

# Environmental Product Declaration





**Boise Cascade**<sup>®</sup>  
ENGINEERED WOOD PRODUCTS




Cradle-to-Grave EPD for Laminated Veneer Lumber and Mass Timber produced by Boise Cascade in White City, Oregon.

Summary Results – Average End of Life Treatment <i>Full Results in Tables 3-7</i>		Cradle-to-Grave Total
Global Warming Potential, Total	kg CO <sub>2</sub> e	-229.73
Global Warming Potential, Fossil	kg CO <sub>2</sub> e	304.25
Global Warming Potential, Biogenic	kg CO <sub>2</sub> e	-533.98
Ozone Depletion	kg CFC11e	6.92E-06
Acidification	kg SO <sub>2</sub> e	2.62
Eutrophication	kg Ne	0.66
SFP (Smog)	kg O <sub>3</sub> e	36.77
Non-renewable Energy	MJ, NCV	5,956



## ASTM Certified Environmental Product Declaration

<b>Program Operator</b>	<b>ASTM International</b> 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA, 19428-2959 USA www.astm.org		
	 <b>ASTM INTERNATIONAL</b> Helping our world work better		
<b>General Program Instructions and Version Number</b>	ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs) - General Program Instructions, version: 6.0		
<b>Declaration Owner</b>	<b>Boise Cascade Wood Products, LLC</b> 1155 Antelope Rd White City, OR 97503-1639 www.bc.com		 <b>Boise Cascade®</b> ENGINEERED WOOD PRODUCTS
<b>Declaration Number</b>	EPD 169		
<b>Declared Product</b>	Laminated Veneer Lumber (LVL); Brand name: VERSA-LAM		
<b>Functional Unit</b>	1 m <sup>3</sup> of LVL and Mass Timber produced at Boise Cascade's facility in White City, Oregon, installed in a building for 75 years.		
<b>Reference PCR and Version Number</b>	<b>ISO 21930:2017</b> Sustainability in Building Construction — Environmental Declaration of Building Products. [7] <b>UL Environment:</b> Product Category Rules for Building-Related Products and Services <b>Part A:</b> Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, v3.2 [11] <b>Part B:</b> Structural and Architectural Wood Products EPD Requirements, v1.0 [12]		
<b>Description of Product's intended application and use</b>	Boise Cascade LVL and mass timber is an engineered wood product with high structural strength and stability. It can be used as building material for headers and joists as well as panel construction.		
<b>Markets of Applicability</b>	Construction Sector, Mass timber design		
<b>Date of Issue</b>	March 31, 2021		
<b>Period of Validity</b>	March 31, 2026		
<b>EPD Type</b>	Product-specific EPD		
<b>EPD Scope</b>	Cradle-to-Grave		
<b>Year of reported manufacturer primary data</b>	2019		
<b>LCA Software</b>	SimaPro v8.5		
<b>LCI Databases</b>	USLCI [9], Ecoinvent 3.5 [15], Datasmart [8]		
<b>LCIA Methodology</b>	TRACI 2.1 [3]		
<b>The sub-category PCR review was conducted by:</b>	Dr. Thomas Gloria (chair) Industrial Ecology Consultants	Dr. Indro Ganguly University of Washington	Dr. Sahoo University of Georgia

<p><b>LCA and EPD Developer</b> This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:</p>	<p><b>Athena Sustainable Materials Institute</b> 280 Albert Street, Suite 404 Ottawa, Ontario Canada K1P 5G8 www.athenasmi.org</p>   <p>James Salazar</p>
<p>This declaration was independently verified in accordance with <b>ISO 14025:2006[4]</b>. The <b>UL Environment “Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report,” v3.2</b> (December 2018), in conformance with <b>ISO 21930:2017</b>, serves as the core PCR, with additional considerations from the <b>USGBC/UL Environment Part A Enhancement (2017)</b>.</p> <p><input type="checkbox"/> INTERNAL                      <input checked="" type="checkbox"/> EXTERNAL</p>	
<p><b>Independent Verifier</b> This life cycle assessment was independently verified in accordance with ISO 14044 [6] and the reference PCR by:</p>	<p>Dr. Thomas Gloria Industrial Ecology Consultants</p> 
<p><b>Limitations</b></p> <ul style="list-style-type: none"> <li>· Environmental declarations from different programs (ISO 14025) may not be comparable.</li> <li>· Comparison of the environmental performance using EPD information shall consider all relevant information modules over the full life cycle of the products within the building.</li> <li>· This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 §5.5 are met. It should be noted that different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.</li> </ul>	

## COMPANY AND PRODUCT DESCRIPTION

### Boise Cascade

Boise Cascade is a manufacturer of engineered wood products. Since our founding in 1957, we've grown to become a leading manufacturer and distributor of building materials in North America and beyond. Through conservation and sustainable practices, we are actively contributing to the responsible use and protection of the natural environment, which benefits our employees, our customers and the communities we work and live in.

### Product Description

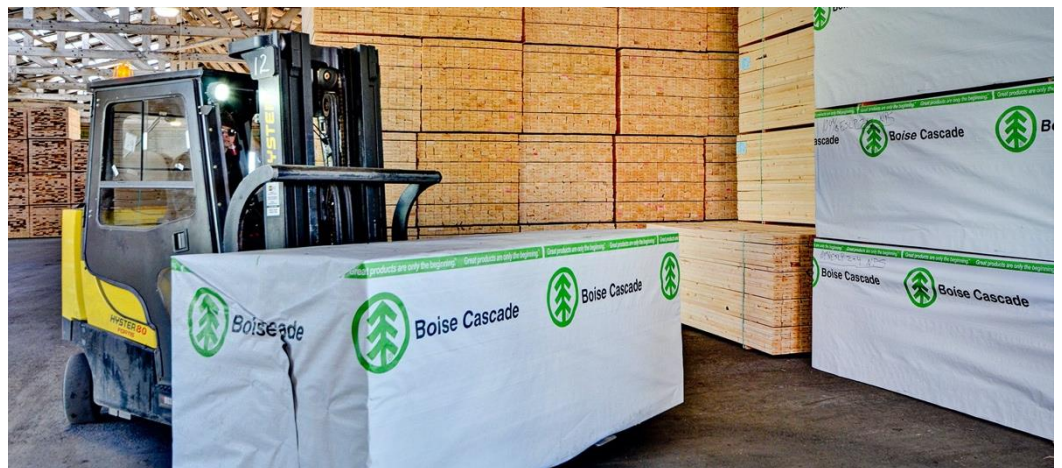
Laminated Veneer Lumber, LVL, is an engineered wood product comprised of thin layers of wood called veneers that are laid up and glued to produce composite beams and headers. VERSA-LAM® laminated veneer lumber (LVL) beams and headers eliminate twisting, shrinking and splitting, and deliver flatter, quieter floors and structures. LVL can be produced in longer lengths and widths than lumber, allowing for reduced waste when sizing and cutting efficiencies are employed.

