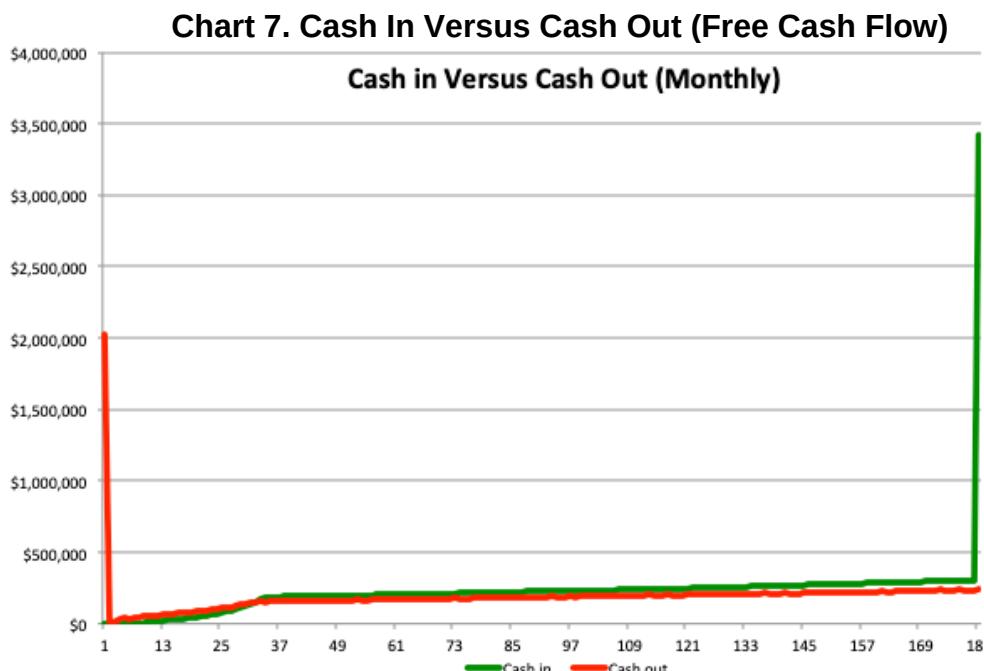


Chart 8, below, shows the undiscounted cash flow on an annual basis. Of note, in year 3 the net cash flow becomes positive which correlates to where the cash in (green

curve) is greater than the cash out (red curve). This also corresponds with the black curve crossing over the x axis

Chart 8. Annual Cash Flow (Free Cash Flow)

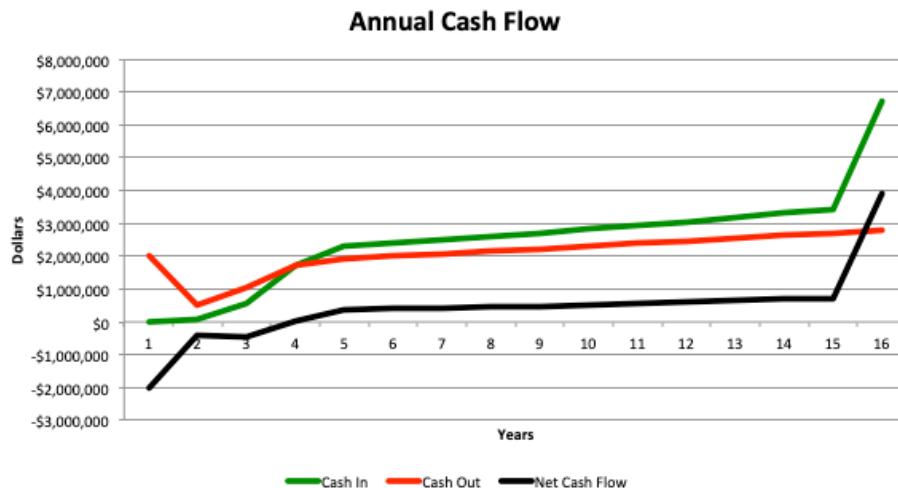
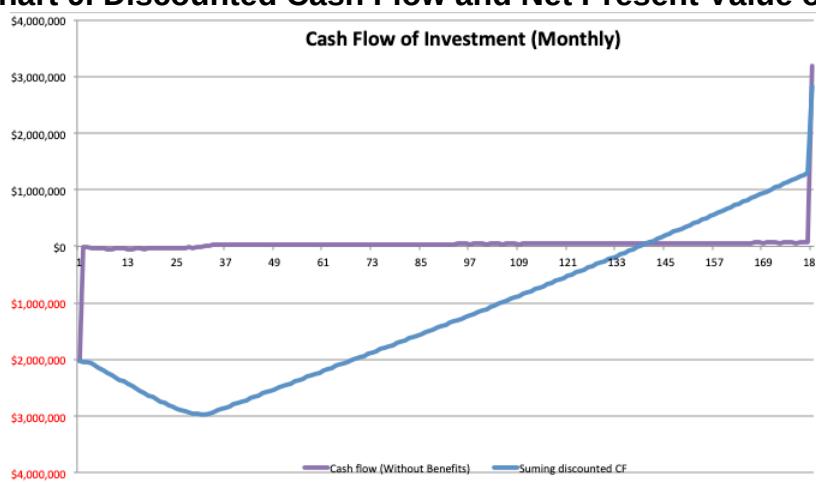


Chart 9, below, shows two curves. The purple curve is the financial cash flow (still ignoring all social and environmental benefits). The blue curve is the present value of the investment over time. Throughout our analysis we use a 5% discount rate. As the previous graphs have also highlighted, the cash flow, purple curve, becomes positive in year 3, or month 31. This month corresponds with the lowest point on the blue curve, which is the overall net present value of the investment over time, signaling that the investment is starting to return positive gains. The investment follows a typical "J Curve" in which a large amount of money is invested and the firm operates at a loss until it can produce and sell enough product to be profitable. After year 3, the firm breaks even and continues to be profitable, and the overall investment becomes positive in year 12, or month 138.

Chart 9. Discounted Cash Flow and Net Present Value over Time



3.5 Comparison to Other Firms

To ensure that our projections were within reason, we compared our cash flow to other firms within similar industries, this included publicly traded timber firms and publicly available market analysis of timber mills. While most publicly reported data is not going to be directly comparable to Fresh Cut, using this information was at least a check to determine if the findings are reasonable. We compared multiples from our cash flow such as:

- Accounts Receivable as a percentage of Sales
- Selling, General, and Administration Expenses (SG&A) as a percentage of Sales
- Accounts Payable as a percentage of Sales
- Cash Balances as a percentage Sales
- Direct Cost of Materials as a percentage of Output Price
- Variable Cost of Manufacturing as a percentage of Total Manufacturing Cost

Most of our comparisons were within range. The greatest deviation consisted of the direct cost of materials to output price. The cost of materials for Fresh Cut is substantially lower than for other firms. That is due to a unique fact about the market for urban wood supply: the collection of some urban wood could actually serve as a source of revenue for Fresh Cut, which lowers the overall direct cost of materials.

Fresh Cut had much lower SG&A multiple as compared to other firms, in part because our SG&A value was tied to direct costs. This can be justified because Fresh Cut will not be a standalone operation. Via partnerships with Humanim, the Forest Service, and the City of Baltimore, some SG&A may be shared with the parent organizations. That said, when replicating this model attention should be paid to this assumption.

3.6 Return on Investment

This section answers the first of our three questions: Would the operation produce a positive return on investment? We find the answer to be yes.

The project generates a positive return on investment. We used multiple Return on Investment methods to guide our recommendation. Each method can be used based on the preferences of the investor. In this case, all methods indicate that the project has a positive return on investment. The payback period is relatively long (over 10 years).

