

# Low Carbon Landscape Design Guide

# dtah + ha/f

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# Carbon and Landscape Architecture



# 1.1 Purpose of the Guide

This guide helps landscape architects apply Life Cycle Assessment (LCA) in day-to-day practice to support municipal net-zero goals.

It builds on City of Toronto-led research and policy, including the City of Toronto Landscape Carbon Benchmarking Study (2025) and Toronto Green Standard Version 4, and reflects how carbon considerations can be integrated into the landscape design process from early planning through detailed design.

The guide provides clear, consistent direction for landscape LCAs by setting out shared assumptions and methods that teams can apply across projects.

It is written primarily for practicing landscape architects, especially those new to landscape LCA, who need a straightforward starting point. It is intended as a general best-practice resource for an evolving field and is not tied to specific development requirements.

## 1.1.1 The Emerging Role of Landscape LCAs in Canada

This guide responds to a growing need for clear and consistent ways to reduce embodied carbon in landscape design. While life cycle assessment is now common for buildings, its use for landscapes in Canada is still new, and there are few shared benchmarks, assumptions, or standards. This guide shows how landscape architects can support low-carbon outcomes by connecting everyday design choices to measurable carbon results and by providing a common starting point to help the profession build and improve best practices over time.

## 1.1.2 Direction, Not Perfection

Designing with a carbon lens, supported by LCA tools, is intended to inform decisions rather than to deliver perfect technical certainty. LCA is most useful as a comparative tool that helps teams understand the relative impacts of design options and identify the materials and assemblies that drive results. Early, iterative testing, even with high-level inputs, can quickly reveal carbon “hotspots” and focus effort where it will have the greatest effect.

Results are expected to be approximate in early phases and to become more detailed as the design and quantities are confirmed. The value lies in the direction of change across iterations, not minor differences in decimal-level outputs. To support consistent interpretation, teams should document key assumptions, data sources, and the version of the analysis used at each stage.

Used this way, LCA becomes one lens within an integrated design process, alongside cost, program, function, constructability, operations, and community priorities. LCA should be used to compare options, target hotspots, and track improvement across design stages.

## 1.1.3 Co-Benefits of Designing with a Carbon Lens

Designing with a carbon lens often reinforces the fundamentals of good landscape architecture, while making those outcomes more visible and defensible in decision-making. Many low-embodied-carbon strategies also strengthen ecological performance through healthier soils, increased biodiversity, and improved habitat function. They can enhance microclimates through shade and evapotranspiration-driven cooling, reduce wind exposure, and improve resilience to heat, flooding, and other extreme weather. These benefits support public health and comfort by creating greener, cooler, and more welcoming outdoor spaces. Additional information on co-benefits is provided in Section 4.1.

## 1.1.4 Costs and Fees

Designing with a carbon lens does not necessarily increase capital or operational costs. Many low-carbon strategies, such as reducing material quantities, simplifying construction, and reusing on-site materials, can reduce upfront costs while improving long-term performance. Selecting durable materials with longer service lives can also reduce maintenance and replacement needs, lowering operational costs and associated use-phase emissions.

LCA requires dedicated effort, particularly when teams are new to the process, but efficiency improves with experience and repeatable workflows. Landscape architects should identify LCA as a distinct scope item in fee proposals so the work is transparent, appropriately resourced, and recognized as part of professional practice.

## 1.2 Glossary

### Whole Life Carbon

Whole Life Carbon (WLC) refers to the total carbon emissions associated with a landscape, infrastructure, building, or product over its entire lifecycle. This includes emissions from material extraction, manufacturing, construction, operation, maintenance, and end-of-life disposal or recycling, and equates to the sum of cumulative Operational Carbon and cumulative Embodied Carbon.

### Operational Carbon

Operational carbon in landscape design refers to the greenhouse gas emissions generated by the ongoing energy use of site systems, such as lighting, irrigation, pumps, and maintenance equipment. It captures the emissions released during the day-to-day functioning of a landscape.

### Embodied Carbon

Embodied carbon in landscape design refers to the greenhouse gas emissions released from extracting, manufacturing, transporting, installing, and eventually disposing of landscape materials. It includes the full carbon footprint of products and construction activities before, during, and after a landscape is built, and accounts for emissions associated with repair and replacement over a 60-year period.

### Upfront Carbon

Upfront carbon in landscape design refers to the greenhouse gas emissions released up to the end of practical completion of a project. This includes emissions from raw material extraction, manufacturing, transportation to site, and all construction and installation activities. Upfront carbon represents the immediate climate impact of delivering a finished landscape.

### Biogenic Carbon

Biogenic carbon refers to the carbon that is naturally absorbed, stored, and released by living or once-living materials such as plants, soils, wood, and other organic matter. It reflects the biological carbon cycle, tracking how landscapes capture CO<sub>2</sub> through growth and eventually return it through decay, maintenance, or disturbance.

### Life Cycle Assessment

Life Cycle Assessment (LCA) for landscape design projects is a method used to quantify the environmental impacts of a landscape from material extraction through construction, maintenance, and end-of-life. It measures multiple impact categories, including Global Warming Potential (GWP), embodied carbon, resource use, water consumption, acidification, eutrophication, and pollution indicators, helping designers evaluate and reduce a project's overall environmental footprint.

### Environmental Product Declarations

Environmental Product Declarations (EPDs) are third-party verified reports that disclose a product's environmental impacts across the life cycle, using a standardized framework that follows EN 15804 or ISO. They help designers compare materials based on reliable, transparently communicated metrics. EPDs provide verified material-level data that LCA tools use, scale, and combine to calculate the environmental impacts of the entire project.

### Carbon Intensity

The amount of carbon dioxide equivalent (CO<sub>2</sub>e) emissions per unit of area or activity. In the context of landscape architecture, Carbon Intensity is quantified in kilograms of CO<sub>2</sub>e per square meter (kgCO<sub>2</sub>e/m<sup>2</sup>), providing a metric for assessing the carbon impact of materials, details and assemblies.

# Introduction to Whole Life Carbon

2

# 2.1 The Carbon Life Cycle

Whole Life Carbon (WLC) refers to the total carbon emissions associated with a landscape, infrastructure, building, or product over its entire life cycle. A WLC approach needs to be adopted in landscape projects to reduce emissions from the early planning stages through to long-term maintenance and stewardship.

The life cycle of carbon in the landscape includes several connected stages (Figure 1):

- **A1-A3**, the product stage, includes emissions associated with raw material extraction, transport to factory, and manufacturing.
- **A4-A5**, the construction stage, includes emissions associated with transport of building material to site, as well as construction and installation.
- **B1-B5**, the use stage, consists of embodied carbon emissions associated with material use, maintenance, repair, replacement and refurbishment.
- **B6-B7**, the operational carbon stage, calculates operational carbon associated with energy and water use.
- **C1-C4**, the end of life stage, includes emissions associated with demolition, deconstruction, transport, waste processing and disposal.

- Benefits and impacts beyond the whole life carbon system boundary are categorized under **module D**. These include net carbon flows from reuse, recycling, energy recovery and biogenic sequestration.

This perspective helps design teams integrate established strategies for reducing operational energy use in site systems with the growing understanding of embodied emissions in materials, construction practices, and maintenance cycles. By looking at carbon across the full life of a landscape, from design and material choices to upkeep and eventual replacement, teams can make clearer decisions that support performance, durability, ecological health, and climate goals.

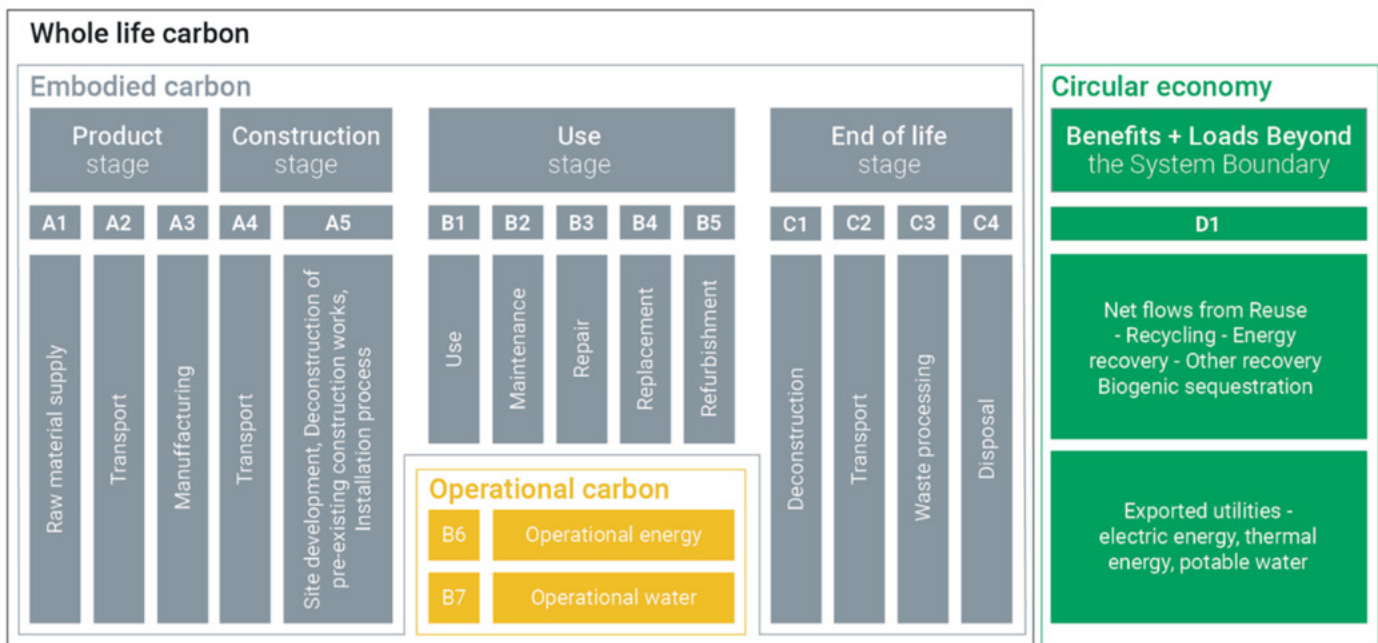


Figure 1: Carbon Life Cycle Stages (Climate Positive Design, 2025).

## 2.2 Sequestration and Carbon Storage

Carbon sequestration is the active storage of carbon from the atmosphere in vegetation or soils. Much of this carbon is stored in plant biomass such as wood, roots, and leaves, while some is released back into the atmosphere through respiration.

The amount and rate of CO<sub>2</sub> a plant can sequester depends on how large it is and how quickly it grows. Warmer regions with more sunlight typically have longer growing seasons, allowing trees and shrubs to absorb more CO<sub>2</sub>. Healthy native ecosystems also sequester significant carbon because of the complex interactions among plants, animals, fungi, and soil microbes.

Carbon storage, on the other hand, describes the retention of that carbon within the landscape over time. This includes carbon held in standing vegetation, soils, mulch layers, and long-lived organic materials. Storage focuses on how long carbon remains out of the atmosphere. While trees and shrubs can store carbon for decades, storage is not permanent; carbon may be released when plants die, decay, are removed, or are disturbed. Soils are an important carbon sink and it is important to avoid disturbance of these soils where possible especially in relation to existing sites.

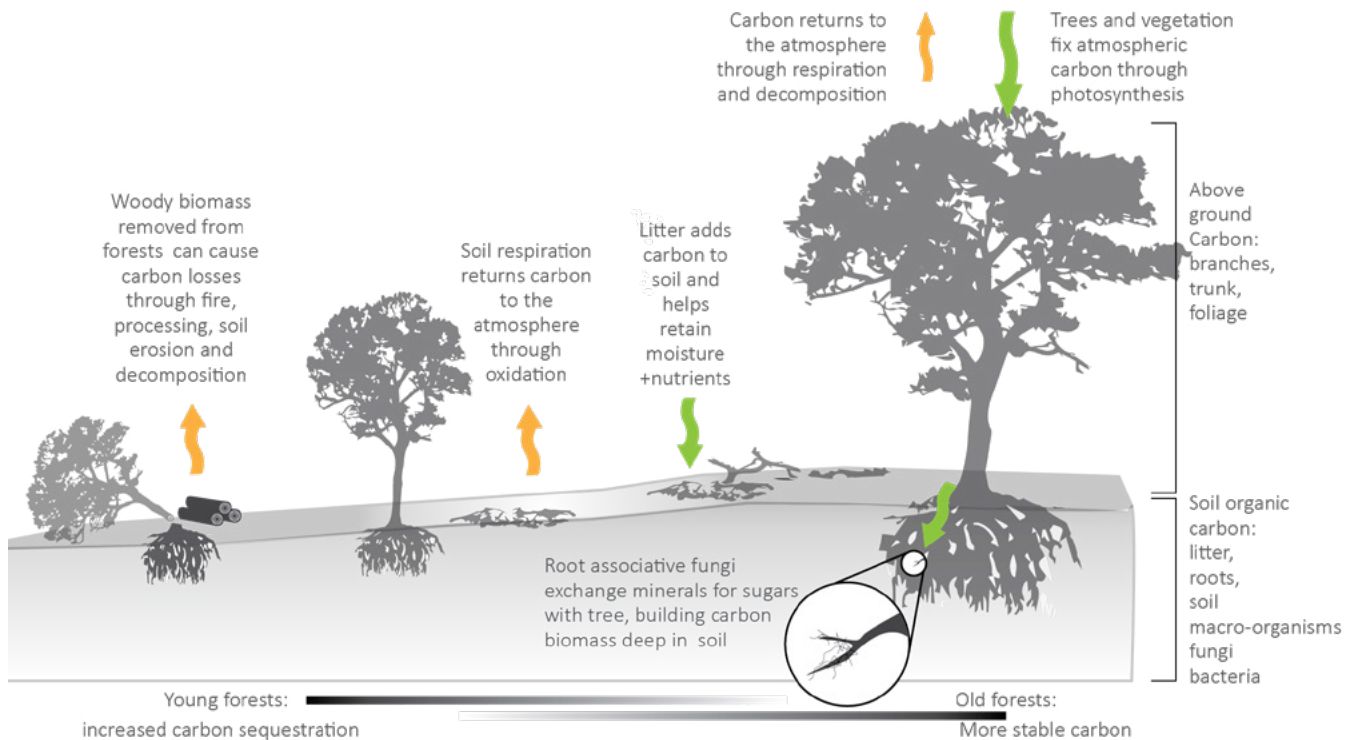


Figure 2: This diagram illustrates the process of carbon sequestration along with the implications of long-term soil carbon storage as trees mature overtime. Maintaining existing trees and undisturbed soils where possible is an important consideration when it comes to landscape design (Minnesota Board of Water and Soil Resources, 2026).

## 2.3 Environmental Product Declarations

Environmental Product Declarations (EPDs) are essential resources for carbon-aware design in landscape architecture. They are third-party verified documents put out by product manufacturers that report the environmental impacts of a specific product across its life cycle. Not all products and materials have EPDs, but as environmental performance becomes more critical, the practice of consulting EPDs is growing globally.

It is important to consider the following information when looking at EPDs:

- **A key metric within EPDs is Global Warming Potential (GWP)**, which quantifies greenhouse gas emissions by life-cycle stage. The unit to measure GWP is in kilograms per CO<sub>2</sub> equivalent (kg/CO<sub>2</sub>e).

- **EPDs are especially valuable for upfront carbon evaluation**, where emissions are locked in at project completion. Selecting products with lower product stage GWP can significantly reduce the immediate climate impact of landscape projects.
- **EPDs drive accountability and market transformation.** By specifying products with verified declarations, landscape architects encourage transparency, support cleaner manufacturing, and strengthen the industry’s ability to deliver climate-positive outcomes.

Landscape architects work with diverse materials—such as concrete, asphalt, steel, stone, soils, mulch, wood products, and site furnishings—and EPDs provide a reliable basis for understanding the carbon implications of these choices. This makes them foundational to informed, low-carbon material selection.