Boise Cascade's mass timber product is based on an LVL product component, produced using the same machinery and with the same composition, but assembled in larger product dimensions so that it may be used as a panel product. As the LVL and mass timber products have identical composition and manufacturing processes, they can be considered to be identical in terms of their environmental impacts as calculated for this EPD.

### Product Composition

Boise Cascade's LVL and mass timber products are comprised of wood veneer (> 90%) and phenol formaldehyde resin (< 10%). See Table 1 for detailed product characteristics.

The wood veneers used in the LVL and mass timber production are produced by Boise Cascade and are procured from sustainably managed forests in the United States.



## METHODOLOGICAL FRAMEWORK

### Type of EPD and Life Cycle Stages

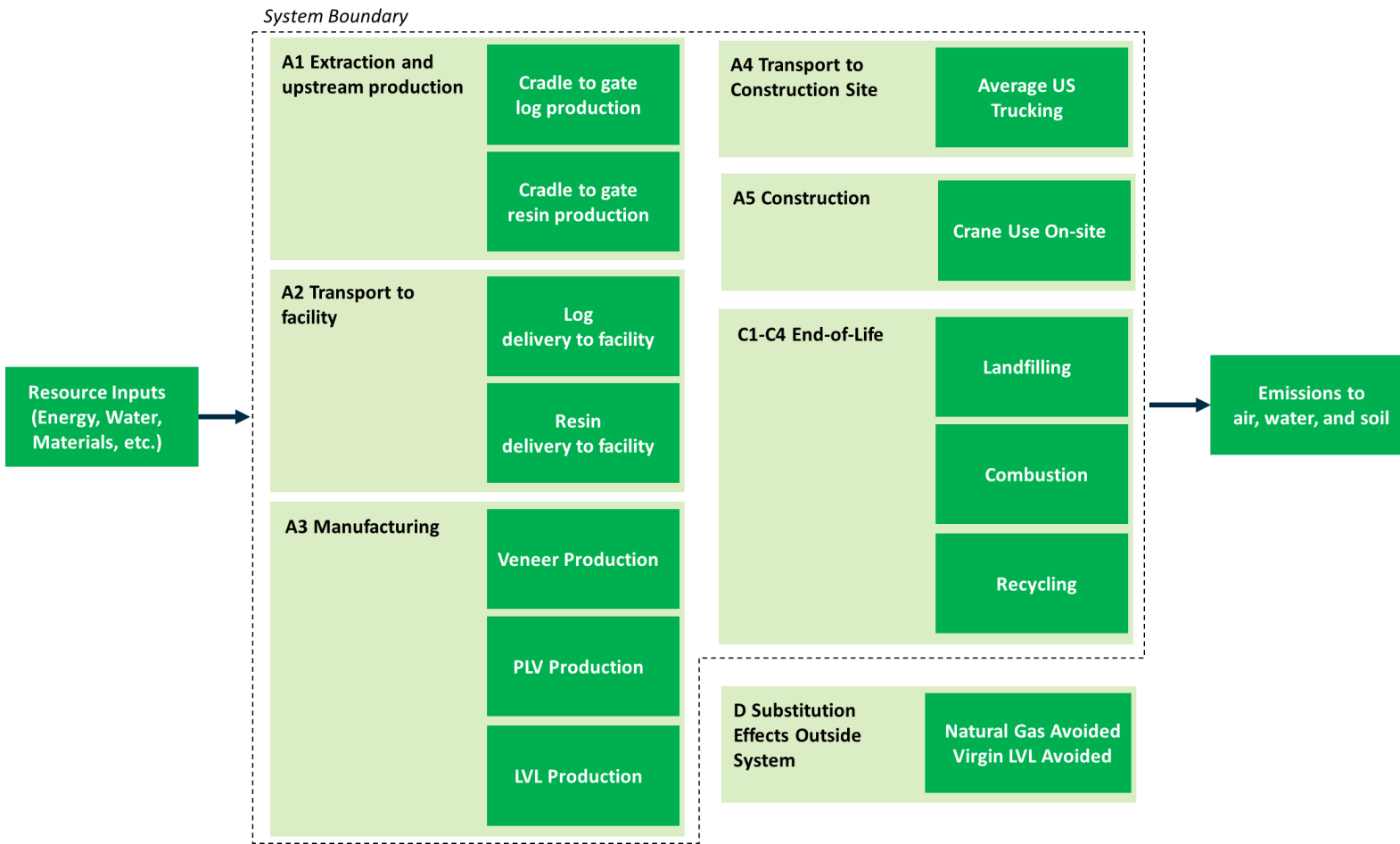
The underlying LCA [5] investigates the product system from cradle-to-grave. This comprises the production stage including the information modules ‘A1 Extraction and upstream production’, ‘A2 Transport to factory’ and ‘A3 Manufacturing’ (Figure 1).

Building Life Cycle Information Modules																	
Production stage			Construction Stage		Use stage							End-of-life stage				Substitution Effects	
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport to waste processing or disposal	Waste processing	Disposal	Benefits Outside System	
																	A1
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Figure 1: Life Cycle Stages and Information Modules per ISO 21930:2017.