Table 10. Various Method of Investment Indicators

Method	Value	Definition	Notes
NPV	\$2,825, 862	Net present value relative to year 0	Accept any project with an NPV greater than zero
IRR	12%	Internal Rate of Return. Calculated using EXCEL IRR formula. It is the discount rate that makes the NPV zero	12% return on the investment.
BC1	1.36	Benefit Cost Ratio (1) computed by taking the ratio of DISCOUNTED net cash flow to DISCOUNTED initial costs.	The higher the BCR the better. Accept any project with a BCR greater than 1
BC2	1.12	Benefit to Cost Ration (2) ratio calculated as summation of discounted gross benefits to summation of discounted costs in each period	The higher the BCR the better. Accept any project with a BCR greater than 1
PB1	113	Payback Period (1) Undiscounted Payback Period (# of months)	In year 10, the investment is overall positive
PB2	138	Payback Period (2) Discounted Payback Period (# of months)	In year 12, the investment is overall positive after accounting for the time value of money

3.7 Sensitivity Analysis

The analysis thus far has created a projection of costs and revenues. Next, we conduct a sensitivity analysis to determine confidence in the assessment that the firm will be NPV positive. This analysis will identify key variables that will drive large changes to the NPV.

3.7.1 Identification of Key Drivers

We selected 5 variables to test the models tolerance. Instead of trying to isolate the effects of a change in one particular cost, such as wages, we looked at costs as a whole. The methodology was driven by the question, “How much higher can costs be than expected while maintaining a positive return on investment?” The chart below summarizes the answer to that question for each variable. In each scenario, the corresponding variable was changed while holding all others constant. The higher the

percentage change a variable can have off of the assumed value without making the investment negative, the less impact that variable has on the overall operation. If all variables have a high tolerance, it adds confidence to the model.

The key takeaway is that cost, revenues, and sale price are the biggest drivers of profitability. We can have a 12% increase in estimated costs and retain a positive investment. Given that we conservatively estimated acquiring the “best” equipment, high input material cost, and paying employees a living wage, we feel confident that there will not be a 12% increase in costs.

Alternatively, we can have a -10% change in revenue and still have a positive investment. Since revenue is driven by the volume of wood collection, the amount produced, the amount sold, and the average price of the wood sold. Fresh Cut has less direct control over these variables. Therefore, the most attention should be paid to input quality and pricing.

Surprisingly, the length of time it takes to ramp up is not a very large factor in the total investment. As the previous sections articulated, the revenues and sales are much harder to predict therefore we did our best to make conservative revenue assumptions. Regardless, the fact that it is a key driver of the model, particular attention should be paid to the average sales price of Fresh Cut in order to allow for adjustments in implementation and operation.

Table 11. Single Variable Analysis

Variable	Estimated Value	Value that makes the NPV Zero	Unit	Break Even % Change
Variation in Revenue	\$25,869,828	\$23,037,340	Present Value	-10.95%
Variation in Cost	\$23,043,966	\$25,877,221	Present Value	12%
Weighted Average Sale Price	\$0.45	\$0.40	Dollars/ BF	-11.80%
Variation in Volume (capacity)	16000	12,299	Tons a year	-23.13%
Ramp Up Time	2	5.50	Years	175%

3.7.2 Two Variable Sensitivity Analysis

The following sensitivity analysis demonstrates the impact of two key variables changing at the same time. Figure 10 on the following page shows the interaction between a change in sales price and cost estimates. If the weighted average sale price is higher than expected (i.e., a percentage of high quality inputs higher than 2.5% of total inputs), there is a greater tolerance for cost overruns. In other words, if the cost is higher than expected, Fresh Cut should pay particular attention to sorting and processing inputs to ensure that the average sales price is accurate. Conversely, if the costs are lower than expected, Fresh Cut can have a greater tolerance for poor quality wood. This is intuitive.

Figure 10. Two Variable Sensitivity: Sales Price and Costs

\$2,825,862		Variation In Sales Price (Weighted Average across Groups)											
		-25%	-20%	-15%	-10%	-5%	0%	5%	10%	15%	20%	25%	
Variation in Cost (total cost a month)	-25%	2,489,479	3,708,954	4,928,429	6,147,904	7,367,378	8,586,853	9,806,328	11,025,803	12,245,277	13,464,752	14,684,227	
	-20%	1,356,966	2,572,504	3,788,042	5,003,580	6,219,117	7,434,655	8,650,193	9,865,730	11,081,268	12,296,806	13,512,343	
	-15.0%	224,454	1,436,054	2,647,655	3,859,255	5,070,856	6,282,457	7,494,057	8,705,658	9,917,258	11,128,859	12,340,459	
	-10.0%	(908,059)	299,604	1,507,268	2,714,931	3,922,595	5,130,258	6,337,922	7,545,585	8,753,249	9,960,912	11,168,576	
	-5.0%	(2,040,572)	(836,846)	366,881	1,570,607	2,774,334	3,978,060	5,181,786	6,385,513	7,589,239	8,792,965	9,996,692	
	0.0%	(3,173,085)	(1,973,295)	(773,506)	426,283	1,626,072	2,825,862	4,025,651	5,225,440	6,425,230	7,625,019	8,824,808	
	5.0%	(4,305,598)	(3,109,745)	(1,913,893)	(718,041)	477,811	1,673,663	2,869,516	4,065,368	5,261,220	6,457,072	7,652,924	
	10.0%	(5,438,110)	(4,246,195)	(3,054,280)	(1,862,365)	(670,450)	521,465	7,133,380	2,905,295	4,097,210	5,289,125	6,481,040	
	15.0%	(6,570,623)	(5,382,645)	(4,194,667)	(3,006,689)	(1,818,711)	(630,733)	557,745	1,745,223	2,933,201	4,121,179	5,309,157	
	20.0%	(7,703,136)	(6,519,095)	(5,335,054)	(4,151,013)	(2,966,972)	(598,891)	585,150	1,769,191	2,953,232	4,137,273		
	25.0%	(8,835,649)	(7,655,545)	(6,475,441)	(5,295,337)	(4,115,234)	(2,935,130)	(1,755,026)	(574,922)	605,182	1,785,285	2,965,389	

Figure 11, below, shows the interaction between a change in revenue and cost estimates. The only difference between this and Figure 10, above, is that this is changing the total revenue rather than just the price. That is, revenue could increase either by selling more or at a higher price. The takeaway is the same findings as Figure 10, above.

Figure 11. Two Variable Sensitivity: Revenue and Costs

\$2,825,862		Variation In Revenue (Weighted Average across Groups)											
		-25%	-20%	-15%	-10%	-5%	0%	5%	10%	15%	20%	25%	
Variation in Cost (total cost a month)	-25%	2,119,396	3,412,888	4,706,379	5,999,870	7,293,362	8,586,853	9,880,345	11,173,836	12,467,327	13,760,819	15,054,310	
	-20%	967,198	2,260,689	3,554,181	4,847,672	6,141,163	7,434,655	8,728,146	10,021,638	11,315,129	12,608,620	13,902,112	
	-15.0%	(185,000)	1,108,491	2,401,982	3,695,465	4,988,965	6,282,457	7,575,948	8,869,439	10,162,931	11,456,422	12,749,913	
	-10.0%	(1,337,199)	(43,707)	1,249,784	2,543,275	3,836,767	5,130,258	6,423,750	7,717,241	9,010,732	10,304,224	11,597,715	
	-5.0%	(2,489,397)	(1,195,906)	97,586	1,391,077	2,684,569	3,978,060	5,271,551	6,565,043	7,858,534	9,152,025	10,445,517	
	0.0%	(3,641,595)	(2,348,104)	(1,054,612)	238,879	1,532,370	2,825,862	4,119,353	5,412,844	6,706,336	7,999,827	9,293,319	
	5.0%	(4,793,794)	(3,500,302)	(2,206,811)	(913,319)	380,172	1,673,663	2,967,155	4,260,646	5,554,138	6,847,629	8,141,120	
	10.0%	(5,945,992)	(4,652,500)	(3,359,009)	(2,065,518)	(772,026)	521,465	1,814,956	3,108,448	4,401,939	5,695,431	6,988,922	
	15.0%	(7,098,190)	(5,804,699)	(4,511,207)	(3,217,176)	(1,924,225)	(630,733)	662,758	1,956,250	3,249,741	4,543,232	5,836,724	
	20.0%	(8,250,388)	(6,956,897)	(5,663,406)	(4,369,914)	(3,076,423)	(1,782,932)	(489,440)	804,051	2,097,543	3,391,034	4,684,525	
	25.0%	(9,402,587)	(8,109,095)	(6,815,604)	(5,522,113)	(4,228,621)	(2,935,130)	(1,641,638)	(348,147)	945,344	2,238,836	3,532,327	

Figure 12 shows variation of input volume and sales price. The variation in volume has less impact than expected. With all current assumptions, Fresh Cut would require an input of only 12,000 tons annually to break even. At higher rates of market capture (upwards of 20,000 tons, or 25% of the total wood waste in Baltimore) there is higher tolerance for lower sales price. That indicates to us that, in the case of a lower than expected sales price, Fresh Cut can increase volume of low quality products and still be profitable. Conversely, Fresh Cut can decrease the amount that it collects and receives, but if it does, Fresh Cut should be more selective to have higher quality products.