**Table 6. LCA Results 20 MPa concrete without air**

Unit	Baseline 20 MPa concrete without air GU 10 SL	20 MPa concrete without air GU	20 MPa concrete without air GU 15 SL	20 MPa concrete without air GU 25 SL	20 MPa concrete without air GU 35 SL	20 MPa concrete without air GU 50 SL	20 MPa concrete without air GUL	
<b>Environmental impacts</b>								
GWP	kg CO <sub>2</sub> eq.	220.29	236.90	211.99	195.38	178.77	153.85	221.84
ODP	kg CFC-11 eq.	5.46E-06	5.38E-06	5.50E-06	5.58E-06	5.66E-06	5.78E-06	5.15E-06
EP	kg N eq.	0.17	0.18	0.17	0.16	0.15	0.14	0.17
AP	kg SO <sub>2</sub> eq.	1.09	1.12	1.08	1.05	1.02	0.99	1.06
POCP	kg O <sub>3</sub> eq.	18.99	19.12	18.93	18.80	18.67	18.48	18.43
<b>Use of primary resources</b>								
RPR <sub>E</sub>	MJ, NCV	63.92	67.78	61.99	58.13	54.27	48.49	67.60
RPR <sub>M</sub>	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRPR <sub>E</sub>	MJ, NCV	1450.79	1481.54	1435.42	1404.67	1373.93	1327.81	1412.35
NRPR <sub>M</sub>	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Use of secondary resources</b>								
SM	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	97.68	108.53	92.25	81.40	70.54	54.26	100.88
RE	MJ, NCV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Abiotic depletion potential</b>								
ADP <sub>f</sub>	MJ, LHV	574.04	572.34	574.90	576.60	578.31	580.87	568.63
ADP <sub>e</sub>	kg Sb	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3: A sample concrete EPD from Concrete Ontario outlines the typical format and information contained within an EPD (Concrete Ontario, 2022).

# **LCA Tools – Overview and Application**

**3**

# 3.1 Introduction

There are a wide range of LCA tools and platforms that are currently available. For the purposes of this guide, only a few tools will be outlined. These represent some of the more accessible and widely used platforms currently within the field of landscape architecture. Over time, it is expected that more tools will be developed but this guide is meant to provide landscape architects with a snapshot of tools that are available now.

Different LCA tools may define their system boundaries differently, like including end of life emissions or broader operational impacts which can lead to variations in carbon intensity outcomes.

This guide does not favour specific tools or companies, but is simply meant to serve as a starting point for undertaking landscape LCAs.

# 3.2 Carbon Conscience

Carbon Conscience is a free, web-based early-design carbon planning tool developed by Sasaki to help teams quickly understand the potential carbon impacts of site planning and urban design moves at the master plan level. It lets teams build simple concept plans and get instant feedback on carbon outcomes for those plans, including:

- Embodied carbon emissions (carbon emitted to build materials and structures)
- Carbon stored in materials and ecosystems
- Carbon sequestered over time through living systems like soil and plants

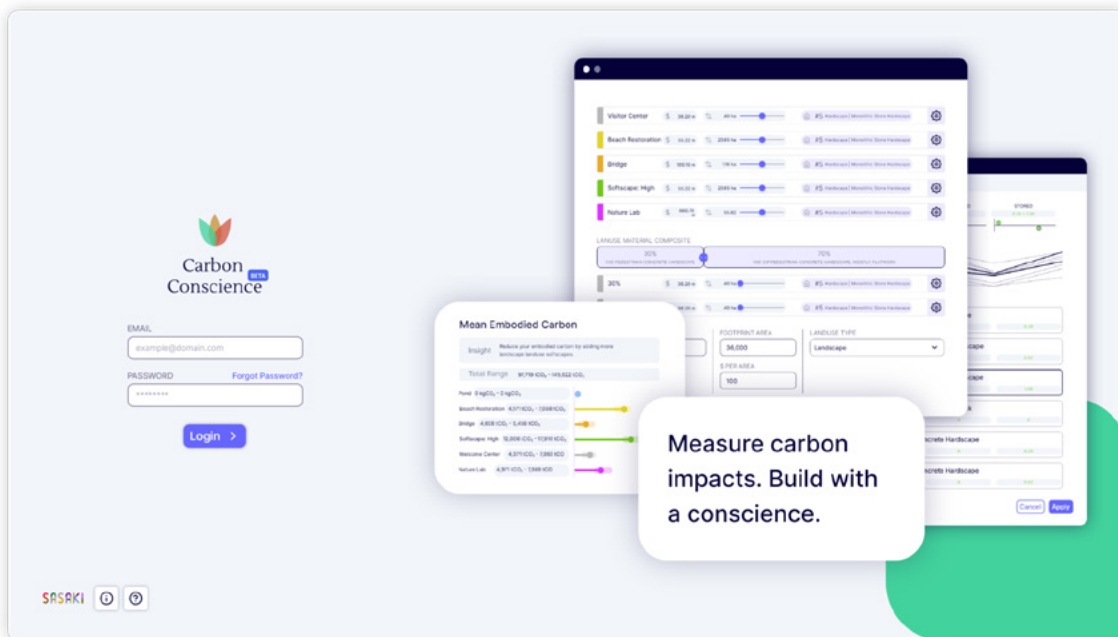


Figure 4: Carbon Conscience Login Page (Sasaki, 2026).

## 3.2.1 How to Use Carbon Conscience

The steps below outline how to get started and how to use Carbon Conscience effectively.

### Start a New Project

Open Carbon Conscience in a web browser and create a free account to save work. Start a new project and define the site area and baseline land use. This establishes the project boundary and enables the tool to begin estimating carbon impacts.

### Define Design Elements

Add landscape, building, and material components that represent the design concept. Select items such as hardscape, planting types, demolition, or building attributes. These inputs allow the tool to estimate embodied emissions, stored carbon, and long-term sequestration associated with various design choices.

### Draw and Map the Plan

Use the sketch or paint tools to spatially assign land uses across the site. As areas are mapped, the tool dynamically updates quantities and carbon metrics. This visual workflow helps teams quickly test alternative layouts and understand how spatial decisions influence carbon performance.

### Review Carbon Outcomes

Analyze the dashboard outputs showing embodied carbon, carbon storage, and projected sequestration over time. Compare scenarios to identify high-impact design moves, such as reducing paving or increasing tree canopy. Use these insights to guide early design direction and set project carbon targets.

### Iterate and Refine

Repeat the process with multiple scenarios to explore lower-carbon strategies. Adjust land uses, materials, and planting mixes to see how performance changes. Early iteration supports better decision-making and prepares the project for more detailed whole-life carbon analysis in later design phases.

## 3.2.2 Official Carbon Conscience User Guide

For step-by-step tutorials, documentation, and Sasaki's official resources, see:

<https://www.carbonconscience.sasaki.com/product-resources>

## 3.3 Pathfinder

Pathfinder is a free and user-friendly LCA tool that helps landscape architects, designers, planners, and engineers calculate greenhouse gas emissions, carbon sequestration, and other climate-related benefits for exterior built environment projects.

The tool is simple to navigate and works best when used in the concept design and detailed design stages of the design process. It supports an iterative design process, allowing users to test different scenarios against a baseline, track performance through project phases, and improve outcomes to align with global climate goals.

The tool is developed by Climate Positive Design, a nonprofit organization committed to addressing climate and biodiversity challenges in natural and built landscapes through advocacy, education, and design.



Figure 5: The Climate Positive Design Toolkit landing page illustrating the vision for the tool and potential futures (Climate Positive Design, 2026).

### 3.3.1 How to Use Pathfinder

The steps below outline how to get started and how to use Pathfinder effectively.

#### Start a New Project

Begin by visiting [ClimatePositiveDesign.org/Education](https://ClimatePositiveDesign.org/Education) and creating a free account. Once logged in, select “Start a New Project.” Enter basic project information, such as project type, size, location, and anticipated design life. This establishes the framework for the assessment and helps the tool generate more accurate results.

#### Build a Material Inventory

Pathfinder requires users to input quantities of site materials and components. Users can add items such as paving, concrete, steel, wood, soil, sod, planting beds, furnishings, and site structures. For each material, enter the unit type and estimated quantity based on the design plans or early conceptual assumptions.

These entries form the basis of the project’s embodied carbon calculations. It is important to note that Pathfinder does not include an exhaustive list of materials and is constantly being refined. This means that the tool presents some limitations as it relates to material choices and is why it is meant to serve as a guideline. Users can also input their own custom materials into the platform using product EPDs (refer to Pathfinder User Manual link below).

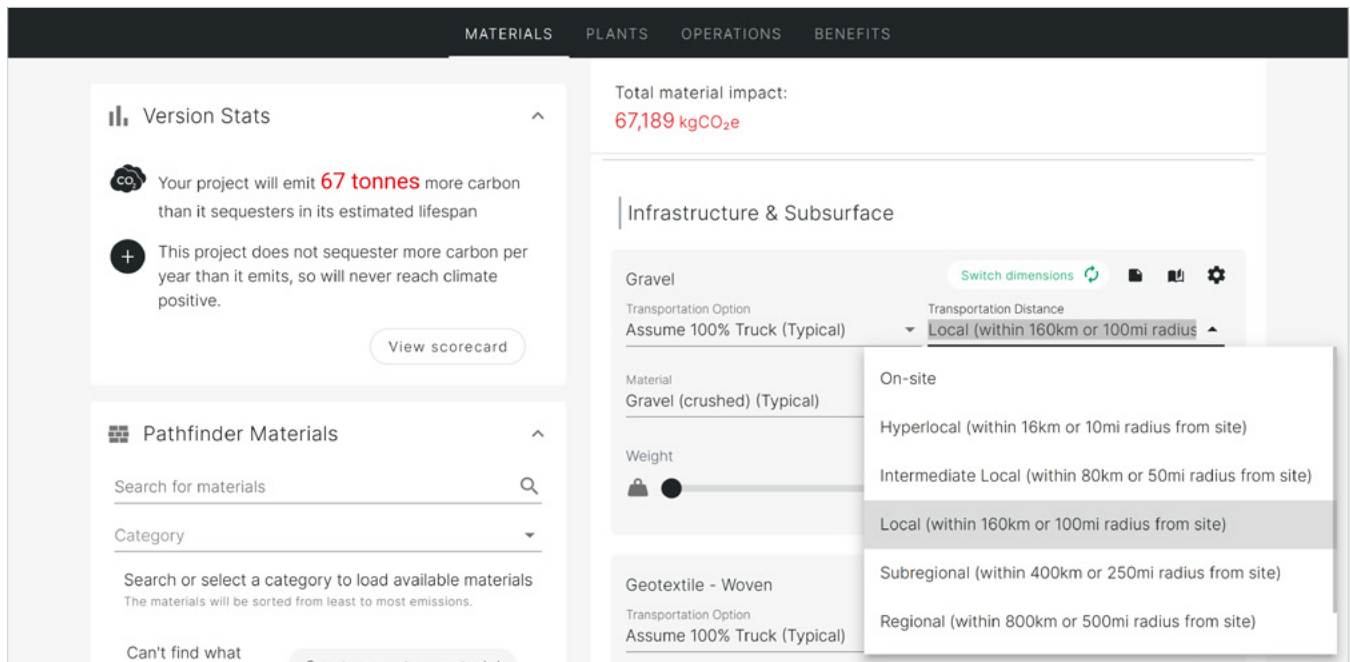


Figure 6: Sample screenshot of material inputs in Pathfinder highlighting the level of granularity that can be captured particularly as it relates to A4 (transportation) emissions (Climate Positive Design, 2026).

## Add Planting and Carbon Sequestration Inputs

Next, enter the number and types of trees, shrubs, and groundcovers. The tool uses species growth rates, climate zone, and planting density to estimate annual carbon sequestration. Plant characteristics - such as size at planting or maturity - can be adjusted to refine the projections.

## Review Upfront Carbon, Operational Carbon, and Sequestration Results

Once materials and plants are entered, Pathfinder automatically calculates:

- Upfront carbon (from materials and construction)
- Operational carbon (from maintenance inputs such as mowing or irrigation)
- Biogenic carbon benefits (from sequestration in vegetation and soils)

The tool provides charts and timelines showing when the project may achieve “climate positive” status – when sequestration outweighs emissions.

## Compare Design Scenarios

One of Pathfinder’s strengths is iteration. Duplicate the baseline project and modify materials, planting strategies, or spatial layouts to see how choices affect emissions. This helps identify low-carbon alternatives early, before decisions are locked in.

## Download Reports and Track Progress

Export results as PDF summaries to share with project teams, clients, or regulatory bodies. Revisit the tool during design development and construction to refine quantities and maintain alignment with carbon goals.

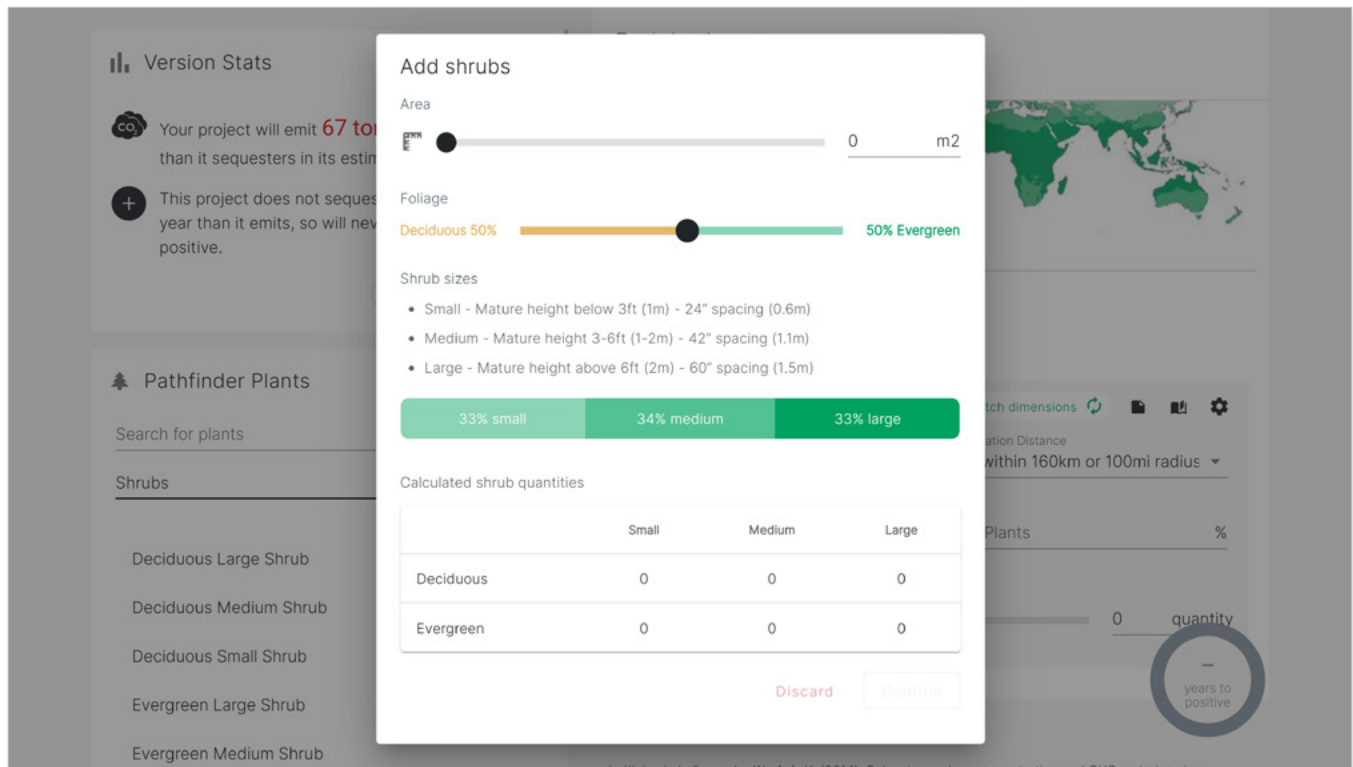


Figure 7: Sample screenshot of planting inputs in Pathfinder. This allows users to capture proposed planting qualities based on plant type, area and spacing (Pathfinder, 2026).