### System Boundaries and Product Flow Diagram

The product system is presented in Figure 2 below and shows the information modules that are included in the system boundary. The product system includes the extraction of logs from the forest and the production of resins in module A1. Module A2 includes the delivery of logs and resin to the production facilities. The manufacturing Module A3 includes the production of veneers and parallel laminated veneer (PLV) which are both valuable products with established markets that serve as precursor products to the eventual LVL product (i.e. several veneers are glued together to produce PLV and several layers of PLV are glued together to produce LVL). Module A4 includes the trucking of the product to the construction site while A5 estimates the construction impacts. Modules C1-C4 describe the end-of-life treatment while Module D, which is assumed to be outside the system boundary, incorporates displacement effects of valuable products resulting from recycling and energy recovery.



**Figure 2:** Cradle-to-Grave LVL and Mass Timber Product System

### Construction and Service Life Assumptions

The product system includes average assumptions as to the transportation of the product to the construction site, 167 miles [13] as well as construction energy use, 2.23 liters diesel [2]. The reference service life for the product is 75 years which is the default specified by the UL Part A PCR [11].

### Benefits Outside the System Boundary

Module D estimates the benefits outside the system boundary, natural gas displacement and the avoidance of producing LVL for future construction projects. To estimate natural gas displacement, we first calculated the potential fuel higher heating value of the product based on a higher heating value of 20.9 MJ/odkg [2] or 10,102 MJ/m<sup>3</sup> product. The energy equivalent amount of natural gas was calculated based on a higher heating value or 38.66 MJ/m<sup>3</sup> [9] or 261 m<sup>3</sup> natural gas/m<sup>3</sup> product. In the case that the product is recovered and reused, we assumed that the avoided LVL production was equal to the A1-A3 impacts calculated as part of this EPD.



## Functional Unit

The functional unit for LVL and mass timber is “one cubic meter (1 m<sup>3</sup>) of laminated veneer lumber (LVL) produced at Boise Cascade’s facility in White City, Oregon installed in a building for 75 years”. The product properties and composition associated with the functional unit are provided in Table 1.

**Table 1:** Product properties and composition of 1 cubic meter of laminated veneer lumber and mass timber

Product properties:	Unit	Value
Mass (including moisture)	kg	483.4
Moisture Content	%	7%
Product composition:	Unit	Value
Wood Veneer	%	> 90%
Resins	%	< 10%

## Allocation Methods

Allocation is the method used to partition the environmental load of a process when several products or functions share the same process. LVL and mass timber manufacturing includes veneer parallel laminated veneer production processes that are multiple output process, where the primary products are one of several valuable coproducts from a common process. In accordance with UL Wood PCR 2019, “mass” was selected as the parameter for allocation of the total inputs/outputs of the production system.

## Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

No material or energy input or output was knowingly excluded from the system boundary.

## Data Sources

Primary and secondary data sources, as well as the respective data quality assessment are documented in the underlying LCA project report [2] in accordance with UL PCR 2019. This EPD estimates the impacts of forest management by the use of average data for Pacific Northwest log production. Third-party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impact to any of the required impact categories identified by the applicable PCR.

## Treatment of Biogenic Carbon and Sustainable Forest Management Certification

Biogenic carbon emissions and removals are reported in accordance with ISO 21930 7.2.7. and 7.2.12. Detailed information is provided in Section 5.1 of the underlying LCA [2]. Table 6 provides additional inventory parameters related to biogenic carbon removal and emissions.

To consider the biogenic carbon dynamics that occur in landfills, UL Environment published an Appendix to the reference PCR that estimates the emissions from landfilling of wood products. The Landfill Modeling for Biogenic Carbon Appendix A is based on the United States EPA WARM model and aligns with the biogenic accounting rules in ISO 21930 Section 7.2.7 and Section 7.2.12.

The WARM model is documented by the EPA at <https://www.epa.gov/warm/documentation-waste-reduction-model-warm>. UL's wood product PCR adopted the WARM model estimations and published those assumptions under Appendix A of the PCR. These background accounting assumptions form the basis for landfill modeling that adjusts the carbon storage as a portion of the initial carbon while accounting for remaining carbon converted to landfill gas. It does not assign the percentage of the wood product sent to the landfill.

ISO 21930 requires a demonstration of forest sustainability to characterize carbon removals with a factor of -1 kg CO<sub>2</sub>e/kg CO<sub>2</sub>. ISO 21930 Section 7.2.11 Note 2 states the following regarding demonstrating forest sustainability: "Other evidence such as national reporting under the United Nations Framework Convention on Climate Change (UNFCCC) can be used to identify forests with stable or increasing forest carbon stocks." The United States UNFCCC annual report Table 6-1 provides annual NET GHG Flux Estimates for different land use categories. This reporting indicates non-decreasing forest carbon stocks and thus the source forests meet the conditions for characterization of removals with a factor of -1 kg CO<sub>2</sub>e/kg CO<sub>2</sub>.

## ENVIRONMENTAL PARAMETERS DERIVED FROM LCA

The impact categories and characterization factors (CF) for the LCIA were derived from the U.S. EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts -TRACI 2.1 [6]. SimaPro v8.5 [10] was used to accumulate the LCI data and to calculate the LCIA results.

The total primary energy consumption is tabulated from the LCI results based on the Cumulative Energy Demand Method published byecoinvent [18]. Lower heating value of primary energy carriers is used to calculate the primary energy values reported in the study. Other inventory parameters concerning material use, waste, water use and biogenic carbon were drawn from the LCI results. ACLCA's Guidance to Calculating non-LCIA Inventory Metrics was followed in accordance with ISO 21930:2017 [1].

Table 6 illustrates the fact that wood products are assumed to largely remain undecomposed in landfills thus permanently storing biogenic carbon. The net effect of the biogenic carbon flowing into the product system in A1 and the total of all outflows that are somewhat less than the A1



input when landfilling is assumed, is that the global warming potential for biogenic carbon is negative. The assumptions regarding biogenic carbon landfill dynamics are described in detail in UL PCR 2019 Addendum 1.

The U.S. Environmental Protection Agency has Materials Management Fact Sheet that assess trends in material recycling, composting, combustion with energy recovery and landfilling in the U.S. For durable wood products (such as construction materials) the 2017 estimates were 0% recycling, 0% composting, 18% combustion with energy recovery and 82% landfilling as a percentage of wood material generated by weight. This assessment can be adjusted for alternative end-of-life scenarios such as 100% landfill or 100% reuse.