Figure 12. Two Variable Sensitivity: Volume and Pricing

\$2,825,862		Variation In Volume (tons a year)											
		12000	12800	13600	14400	15200	16000	16800	17600	18400	19200	20000	
\$/Ton		-25%	-20%	-15%	-10%	-5%	0%	5%	10%	15%	20%	25%	
\$129.71	-25%	(4,733,366)	(4,421,310)	(4,109,253)	(3,797,197)	(3,485,141)	(3,173,085)	(2,861,028)	(2,548,972)	(2,236,916)	(1,924,860)	(1,612,803)	
\$138.35	-20%	(3,833,524)	(3,461,478)	(3,089,433)	(2,717,387)	(2,345,341)	(1,973,295)	(1,601,250)	(1,229,204)	(857,158)	(485,113)	(113,067)	
\$147.00	-15.0%	(2,933,682)	(2,501,647)	(2,069,612)	(1,637,577)	(1,205,541)	(773,506)	(341,471)	90,564	522,599	954,635	1,386,670	
\$155.65	-10.0%	(2,033,840)	(1,541,815)	(1,049,791)	(557,766)	(65,742)	426,283	918,308	1,410,332	1,902,357	2,394,382	2,886,406	
\$164.30	-5.0%	(1,133,998)	(581,984)	(29,970)	522,044	1,074,058	1,626,072	2,178,086	2,730,101	3,282,115	3,834,129	4,386,143	
\$172.94	0.0%	(234,156)	377,847	989,851	1,601,855	2,213,858	2,825,862	3,437,865	4,049,869	4,661,872	5,273,876	5,885,880	
\$181.59	5.0%	665,688	1,337,679	2,009,672	2,681,665	3,353,658	4,025,651	4,697,644	5,369,637	6,041,630	6,713,623	7,385,616	
\$190.24	10.0%	1,565,528	2,297,510	3,029,493	3,761,475	4,493,458	5,225,440	5,957,423	6,689,405	7,421,388	8,153,370	8,885,353	
\$198.88	15.0%	2,465,370	3,257,342	4,049,314	4,841,286	5,633,258	6,425,230	7,217,201	8,009,173	8,801,145	9,593,117	10,385,089	
\$207.53	20.0%	3,365,212	4,217,173	5,069,135	5,921,096	6,773,057	7,625,019	8,476,980	9,328,942	10,180,903	11,032,864	11,884,826	
\$216.18	25.0%	4,265,054	5,177,005	6,088,955	7,000,906	7,912,857	8,824,808	9,736,759	10,648,710	11,560,661	12,472,612	13,384,562	

4.0 Social & Environmental Impacts: Economic Model

Section 3 answered the first of our three questions by demonstrating the project has a positive return on investment. Therefore, we do not need to incorporate the social or environmental benefits associated with the project to justify investment into the project. That said, it is a worthwhile exercise to articulate and demonstrate the social and environmental impacts. In incorporating these impacts, we transition from a financial model to a social and economic model.

This section answers the second of our three questions: can the operation be justified on a social basis? We find the answer to be yes.

4.1 Benefits of Fresh Cut

The benefits can be categorized as follows:

- **Material sales:** The sale of Fresh Cut products (laid out in financial model).
- **Workforce development:** Being intentional about labor practices creates meaningful workforce opportunities. As part of Humanim's overall human services and workforce development strategy, Fresh Cut can tap into Humanim's experience serving individuals who are formerly incarcerated or are otherwise un- or under-employed. Humanim can provide them with the training and support services that set them up to find sustainable employment. Currently, many of their Details employees eventually move on to jobs in construction or elsewhere. In addition to benefits to families, communities, and society at large from getting these individuals sustainably employed, there are monetizable benefits to city and state governments primarily through avoided costs of incarceration from reduced recidivism, as well as greater income tax revenue and avoided payments for unemployment programs like Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance to Needy Families (TANF).
- **Landfill Avoidance:** As articulated previously, the vast majority of urban wood waste ends up in landfills. By diverting that wood from the landfill and processing it into materials that can be sold, overcrowded municipal landfills can slow their use of precious space. They also reduce methane and other greenhouse gas emissions released from decomposing landfill waste, as well as transportation costs and emissions.
- **Carbon Sequestration:** By taking viable wood and turning it into a wood product, you sequester the carbon for the life of that product. To control for wood products like chips and compost, in our analysis we assume the only 25% of the wood will actually be sequestered. Of that 25%, we then control for the amount of carbon in the wood, accounting for the mass in the wood, less water. That allows us to calculate the amount of carbon in the wood and how much is recovered during

processing. We use the EPA's Social Cost of Carbon using a conservative 3% discount rate.²⁰

- **Acquisition Savings to the City of Baltimore:** Potential savings through partnerships. Camp Small estimates that their operations save Baltimore City Agencies \$234,000 annually by providing playground mulch, landscape mulch, logs, lumber, and compost. In our PFS feasibility assessment, Quantified Ventures calculated a potential savings of \$141,800 per year for the City. This number is an estimation that includes \$56,400 in tipping fees for 1,200 tons of leaves at BRESCO, \$80,000 average for wood grinding and removal at Camp Small, and \$5,400 in fuel and labor costs for hauling 2,340 tons of manure from the Maryland Zoo to Quarantine Road Landfill

Table 12. Summary of Benefits

	Monetary	Environment	Social
Included	<ul style="list-style-type: none"> - Monetary Sales - Reduced recidivism - Avoided unemployment benefit costs (e.g., SNAP, TANF, etc.) - Taxes to city and state (sales, income) 	<ul style="list-style-type: none"> - Landfill: "Opportunity cost" of space - Carbon Sequestration: Creation of wood products that sequester the carbon rather than disposing of it in a landfill 	<ul style="list-style-type: none"> - Local Jobs and Local Products - Workforce Development: Reduced recidivism
Excluded	<ul style="list-style-type: none"> - Broader economic multiplier effects. - Greater economic participation - Community development - Secondary market benefits. Increased value in products for local wood premiums - Savings from production of wood products that can be put to public use (wood chippings for playgrounds, etc) 	<ul style="list-style-type: none"> - Transform urban forestry operations into a cradle-to-cradle model and revenue source 	<ul style="list-style-type: none"> - Jobs in secondary market - Compelling Story and Narrative