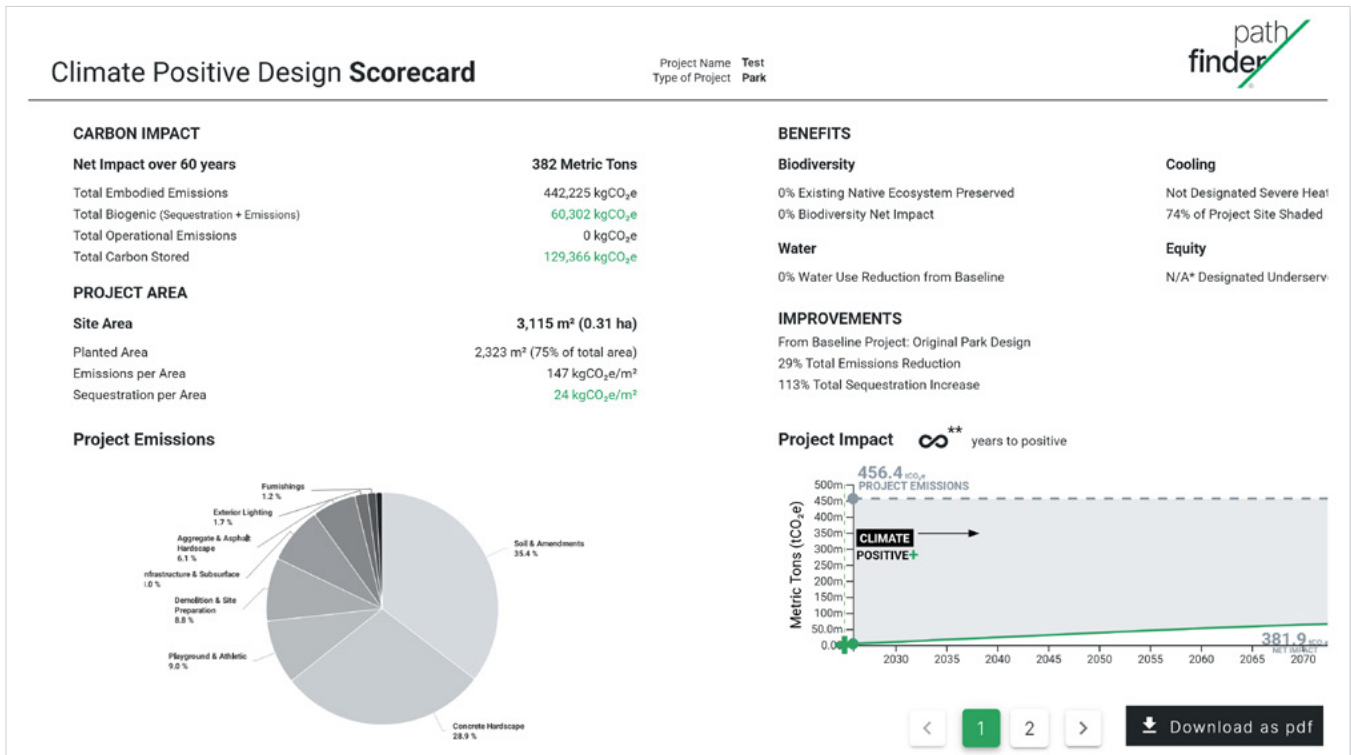


Figure 8: Sample screenshot of Pathfinder scorecard. This includes a pie chart to understand the proportions of emissions by category. Once a design alternative is inputted into the tool, the “improvements” section highlights reductions in carbon from the initial design (Pathfinder, 2026).

### 3.3.2 Official Pathfinder User Guide

The official Pathfinder User Guide provides detailed, step-by-step instructions for using Climate Positive Design’s Pathfinder tool to assess and compare the carbon performance of landscape projects. It guides users through entering project inputs, understanding output scorecards, and interpreting results to support informed, low-carbon design decisions.

The User Guide explains core concepts, workflows, inputs and outputs, and practical tips to help both new and experienced users get the most out of Pathfinder, making it a key resource for learning to use the platform.

[https://climatepositivedesign.org/wp-content/uploads/2025/10/CPD\\_Pathfinder-3.2\\_User-Guide.pdf](https://climatepositivedesign.org/wp-content/uploads/2025/10/CPD_Pathfinder-3.2_User-Guide.pdf)

## 3.4 One Click LCA

One Click LCA is a licensed software tool that helps measure and reduce the environmental impacts of buildings and infrastructure projects. It calculates both embodied and operational carbon using EPDs and regional data, following standard methodologies.

The platform offers different subscription levels, allowing users to perform both early-stage, high-level carbon estimates and detailed analyses at later design stages.

Detailed assessments can include element-level quantities, product-specific EPDs, scenario comparisons, and reporting that meets green building certification and regulatory requirements.

One Click LCA is a highly optimized tool for building and infrastructure carbon analysis, but for landscape analysis it requires more manual inputs to model replacement cycles, soil carbon sequestration, vegetation growth, and other landscape-specific factors, than a software like Pathfinder that is specifically designed for landscapes.

However, given its extensive library of EPDs covering many landscape materials such as concrete, timber, soils, and site furnishings, One Click LCA offers more ability to be specific about EPD selection and replacements, particularly useful for specifications and procurement stages.

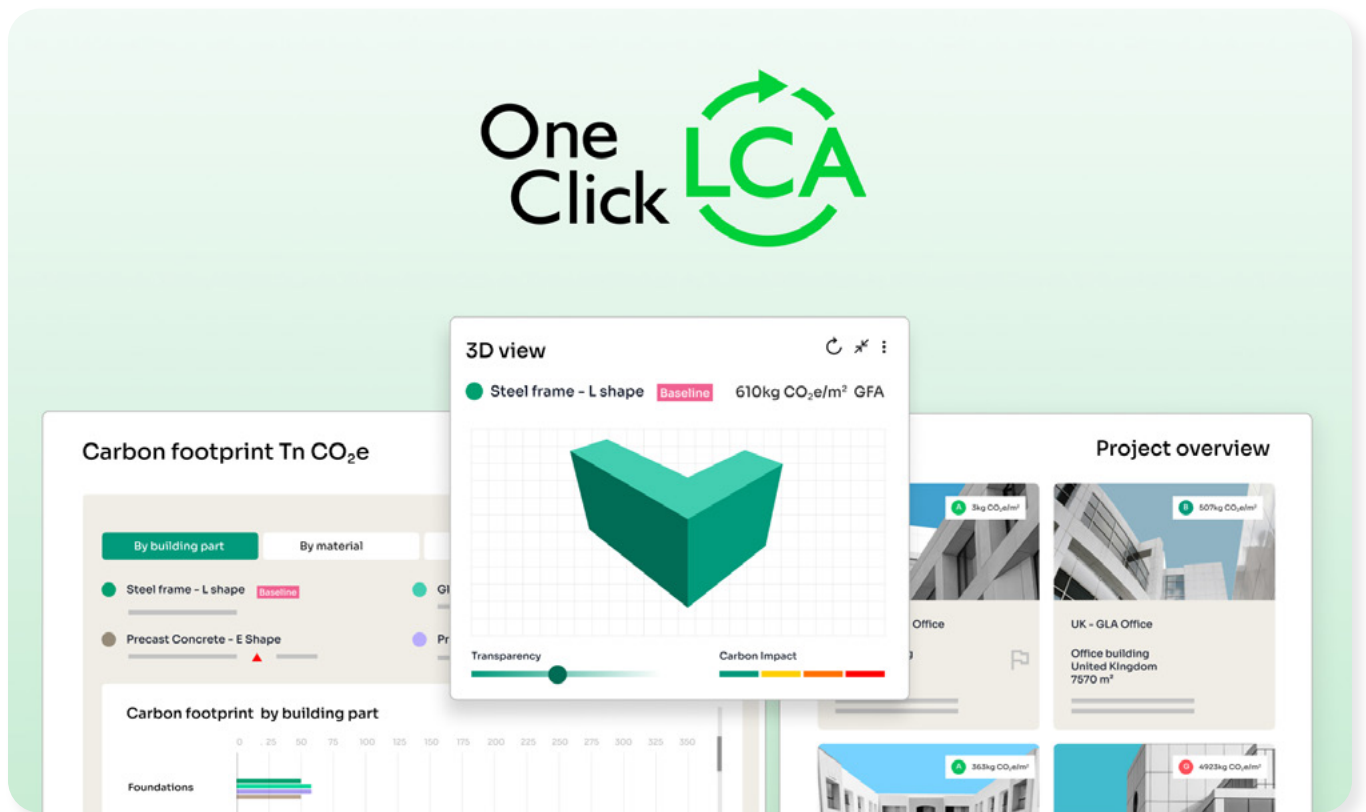


Figure 9: One Click LCA web page showing a preview of the user interface along with the total carbon footprint for various assemblies and design scenarios (One Click LCA, 2026).

### 3.4.1 How to Use One Click LCA

The steps below outline how to get started and how to use OneClick LCA effectively.

#### Set Up the Project

Create a new project in One Click LCA and select the project type (e.g., landscape or civil infrastructure). Input basic project information: location, area, project phase (concept, design, construction), and relevant standards or certification schemes.

#### Define the Scope

Determine whether embodied carbon, operational carbon, or both will be tracked. For landscape projects, separate hardscape components such as concrete, unit pavers, asphalt, stone, timber decking, site furnishings and softscape components such as soils, mulch, plants, sod, and carbon sequestration in planting soils.

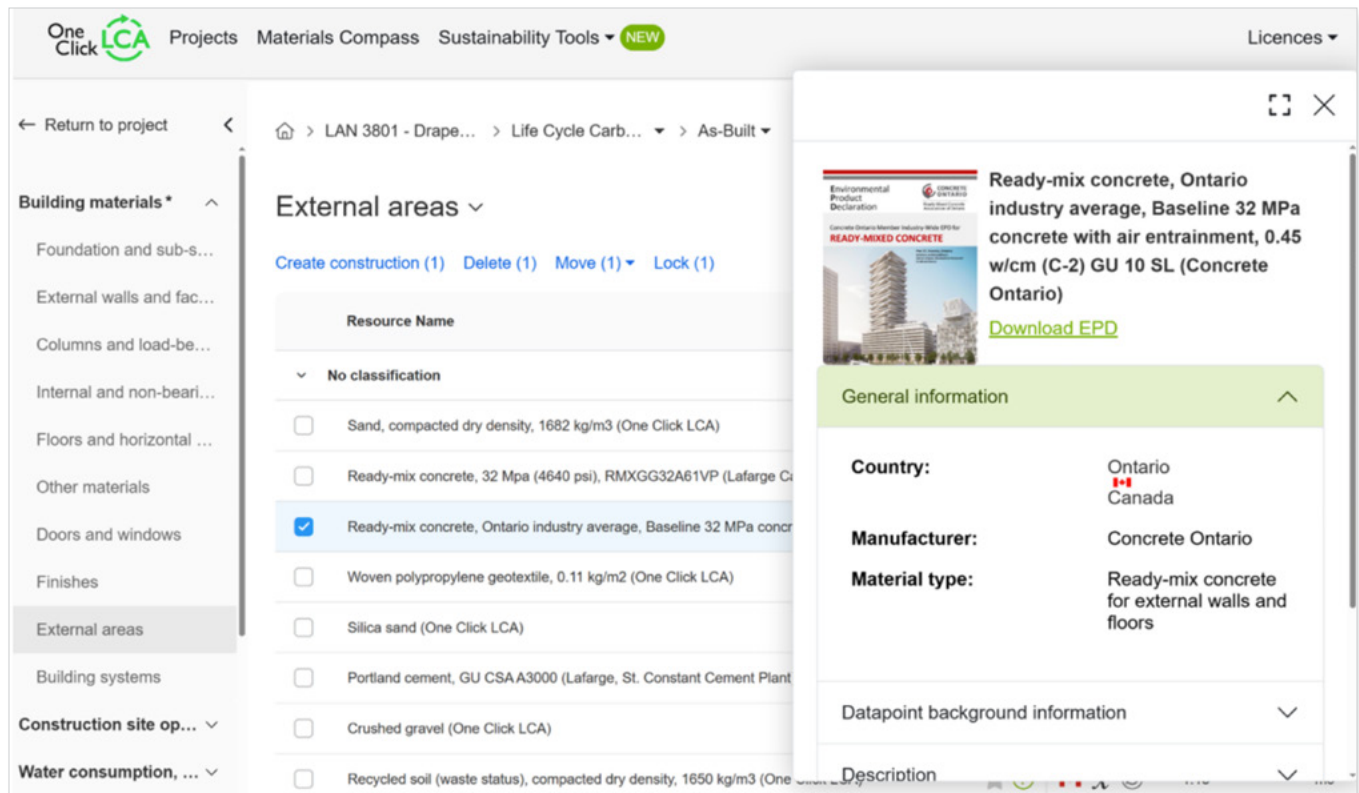


Figure 10: One Click LCA screenshot illustrating the database of EPDs available to users (One Click, 2026).

### Input Material Quantities

Enter material quantities for each element of the landscape design. Group materials logically (e.g., paving, walls, planting beds, trees, shrubs). Include dimensions, volumes, or unit counts for accurate results.

### Assign Environmental Data

Use EPDs for specific products where available. For generic materials, use regional default data provided by One Click LCA. For soils and vegetation, specify soil type, depth, and carbon content. Input plant species and expected growth/sequestration rates over the project lifespan.

### Run Carbon Calculations

The tool calculates carbon impacts across the full project life cycle. This includes upfront emissions through construction, use-stage impacts from maintenance and replacements, and end-of-life emissions from demolition and removals. It also accounts for biogenic carbon storage and ongoing carbon sequestration in soils and vegetation.

### Analyse Data and Compare Scenarios

Review results by element, material, or life cycle stage to understand key carbon drivers. Test material substitutions such as low-carbon concrete, recycled steel, durable wood, or native plantings. Evaluate how planting density, soil management, and maintenance strategies affect net carbon, and compare scenarios to identify lower-carbon design options.

**Building life-cycle carbon footprint** [Download Results Summary](#)

Result category	Global warming kg CO2e ⓘ	Biogenic carbon storage kg CO2e bio ⓘ
A1-A3 ⓘ Construction Materials	2,527.96	63.34
+ A4 ⓘ Transportation to site	56.71	0
+ A5 ⓘ Construction/installation process	120.92	
+ B1 ⓘ Use phase	0	19,359
B2 Maintenance	284.97	7.23
+ B3 ⓘ Repair	0	
+ B4-B5 ⓘ Material replacement and refurbishment	0.61	
B6 ⓘ Energy consumption	7,185.6	
B7 ⓘ Water use		
+ C1-C4 ⓘ End of life	94.15	
+ D ⓘ External impacts (not included in totals)	-361.41	
<b>Total</b>	<b>10,270.92</b>	<b>19,429.57</b>

Figure 11: One Click LCA screenshot of the life-cycle carbon footprint of a project. This allows users to see the total embodied carbon at each carbon cycle stage as it compares to the total carbon storage (One Click LCA, 2026).

## 3.5 LCA Tools Comparison

The chart below compares the three tools outlined in the previous sections to serve as a quick reference guide for users.

Tool	Carbon Conscience	Pathfinder	One Click LCA
<b>Free/ Licensed</b>	<ul style="list-style-type: none"> <li>• Free</li> </ul>	<ul style="list-style-type: none"> <li>• Free</li> </ul>	<ul style="list-style-type: none"> <li>• Licensed</li> </ul>
<b>Best Project Stages</b>	<ul style="list-style-type: none"> <li>• Pre design and Conceptual Design.</li> <li>• Master planning, land use &amp; sketch alternatives.</li> </ul>	<ul style="list-style-type: none"> <li>• Conceptual to Schematic Design.</li> <li>• Can be used in later iterative design phases, but not best suited for specificity with EPDs.</li> </ul>	<ul style="list-style-type: none"> <li>• Design Development and later phases when material quantities and specifications are more decided.</li> <li>• Can achieve more accurate EPD-based results.</li> </ul>
<b>Carbon Stages</b>	<ul style="list-style-type: none"> <li>• Early-stage comparative estimates of emission, storage, and sequestration.</li> <li>• Does not provide a detailed breakdown into standard LCA stages like <b>A1–A5, B, or C</b> the way a full LCA tool would.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>A</b> and <b>B</b> Stages.</li> <li>• Biogenic Sequestration reported separately.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>A-C</b> Stages.</li> <li>• Biogenic Sequestration reported separately.</li> </ul>
<b>Key Outputs</b>	<ul style="list-style-type: none"> <li>• Carbon estimates by land use type and material, stored carbon, and potential carbon sequestration for scenario comparisons.</li> </ul>	<ul style="list-style-type: none"> <li>• Climate Positive Design Scorecard showing years to carbon neutral, net carbon impact over time, sequestration, embodied profile, and design suggestions to reduce carbon.</li> </ul>	<ul style="list-style-type: none"> <li>• Full LCA results include global warming potential (kg/CO<sub>2</sub>e) by life cycle stage, biogenic carbon, and potentially other impact categories depending on defined scope.</li> </ul>

## 3.6 Additional LCA Software

Traditional LCA platforms allow detailed analysis of materials and life-cycle impacts and can be used for landscape carbon analysis when suitable data are available. However, they are general-purpose tools mainly developed for buildings, products, and infrastructure, and usually require additional customization to accurately represent landscape-specific systems and processes.

### Open LCA:

A free, open-source software used to model and analyze the environmental impacts of products, buildings, and systems through life cycle assessment.

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### GaBi:

A licensed LCA software developed by Sphera. A subscription to the platform enables users to model and quantify the environmental impacts of products, processes, and systems.

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### SimaPro:

A licensed LCA software developed by PRé Sustainability. A subscription to the platform enables users to model and quantify the environmental impacts of products, processes, and systems.

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### EC3:

A free, web-based embodied carbon benchmarking tool developed by Building Transparency that uses EPD data to help teams compare and reduce material impacts. It is not a full LCA tool and is typically used alongside other LCA software for comprehensive analysis.