The transparent presentation of LCA information allows the user to examine the relative difference between environmental impacts with and without biogenic carbon, with and without substitution effects, and with three different end-of-life scenarios. Table 8 provides a comprehensive list of the combinations of biogenic carbon, substitution effects and end-of-life scenarios for Global Warming Potential.

### Detailed Biogenic Carbon Results

To ensure transparency, Table 2 shows additional inventory parameters related to biogenic carbon removal and emissions. The carbon dioxide flows are presented unallocated to consider co-products leaving the product system in information module A3. Even though, the system boundary of this study included only the information modules A1-A3, in accordance with ISO 21930, BCEK was reported in A5 and B CEP of the main product in C3/C4.

**Table 2:** Biogenic carbon inventory parameters

Additional Inventory Parameters		A1 All Scenarios	A3 All Scenarios	C4 Landfill Scenario	C4 Incin. Scenario	C4 Reuse Scenario	D Incin. Scenario
Biogenic Carbon Removal from Product	kg CO <sub>2</sub>	-1767.33	-	-	-		
Biogenic Carbon Emission from Product	kg CO <sub>2</sub>	-	784.35	124.80	777.59	777.59	-566.02
Biogenic Carbon Removal from Packaging	kg CO <sub>2</sub>	-	-	-	-		
Biogenic Carbon Emission from Packaging	kg CO <sub>2</sub>	-	-	-	-		
Biogenic Carbon Emission from Combustion of Waste from Ren. Sources Used in Production	kg CO <sub>2</sub>	-	205.39	-	-		
<b>Total Biogenic CO<sub>2</sub> Removals &amp; Emissions</b>							
Net biogenic carbon emission landfill scenario	kg CO <sub>2</sub>	-652.79					
Net biogenic carbon emission incineration scenario	kg CO <sub>2</sub>	0.00					
Net biogenic carbon emission reuse scenario	kg CO <sub>2</sub>	0.00					
<b>Average end-of-life treatment</b>	<b>kg CO<sub>2</sub></b>	<b>-533.98</b>					

## RESULTS

Table 3 shows the results for the *cradle-to-gate* (A1-A3) LVL and mass timber product system. The cradle-to-gate results align with the North American industry average EPD for LVL developed by the American Wood Council and Canadian Wood Council in 2020. The cradle-to-gate results are identical to the A1-A3 results that are presented in Section 4.3 as a part of the cradle-to-gate plus end-of-life system boundaries except for the accounting of biogenic carbon. In the cradle-to-gate results, the biogenic carbon stored in the primary product is conservatively accounted as an emission in module A3 as the end-of-life modules (C1-C4) are not considered.

**Table 3:** Results Summary for 1 m<sup>3</sup> of LVL and Mass Timber – Cradle-to-Gate Scope

Core Mandatory Impact Indicator			A1-A3	A1	A2	A3
Global warming potential – Total	GWP <sub>TOTAL</sub>	kg CO <sub>2</sub> e	<b>239.47</b>	-1,630.63	6.79	1,863.31
Global warming potential – Fossil	GWP <sub>FOSSIL</sub>	kg CO <sub>2</sub> e	<b>239.47</b>	136.70	6.79	95.98
Global warming potential – Biogenic	GWP <sub>BIO</sub>	kg CO <sub>2</sub> e	<b>0.00</b>	-1,767.33	6.79	1,767.33
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	<b>6.19E-06</b>	9.21E-08	2.79E-10	6.10E-06
Acidification potential of soil and water sources	AP	kg SO <sub>2</sub> e	<b>2.13</b>	1.53	0.08	0.51
Eutrophication potential	EP	kg Ne	<b>0.63</b>	0.03	0.00	0.59
Formation potential of tropospheric ozone	SFP	kg O <sub>3</sub> e	<b>23.13</b>	12.10	2.08	8.94
Abiotic depletion potential for fossil resources	ADPF	MJ, NCV	<b>4,836.90</b>	3,525.67	95.87	1,215.35
Fossil fuel depletion	FFD	MJ Surplus	<b>634.27</b>	496.70	14.01	123.56
<b>Use of Primary Resources</b>						
Renewable primary energy carrier used as energy	RPRE	MJ, NCV	<b>2,532.87</b>	0.61	0.00	2,532.26
Renewable primary energy carrier used as material	RPRM	MJ, NCV	<b>8,864.53</b>	8,864.53	0.00	0.00
Non-renewable primary energy carrier used as energy	NRPRE	MJ, NCV	<b>5,417.91</b>	3,799.85	101.58	1,516.48
Non-renewable primary energy carrier used as material	NRPRM	MJ, NCV	<b>0.00</b>	0.00	0.00	0.00
<b>Secondary Material, Secondary Fuel and Recovered</b>						
Secondary material	SM	kg	<b>0.00</b>	0.00	0.00	0.00
Renewable secondary fuel	RSF	MJ, NCV	<b>0.00</b>	0.00	0.00	0.00
Non-renewable secondary fuel	NRSF	MJ, NCV	<b>0.00</b>	0.00	0.00	0.00
Recovered energy	RE	MJ, NCV	<b>0.00</b>	0.00	0.00	0.00
<b>Mandatory Inventory Parameters</b>						
Consumption of freshwater resources	FW	m <sup>3</sup>	<b>0.58</b>	0.00	0.00	0.58
<b>Indicators Describing Waste</b>						
Hazardous waste disposed	HWD	kg	<b>0.00</b>	0.00	0.00	0.00
Non-hazardous waste disposed	NHWD	kg	<b>0.01</b>	0.00	0.00	0.01
High-level radioactive waste, conditioned, to final repository	HLRW	m <sup>3</sup>	<b>1.01E-07</b>	1.40E-09	0.00E+00	9.93E-08
Intermediate- and low-level radioactive waste, conditioned, to final repository	ILLRW	m <sup>3</sup>	<b>9.27E-07</b>	7.84E-09	0.00E+00	9.20E-07
Components for re-use	CRU	kg	<b>0.00</b>	0.00	0.00	0.00
Materials for recycling	MR	kg	<b>0.00</b>	0.00	0.00	0.00
Materials for energy recovery	MER	kg	<b>0.00</b>	0.00	0.00	0.00
Recovered energy exported from the product system	EE	MJ, NCV	<b>0.00</b>	0.00	0.00	0.00

Tables 4-7 present the LCIA and LCI parameter results for the functional unit of 1 m<sup>3</sup> of LVL and mass timber over a service life of 75 years. The *cradle-to-grave* results includes the delivery of the product to the construction site, construction, use, and the end-of-life. Table 4 presents the weighted average results for the typical waste treatment in the United States for durable wood products, 82% landfill and 18% incineration [14]. As per the PCR and ISO 21930 Section 7.1.7, the results for each of the individual options are also separately reported. These options also include 100% landfilling (Table 5), 100% incineration (Table 6) and 100% reuse (Table 7).