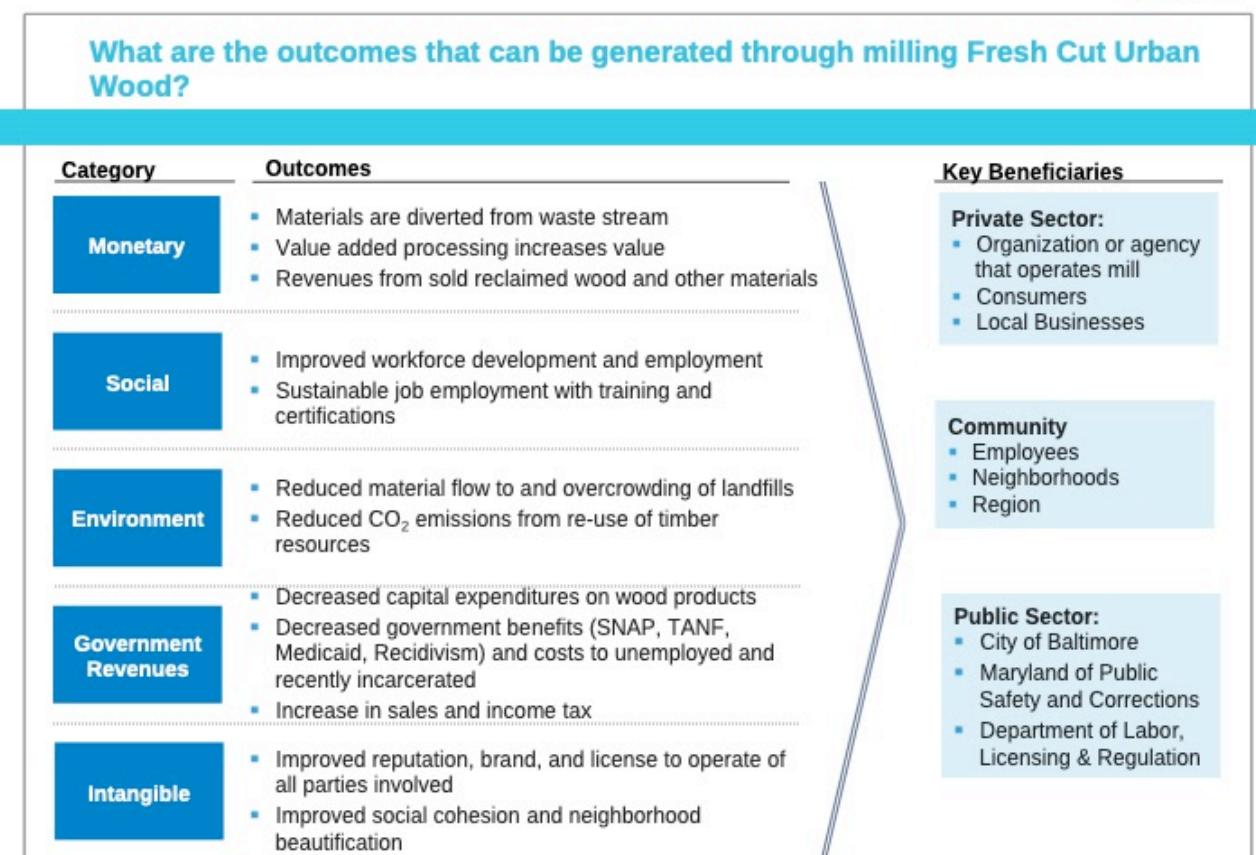
²⁰ EPA. Social Cost of Carbon. https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html

4.2 Beneficiaries

In addition to the diffuse benefits of the proposed intervention that accrue to individuals, communities, and society at large, we consider the benefits described above to accrue to the following entities:

- The **State government of Maryland** and the **City government of Baltimore** are the primary beneficiaries. Within those governments, various benefits accrue to individual departments (e.g., labor, housing and community development, public safety, public works, public health, police and fire, etc.).
- **Private companies in Baltimore**: tree and lawn care companies may benefit from having a greater skilled labor pool through the workforce development outcomes.
- Finally, the scaled supply of reclaimed materials supports **secondary industries** that manufacture and sell products made from those materials. Furniture companies may benefit from a unique supply sourcing and the premium associated with selling urban wood.

Figure 13. Benefits Summary



What are the outcomes that can be generated through milling Fresh Cut Urban Wood?		
Category	Outcomes	Key Beneficiaries
Monetary	<ul style="list-style-type: none"> Materials are diverted from waste stream Value added processing increases value Revenues from sold reclaimed wood and other materials 	Private Sector: <ul style="list-style-type: none"> Organization or agency that operates mill Consumers Local Businesses
Social	<ul style="list-style-type: none"> Improved workforce development and employment Sustainable job employment with training and certifications 	Community <ul style="list-style-type: none"> Employees Neighborhoods Region
Environment	<ul style="list-style-type: none"> Reduced material flow to and overcrowding of landfills Reduced CO₂ emissions from re-use of timber resources 	
Government Revenues	<ul style="list-style-type: none"> Decreased capital expenditures on wood products Decreased government benefits (SNAP, TANF, Medicaid, Recidivism) and costs to unemployed and recently incarcerated Increase in sales and income tax 	Public Sector: <ul style="list-style-type: none"> City of Baltimore Maryland of Public Safety and Corrections Department of Labor, Licensing & Regulation
Intangible	<ul style="list-style-type: none"> Improved reputation, brand, and license to operate of all parties involved Improved social cohesion and neighborhood beautification 	

4.3. Outcomes Analysis

Table 13 below summarizes the benefits for the stakeholders listed above.

Table 13. Benefits Summary

Method	Value	Drive of Value
Fresh Cut	\$2,826K	Retail Operations
Baltimore City	\$524K	Income tax, landfill
State of Maryland	\$1,682K	SNAP, TANF, Medicaid, income tax, recidivism
Federal Government	\$1,745K	SNAP, TANF, Medicaid, income tax*
Labor	\$2,991K or 100+ jobs	Increased Earnings less government benefits avoided*
Environmental	\$863,743 or 28,000 tons sequestered	Carbon Sequestration

* See Section 4.4 for key assumptions and drivers of these calculations

4.4 Key Assumptions for Outcomes

Much of the outcomes analysis was derived from our PFS Feasibility Assessment which explored how a Social Impact Bond (SIB), a form of PFS financing, could scale the operations of Details, a part of Humanim. Details is a social enterprise focused on deconstructing vacant houses through the employment of formerly incarcerated or otherwise un- or under-employed people. The outcomes associated with Details are similar to the benefits associated with Fresh Cut.

Table 14. Key Assumptions for the Economic model

Key assumptions underlying Outcomes Analysis financial and economic projections		
Parameter	Base case assumption	Rationale
Cohort sizes and workforce assignments,	From Humanim team	<ul style="list-style-type: none"> ▪ All of these values came directly from the Humanim team.
Use of counterfactual for workforce development outcomes	Yes	<ul style="list-style-type: none"> ▪ To properly value workforce development outcomes, we compared to a counterfactual model. This model assumed that not all participants

		would simply return to prison or stayed unemployed indefinitely were it not for the intervention.
Recidivism rate (counterfactual)	51%	<ul style="list-style-type: none"> A 2010 sample of 472 recent parolees in Baltimore²¹ found that, on average, a parolee had served about 7,436 days, or 20.4 years, in prison over the course of their lives. Dividing by an average age of 40.3 yields an estimated steady state recidivism rate – here defined as the long-term probability of a participant being incarcerated for any given year – of 51%. Note that this differs from other measures of recidivism measured within 1 (16%²²) or 3 years (73%²³) post-release only, since it approximates long-term dynamics. See Appendix D for a nuanced discussion of recidivism and unemployment modeling.
Employment rate (counterfactual)	26%	<ul style="list-style-type: none"> About 76% of prisoners from Baltimore come from just 25 “high incarceration areas”, which experience overall levels of employment of 53% (of population aged 16-64).²⁴ Assuming former inmates return to these areas, and those who don’t recidivate mirror the general population, the expected counterfactual employment rate is estimated as 53% * (1 – 51%) = about 26%.
Unemployment rate (counterfactual)	23%	<ul style="list-style-type: none"> The remaining hypothetical counterfactual population that has neither recidivated nor is sustainably employed is considered to be unemployed, either in the labor force and looking or not in the labor force by circumstance or choice. $1 - (51\% + 26\%) = 23\%$.
Recidivism rate (post intervention)	25%	<ul style="list-style-type: none"> Humanim estimates that of those participants who begin any given year

²¹ http://choiceresearchassoc.com/documents/psc_recidivism_final_april_2014.pdf

²² *Ibid.*

²³ <http://www.baltimoresun.com/news/opinion/readersrespond/bs-ed-prisoners-letter-20151002-story.html>

²⁴ http://www.justicepolicy.org/uploads/justicepolicy/documents/rightinvestment_design_2.23.15_final.pdf

		employed, only 75% will remain employed by the end of that year, for the first 2-3 years post-release. While the remaining 25% is likely not all going back to prison, we used that as a conservative assumption, one that reflects longer-term steady state likelihood, and a target at roughly half the counterfactual rate.
Employment rate (modeled intervention)	53%	<ul style="list-style-type: none"> ▪ The goal of the intervention is to equip people who were formerly incarcerated to sustainably re-enter the workforce and re-integrate into society. We therefore took as the target the overall employment levels reflected in the 25 “high incarceration areas”, which is still a conservative assumption considering that it is less than the overall employment level across Baltimore (60%) and does not account for differences in demographics between the target population and the overall population (e.g., with regard to age, gender, marital status, health status, etc.)
Unemployment rate (modeled intervention)	22%	<ul style="list-style-type: none"> ▪ The remaining percentage of the cohorts is $1 - (25\% + 53\%) = 22\%$. See corresponding numbers above from counterfactual. This number also makes sense since it is only slightly less than that estimated for the counterfactual, which reflects that people who are not going back to prison but are remaining unemployed may be offset by people who would have remained unemployed but find sustainable employment through the workforce development intervention
Discount rate	5%	<ul style="list-style-type: none"> ▪ This reflects the State’s cost of borrowing, which is the yield of most State of Maryland general obligation bonds no matter the term.²⁵ Note that coupon rates for bonds issued by special State agencies, such as the