# Low Carbon Design Strategies in Landscape Architecture

4

# 4.1 General Strategies

## 4.1.1 Introduction

This section outlines strategies that apply to most landscape projects, regardless of typology or approvals phase. It focuses on setting a low-carbon direction early, establishing clear decarbonization goals, and using iterative carbon analysis to guide trade-offs as design decisions and quantities become more defined.

It also emphasizes clear communication of results and the integration of carbon outcomes with broader project value, including co-benefits for ecology and public space.

### Strategies to be outlined:

1. Earlier is Better
2. Set Decarbonization Goals
3. Do the Homework Early
4. Track Progress and Iterate Design
5. Tell the Carbon Story
6. Don't Forget about Co-Benefits

## 4.1.2 Strategies

### Earlier Is Better

The biggest carbon reductions come from decisions made early, when the design is still flexible and change is easy.

- Use LCA tools as early as possible to test options during concept design, when layout strategies can still shift.
- For master planning or multi-phase project layouts, when quantities are not yet defined, use high level tools such as Carbon Conscience (see Section 3.2) to compare scenarios and directions rather than precise numbers.
- Early analysis helps establish a clear low carbon direction that can be carried through later phases, reducing the risk of backtracking or redesign once approvals, budgets, and details begin to lock in.
- Start carbon conversations across disciplines early, especially on large or multi-phased projects where many teams will shape the work over time. Shared understanding at the outset increases the chance that low carbon intentions carry through to the built project.
- Low-carbon design is about making informed trade-offs. Not every strategy fits every site or program, but early choices can almost always move a project in a better direction.

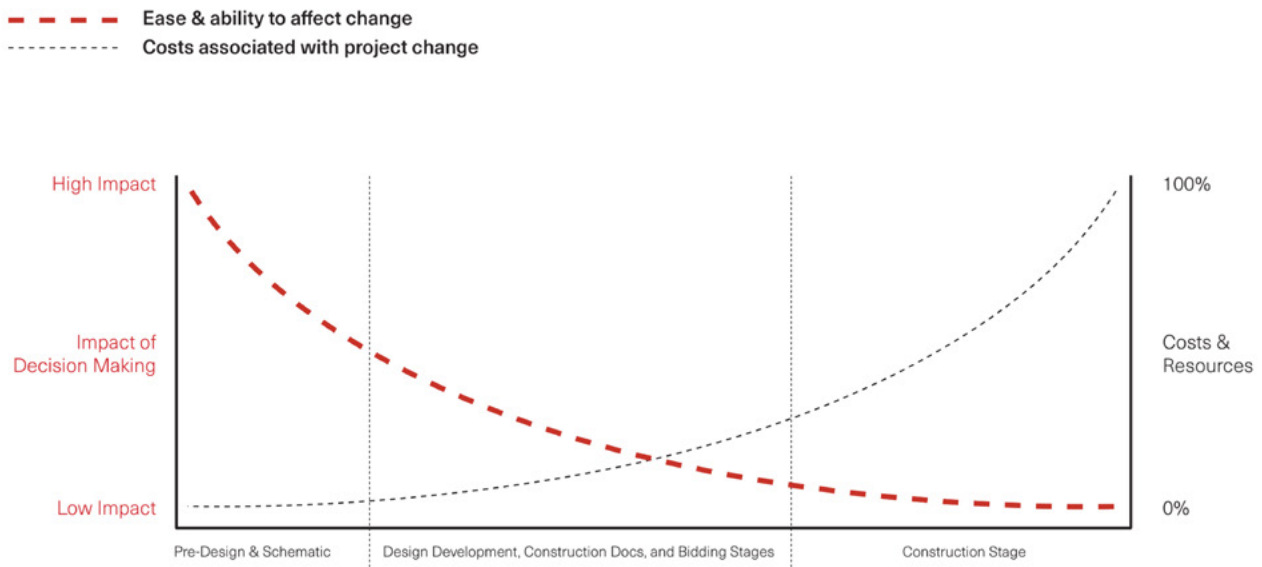


Figure 12: This figure illustrates that the greatest opportunity for reductions in carbon are at the earlier stages of the design process where the cost of change is less (as compared to the construction phase where costs are much greater). This highlights the importance of establishing a low carbon approach at the outset of a project (Ha/f Climate, 2024).

## Set Decarbonization Goals

Clear carbon goals work best when they are set at the very beginning of a project and revisited as the design evolves.

- Define what low carbon success looks like for the project early, before key decisions around layout, materials, and budget are fixed.
- Align the project team on why decarbonization matters for this project, whether that is policy compliance, climate commitments, long term performance, or leadership.
- Confirm shared commitment across the full consultant team, so reducing embodied carbon and supporting sequestration are treated as core design objectives, not optional add-ons.

- Where benchmarks exist, set a simple carbon intensity target (for example, kgCO<sub>2</sub>e per m<sup>2</sup>) using the ranges from the City of Toronto's Landscape Carbon Benchmarking Study, so the team has a clear number to design toward and compare options against.
- Be clear about who is responsible for updating carbon analysis and approving carbon-related decisions as the project evolves.

### Key Tip:

Consider creating a simple project decarbonization charter that sets out goals, roles, and expectations. Having something in writing that everyone agrees to can help keep the team aligned as the project moves through different phases.



Figure 13: Sasaki and the design team working on the Colby College Athletics Centre in Maine set out clear intentions related to embodied carbon reductions at the start of the project. MVVA as the Landscape Architects worked with the existing site and surrounding topography to create positive outcomes for both the building and landscape (MVVA, 2020).

## Do the Homework Early

A little research at the start of a project can go a long way in shaping realistic and effective low carbon decisions.

- Review relevant policies, standards, and guidelines early, so carbon goals align with regulatory requirements and emerging expectations.
- Look to current best practices and built precedents to understand what has worked elsewhere and what is transferable to the project context.
- Explore innovative and evolving approaches where landscape architects can lead. This is an opportunity to shape new norms, test better ways of working, and demonstrate how low carbon strategies can strengthen design outcomes.

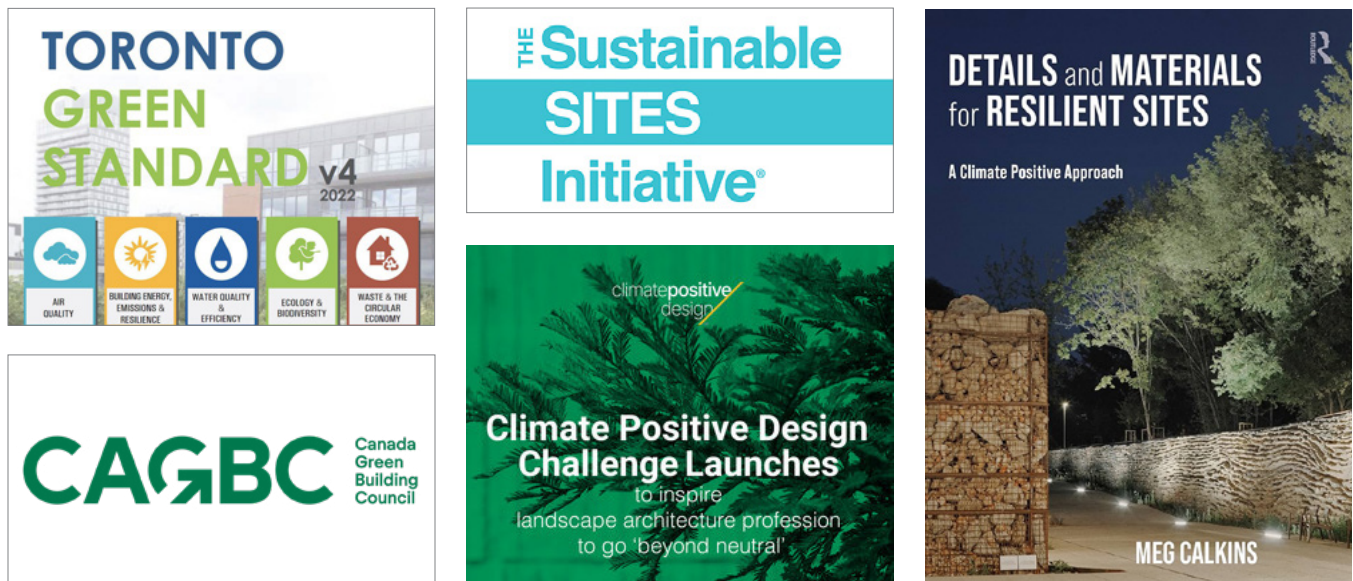


Figure 14: Relevant policies, standards and publications that can support the design of low carbon landscapes.

## Track Progress and Iterate Design

Designing with a carbon lens works best when it is treated as an iterative process rather than a one-time calculation.

- Use carbon analysis to compare options and refine the design over time. Early on, this might mean testing different layouts, hardscape ratios, or planting strategies. Later, it can focus on details, products, and material assemblies.
- Track results as the design evolves, even if the numbers are high level at first. Seeing how changes improve performance helps teams stay focused and motivated.
- Document key iterations and decisions so the carbon story of the project is clear. This makes it easier to explain why certain choices were made and how they led to better outcomes for carbon, cost, and overall design quality.

### Key Tip:

Pay special attention during value engineering and late design changes, when well-intended substitutions can unintentionally increase carbon.

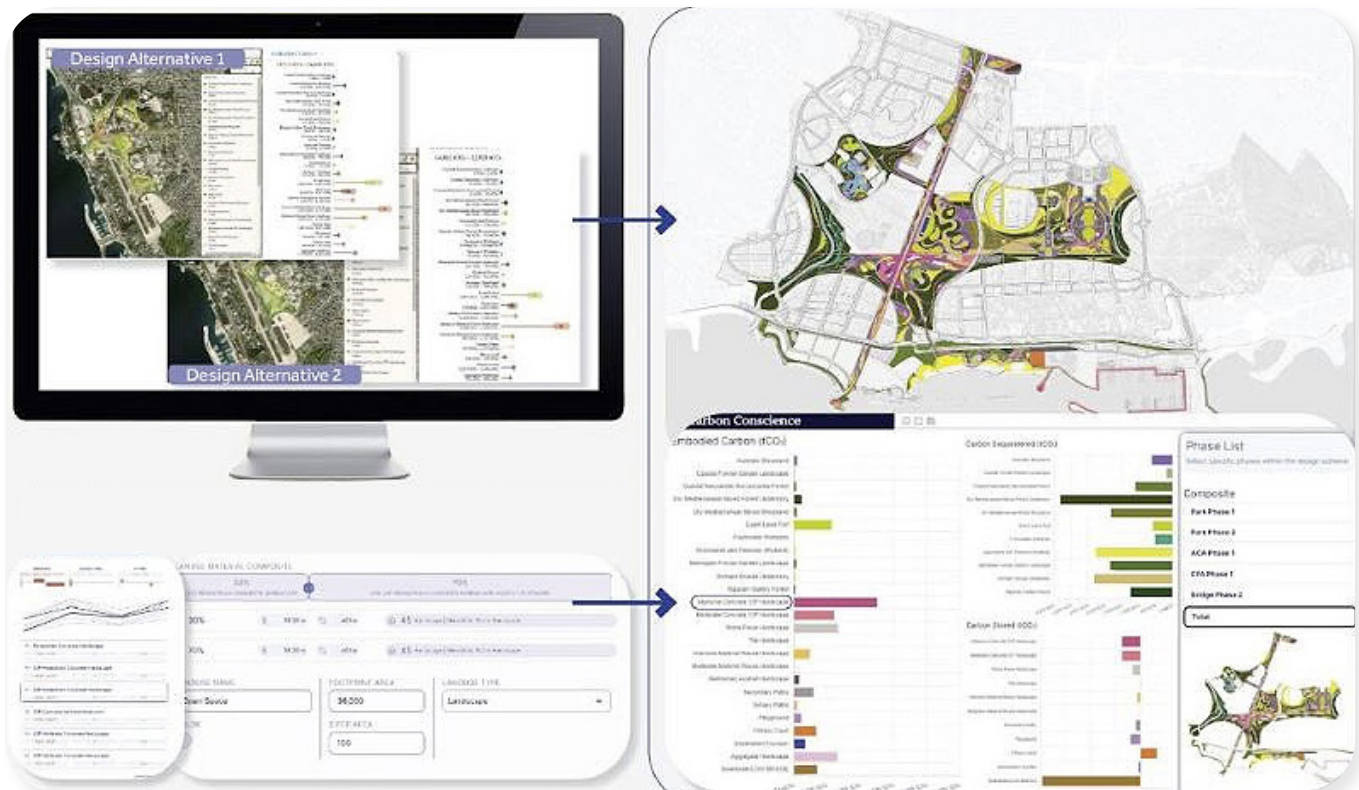


Figure 15: Screenshot of the Carbon Conscience app showing various design alternatives. Iteration and assessment is an important part of the design process and can help lead to more climate positive outcomes (Sasaki, 2026).

## Tell the Carbon Story

Designing with carbon in mind is important, but it only works if people understand why the choices matter. Different project partners care about different things, so there is no single carbon message that fits everyone.

- Shape the carbon story to match the audience. A client may care about cost and risk, a planner about policy alignment, and a contractor about constructability.
- Use clear, relatable language and simple comparisons to show how design decisions lead to better outcomes, rather than focusing only on technical metrics.
- Be upfront about cost. Many low carbon strategies reduce material quantities or simplify construction and do not necessarily add cost and sometimes save money.
- Work with the project team to find a way of communicating about carbon that feels natural and effective for the project. A shared narrative helps build support, maintain momentum, and carry low carbon intent through all phases of work.
- Where possible, reflect on outcomes after construction and carry lessons learned forward to the next project.



Figure 17: Landscape Carbon Benchmarking Study baseline and redesign scenarios.

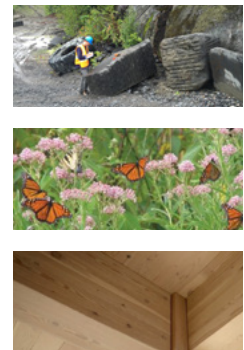
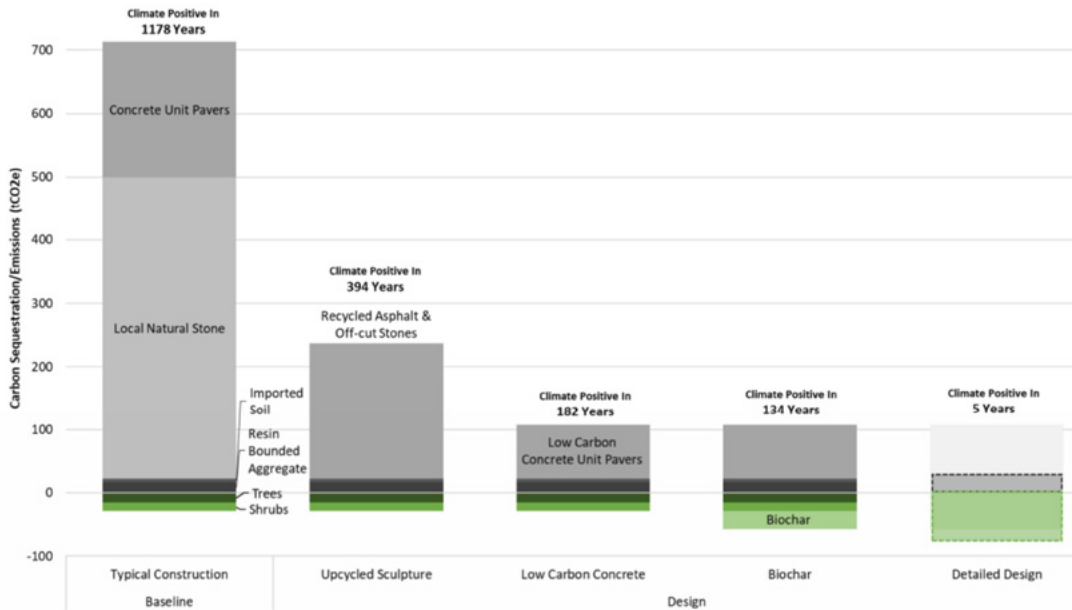


Figure 16: This chart, developed for the 229 Richmond park competition in downtown Toronto compares several low carbon design options to a typical baseline construction project providing a tangible understanding of improvements that can be made based on materiality and soil amendments. The three photos to the right illustrate the proposed material palette of granite offcuts, pollinator planting and timber construction (DTAH, 2023).

## Don't Forget About Co-Benefits

Low carbon design is rarely just about carbon. Many of the strategies that reduce embodied emissions also deliver wider benefits that strengthen the overall project.