**Table 4: Results Summary for LVL and Mass Timber – Avg. End-of-Life Treatment, 82% Landfill / 18% Combustion w/ Energy Recovery**

Core Mandatory Impact Indicator	Indicator	Unit	Total A-C	Total w/ D	A1	A2	A3	A4	A5	B	C1	C2	C4	D
Global warming potential – Total	GWP <sub>TOTAL</sub>	kg CO <sub>2</sub> e	-229.73	-332.74	-1,630.63	6.79	1,085.72	21.27	7.14	0.00	16.80	12.03	251.15	-103.02
Global warming potential - Fossil	GWP <sub>FOSSIL</sub>	kg CO <sub>2</sub> e	304.25	201.24	136.70	6.79	95.98	21.27	7.14	0.00	16.80	12.03	7.54	-103.02
Global warming potential - Biogenic	GWP <sub>BIOGENIC</sub>	kg CO <sub>2</sub> e	-533.98	-533.98	-1,767.33	0.00	989.74	0.00	0.00	0.00	0.00	0.00	243.61	0.00
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	7.05E-06	2.53E-06	9.21E-08	2.79E-10	6.10E-06	8.98E-10	1.34E-07	0.00E+00	3.16E-07	5.02E-10	4.08E-07	-4.52E-06
Acidification potential of soil and water sources	AP	kg SO <sub>2</sub> e	2.96	2.10	1.53	0.08	0.51	0.25	0.10	0.00	0.23	0.13	0.13	-0.87
Eutrophication potential	EP	kg Ne	0.68	0.66	0.03	0.00	0.59	0.01	0.01	0.00	0.01	0.01	0.01	-0.01
Formation potential of tropospheric ozone	SFP	kg O <sub>3</sub> e	46.14	43.80	12.10	2.08	8.94	6.28	3.09	0.00	7.27	3.17	3.20	-2.34
Abiotic depletion potential (ADP <sub>fossil</sub> )	ADP <sub>f</sub>	MJ, NCV	5,748.87	4,123.86	3,525.67	95.87	1,215.35	305.25	98.57	0.00	232.02	170.68	105.45	-1,625.02
Fossil fuel depletion	FFD	MJ Surplus	763.26	496.03	496.70	14.01	123.56	45.11	14.67	0.00	34.53	25.22	9.46	-267.23
<b>Use of Primary Resources</b>														
Renewable primary energy used as energy	RPRE	MJ, NCV	4,080.23	4,079.28	0.61	0.00	2,532.26	0.00	0.12	0.00	0.29	0.00	1,546.95	-0.95
Renewable primary energy used as material	RPRM	MJ, NCV	8,864.53	8,864.53	8,864.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable primary energy used as energy	NRPRE	MJ, NCV	6,384.97	4,581.79	3,799.85	101.58	1,516.48	323.57	104.64	0.00	246.31	180.93	111.61	-1,803.19
Non-renewable primary energy used as material	NRPRM	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Secondary Material, Secondary Fuel and Recovered Energy</b>														
Secondary material	SM	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuel	RSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuel	NRSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy	RE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Mandatory Inventory Parameters</b>														
Consumption of freshwater resources	FW	m <sup>3</sup>	0.62	0.62	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.04	0.00
<b>Indicators Describing Waste</b>														
Hazardous waste disposed	HWD	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed	NHWD	kg	395.41	395.41	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	395.40	0.00
High-level radioactive waste	HLRW	m <sup>3</sup>	1.02E-07	1.01E-07	1.40E-09	0.00E+00	9.93E-08	0.00E+00	4.33E-11	0.00E+00	1.02E-10	0.00E+00	8.87E-10	-1.15E-09
Intermediate- and low-level radioactive waste	ILLRW	m <sup>3</sup>	9.98E-07	9.92E-07	7.84E-09	0.00E+00	9.20E-07	0.00E+00	2.08E-10	0.00E+00	4.90E-10	0.00E+00	6.96E-08	-5.52E-09
Components for re-use	CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for recycling	MR	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for energy recovery	MER	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy exported	EE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 5: LCIA Results Summary for LVL and Mass Timber – 100% Landfilling at End-of-Life**