²⁵ Maryland State Treasurer’s office. More information and official documents at <http://www.treasurer.state.md.us/debtmanagement/faq-on-bonds.aspx>

		Community Development Administration, may differ.
Time horizon to value benefits	2 years post-cohort for individuals 15 years for their entire operation	<ul style="list-style-type: none"> We based this off of Humanim's information regarding the first 2-3post release.
Carbon Sequestration		<ul style="list-style-type: none"> To control for wood products like chips and compost, in our analysis we assume the only 25% of the wood will actually be sequestered. Of that 25%, we then control for the amount of mass in the wood, less water. That allows us to calculate the amount of carbon in the wood and how much is recovered during processing.
Maryland Sales Tax	6%	<ul style="list-style-type: none"> Maryland has a statewide sales tax of 6% the city does not
Baltimore Income Tax	3.2%	<ul style="list-style-type: none"> We are treating the full employment salaries as taxed at the Baltimore rate of 3.2%. Even though some employees may qualify for the Earned Income Tax Credits, we separate that policy from the impact of this job program
Maryland Income Tax	Incremental Marginal Tax Rates	<ul style="list-style-type: none"> Like the Federal Government, the State of Maryland uses marginal tax rates. We identify the marginal tax rate for the income brackets of each job position.
Federal Income Tax	Incremental Marginal Tax Rates	<ul style="list-style-type: none"> The employees do not generate enough to hit the State and Local Tax Deduction. Therefore, we follow a similar method as to calculate State Income Taxes. We identify the marginal tax rate for the income brackets of each job position. The taxable salary is the salary is less state and local taxes paid.
Federal: FICA and Medicaid	6.2% and 1.45%, respectively	<ul style="list-style-type: none"> Federal rates for income that go to FICA and Medicaid. These benefits are a transfer payment from labor to the Federal Government.
SNAP Benefits	\$1,261 per person, 50% are no longer	<ul style="list-style-type: none"> Calculated from CBPP and USDA FY16 data. This takes the total amount of people in the program and the administrative cost. We only look at

	receiving, 80% post cohort 94% to Federal Government	the per person cost, less administrative costs. That is, we assume any one individual will not have an impact on total overhead. 94% is attributed to the Federal Government as they fund the entirety of the program and the administrative costs are shared with the state (6%) ²⁶ ²⁷ . Since the hourly wage is close to the eligibility cut off, we only count 50% of the cost of SNAP. Following the 12 month cohort, we assume a 80% retention rate of employment.
Temporary Assistance to Needy Families (TANF)	\$12,450 a year 57% no longer receive benefits, 80% post cohort 60% savings to State	<ul style="list-style-type: none"> ▪ TANF is one of the few programs in which the number of individuals is lower than the number of employed in Maryland, an indicator of if a job drives a reduction in benefits. This is, in part, due to work requirements. Individuals need to have children in order to qualify for TANF. Therefore, we used the average of Baltimore city incarcerated that have children as a proxy, 57%. Lastly, since the income of Fresh Cut is much higher than the eligibility limit we assume 100% are no longer enrolled during the cohort period and 80% after. 40% is from Federal Sources and 60% from State²⁸ Since we are only looking two years past the cohort date, we do not need to account do not need to account the 60 month enrollment limit.
Medicaid	\$4,494 per person, 10% no longer receive benefits 61% Savings to Federal government	<ul style="list-style-type: none"> ▪ 61% from the Federal funds. We took the total population of unemployed in Maryland over the members of Medicaid to determine that the unemployed population only makes up 10% of Medicaid. Given that the Fresh Cut income is within the eligibility

²⁶ <https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap>

²⁷ https://www.cbpp.org/sites/default/files/atoms/files/snap_factsheet_maryland.pdf

²⁸ City of Baltimore:

<http://health.baltimorecity.gov/sites/default/files/Children%20of%20Incarcerated%20Parents%20Updated.pdf>

		income limits, we assume that most will still receive Medicaid Benefits. ²⁹³⁰
Recidivism Cost	44,600 cost per person, 100% to State Government	<ul style="list-style-type: none"> ▪ The cost of incarceration is \$44,601³¹ in Baltimore and the success rate of the public safety compact at reducing recidivism is 10%³².

5.0 Lack of Current Investment

This report has outlined the social, environmental, and economic benefits of an urban wood industry. In Baltimore, we found that it is a profitable investment both as an individual actor and society. Our findings beg an obvious question, “if it is a profitable investment, why doesn’t every city have an urban mill already?” Currently, cities in the United States do not have urban milling operations and very few partner with local governments or operate at scale. Therefore, it is useful to explore this question.

5.1 Adoption and Diffusion of New Innovations and Practices

From business, we know that the acceptance of new innovations does not happen instantaneously. The time delay between innovation and standard industry practice is a focus of economists and marketing experts alike. The research can be divided into two fields: adoption and diffusion. Adoption models focus on the characteristics of the person or industry who may or may not adopt the new technology. Diffusion models focus on the rate and timing of the acceptance of a new technology.

5.1.1 Adoption

Adoption is the acceptance and continued use of a new innovation. The adoption process is dependent on the “behavioral and mental states” people pass through, leading to either adoption or rejection. The field relies on the work of Everett Rogers. In 1983, Rogers created an idealized model that categorizes the “character of adopters as a function of time” into five groups across a normal distribution depicted in the figure below. An individual’s age, education, income, risk tolerance, and other factors affect where they fall on his spectrum.³³

²⁹ <https://www.kff.org/medicaid/state-indicator/distribution-of-medicaid-enrollees-by-enrollment-group/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>

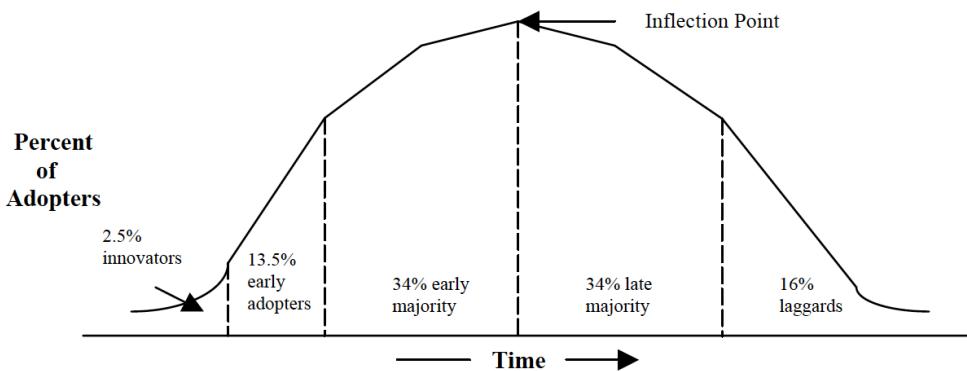
³⁰ <http://www.kff.org/medicaid/state-indicator/medicaid-spending-per-enrollee/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>

³¹ https://storage.googleapis.com/vera-web-assets/downloads/Publications/price-of-prisons-2015-state-spending-trends/legacy_downloads/the-price-of-prisons-2015-state-spending-trends.pdf

³² http://choiceresearchassoc.com/documents/psc_recidivism_final_april_2014.pdf

³³ Rogers Everett, M., 2003. Diffusion of Innovations. Fifth edition. The Free Press, New York.

Figure 14. Roger's Adoption Model- Bell-Shaped Frequency curve
 (figure copied from PATH 2004)³⁴



The model is based on a probability distribution. Note that the mean, or point of inflection on the normal curve, corresponds to the inflection point on the Logistics Curve.