- Recognize that low carbon decisions often support multiple outcomes at once, from improved biodiversity and stormwater performance to better public space, comfort, and human health.
- Highlight capacity building as a co-benefit. Each project helps teams, clients, and contractors learn new approaches that can be applied more easily next time.
- Remember that low carbon does not automatically mean higher cost. In many cases, material reduction, simpler assemblies, and reuse can save money while reducing emissions.
- Low-carbon strategies should always respond to local climate, culture, and community needs, not override them.
- Weave co-benefits into the design narrative and decision making throughout the project, rather than treating carbon as a separate or competing priority. Framing carbon as part of a broader value story helps avoid tunnel vision and builds stronger support for low carbon outcomes.

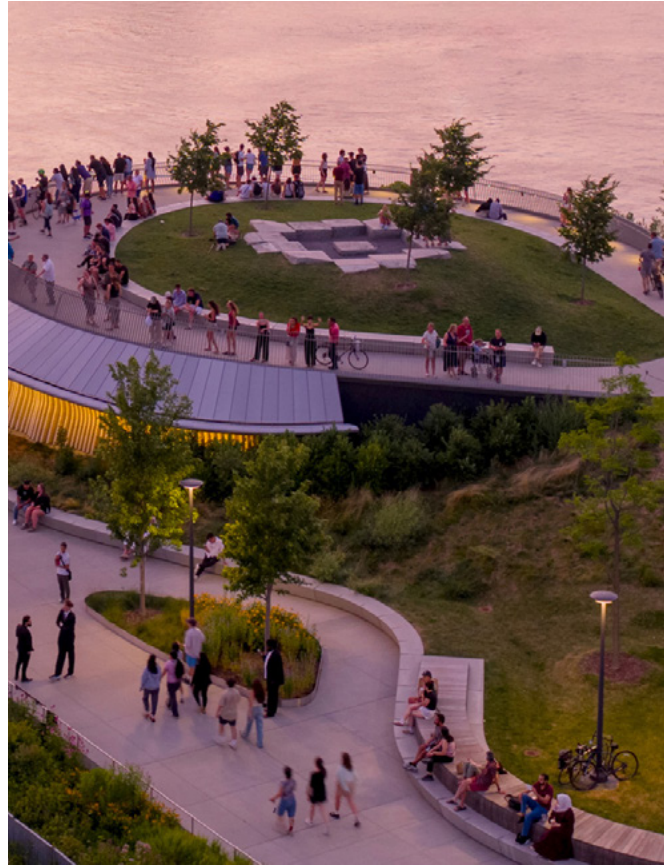


Figure 18: Low carbon design is just one lens in which landscapes are designed and support multiple outcomes at once. Kiweki Point in Ottawa by Janet Rosenberg & Studio (JRS) illustrates how landscapes can support biodiversity, stormwater management and human health (JRS, 2025).

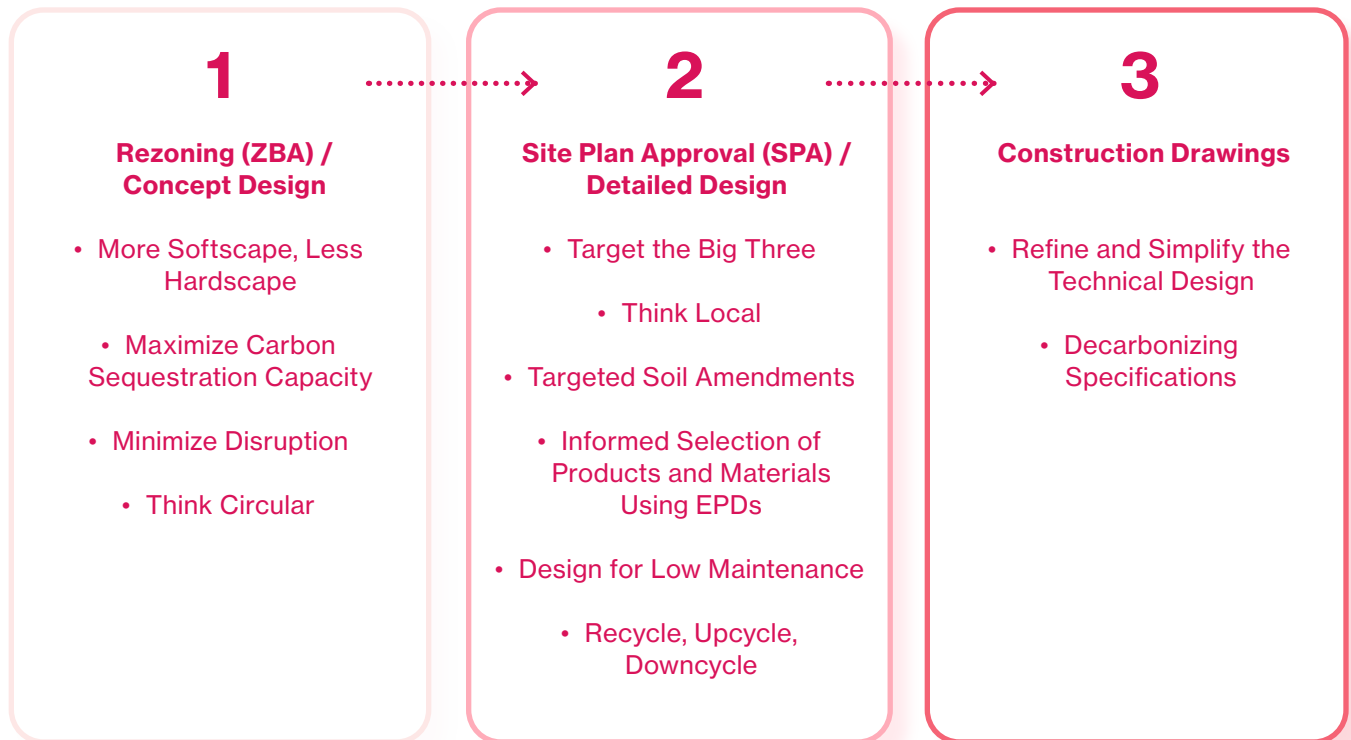
## 4.2 Strategies by Design & Approvals Phases

### 4.2.1 Introduction

The following section will look at advice for three phases of work:

1. Rezoning / Concept Design
2. Site Plan Approval / Detailed Design
3. Construction Drawings

This phased approach has been adopted from the ASLA guide, Decarbonizing the Design Process. As a project progresses, the opportunities for low carbon design evolve and guidance shifts accordingly, matching the level of detail being worked with. Within the context of Ontario, there are specific planning and municipal approvals that a project typically moves through. This section is meant to offer high level guidance and strategies to use throughout the design process.



## 4.2.2 Rezoning / Concept Design

### More Softscape, Less Hardscape

At rezoning or concept design, the simplest big lever is this. Treat hardscape as precious, and design as much of the site as living landscape as possible.

- Projects with a higher share of hardscape also tended to have higher carbon intensity (City of Toronto Carbon Benchmarking Study, 2025). For a lower kgCO<sub>2</sub>e per m<sup>2</sup> outcome, reducing hardscape area is one of the most reliable first moves.
- Start by right-sizing paved and built areas to the actual program needs. Keep asking what can be smaller, simpler, or shared.
- Use the “less is more” mindset for carbon intensive materials like concrete, unit pavers, and asphalt. Reduce overall paved area before starting to fine tune product choices.
- Keep an eye out for low carbon concrete. Research is ongoing but there are some products available on the market that might help to reduce the carbon impact of concrete in the coming years.
- Where hard surfaces are needed, make them work harder. Combine functions, keep edges efficient, and avoid oversizing plazas, paths, and service areas.
- Pair the shift toward softscape with green infrastructure moves that are easier to “bake in” now than later, like working with drainage patterns, using landforms to avoid retaining walls, and choosing permeable paving where it fits.



Figure 19: Large swaths of planting found at Dr. Lillian McGregor Park in Toronto by DTAH. Reductions in hardscape can have significant implications for a site’s total carbon intensity (DTAH, 2022).

## Maximize Carbon Sequestration Capacity

Once hardscape has been reduced, the next opportunity is to make the living parts of the site do more work. More “soft” usually means more potential to pull carbon out of the air and store it in plants and soils.

- Protect what already exists. Identify mature trees and existing ecosystems early, then plan the design around keeping them intact.
- Restore before additions are made. Where there are native ecologies on site, prioritize restoring and expanding them, and create the conditions for them to thrive.
- Plant for storage, not just looks. Aim for a multilayered, native, dense, and diverse palette, and where it is appropriate, plant more like a forest system than a collection of specimens. That includes options like mini-forests, rewilding, habitat restoration, or afforestation.
- Be cautious with turf. Avoid synthetic turf where possible, and limit high-maintenance lawn. It is also important to note that in some municipalities artificial turf is considered hardscape. If turf lawn is required, lean toward native or adapted species and specify seed or hydroseed rather than sod.



Figure 20: Dense, layered vegetation found in Sankt Kjelds Square & Bryggervangen, Copenhagen by SLA. This approach supports the growth of diverse plant communities, creating more opportunities to sequester carbon (SLA, 2019).

## Minimize Disruption

Keeping existing soils and vegetation intact is one of the simplest ways to avoid releasing stored carbon. This is often easier to achieve on park and open space projects than on development sites, but the principle still applies at all scales.

- Identify healthy soils, mature trees, and intact ecologies early, and design around them wherever possible.
- Minimize grading, soil stripping, and large cut and fill operations, which can release stored soil carbon and add hauling emissions.
- Balance cut and fill at a concept level to reduce off site disposal and material import.
- Where access is needed, consider lighter touch approaches, such as elevated paths or routing circulation around sensitive areas instead of through them.



Figure 22: Preservation of mature trees during the construction of St. Andrew's Playground Park in Toronto by DTAH. Minimizing soil disruption and working with the existing canopy can have positive impacts on low carbon outcomes (DTAH, 2021).

## Think Circular

Early design is the best time to see the site as a resource, not a blank slate. Materials and elements already on site often hold both carbon and value.

- Look for opportunities to reuse, upcycle, or downcycle what is already there, such as concrete, asphalt, stone, soils, or even felled trees.
- Get creative with how existing materials can be reworked into new site elements, edges, furnishings, or sub bases instead of being hauled away.
- Test circular options early using LCA tools to compare reuse scenarios against new materials and clearly show the carbon benefit with data.
- Look for opportunities to bring in reused materials from off-site. This is a much more complex process and requires additional considerations but could create opportunities to use materials that might be otherwise disposed of on another building site.
- Make circular reuse part of the concept, not an afterthought. Early decisions create the space to refine and optimize these strategies later, when details, specifications, and construction methods are developed.



Figure 21: A real-world example of circular design in action at the Raleigh Ironworks by Future Green Studio. Old concrete from a demolished building was reused as seating blocks. Steel from an industrial structure has been repurposed into swings (Tzu Chen, 2025).

## 4.2.3 Site Plan Approval / Detailed Design

### Target the Big Three

In development projects, most landscape emissions are concentrated in a small number of material categories. For the biggest reduction with the least effort at Site Plan Approval (SPA) and Detailed Design, focus here first.

- **Concrete Hardscape:** This category typically drives the largest share of emissions. It includes cast-in-place concrete (CIP) paving, curbs, slabs, walls, footings, and stairs, as well as precast concrete pavers, panels, and units. It also captures reinforcement and supporting components, such as rebar, welded wire mesh, sand setting beds, and concrete footings/ foundations tied to landscape elements.
- **Aggregate & Asphalt Hardscape:** This includes asphalt paving, compacted aggregate base, crushed stone paving (such as decomposed granite), pipe bedding material, and other aggregate-based hardscape layers that support paved areas and underground infrastructure.
- **Soil & Amendments:** This category includes amended or imported soils and organic mulch. At a high level, reduce the amount of imported soil and also think about targeted soil amendments (see section below). While these materials may seem low-impact individually, the large volumes used on development sites mean they can contribute significantly to overall carbon emissions.

Most development sites are unable to amend existing soils and rely heavily on imported soils that must be trucked in from off-site (the transportation stage (A4) emissions also being a key consideration). This is still an emerging field of study and more research is needed to understand the mechanisms that contribute to this high emissions number.

Together, these three categories account for about 85% of total project emissions in the City of Toronto's Landscape Carbon Benchmarking Study. Targeting them first is the most reliable way to move the needle in SPA and Detailed Design.

#### Key Tip:

**Start with reduction, then refine. First reduce quantities where possible, then optimize details and assemblies, and finally use lower-carbon or alternative products where they make sense.**



Figure 23: Targeting these three material categories outlined above present a key opportunity to make meaningful reductions in embodied carbon on-site.

## Think Local

Where materials come from matters, especially for the heavy, high-volume materials that dominate landscape construction.

- Prioritize local and regional sourcing to reduce transportation emissions, which can significantly affect overall carbon results for concrete, aggregate, soils, and planting materials.
- Focus first on bulky materials like soil, compost, mulch, stone, and aggregate, where hauling distances add up quickly.

- Be clear about what “local” means. Ask where materials are extracted, processed, and delivered from, and consider how they are transported.
- Build local sourcing expectations into specifications and tender documents so they are carried through procurement, not value-engineered out later.

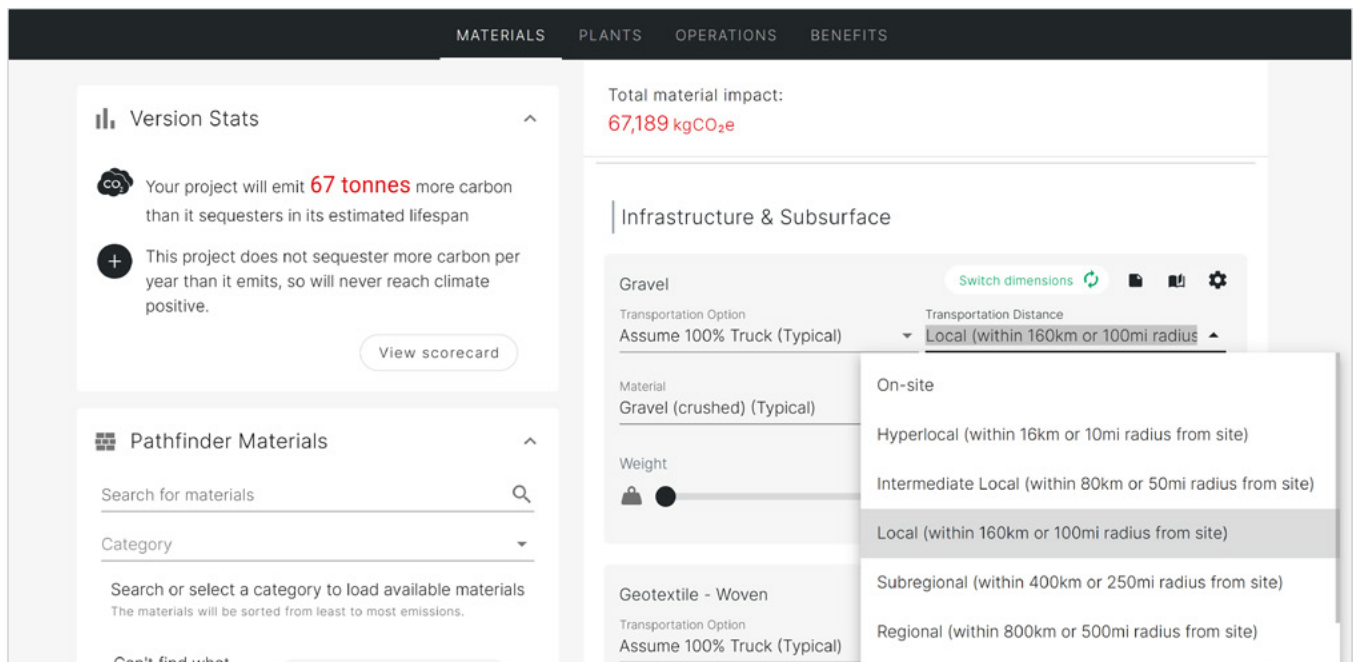


Figure 24: Screenshot of Pathfinder highlighting various transportation distances. Understanding how far materials travel to get to a site is an important consideration in material selection (Climate Positive Design, 2025).

## Targeted Soil Amendments

Healthy soils are one of the biggest opportunities in detailed design. When soils are treated as living systems rather than just a growing medium, they can significantly improve plant performance and increase long term carbon storage.

- Treat soil as a carbon asset. Good soil structure and biology support stronger root systems and long-term sequestration, making soil decisions just as important as plant selection.
- Test first, then amend with intention. Use soil testing to understand what is already on site and tailor amendments accordingly, rather than defaulting to imported, generic mixes or fertilizers.
- Use biology focused amendments to build capacity. Compost, compost tea, probiotic inoculants, and vermiculture can help rebuild soil life and improve the soil's ability to store carbon over time.
- Include biochar where it fits. Biochar can lock carbon into the soil while improving nutrient retention and plant health, especially in degraded or disturbed soils.
- Protect soils during construction. Minimize compaction and disturbance by clearly defining soil protection zones and limiting construction traffic in planted areas.