Core Mandatory Impact Indicator	Indicator	Unit	Total A-C	A1	A2	A3	A4	A5	B	C1	C2	C4
Global warming potential – Total	GWP <sub>TOTAL</sub>	kg CO <sub>2</sub> e	-353.55	-1,630.63	6.79	1,085.72	21.27	7.14	0.00	16.80	12.03	127.32
Global warming potential - Fossil	GWP <sub>FOSSIL</sub>	kg CO <sub>2</sub> e	299.24	136.70	6.79	95.98	21.27	7.14	0.00	16.80	12.03	2.52
Global warming potential - Biogenic	GWP <sub>BIOGENIC</sub>	kg CO <sub>2</sub> e	-652.79	-1,767.33	0.00	989.74	0.00	0.00	0.00	0.00	0.00	1.25E+02
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	7.14E-06	9.21E-08	2.79E-10	6.10E-06	8.98E-10	1.34E-07	0.00E+00	3.16E-07	5.02E-10	4.98E-07
Acidification potential of soil and water sources	AP	kg SO <sub>2</sub> e	2.85	1.53	0.08	0.51	0.25	0.10	0.00	0.23	0.13	0.02
Eutrophication potential	EP	kg Ne	0.67	0.03	0.00	0.59	0.01	0.01	0.00	0.01	0.01	0.00
Formation potential of tropospheric ozone	SFP	kg O <sub>3</sub> e	43.57	12.10	2.08	8.94	6.28	3.09	0.00	7.27	3.17	0.63
Abiotic depletion potential (ADP <sub>fossil</sub> )	ADP <sub>f</sub>	MJ, NCV	5,676.48	3,525.67	95.87	1,215.35	305.25	98.57	0.00	232.02	170.68	33.06
Fossil fuel depletion	FFD	MJ Surplus	758.31	496.70	14.01	123.56	45.11	14.67	0.00	34.53	25.22	4.50
<b>Use of Primary Resources</b>												
Renewable primary energy used as energy	RPRE	MJ, NCV	2,534.07	0.61	0.00	2,532.26	0.00	0.12	0.00	0.29	0.00	0.79
Renewable primary energy used as material	RPRM	MJ, NCV	8,864.53	8,864.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable primary energy used as energy	NRPRE	MJ, NCV	6,309.92	3,799.85	101.58	1,516.48	323.57	104.64	0.00	246.31	180.93	36.56
Non-renewable primary energy used as material	NRPRM	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Secondary Material, Secondary Fuel and Recovered Energy</b>												
Secondary material	SM	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuel	RSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuel	NRSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy	RE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Mandatory Inventory Parameters</b>												
Consumption of freshwater resources	FW	m <sup>3</sup>	0.58	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00
<b>Indicators Describing Waste</b>												
Hazardous waste disposed	HWD	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed	NHWD	kg	483.38	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	483.37
High-level radioactive waste	HLRW	m <sup>3</sup>	1.02E-07	1.40E-09	0.00E+00	9.93E-08	0.00E+00	4.33E-11	0.00E+00	1.02E-10	0.00E+00	1.08E-09
Intermediate- and low-level radioactive waste	ILLRW	m <sup>3</sup>	1.01E-06	7.84E-09	0.00E+00	9.20E-07	0.00E+00	2.08E-10	0.00E+00	4.90E-10	0.00E+00	8.51E-08
Components for re-use	CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for recycling	MR	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for energy recovery	MER	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy exported	EE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 6:** LCIA Results Summary for LVL and Mass Timber – 100% Incineration with Energy Recovery at End-of-Life

Core Mandatory Impact Indicator	Indicator	Unit	Total A-C	Total w/ D	A1	A2	A3	A4	A5	B	C1	C2	C4	D
Global warming potential – Total	GWP <sub>TOTAL</sub>	kg CO <sub>2</sub> e	326.81	-239.21	-1,630.63	6.79	1,085.72	21.27	7.14	0.00	16.80	12.03	807.68	-566.02
Global warming potential - Fossil	GWP <sub>FOSIL</sub>	kg CO <sub>2</sub> e	326.81	-239.21	136.70	6.79	95.98	21.27	7.14	0.00	16.80	12.03	30.09	-566.02
Global warming potential - Biogenic	GWP <sub>BIOGENIC</sub>	kg CO <sub>2</sub> e	0.00	0.00	-1,767.33	0.00	989.74	0.00	0.00	0.00	0.00	0.00	777.59	0.00
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	6.64E-06	-1.82E-05	9.21E-08	2.79E-10	6.10E-06	8.98E-10	1.34E-07	0.00E+00	3.16E-07	5.02E-10	4.95E-10	-2.48E-05
Acidification potential of soil and water sources	AP	kg SO <sub>2</sub> e	3.46	-1.30	1.53	0.08	0.51	0.25	0.10	0.00	0.23	0.13	0.63	-4.76
Eutrophication potential	EP	kg Ne	0.69	0.62	0.03	0.00	0.59	0.01	0.01	0.00	0.01	0.01	0.03	-0.08
Formation potential of tropospheric ozone	SFP	kg O <sub>3</sub> e	57.71	44.84	12.10	2.08	8.94	6.28	3.09	0.00	7.27	3.17	14.76	-12.86
Abiotic depletion potential (ADP <sub>fossil</sub> )	ADP <sub>f</sub>	MJ, NCV	6,074.26	-2,854.40	3,525.67	95.87	1,215.35	305.25	98.57	0.00	232.02	170.68	430.83	-8,928.66
Fossil fuel depletion	FFD	MJ Surplus	785.51	-682.79	496.70	14.01	123.56	45.11	14.67	0.00	34.53	25.22	31.71	-1,468.30
<b>Use of Primary Resources</b>														
Renewable primary energy used as energy	RPRE	MJ, NCV	11,029.48	11,024.25	0.61	0.00	2,532.26	0.00	0.12	0.00	0.29	0.00	8,496.19	-5.23
Renewable primary energy used as material	RPRM	MJ, NCV	8,864.53	8,864.53	8,864.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable primary energy used as energy	NRPRE	MJ, NCV	6,722.31	-3,185.32	3,799.85	101.58	1,516.48	323.57	104.64	0.00	246.31	180.93	448.95	-9,907.63
Non-renewable primary energy used as material	NRPRM	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Secondary Material, Secondary Fuel and Recovered Energy</b>														
Secondary material	SM	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuel	RSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuel	NRSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy	RE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Mandatory Inventory Parameters</b>														
Consumption of freshwater resources	FW	m <sup>3</sup>	0.78	0.78	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.20	-0.01
<b>Indicators Describing Waste</b>														
Hazardous waste disposed	HWD	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed	NHWD	kg	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High-level radioactive waste	HLRW	m <sup>3</sup>	1.01E-07	9.45E-08	1.40E-09	0.00E+00	9.93E-08	0.00E+00	4.33E-11	0.00E+00	1.02E-10	0.00E+00	0.00E+00	-6.30E-09
Intermediate- and low-level radioactive waste	ILLRW	m <sup>3</sup>	9.28E-07	8.98E-07	7.84E-09	0.00E+00	9.20E-07	0.00E+00	2.08E-10	0.00E+00	4.90E-10	0.00E+00	0.00E+00	-3.03E-08
Components for re-use	CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for recycling	MR	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for energy recovery	MER	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy exported	EE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