1. Innovators (2.5%)
2. Early adopters (13.5%)
3. Early majority (34%)
4. Late majority (34%)
5. Laggards (16%)

Organizational and Social Factors Influence Innovation Adoption. Studies show that the characteristics of a firm and the location of a firm affect the likelihood of innovation. Factors that affect adoption include income level, firm size, region, the builder's age and education level. These factors may explain why some regions of the country have more urban mills than others.

Tree Care, Timber, Wood Products, and Construction are “laggard” industries. The attributes of the product and characteristics of the industry affect the likelihood of adoption. Certain people and certain industries are more inclined to adopt new technologies and certain products within those industries are more likely than others to diffuse. A laggard industry is the least likely to innovate in Roger's Adoption Model (last 16%). The industries that supply urban wood and industries that purchase urban wood products are typically risk-averse, fragmented and path dependent. Culture plays a large part in the ability to learn new methods and forget old ones. Culture is a factor in the propensity to innovate. Since the industry is a particularly conservative culture, it is especially slow. This may explain the lack of private investment in urban wood mills.

Difficulty with Green Products Adoption in General. Urban wood processing has the ability to divert waste from the landfill and can be considered and marketed as a green product. If green products have difficulty being adopted by customers, it may explain the lack of investment in urban wood. Green consumer research has been

³⁴PATH. (2004) “The Diffusion of Innovation in the Residential Building Industry”.

largely dominated by three fields: economics, psychology, and marketing. Economics focuses on rational choices and decision-making, psychology emphasizes attitudes and beliefs. Marketing research applies both fields. Overall, the research on adoption of sustainable products reveals that consumers are willing to support the purchase of green products, but the results are unpredictable. The variability of adoption of products increases uncertainty and risks. Research also identifies an “attitude-behavior gap” and a “paradox” of slow adoption green products. The attitude behavior gap references the fact that research indicates upwards of 75% of Americans claim to embrace sustainable products, but sustainable good and services have received limited success in the marketplace. The greater the uncertainty, the greater the lack of investment.³⁵

5.1.2 Diffusion

Diffusion is defined as “the spread of an innovation throughout a social system” (Howard and Moore 1998 in PATH 2004). The diffusion of a new technology takes time and the earliest stages are the most important. New technologies must engage a critical mass in order to fully diffuse through an industry. Like adoption, industry and individual characteristics affect diffusion. With this in mind, Rogers incorporated human behavior into the models to assess the likelihood of a new innovation being adopted. Roger’s “Diffusion of Innovation” introduced Roger’s Five Forces: the five essential characteristics that an innovation needs to be successfully adopted.

1. Perceived advantages
2. Compatibility
3. Complexity
4. Divisibility/trial-ability
5. Observe-ability

We explore the five forces in the context of urban wood below.

(1) Perceived Advantages:

Substitute Products and Pricing. Depending on the offering, it may be difficult for some urban mill products to compete. Many wood products are commodities that can be bought and sold in many different locations. Therefore, urban mills may be competing against traditional mills. While urban wood milling may avoid costs such as transportation, it will also incur costs as that large scale timber firms avoid. Those costs include the high holding costs of urban real estate and the inability to capture the benefits of the economies of scale that large-scale timber firms achieve. It is the recommendation in this report that the firm serves as a “price taker”, selling at the market price even if it means a loss, for products in which the nature of urban wood provides little benefit but sell at the highest price possible for products in which the nature of the urban wood provides benefit. That is, a live-edge slab from the inner city that will serve as a conference table serve as a “talking piece”. It may sell with a price

³⁵ Ramirez, Edward (2013) “The Consumer Adoption of Sustainability-Oriented Offerings: Toward a Middle-Range Theory”

premium because of the value that customers put on its origin and background. The value placed on the wood's origin may not transfer to other products, such as chips that are used for a playground.

Competitive Advantage and Increased Profit Associated with Innovation. In order for innovation to occur there must be an initial price advantage. The recognition of the substitution effect and the entrepreneur's inability to meet or beat market pricing may dissuade entrepreneurs from entering the market.

(2) Compatibility:

Boutique Approach: The vast majority of the urban wood mills are operated by small business owners. They are often passion projects with a high amount of value placed on their social mission. This model may not be compatible with the market needs in order to have a viable urban wood market nationally. Given scale of urban wood waste and the commodity market of many of the potential products, the boutique approach does not fit well.

Variation in Product Availability: Urban wood has imperfections and variations in quality and quantity. Depending on the customer base, this may not fit with their needs for consistency in production.

(3) Complexity

Diversity of Products: As described in detail in section ##, the amount of variations between inputs make it hard to predict demand and revenue projects.

Supply Chain Costs: If utility companies and public works are ignored, urban tree care is a low concentration industry, meaning many firms make up a small portion of the market share. This may add costs to the supply chain. It is costly and time intensive to create and maintain relationships with multiple firms. The inability to contract with enough suppliers to ensure sufficient quantity of inputs may affect investment. Even if a firm can capture enough of the supply to justify operations at scale, given the number of firms that would be required, there is a high transaction cost associated with managing that many private generators of wood material. Additionally, there will be costs associated with the inconsistency of quantity of inputs. Unlike a traditional mill that can adequately plan its supply of wood through coordinated harvests, urban wood mills are dependent on events such as storms.

(4) Trialability

Access to Capital: Discussed in detail in Section 5.2

I interviewed Michael Devere, the architect of the first Cross Laminated Timber structure in the US: a church tower in Gastonia, NC. At the time, he was exploring the process of raising money to open a CLT manufacturing plant on the East Coast.

"It has been our general observation that there are a lot of people with a lot of money sitting on the sidelines. They see the product and are interested... All of the investors want a sure thing to invest in. Being that there is really no market to speak of, they want to see "proof" that a demand for the product is there. Also, investors see this as a high-risk venture being that there is no proven market. So, they want the lion's share of ownership".

Risk and Uncertainty. High Cost with Little Gains. There is a high start-up cost associated with urban milling. It does not leave itself to be easily tested. Looking at the incentives of investment and inability to have insurance to mitigate against failure may explain a lack of investment. While large major corporations may be able to tolerate the risk associated with a new, untested venture that is small in scale compared to the overall net revenue; the vast majority of urban mills are owned and operated by a small, private businesses. Frequently, the urban mill makes up the majority if not the only part of the business. Therefore, these startups are exposed to large unmitigated risks that may not justify the transaction.

5.1.2 Opportunity

The previous section identifies reasons for a lack of investment in urban mills. Given the benefits that urban mills provide, it is imperative to find an operating model that can remove those barriers. Articulating and measuring the social and environmental value of an urban operation are also important. Recognizing the challenges we have identified, the first urban mill operation(s) will be important to reducing the diffusion challenges listed here for more widespread adoption of urban mills throughout the United States.

5.2 Financing Considerations

Even though Fresh Cut produces a positive return for investors there are a few concerns around financing an operation like this that should be noted.

Concerns:

- **Access To Capital:** Access to capital for social ventures and for new enterprises can be difficult. As this report highlights there is a large capital investment required upfront and a great deal of variability in the market. Traditional lenders may not be willing to take the time to get educated on the issue and therefore access to capital may be constrained.
- **"J Curve":** Fresh Cut is not in the black for three years. That may make traditional loans harder to come by as the debt service to coverage ratio will seem too risky.
- **Long Payback Period:** Fresh Cut is not an overall positive investment until year 12. That could be too long for some investor to wait. That said, once the operation is operating profitably, the investor could potentially sell their stake prior to year 12.

Opportunities:

- **Leveraging Impact Capital:** This social enterprise is highly impactful. This may unlock more friendly and concessionary investors.
- **Opportunity Zones:** If the business is operating in a designated Opportunity Zone (OZ), it may be ripe for an equity investment from a qualifying Opportunity Fund. This could address the investor concerns around the ramp up period and the longer time horizon for full payback. Additionally, the OZ investment provides capital gains deferment and a step up in basis for the investor. This added “boost” in investor return, could help secure an investor who normally would think of Fresh Cut as either too risky or too low of a return.
- **Philanthropy or Partnerships:** Fresh Cut is self-sustaining after 3 years of operations. Philanthropic donors could provide the upfront capital investment and then allow Fresh Cut to operate without a large debt burden. This would allow the social enterprise to cover its own operational expenses and be self-sustaining.
- **New Markets Tax Credits:** The venture may qualify for New Markets Tax Credits. The size of the investment may be too small, as most New Markets Tax Credits need to be greater than 5 million in initial investment to cover the transaction costs, but it should be considered for a larger project or a combination of projects.
- **Interest Set Aside:** The debt can be structured so that the initial interest payments can be included into the loan size. This would allow for Fresh Cut to guarantee the source of interest payments in the first few years, prior to profitability.
- **Pay For Success:** PFS financing could be an opportunity to finance off of the social and environmental outcomes. This is discussed in detail in Section 7.