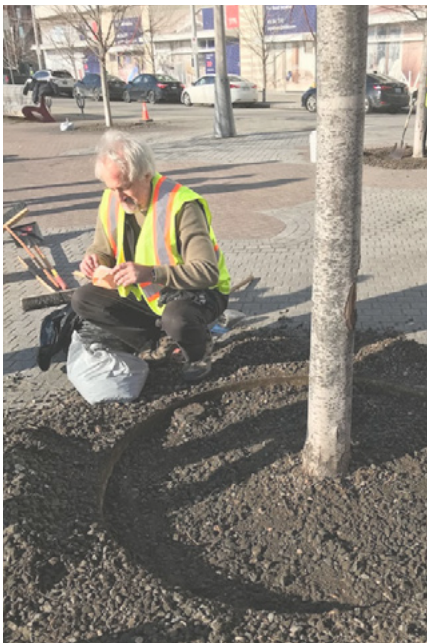


Figure 25: Research into biochar as a soil amendment is being undertaken by the Thomas Lab at the University of Toronto (U of T). These images show biochar being applied to existing trees along Toronto's Waterfront but there are applications in new planting to lock carbon into the soils and improving nutrient retention (University of Toronto, Thomas Lab, 2025).

## Informed Selection of Products and Materials Using EPDs

At SPA and Detailed Design, product choices start to matter more, and EPDs are one of the best tools for making informed decisions.

- Use EPDs to compare similar products and assemblies, rather than relying on assumptions or generic specifications. Even small differences can add up across large areas.
- Focus EPD use on the high impact materials first, especially concrete products, unit pavers, aggregates, and site furnishings, where verified data can meaningfully influence totals.

- Treat EPDs as a decision support tool, not a pass or fail test. They help teams understand relative performance and have better conversations with suppliers and contractors.
- To avoid being limited to what is easy to specify, ask manufacturers for EPDs early. This signals demand, helps shift the market, and gives teams better information while there is still time to adjust details and specifications.

**LABELING sustainability**  
CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION

**EPDs**

**Maglin Site Furniture EPD Transparency Brief**

**DECLARATION OWNER** Maglin Site Furniture  
3-468 Innovation Way, Woodstock, ON  
<https://www.maglin.com/>

**PRODUCT TYPE** Bench

**DECLARED FUNCTIONAL UNIT** 1 Bench - all 870 backless wall mount benches with thermally modified ash wood

**PRODUCT NAME** 800 Series - 870 Backless Wall Mount Bench

**DESCRIPTION** 800 Series - 870 Backless Wall Mount Bench; 65.5in L, Cast Aluminum Ends, Thermally Modified Ash Wood Seat

**PROGRAM OPERATOR** Labeling Sustainability  
11670 W Sunset Blvd., Los Angeles, CA 90049  
[www.epdregistration.com](http://www.epdregistration.com)

**PRODUCT CATEGORY RULE (PCR)** ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services and Sub Product Category Rule for Site Furnishings, CSI MasterFormat, Section 32 22 00  
PCR Program Operator: Labeling Sustainability  
PCR review was conducted by: Geoffrey Guest, Ph.D.

**INDEPENDENT LCA REVIEWER AND EPD VERIFIER** This declaration was independently verified in accordance with ISO 14025:2005.  
Independent verification of the declaration, according to ISO 14025:2005  
Internal; External X  
Third Party Verifier  
Geoffrey Guest, Certified 3rd Party Verifier under the Labeling Sustainability Program ([www.labelingsustainability.com](http://www.labelingsustainability.com)), CSA Group ([www.csaregistry.ca](http://www.csaregistry.ca))

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**EPD NUMBER** 4945ba4f-a0e9-47dc-b94e-ee519f93c86f-6

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**800 Series - 870 Backless Wall Mount Bench EPD Transparency Brief**

**System boundary**  
The following figure depicts the cradle-to-grave system boundary considered in this study:

**A1 - A3 Product Stage**  
A1 Raw material supply  
A2 Transport  
A3 Manufacturing

**A4 - A5 Installation Process Stage**  
A4 Transport to Site  
A5 Installation Process

**B1 - B7 Use Stage**  
B1 Use  
B2 Maintenance  
B3 Repair  
B4 Replacement  
B5 Refurbishment  
B6 Operational energy use  
B7 Operational water use

**C1 - C4 End of Life Stage**  
C1 De-installation/Demolition  
C2 Transport  
C3 Waste processing  
C4 Disposal of waste

\*Note: B1 - C1 and C4 not declared.

Midpoint Impact Categories	Unit	MBE-0870-00162
GWP100 Climate change: global warming potential (GWP100)	kg CO <sub>2</sub> -eq	116
ODP Ozone depletion: ozone depletion potential (ODP)	kg CFC-11-eq	1.09E-06
AP Acidification: acidification potential (AP)	kg SO <sub>2</sub> -eq	0.511
EP Eutrophication: eutrophication potential	kg N-eq	0.424
SFP Smog formation potential	kg O <sub>3</sub> -eq	6.19
ADPFossil Energy resources: non-renewable: abiotic depletion potential (ADP): fossil fuels	MJ	1240

Resource Inventory Metrics (Inventory Indicators ISO21930)	Unit	MBE-0870-00162
PRPE Cumulative energy demand - renewable energy resources	MJ	125
PRM Renewable primary resources with energy content used as material (i.e., PERM)	MJ	0.468
NRPE Cumulative energy demand - non-renewable energy resources	MJ	125
NRPRM Non-renewable primary resources with energy content used as material (i.e., PENRM)	kg	5.06
SM Use of secondary material	MJ	4.07
RSF Use of renewable secondary fuels	MJ	0.0243
RE Recovered energy	MJ	0.546
FW Use of net fresh water	m <sup>3</sup>	1.08

Waste/Output Inventory Metrics (Inventory Indicators ISO21930)	Unit	MBE-0870-00162
HWD Hazardous waste disposed	kg	15.7
NHWD Non-hazardous waste disposed	kg	263
HLRW High-level radioactive waste disposed	kg	0.00332
ILLRW Intermediate and low-level radioactive waste disposed	kg	0.00167
MR Materials for recycling	kg	1.45
MER Materials for energy recovery	kg	0.000143
Eel Exported energy - electricity	MJ	0.631
EHeat Exported energy - heat	MJ	0.153

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Figure 26: Sample EPD produced by Maglin Site Furnishings. Suppliers are increasingly creating EPDs for their products. Landscape Architects can request EPDs to evaluate different design options and are an important tool to aid in the selection of products and materials (Maglin, 2023).

## Design for Low-Maintenance

Design decisions made at SPA and Detailed Design can lock in maintenance demands for decades. Lower-maintenance landscapes tend to perform better over time, both for carbon and for operations.

- Avoid designs that rely on intensive upkeep, such as large areas of irrigated sod, short-lived planting, or elements that require frequent replacement.
- Choose durable materials and planting strategies that are suited to site conditions and can age in place without constant intervention.
- Use tools like Pathfinder to begin modelling operational emissions (B-Stages), and use that information to have informed conversations with owners, developers, or municipal departments about realistic and lower-carbon maintenance approaches.



Figure 28: Long term, intensive maintenance practices can be a source of significant B-stage emissions and should be a consideration in the design of low carbon landscapes (City of Toronto, 2025).

## Recycle, Upcycle, Downcycle

At SPA and Detailed Design, circular ideas need to move from intent to execution. This is where reuse strategies are tested, detailed, and made buildable.

- Identify specific materials and assemblies that can be reused on site, such as concrete broken and reused as aggregate, stone reset as paving or walls, or wood repurposed for site elements.
- Conduct reclamation audits prior to demolition to inventory potential reusable construction products on-site. This may also include material testing to ensure the integrity of reclaimed elements on-site.
- Design details that can accommodate reused or irregular materials, rather than relying only on standardized, new products.
- Where direct reuse is not possible, plan for downcycling, such as using crushed concrete or reclaimed aggregate in sub bases, bedding layers, or fill.
- Use LCA tools to compare reuse and new-material options at a detailed level, helping confirm the carbon benefit and support discussions with contractors and reviewers.
- Coordinate early with contractors and suppliers to confirm constructability, tolerances, and sequencing, so circular strategies survive pricing and construction.



Figure 27: Materials gathered on-site as part of the 2 Tecumseth Street development. Located on the site of a former abattoir, this project was able to salvage over 21,000 tonnes of usable material which will be reintegrated into the landscape of the new project (TAS, 2023).

## 4.2.4 Construction Drawings

### Refine and Simplify the Technical Design

Construction drawings are where carbon intent either holds or quietly slips away. This phase is about tightening details, avoiding over-engineering, and coordinating closely with the team to make sure assemblies are doing only what they need to do.

- Review details with a “right size” mindset. Large concrete or metal elements like seat walls, stairs, retaining walls, and signage structures are often overbuilt by default. Reducing thickness, height, or extent can deliver meaningful carbon savings without changing design intent.
- Coordinate early and often with structural and civil engineers to optimize reinforcing. Align reinforcement, footing sizes, and structural capacity to the actual loads and intended use, not worst-case assumptions.
- Confirm where lower-carbon or alternative technologies are appropriate and acceptable. Options like Glass Fiber Reinforced Concrete (GFRC), fiberglass dowels, or fiber reinforcement in concrete mixes can reduce material volumes while maintaining performance.
- Revisit subsurface assemblies with fresh eyes. Explore alternatives to carbon-intensive solutions such as geofoam where fill, grading, or landscape-based approaches can achieve the same outcome more simply.
- Treat every detail as an opportunity to simplify. Fewer layers, fewer materials, and clearer constructability generally mean lower embodied carbon and fewer surprises during construction.



Figure 29: Open, shared tree planters at Toronto’s Water’s Edge Promenade provide continuous soil volume, aeration, and drainage that support stronger tree growth. Compared with hardscape-contained tree pits and soil cell systems, they can reduce concrete, edge restraint, and proprietary components, lowering material intensity and embodied carbon while improving constructability and maintenance access. (DTAH, 2025).

## Decarbonizing Specifications

Drawings can point in the right direction, but it is the specifications that make low-carbon intent stick once pricing, substitutions, and procurement start moving. Clear specifications are also a way to manage real-world construction pressures, where substitutions and sequencing changes are often unavoidable.

The strategies below are informed by ASLA's Decarbonizing Specifications guide, which offers best-practice direction on how to carry climate goals through construction documentation.

- Treat specifications as the carbon enforcement tool. Use Division 1 to set clear expectations around carbon accountability so sustainability goals are understood alongside cost, schedule, and quality.
- Make low-carbon part of submittals. Require carbon-related documentation such as EPDs for key materials, especially where better data can meaningfully influence decisions.
- Write smart substitution rules. Link substitutions to equivalent sustainability criteria, such as verified carbon data, recycled content, or sourcing distance, so intent is not lost during construction.
- Specify performance where it matters most. For high-impact materials like concrete, use performance-based requirements, such as strength and carbon intensity thresholds, that allow flexibility while still driving lower-carbon outcomes.
- Protect what remains. Clear requirements for soil, tree, and vegetation protection help preserve existing carbon storage and avoid unnecessary damage during construction.

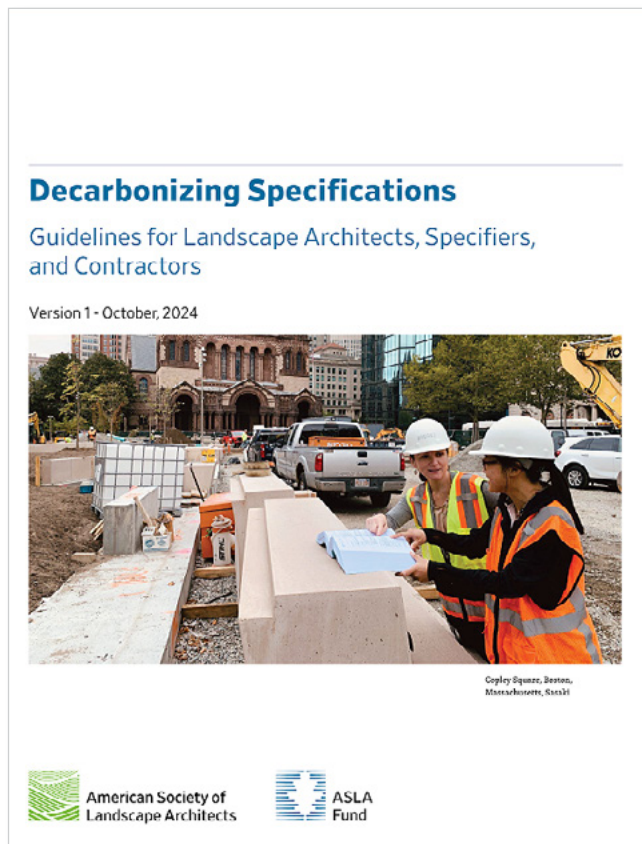


Figure 30: ASLA Decarbonizing Specifications provides key insights into how best to ensure low carbon practices are carried through to construction into the final built work (ASLA, 2024).

# Case Studies

5

## **Introduction**

Two case study sites were selected to provide users with a range of examples for both a private, on-slab development condition and a public, on-grade park condition. These two studies will apply the principles of low-carbon design that have been outlined throughout this report.

Each study began with initial Pathfinder inputs for the design as proposed in the SPA drawing set (for the private development) and the IFC drawing set (for the public park). Once an initial Pathfinder scorecard was generated for each site, a low carbon redesign was completed.

# 5.1 Private Development Landscape

## Project Description

The project selected for this case study is a mid-rise building currently under construction in Toronto.

- This project includes a private courtyard, a series of stoops (for at-grade units), both a retail and residential frontage, along with a laneway.
- The streetscape portion of this project was not included as part of the total carbon footprint since designers are required to use city standard details within the ROW. Further study of these details is needed to explore low-carbon design options that are beyond the current control of designers working on streetscape projects.

## Baseline Design (Before)

- In the initial Pathfinder scorecard, the main contributors to the overall carbon footprint were concrete hardscape, soil and amendments and furnishings.
- The most predominate material used on-site was concrete. Being responsible for over half of the embodied carbon meant that was the primary focus of the redesign.
- Soil volume on-slab was provided largely through concrete retaining walls.
- The overall planting area was limited on-site, with the moderate management lawn contributing to the overall carbon impact vs. supporting sequestration.

## Landscape Redesign (After)

Overall, the low-carbon redesign was able to see a **37% reduction** in the **total emissions** from the baseline design in addition to an **increase of 57%** in the **total sequestration** for the site. A slightly different approach was employed to reduce overall embodied carbon. There was less flexibility when it came to the ground plane considering the entire project was on slab.

- In the redesign, all pedestrian CIP concrete paving was swapped to low carbon concrete unit pavers and CIP concrete walls were constructed using salvaged concrete. This offers a slightly different look but there were significant elevation changes throughout the project that still required retaining walls.
- The vehicular concrete paving was changed to asphalt, and all concrete curbs were replaced with granite. Although slightly more expensive, the durability and lifespan of stone is typically greater than CIP concrete paving.
- For softscape, both the amount and intensity of planting were increased. Due to the limitations of planting on slab only a few shade canopy trees were added in the courtyard and small, ornamental trees were added to the residential stoops. The main boosts to sequestration came by introducing a mini forest, taking advantage of shared soil volumes.
- Additionally, reducing the areas of moderate management lawn (a source of embodied carbon) and replacing with a no-mow or low maintenance lawn allowed for an increase in sequestration across the site.