**Table 7: LCIA Results Summary for LVL and Mass Timber – 100% Reuse at End-of-Life**

Core Mandatory Impact Indicator	Indicator	Unit	Total A-C	Total w/D	A1	A2	A3	A4	A5	B	C1	C2	C4	D
Global warming potential – Total Fossil & Biogenic	GWP <sub>TOTAL</sub>	kg CO <sub>2</sub> e	296.72	57.25	-1,630.63	6.79	1,085.72	21.27	7.14	0.00	16.80	12.03	777.59	-239.47
Global warming potential - Fossil	GWP <sub>FOSSIL</sub>	kg CO <sub>2</sub> e	296.72	57.25	136.70	6.79	95.98	21.27	7.14	0.00	16.80	12.03	0.00	-239.47
Global warming potential - Biogenic	GWP <sub>BIOGENIC</sub>	kg CO <sub>2</sub> e	0.00	0.00	-1,767.33	0.00	989.74	0.00	0.00	0.00	0.00	0.00	777.59	0.00
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	0.00	0.00	9.21E-08	2.79E-10	6.10E-06	8.98E-10	1.34E-07	0.00E+00	3.16E-07	5.02E-10	0.00	-6.19E-06
Acidification potential of soil and water sources	AP	kg SO <sub>2</sub> e	2.83	0.70	1.53	0.08	0.51	0.25	0.10	0.00	0.23	0.13	0.00	-2.13
Eutrophication potential	EP	kg Ne	0.67	0.04	0.03	0.00	0.59	0.01	0.01	0.00	0.01	0.01	0.00	-0.63
Formation potential of tropospheric ozone	SFP	kg O <sub>3</sub> e	42.94	19.82	12.10	2.08	8.94	6.28	3.09	0.00	7.27	3.17	0.00	-23.13
Abiotic depletion potential (ADP <sub>fossil</sub> )	ADPF	MJ, NCV	5,643.42	806.53	3,525.67	95.87	1,215.35	305.25	98.57	0.00	232.02	170.68	0.00	-4836.90
Fossil fuel depletion	FFD	MJ Surplus	753.80	119.53	496.70	14.01	123.56	45.11	14.67	0.00	34.53	25.22	0.00	-634.27
<b>Use of Primary Resources</b>														
Renewable primary energy used as energy	RPRE	MJ, NCV	2,533.28	0.41	0.61	0.00	2,532.26	0.00	0.12	0.00	0.29	0.00	0.00	-2,532.87
Renewable primary energy used as material	RPRM	MJ, NCV	8,864.53	0.00	8,864.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-8,864.53
Non-renewable primary energy used as energy	NRPRE	MJ, NCV	6,273.36	855.45	3,799.85	101.58	1,516.48	323.57	104.64	0.00	246.31	180.93	0.00	-5,417.91
Non-renewable primary energy used as material	NRPRM	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Secondary Material, Secondary Fuel and Recovered Energy</b>														
Secondary material	SM	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuel	RSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuel	NRSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy	RE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Mandatory Inventory Parameters</b>														
Consumption of freshwater resources	FW	m <sup>3</sup>	0.58	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	-0.58
<b>Indicators Describing Waste</b>														
Hazardous waste disposed	HWD	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed	NHWD	kg	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
High-level radioactive waste	HLRW	m <sup>3</sup>	1.01E-07	1.45E-10	1.40E-09	0.00E+00	9.93E-08	0.00E+00	4.33E-11	0.00E+00	1.02E-10	0.00E+00	0.00E+00	-1.01E-07
Intermediate- and low-level radioactive waste	ILLRW	m <sup>3</sup>	9.28E-07	6.99E-10	7.84E-09	0.00E+00	9.20E-07	0.00E+00	2.08E-10	0.00E+00	4.90E-10	0.00E+00	0.00E+00	-9.27E-07
Components for re-use	CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for recycling	MR	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for energy recovery	MER	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy exported	EE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## INTERPRETATION

The primary sources of impacts across the life cycle are the manufacturing of the product itself (Modules A1-A3) and the net flows of biogenic carbon. Table 2 shows that the flows of biogenic carbon out of the system in Module A3 (combustion emissions and the export of coproducts to other product systems) and Module C4 (landfill gas and incineration emissions) are significantly less than the flows of biogenic carbon into the system in Module A1 (removal of biomass from a net neutral sustainable forest). The permanent biogenic carbon storage is so significant (534 kg CO<sub>2</sub>eq.) that this net benefit is larger than the total fossil emissions from all other modules and causes the total global warming potential to be negative. The total global warming potential of -258 kg CO<sub>2</sub>eq. means the product system removes more greenhouse gases from the atmosphere than are emitted in its production and disposal combined.

Table 8 provides a comparison of the global warming potential of the various results based on three variables: whether the biogenic carbon emissions are included, whether substitution effects (Module D) are included, and what assumptions are made as to the end-of-life treatment.

Global warming potential **Result 1** (239.47) in Table 8 references the *cradle-to-gate* GWP result shown in Table 3. The end-of-life modules (C1-C4), construction (A4, A5) and use (B1-B7) are outside the scope while the biogenic carbon is conservatively assumed to be completely emitted. Thus, in GWP **Result 1**, the results with and without biogenic carbon are identical.

This *cradle-to-gate* result serves as the baseline for the other *cradle-to-grave* scenarios that include end-of-life modules, which are presented in Tables 4 through 7. They include:

- Table 4 – Average end-of-life treatment assumed to be 82% landfill and 18% combustion with energy recovery
- Table 5 - End-of-life treatment assumed to be 100% landfill
- Table 6 - End-of-life treatment assumed to be 100% incineration with energy recovery
- Table 7 - End-of-life treatment assumed to be 100% reuse

The choice between use of Table 4, 5, 6 or 7 depends on the intended method of disposal or reuse. For this EPD, Table 4 is considered to be the most common representation of mass timber based on the average end-of-life treatment for wood products. Regardless of the *cradle-to-grave* table chosen, there is an additional GWP impact, relative to *cradle-to-gate* Table 1, caused by the combustion of fossil fuels in demolition, transportation to waste treatment, and landfill operations (where applicable).

Once the *cradle-to-grave* table is selected, then the next selection is whether or not to include biogenic carbon or substitution effects. Each table is broken down to disclose the combined impact of including or excluding biogenic carbon and/or substitution effects.

Table 8 serves to tabulate the GWP impact for each assumption. For example, Table 4 – average end-of-life treatment assumed to be 82% landfill and 18% combustion with energy recovery, which is represented in Table 8 by **Result 2, 6 and 10**.