5.2 Regulatory Considerations

Having a strong regulatory environment that supports urban wood operations as a solution to economic development plays an important role in creating demand for this type of intervention. Public sector support is key, and it can come either through policies or through public education in terms of the following:

- Contracts and partnerships with public utilities and department of forestry
- Legal clarity around partnering with selling products generated from public sources
- Concerns or awareness around milling and timber operations
- Workforce development and training programs

6.0 Overview of Humanim's work as a solution

A key success factor for any PFS transaction is a service provider with a track record of executing the intervention, evidence of the impact they have generated, ability to scale, and established partnerships with other key stakeholders.

Track record and evidence of impact

Humanim has a 46-year history of providing workforce development and support services to individuals with barriers to employment throughout Maryland. Humanim has innovated and delivered workforce development and support services as part of a methodology to alleviate poverty to over 4,000 people a year.

Humanim launched Details, a deconstruction and innovative reuse social enterprise, in July 2012. To date, Details has trained and employed over 165 low-income residents of Baltimore City with barriers to employment, of which 75% were formerly incarcerated. Details successfully leveraged foundation dollars to change the landscape of Baltimore blight removal by successfully completing the first city deconstruction pilot project. Details was awarded Innovator of the Year as well as the Building Material Reuse Association's Annual Training Award.

Brick and Board grew as its own unique social enterprise out of Details Deconstruction to process and handle the material extracted through the deconstruction process making sure that the material of the past is preserved for the future. Brick and Board hires and trains the next generation of sawyers, salvage experts, and craftspeople from Baltimore neighborhoods that have experienced the greatest levels of disinvestment. Through Details Deconstruction and Brick and Board, Humanim has developed one of the largest wholesale markets in the US for reclaimed brick from Baltimore City.

Partnerships and Initiatives

Humanim has forged strong strategic partnerships with public-sector entities, allied community-based organizations, as well as institutions and businesses with a presence in Baltimore City.

- **Partnership with Baltimore City Department of Housing and Community Development:** Details was awarded a three-year Deconstruction Master Services contract from the City of Baltimore. Additionally, the success of the partnership between Baltimore Housing and Details influenced the addition of deconstruction to Governor Hogan's Project C.O.R.E.
- **Partnership with the USDA Forest Service:** A key player in the development and growth of Details Deconstruction and Brick and Board is the Forest Service. The Forest Service's interest in urban wood harvesting and the subsequent job creation and land conservation has been beneficial in many ways for Humanim's

construction related enterprises. FOREST SERVICE's partnership with Room & Board supports the secondary materials market by creating a consistent and sustainable demand, and also opens up the path for Details to be scaled nationally.

- **Partnership with the USDA Forest Service and City of Baltimore:** The Baltimore Wood Project is an initiative of the USDA Forest Service, in partnership with the City of Baltimore, Humanim, and others.³⁶ The project is re-engineering management of urban wood waste streams. Specifically, wood is salvaged from building deconstruction and tree care operations and taken to a facility dedicated to sorting and processing wood rather than to a landfill or other waste facility. From there, the wood is re-purposed and sold locally. The project saves the city money, creates jobs, provides new revenue streams, and promotes sustainability. For example, according to Humanim, as much as 90% of building waste is diverted from the local landfills through recovery and re-purposing of wood. Additionally, a deconstruction project creates 6-8 jobs for every 1 job in a standard demolition.³⁷ There is substantial scope for additional scaling of the project as thousands more vacant homes in Baltimore are slated for demolition in the coming years and about 200,000 ash trees are at risk due to the emerald ash borer insect.
- **Partnership with Camp Small:** Since 2016 Humanim and Recreation and parks' Forestry have partnered to better understand Baltimore's wood economy, and to develop a strategic plan for capturing values lost as well as increasing workforce.

³⁶ <http://www.baltimorewoodproject.org/>

³⁷ <http://www.baltimorewoodproject.org/>

7.0 Overview of Baltimore City's Work as a Solution

Managed by Recreation and Parks' Forestry, Camp Small has been Baltimore City's collection facility for removed and downed street trees and park trees for the past 70 years. With support from Baltimore's office of Sustainability, Camp Small's urban wood utilization initiative began in 2016 after receiving an Innovation fund of \$98,000 from the City's Bureau of Budget and Management Resource. Through the revenue of sales and savings the loan was paid back, in full, within the first two years.

The goal of this program is to capture the highest possible value from the materials collected at Camp Small. Prior to the programs establishment the department would contract a company to grind and haul away all of the material.

The program works closely with City agencies outside of Recreation and Parks to develop unique avenues of sale and utilization. The material collected at Camp Small is a surplus material for Baltimore City, allowing the program to sell the products at their highest value. It has also worked closely with Baltimore's Department of Purchasing to develop alternative methods of sale which allow customers to make small remote transactions. They have developed liability waivers through the Department of Risk Management that allow customers to do minimal processing.

In 2017, Recreation and Parks created its first Nature Playspace, thirty logs from Camp Small were utilized throughout the play area for climbing, seating, and as a border. It has since been involved with over a dozen additional play-spaces and outdoor classrooms throughout Baltimore City. To create these spaces Camp Small has partnered with community organizations, private companies, City Schools, Department of Natural Resources, Heart of America, Civic Works, and the national Wildlife Foundation.

In 2018, Camp Small developed a contract with a local sawmill for the processing of City logs that were being removed for utility and Public works projects. Over 45,000 board foot of lumber has been produced into tongue and groove boards and pressure treated lumber, and is being used by the Department of Recreation and Parks in their upcoming building projects. The material is providing Recreation and Parks over \$170k in cost savings. Under the same contract, City logs are now being used to produce the tree planting stakes used by the Division of Forestry as well as it's City wide tree planting partnerships.

In January of 2018, Camp Small was awarded a grant from American Forests for the purchase of a portable saw mill, lumber kiln, and firewood splitter to help kickstart a wood products program at Camp Small. This program will not only allow for materials to become higher value products which result in increased revenue, but it also creates job opportunities as well educational opportunities and allows Camp Small to continue its efforts to grow and shape Baltimore's wood economies.