**CIP CONCRETE PAVING**

Responsible for ~50% of emissions in concrete hardscape category

**CONCRETE UNIT PAVERS**

Responsible for ~12% of emissions in concrete hardscape category

**SOD PLANTING**

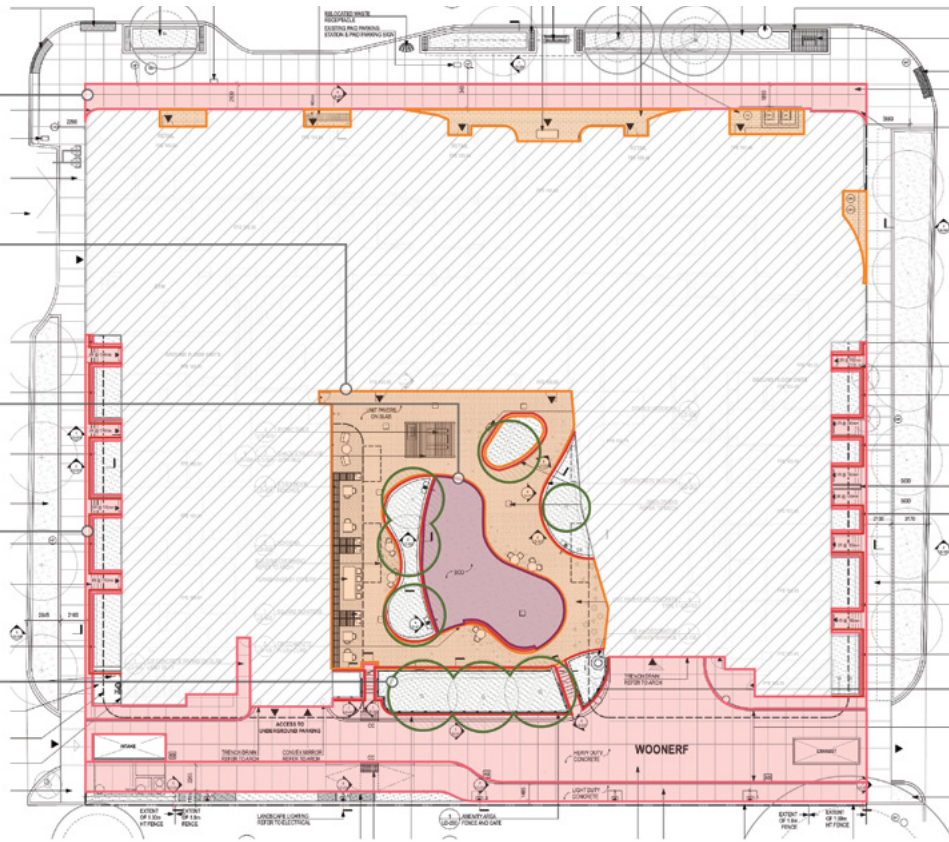
Moderate management lawn - carbon positive element

**CIP CONCRETE WALL**

Responsible for ~30% of emissions in concrete hardscape category

**CANOPY TREE PLANTING**

8 new trees



**BEFORE**

**LOW CARBON UNIT PAVERS**

4X less carbon than CIP concrete unit pavers

**NO MOW LAWN**

Carbon negative element  
Responsible for 30% of total site sequestration

**SALVAGED CONCRETE WALL**

40% reduction in carbon from CIP concrete wall

**ORNAMENTAL TREE PLANTING**

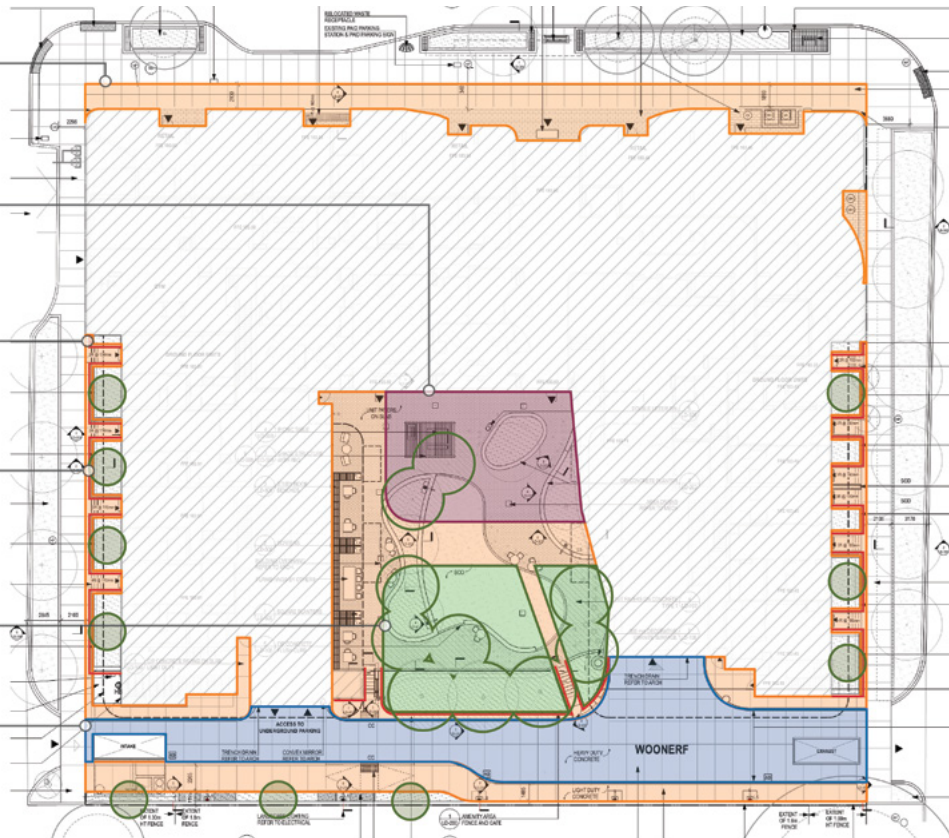
Low intensity planting containers with new ornamental tree planting

**MINI-FOREST**

Responsible for 25% of total site sequestration

**ASPHALT PAVING**

30% reduction in carbon from CIP concrete paving



**AFTER**

This case study represents a typical development typology that can be found throughout the city and beyond. There are opportunities to make relatively straightforward design decisions that can deliver meaningful carbon reductions without changing the program or layout. In the context of development, there are sometimes limited ways in which landscape architects can influence design in these projects but having conversations early about soil volume and assemblies with the design team is an important step in reducing embodied carbon.

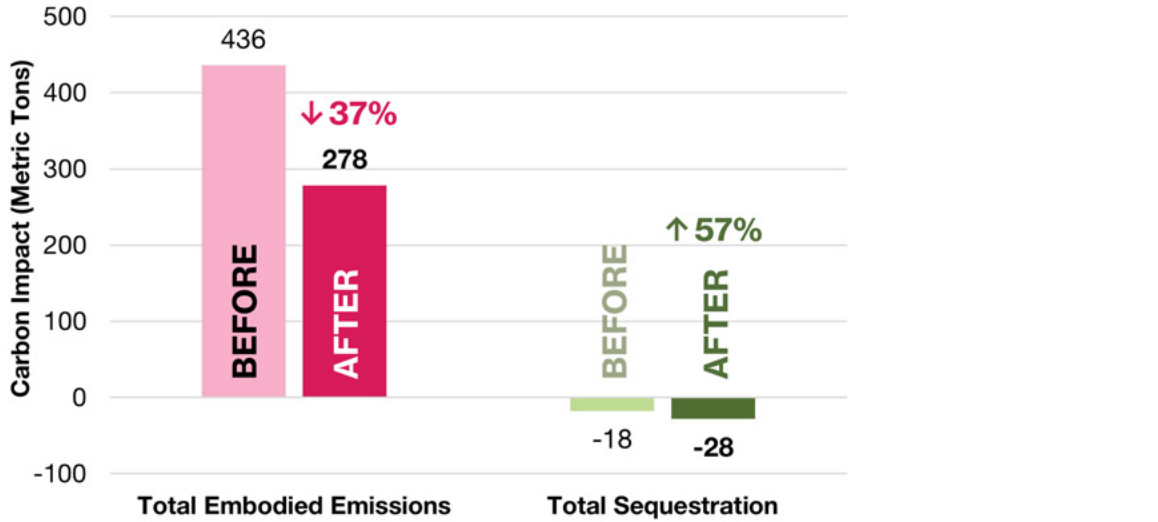


Figure 32: Bar chart showing the net carbon impact over 60 years vs. the total sequestration for both the baseline and low carbon redesign.

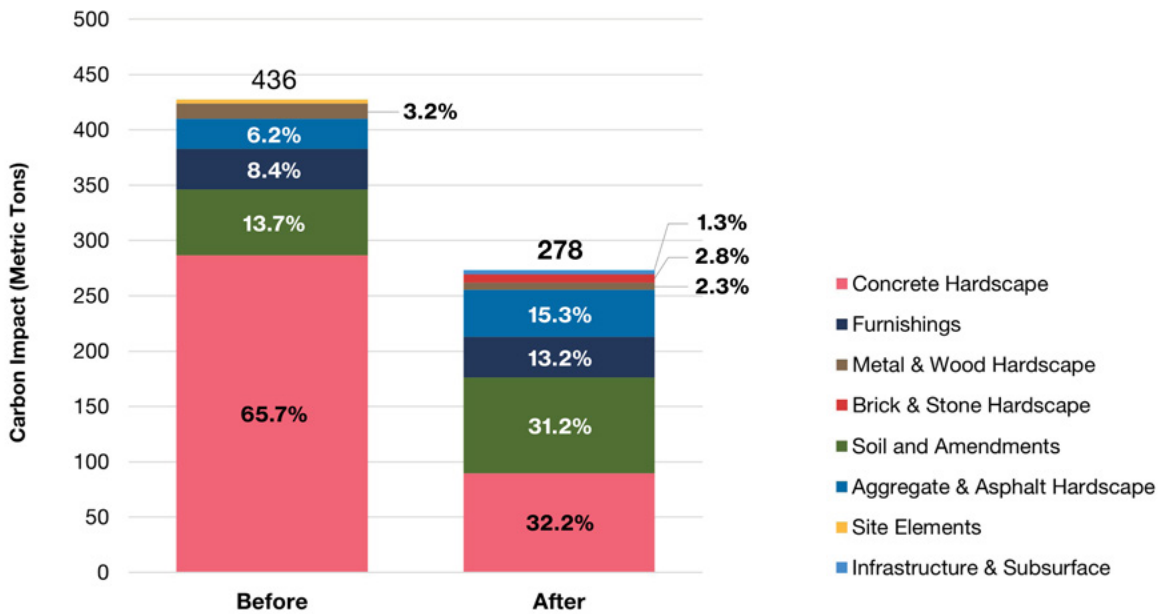


Figure 31: Bar chart showing project emissions by category for both the baseline (before) and low carbon redesign (after). The shifting percentages illustrate the relationship between material categories and embodied carbon.

## 5.2 City Park

### Project Description

This public park is a relatively small neighbourhood park located in midtown Toronto that was recently constructed.

- The project was an existing park that was selected to undergo improvements which included upgrading the play equipment and enhancing the programmatic uses already present on-site.
- The site was selected due to the quantity of existing mature trees, along with a set of existing, on-grade conditions that provided opportunities for material re-use.
- Unlike development sites, existing City of Toronto parks have a set of site conditions and uses that designers are asked to respond to.
- Development work for the most part requires the complete demolition of a site which provides very few opportunities for material salvaging or re-use. Most landscape architects work in a variety of contexts and it is important to think about re-use as part of a low-carbon approach to design.

### Baseline Design (Before)

- The Pathfinder inputs for this park accounted for the existing tree canopy and the demolition of the materials on-site.
- The impact of the existing tree canopy and its ability to sequester carbon is inputted into Pathfinder based on the height and age of the tree (Refer to the assumptions and methodology section for more information). Since the age of a tree is not a typical metric found in an arborist report, the sequestration numbers Pathfinder generates is an approximate ballpark to understand the impact existing trees can have on a site.
- The materials present on-site represent an opportunity for salvage and re-use which will be used as part of the low-carbon redesign.
- In the baseline Pathfinder scorecard, the main contributors to the overall carbon footprint were playground/athletic, concrete hardscape, along with demolition and site preparation.
- The baseline design proposed the use of EPDM Rubber Surfacing. The embodied carbon of this element was 9.5X greater than engineered fiber mulch safety surfacing.

### Landscape Redesign (After)

Overall, the low-carbon redesign was able to see a **35% reduction** in the total emissions from the baseline design in addition to an **increase of 113%** in the **total sequestration** for the site. The redesign saw these reductions by employing the strategies outlined earlier in this guide.

- The material substitution in the play area to engineered fiber mulch safety surfacing was an easy win when it came to embodied carbon. Since the rubber surfacing component was removed, the decision was made to keep the play equipment the same.
- Through the reuse of unit pavers and stabilized crushed stone paving, the concrete paving area was reduced by 50%.
- Unit pavers that were removed as part of the baseline design were re-used on-site. A new layer of compacted aggregate base and sand setting bed were included in the calculations to reflect a more realistic assembly.
- All medium trees that were removed as part of construction were re-used on-site for log seating in the play area. All small trees removed were reprocessed as biochar that could be used on-site for any proposed planting.
- All fill previously hauled off site could be re-used as part of the redesign (with the addition of soil amendments).
- All compacted aggregate was swapped to use recycled aggregate.
- Swapping sod areas to mini forest contributed to a significant increase in sequestration, although more off-site soil would be required to support this additional planting.
- By swapping out moderate maintenance lawn (a carbon negative element) to no-mow lawn, the sequestration capacity saw a significant increase.



Figure 33: This before and after image shows the reductions in overall carbon and increase in sequestration following the redesign of the selected park case study. Through a series of targeted strategies the overall carbon footprint from the baseline design went down 35% and saw an increase of 113% in sequestration of the baseline (DTAH, 2026).

**CANOPY TREE PLANTING**  
13 new trees planted

**EPDM SAFETY SURFACE**  
Responsible for ~95% of emissions  
in playground category

**CAST IN PLACE  
CONCRETE  
PAVING**  
Responsible for ~62% of  
emissions in concrete  
hardscape category



**BEFORE**

**SALVAGED UNIT PAVERS**  
Combined with stabilized crushed stone  
paving, reducing concrete paving area by 50%

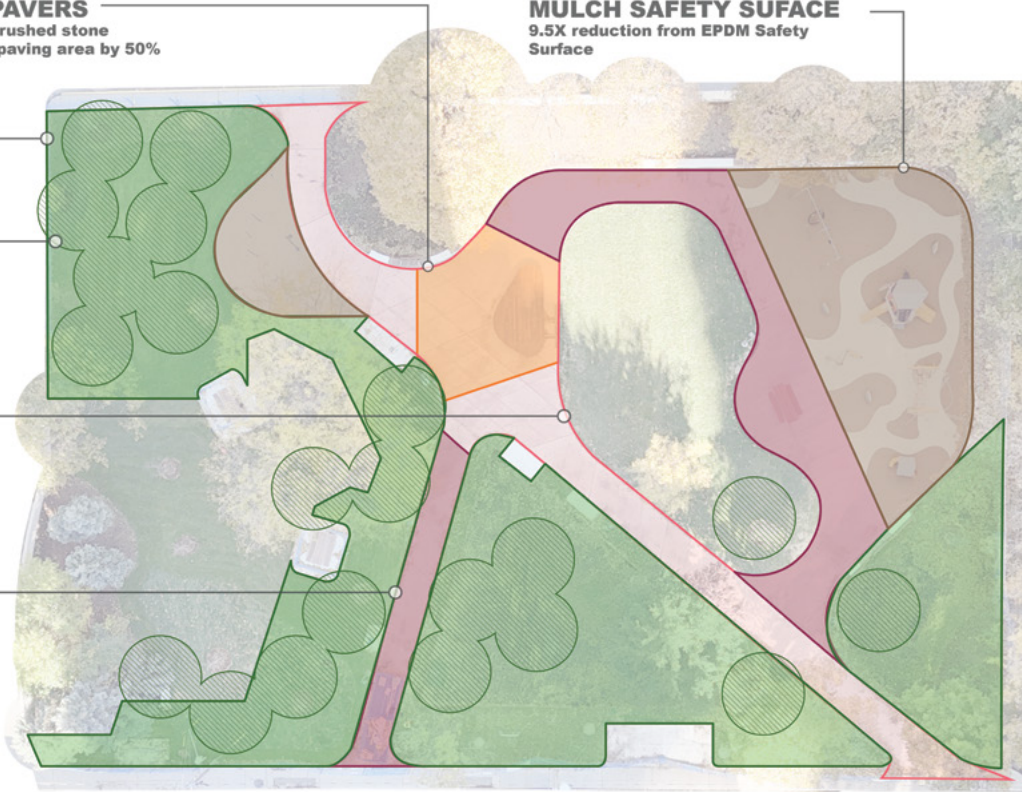
**MULCH SAFETY SURFACE**  
9.5X reduction from EPDM Safety  
Surface

**MINI-FOREST**  
2X increase in total  
sequestration per sqm

**ADDITIONAL  
CANOPY TREE  
PLANTING**  
10 more canopy trees  
planted from baseline

**CAST IN PLACE  
CONCRETE  
PAVING**  
Area reduced by 50%  
through use of alternate  
materials

**STABILIZED  
CRUSHED  
STONE PAVING**  
4.5X less carbon than  
concrete paving



**AFTER**

Overall, this case study reinforces a key lesson; when the biggest carbon drivers are targeted first, meaningful reductions are achievable even within a small park project. Although this redesign led to an infinite number of years until climate positive, the biggest takeaway is improvement and a trend in the right direction.