- **Result 2** (304.25) excludes the biogenic carbon impacts on GWP as well as the substitution effects. This result is closely related to the cradle-to-gate **Result 1** (239.47).
- **Result 6** (-229.73) includes the biogenic carbon impacts and excludes the substitution effects.
- **Result 10** (-332.74) includes both biogenic carbon impacts and the substitution effects of reusing the product at end of life as well as fossil fuel substitution caused by the recovery of energy for the portion of the material that is burned at end-of-life.

Summarizing the GWP impacts presented in Table 4, the cradle-to-gate 239.47 increases to 304.25 when end-of-life modules are added without biogenic carbon or substitution effects. When biogenic carbon is added, there is a dramatic drop in GWP to -229.73. When substitution effects are also added to biogenic carbon, the GWP impact drops further to -332.74.

Using the same methodology, there are other *cradle-to-grave* scenarios in Tables 5, 6 and 7 to consider for end-of-life treatments for mass timber. They are provided as a basis of comparison when considering different methods of disposal or reuse.

The lowest global warming potential is realized in Table 5 - end-of-life treatment assumed to be 100% landfill, which is represented in Table 8, **Result 7** (-353.55) where biogenic carbon is added. There are no substitution effects with a landfill scenario. This scenario maximizes the permanent sequestration of carbon in the landfill which, strictly in terms of the global warming potential, is the most beneficial treatment for wood at end-of-life under the study's assumptions.

The highest global warming potential result is realized in Table 6 - end-of-life treatment assumed to be 100% incineration with energy recovery, which is represented in Table 8, **Result 4 and 8** (326.81) that excludes the beneficial fossil fuel substitution effects. This scenario assumes the worst-case carbon storage and fossil fuel combustion. However, when the substitution effect is added, **Result 11** (-239.21) shows a significant GWP reduction, meaning the potential energy recovery value of the product is greater than the fossil fuel combusted in the rest of the life cycle.

Clearly, the broad range of GWP impact between 326.81 and -353.55 illustrates the importance of making the correct assumptions in life-cycle analysis based upon the intended use. The user is responsible for determining the intended use of the product. Boise Cascade offers this information to help the user make an informed decision.

**Table 8: End-of-Life Considerations: Impact on Global Warming Potential (GWP)**

GWP Result #	Source of Result	Cradle-to-Gate; A1-A3 Impacts	A4, A5, B1-B7 Impacts	C1-C4 Impacts	Biogenic Carbon Impacts <sup>(1)</sup>	Substitution Module D Impacts <sup>(2)</sup>	End-of-Life Percent Assigned to Landfill	End-of-Life Percent Assigned to Combustion with Energy Recovery (Incineration)	End-of-Life Percent Assigned to Reuse	GWP (kg CO <sub>2</sub> e)
1	Table 3 <sup>(3)</sup>	Declared	Not Declared	Not Declared	Either Declared or Not <sup>(5)</sup>	Not Declared	N/A	N/A	N/A	239.47
2	Table 4	Declared	Declared	Declared	Not Declared	Not Declared	82%	18%	N/A	304.25 <sup>(4)</sup>
3	Table 5	Declared	Declared	Declared	Not Declared	Not Declared	100%	N/A	N/A	299.24
4	Table 6	Declared	Declared	Declared	Not Declared	Not Declared	N/A	100%	N/A	326.81
5	Table 7	Declared	Declared	Declared	Not Declared	Not Declared	N/A	N/A	100%	296.72
<b>6</b>	<b>Table 4</b>	<b>Declared</b>	<b>Declared</b>	<b>Declared</b>	<b>Declared</b>	<b>Not Declared</b>	<b>82%</b>	<b>18%</b>	<b>N/A</b>	<b>-229.73<sup>(4)</sup></b>
7	Table 5	Declared	Declared	Declared	Declared	Not Declared	100%	N/A	N/A	-353.55
8	Table 6	Declared	Declared	Declared	Declared	Not Declared	N/A	100%	N/A	326.81
9	Table 7	Declared	Declared	Declared	Declared	Not Declared	N/A	N/A	100%	296.72
10	Table 4	Declared	Declared	Declared	Declared	Declared	82%	18%	N/A	-332.74
11	Table 6	Declared	Declared	Declared	Declared	Declared	N/A	100%	N/A	-239.21
12	Table 7	Declared	Declared	Declared	Declared	Declared	N/A	N/A	100%	57.25

1 - Biogenic carbon emissions and removals are reported in accordance with ISO 21930 7.2.7 and 7.2.12.

2 - The substitution effects from energy and material recovery were estimated based on secondary data for biomass combustion relative to natural gas combustion, as well as primary data for virgin LVL/mass timber production.

3 - Useful when comparing to other mass timber Cradle-to-Gate EPDs.

4 - The Table 4 difference between -229.73 and 304.25 (with and without biogenic carbon) is -533.98 found in Table 2.

5 - GWP remains the same whether or not biogenic carbon is declared.

## LIMITATIONS

### Comparability

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance using EPD information shall consider all relevant information modules over the full life cycle of the products within the building.

This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 §5.5 are met. In addition, to be compared EPDs must comply with the same core and sub-category PCRs (Part A and B) and include all relevant information modules. It should be noted that different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

### Forest Management

While this EPD does not address landscape level forest management impacts, potential impacts may be addressed through requirements put forth in regional regulatory frameworks, ASTM 7612-15 guidance, and ISO 21930 Section 7.2.11 including notes therein. These documents, combined with this EPD, may provide a more complete picture of environmental and social performance of wood products.

While this EPD does not address all forest management activities that influence forest carbon, wildlife habitat, endangered species, and soil and water quality, these potential impacts may be addressed through other mechanisms such as regulatory frameworks and/or forest certification systems which, combined with this EPD, will give a more complete picture of environmental and social performance of wood products.

### Scope of the EPD

EPDs can complement but cannot replace tools and certifications that are designed to address environmental impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, etc.

### Data

National or regional life cycle averaged data for raw material extraction does not distinguish between extraction practices at specific sites and can greatly affect the resulting impacts.

### Accuracy of Results

EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact when averaging data.

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