8.0 Why Pay for Success (PFS)

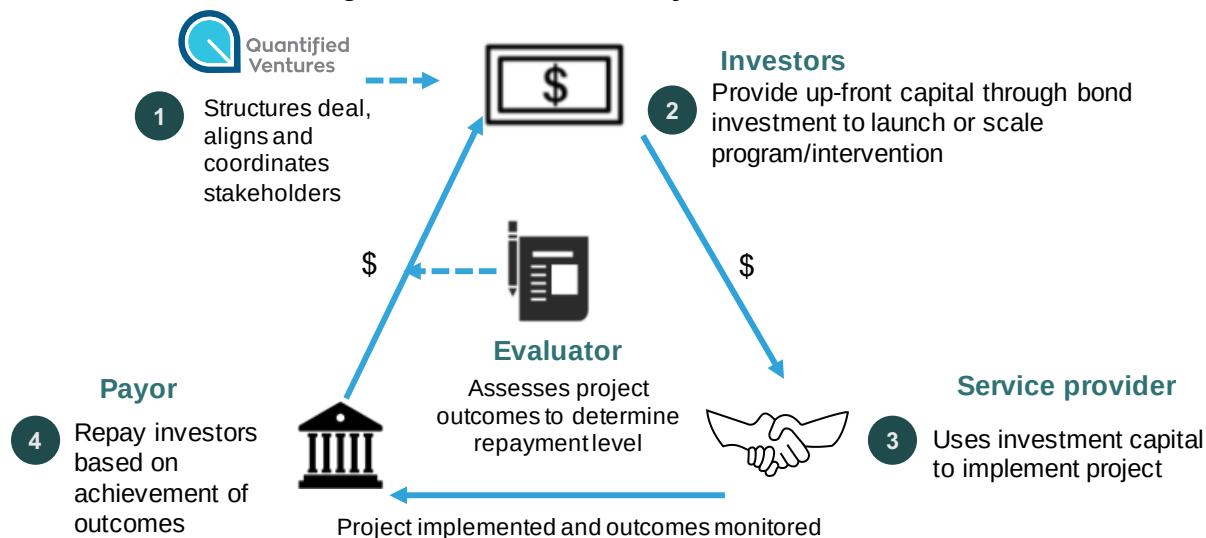
8.1 PFS Overview

PFS is a contracting and financing mechanism in which investors provide up-front capital for a program or intervention, with payments tied to the achievement of specific measurable outcomes. PFS deals are useful tools for aligning the incentives of stakeholders from multiple sectors with seemingly different or conflicting priorities and goals, such as project developers or service providers with those of payor. They also shift some risk to the private sector, and integrate multiple parties in a complex transaction. Additionally, PFS is consistent with existing Forest Service programs and approaches of constructing public-private partnerships to maximize efforts in pursuing strategic goals.

While each transaction is different, most projects involve the following parties:

- **Investors** provide up-front, at-risk capital to enable the program to scale. If the project outcomes are successful, the investor receives a higher return on their investment.
- **Payors** are the entities that realize cost savings, revenue increases, and/or other positive outcomes resulting from the scaled program. Payors can be either private or public entities, such as municipal or state governments. They use PFS to shift some the risk to investors that the program will achieve the desired outcomes.
- **Service Providers** (non-profit or for-profit) deliver the selected service or solution to the target population and geography, with the goal of achieving improved social, health, or environmental outcomes in the target population, as well as the projected financial benefits to the payor.
- **Evaluators** are independent entities that measure the impact of the program against the agreed-upon outcomes as well as the financial impact to the payor.

Figure 14. Generalized Pay for Success Model



8.2 Benefits of PFS to Scale Fresh Cut

PFS transactions provide several benefits when compared to traditional financing methods:

1. **Access to Impact Capital:** Private investors who are interested in the outcomes of the project provide the upfront capital and are willing to take on some of the risk. The upfront payment provides cash flow timing relief for servicers and hence, increases the success of the project and impact from it.
2. **Reduced Risk:** Private investors take on the downside risk if the intervention is less effective than expected, protecting the capital budget of the City or State agency.
3. **Link to Outcomes:** The PFS model links payments to social outcomes (such as job creation) which aligns incentives and reduces risk.
4. **Improved Data Collection:** Through the evaluation process, valuable data is gained on the cost-effectiveness and scalability of deconstruction in this case which can help in future planning and reporting.
5. **Stakeholder Engagement Support:** This model requires stakeholder engagement across multiple entities and presents opportunities to engage new partners.
6. **Promote Sustainable Practices:** Through this process, more sustainable practices such as deconstruction will be promoted for the benefit of the local community.

Based on the fact that the outcomes of the proposed intervention benefit multiple entities, that their magnitude may be uncertain, and with considerations for conserving limited public budgets, we believe that a PFS transaction would be a highly efficient and impactful method to finance the intervention when compared to traditional financing.

9.0 Expansion to Other Cities

One of the goals of this report is highlight how an Urban Wood enterprise should think about the positive social outcomes associated with their work. It is also should be a tool for an organization like Humanim that may be able to replicate elsewhere. The figures and charts below helpful as a starting point, but the concentration of Urban Wood waste should be the primary focus to identify a city.

Figure 15. Urban Wood Waste Nationally

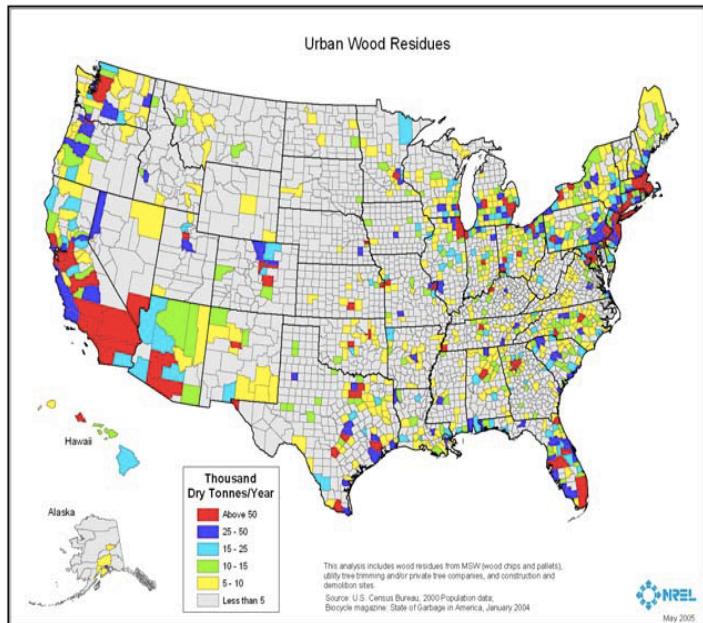


Figure 16. Top 10 States with Urban Wood Waste*

State	Urban Wood Residues (Thousand Dry Tonnes)
California	3,901
Texas	2,307
New York	2,041
Florida	1,678
Illinois	1,337
Ohio	1,272
Pennsylvania	1,238
Michigan	1,196
Georgia	924
New Jersey	894

Urban Wood Operations is typically seen in areas with one or more of the following conditions:

- Large amount of Urban Wood waste
- Large Tree canopy or Tree Cover with a large amount to hardwoods
- Threats of tree blight such as Hemlocks threatened by wooly adelgid and oaks threatened by Gypsy Moths or Ash threatened by the emerald ash borer.
- Strong and accessible materials reuse market – could include export markets and large metropolitan areas with a consistent demand for used building materials
- Strong nonprofit partners/programs that are focused on achieving both social and environmental objectives
- A high cost to landfill use. Either Limited landfill space or a high tipping fee helps the opportunity cost.
- A culture that is willing to pay a premium for local and sustainable products

10.0 Next Steps

Following our analysis, we recommend the partnership take following steps to add the Fresh Cut operation to the Baltimore Urban Wood Economy:

1. **Gain Clarity on Partnerships and of Scale:** In order to transition from feasibility to implementation, the partnership needs to determine which partners are agreeable to execute Fresh Cut. This will provide greater clarity on roles and responsibilities. It will provide insight in the land acquisition and into startup costs. Lastly, it will drive the conversation around the legal and regulatory restrictions around selling wood products procured from publicly financed operations.
2. **Explore Interest from Funding/Financing Options:** We identified a few sources of funding including government appropriations, impact capital, and philanthropic funds. All of these options should be explored and further evaluated using a cost benefit analysis. Finally, the partnership should engage investor interest and the feasibility of each option. This will provide clarity on which financing/funding option to pursue.
3. **Business and Operations Plan:** This report determined that the Fresh Cut operation is feasible. Executing the plan requires further analysis of the first two steps above: partnerships, agreements, and financing. Once the plan is codified, Fresh Cut can be included into the Baltimore Urban Wood economy.
4. **Identify areas for Replication:** The partnership should create a detailed criteria for replication. Using the criteria, the partnership should identify and engage two cities for replication.

11.0 Conclusion

Based on our analysis, we believe that Fresh Cut is a viable business model that will be profitable after 3 years and be a profitable investment overall. We believe that there is a strong impact and economic potential for Fresh Cut. This operation has the ability to train and pay 100s of individuals in Baltimore who would normally be left out of the workforce or highly likely to return to prison. By working with that population, the project could save hundreds of thousands of dollars to the federal, state, and city governments. By diverted urban wood waste, the project will also sequester thousands of tons of carbon into wood products. Given that Baltimore is just one city in the U.S. that experiences high levels of urban wood waste, incarceration, and unemployment, we believe there is high potential for scalability across the country, and by using the frameworks laid out here, we encourage the project team to strategically consider where best to scale and how to maximize the impact of the intervention.

Appendix A: Fresh Cut Flow Chart

Fresh Cut Process Flow Chart