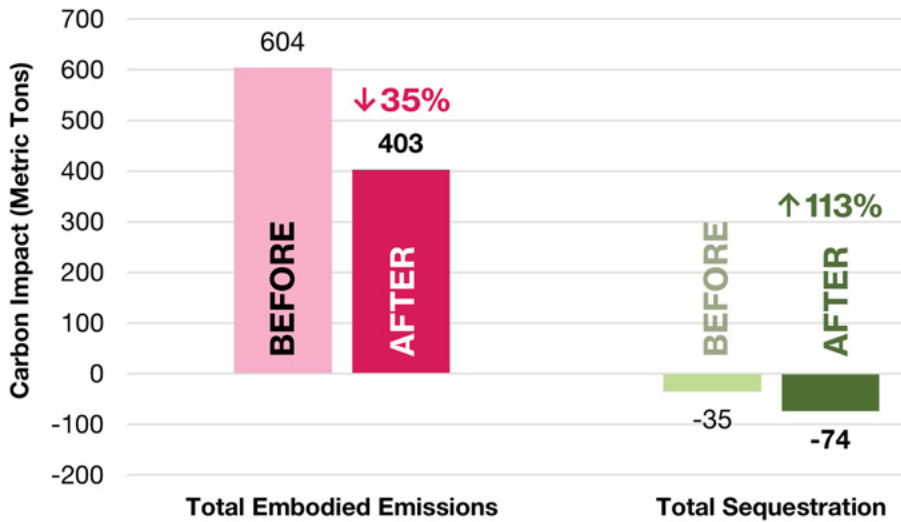


Figure 34: Bar chart showing the net carbon impact over 60 years vs. the total sequestration for both the baseline and low carbon redesign.

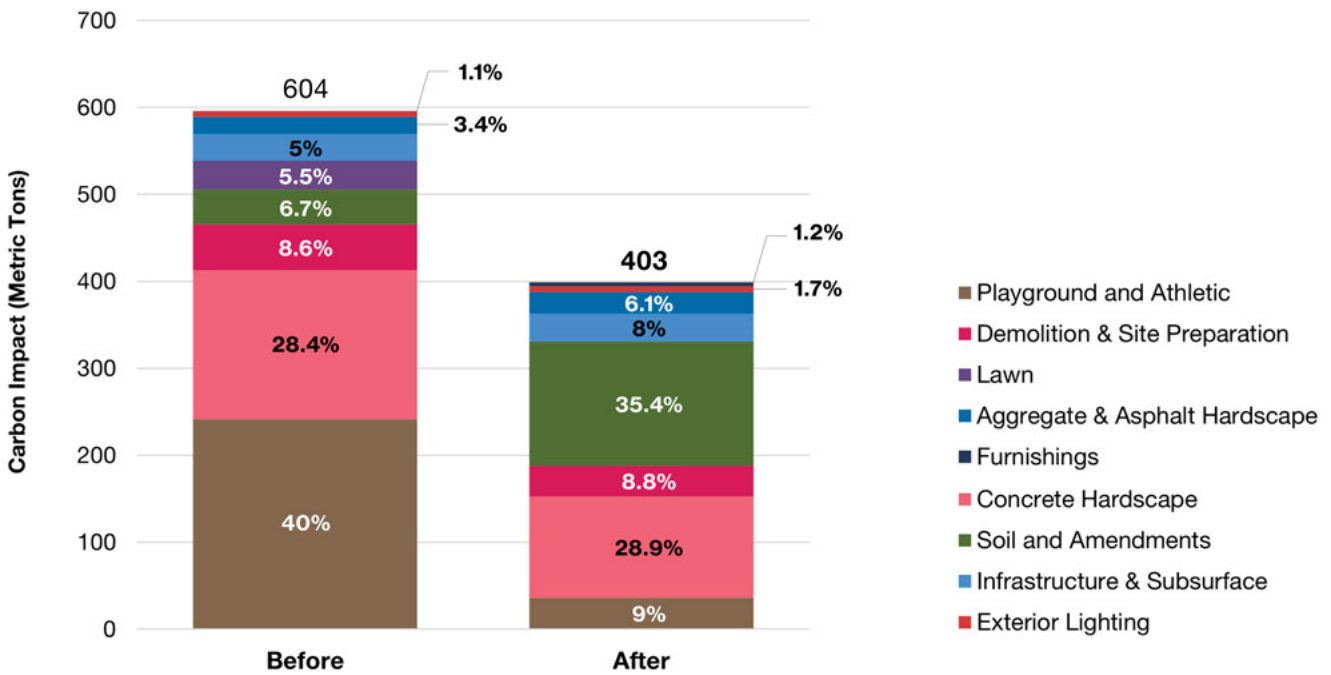


Figure 35: Bar chart showing project emissions by category for both the baseline (before) and low carbon redesign (after). The shifting percentages illustrate the relationship between material categories and embodied carbon.

## 5.3 Assumptions for Case Studies

### Development Case Study

- The SPA set was used for all area take-off calculations and did not account for changes during construction.
- Low Carbon Unit pavers were inputted using the EPD for EcoTerra pavers by Unilock. The depth of these pavers was assumed to be 80mm.
- In the low carbon redesign, all wood fencing and pergolas were swapped to salvage wood – cut. This was a slightly lower carbon alternative to milled softwood.
- A depth of 1.5m was assumed for the average depth of soil for tree planting. Our calculations also assumed a shared soil volume between trees and shrub planting.
- Metal grates in the redesign scenario were swapped out to 100% recycled aluminium.

### Park Case Study

- The IFC set was used which did not account for changes during construction.
- Areas within the tree protection fencing to the west of the site were undisturbed and no work was proposed within that boundary
- The ages of existing trees on-site were estimated using a formula that took the approximate DBH (in inches) of each tree from the Arborist Report and applied a growth rate based on the species of tree. An additional 25% reduction was used to account for less-than-ideal growing conditions for a tree in an urban landscape. The approximate ages of the trees combined with their height were inputted into Pathfinder accordingly.
- In the redesign scenario all concrete footings and benches were maintained.

### Assumptions for Transportation Distances (Applies to both Case Studies)

Hyperlocal (16km radius):	Removal of Site Soil (off-haul) (assuming uncontaminated soil is not present), Organic Mulch
Intermediate Local (80km radius):	Cast-in-Place Concrete Paving, Cast-in-Place Concrete Wall, Cast-in-Place Concrete Spread Footing, Cast-in-Place Concrete Sonotube Footing, Cast-in-Place Concrete Mow Curb, Compacted Aggregate Base, Amended Planting Soil, Sand Setting Bed, Stabilized Crushed Stone Paving 4" (100mm) Depth, Precast Concrete Stairs, Precast Concrete Unit Pavers, Cast-in-Place Concrete Subslab
Local (160km radius):	Concrete Paving or Slab Demolition, Aggregate Base Demolition, Concrete Wall Demolitions, Salvaged Concrete Wall, Concrete Wall Rebar Demolition, Moderate Management Lawn, No-Mow Lawn/Meadow, Deciduous Large Tree, Perennials/Perennial Grasses, Deciduous Small Shrub, Deciduous Medium Shrub, Deciduous Large Shrub, Engineer Fiber Mulch Safety Surface, Synthetic Turf
Subregional (400km radius):	Reinforcement for Narrow CIP Walls, Reinforcement for CIP Sonotube Footing, EPDM Safety Surface, Synthetic Turf
Regional (800km radius):	Light Pole Luminaire, Maintenance Hole Cover, ADA truncated dome pavers/Tactile Walking Surface Indicator (TWSI), Site Furnishings, Decking, Decking Fasteners, Geotextile - Non-woven, Stone Paving or Pavers, Stone Steps, Stone Curb, Metal Grates, Wood Fence, Steel Fencing Fasteners, Expanded Metal Fencing, Wood Pergola (Shade Structure), Light Bollard, Metal Grates

# 5.4 Pathfinder Scorecards

## 5.4.1 Example Private Development Landscape (Before)



### CARBON IMPACT

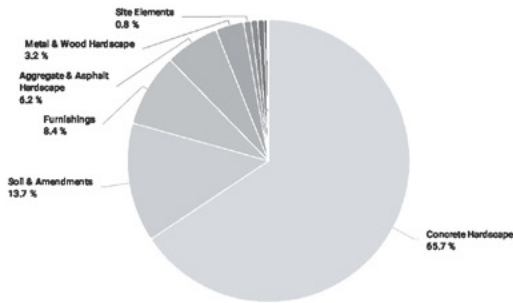
#### Net Impact over 60 years

Total Embodied Emissions	436,570 kgCO <sub>2</sub> e
Total Biogenic (Sequestration + Emissions)	10,790 kgCO <sub>2</sub> e
Total Operational Emissions	0 kgCO <sub>2</sub> e
Total Carbon Stored	21,236 kgCO <sub>2</sub> e

### PROJECT AREA

Site Area	1,553 m <sup>2</sup> (0.16 ha)
Planted Area	704 m <sup>2</sup> (45% of total area)
Emissions per Area	286 kgCO <sub>2</sub> e/m <sup>2</sup>
Sequestration per Area	12 kgCO <sub>2</sub> e/m <sup>2</sup>

### Project Emissions



### BENEFITS

#### Biodiversity

0% Existing Native Ecosystem Preserved  
0% Biodiversity Net Impact

#### Water

0% Water Use Reduction from Baseline

#### IMPROVEMENTS

From Baseline Project: N/A\*  
N/A\* Total Emissions Reduction  
N/A\* Total Sequestration Increase

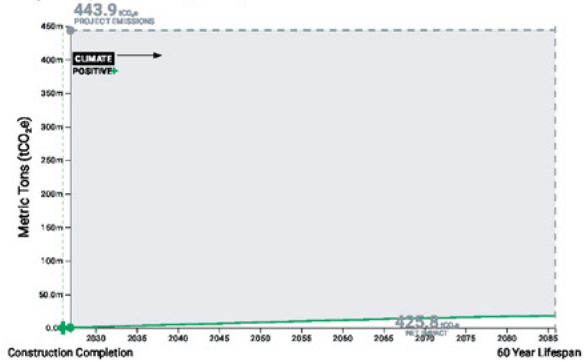
#### Cooling

Not Designated Severe Heat Zone  
39% of Project Site Shaded

#### Equity

N/A\* Designated Underserved Community

### Project Impact ∞\*\* years to positive



### CARBON IMPACT

#### Embodied Carbon Emissions

##### Aggregate Asphalt Hardscape

Compacted Aggregate Base	585 kgCO <sub>2</sub> e
Compacted Aggregate Base	85 kgCO <sub>2</sub> e
Compacted Aggregate Base	6,031 kgCO <sub>2</sub> e
Compacted Aggregate Base	1,282 kgCO <sub>2</sub> e
Compacted Aggregate Base	560 kgCO <sub>2</sub> e
Compacted Aggregate Base	1,018 kgCO <sub>2</sub> e
Compacted Aggregate Base	193 kgCO <sub>2</sub> e
Compacted Aggregate Base	622 kgCO <sub>2</sub> e
Compacted Aggregate Base	2,829 kgCO <sub>2</sub> e
Compacted Aggregate Base	11,430 kgCO <sub>2</sub> e
Compacted Aggregate Base	2,754 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>27,388 kgCO<sub>2</sub>e</b>

##### Brick Stone Hardscape

Stone Paving or Pavers	1,477 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>1,476 kgCO<sub>2</sub>e</b>

##### Concrete Hardscape

Cast-In-Place Concrete Wall	9,203 kgCO <sub>2</sub> e
Reinforcement: for Narrow CIP Concrete Walls	410 kgCO <sub>2</sub> e
Precast Concrete Unit Pavers	9,027 kgCO <sub>2</sub> e
Cast-In-Place Concrete Paving	22,814 kgCO <sub>2</sub> e
Cast-In-Place Concrete Paving	8,287 kgCO <sub>2</sub> e
Precast Concrete Stairs	2,676 kgCO <sub>2</sub> e
Reinforcement: for Narrow CIP Concrete Walls	746 kgCO <sub>2</sub> e
Precast Concrete Stairs	2,065 kgCO <sub>2</sub> e
Cast-In-Place Concrete Subslab	2,700 kgCO <sub>2</sub> e
Cast-In-Place Concrete Wall	12,930 kgCO <sub>2</sub> e
Sand Setting Bed	223 kgCO <sub>2</sub> e
Cast-In-Place Concrete Mow Curb	317 kgCO <sub>2</sub> e
Precast Concrete Unit Pavers	25,471 kgCO <sub>2</sub> e
Sand Setting Bed	1,261 kgCO <sub>2</sub> e
Cast-In-Place Concrete Subslab	3,499 kgCO <sub>2</sub> e
Cast-In-Place Concrete Mow Curb	1,031 kgCO <sub>2</sub> e
Cast-In-Place Concrete Paving	23,435 kgCO <sub>2</sub> e
Cast-In-Place Concrete Paving	94,690 kgCO <sub>2</sub> e
Cast-In-Place Concrete Wall	48,819 kgCO <sub>2</sub> e
Cast-In-Place Concrete Wall	6,287 kgCO <sub>2</sub> e

Reinforcement: for Narrow CIP Concrete Walls	470 kgCO <sub>2</sub> e
Sand Setting Bed	34 kgCO <sub>2</sub> e
Cast-In-Place Concrete Wall	12,372 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>288,863 kgCO<sub>2</sub>e</b>

##### Exterior Lighting

Light Bollard	522 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>522 kgCO<sub>2</sub>e</b>

##### Furnishings

Maglin Bench	23,232 kgCO <sub>2</sub> e
Maglin Trash Receptacle	551 kgCO <sub>2</sub> e
Maglin Trash Receptacle	1,102 kgCO <sub>2</sub> e
Maglin Bench	1,894 kgCO <sub>2</sub> e
Maglin Table	5,831 kgCO <sub>2</sub> e
Maglin Chair	3,260 kgCO <sub>2</sub> e
Maglin Plank Table	932 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>36,812 kgCO<sub>2</sub>e</b>

##### Infrastructure Subsurface

Geotextile - Nonwoven	158 kgCO <sub>2</sub> e
Maintenance Hole Cover	3,177 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>3,335 kgCO<sub>2</sub>e</b>

##### Metal Wood Hardscape

Steel Fencing Fasteners (Lump Sum)	20 kgCO <sub>2</sub> e
Wood Fence	596 kgCO <sub>2</sub> e
Steel Fencing Fasteners (Lump Sum)	85 kgCO <sub>2</sub> e
Wood Fence	4,634 kgCO <sub>2</sub> e
Metal Grates	5,491 kgCO <sub>2</sub> e
Expanded Metal Fencing	2,926 kgCO <sub>2</sub> e
Wood Fence	511 kgCO <sub>2</sub> e
Steel Fencing Fasteners (Lump Sum)	12 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>14,274 kgCO<sub>2</sub>e</b>

##### Playground Athletic

Synthetic Turf	204 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>204 kgCO<sub>2</sub>e</b>

##### Site Elements

ADA Truncated Dome Pavers	812 kgCO <sub>2</sub> e
ADA Truncated Dome Pavers	654 kgCO <sub>2</sub> e
Wood Pergola (Shade Structure)	2,152 kgCO <sub>2</sub> e

#### Soil Amendments

Amended Planting Soil	7,143 kgCO <sub>2</sub> e
Organic Mulch	383 kgCO <sub>2</sub> e
Organic Mulch	38 kgCO <sub>2</sub> e
Amended Planting Soil	1,797 kgCO <sub>2</sub> e
Organic Mulch	199 kgCO <sub>2</sub> e
Amended Planting Soil	43,557 kgCO <sub>2</sub> e
Organic Mulch	789 kgCO <sub>2</sub> e
Organic Mulch	182 kgCO <sub>2</sub> e
Amended Planting Soil	4,949 kgCO <sub>2</sub> e
Amended Planting Soil	1,040 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>60,078 kgCO<sub>2</sub>e</b>

#### Total Embodied Carbon

436,570 kgCO<sub>2</sub>e

#### Biogenic (Sequestration + Emissions)

Lawn	3,617 kgCO <sub>2</sub> e
Moderate Management Lawn	3,319 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>3,319 kgCO<sub>2</sub>e</b>

#### Shrubs

Deciduous Small Shrub	2,488 kgCO <sub>2</sub> e
Deciduous Small Shrub	108 kgCO <sub>2</sub> e
Deciduous Medium Shrub	668 kgCO <sub>2</sub> e
Deciduous Small Shrub	971 kgCO <sub>2</sub> e
Deciduous Medium Shrub	1,542 kgCO <sub>2</sub> e
Deciduous Medium Shrub	3,456 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>9,272 kgCO<sub>2</sub>e</b>

#### Trees

Deciduous Large Tree	4,837 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>4,837 kgCO<sub>2</sub>e</b>

#### Total Sequestration

18,146 kgCO<sub>2</sub>e

#### Total Biogenic-Related Emissions

7,375 kgCO<sub>2</sub>e

#### Total Biogenic Impact

10,790 kgCO<sub>2</sub>e

#### Net Impact over 60 Years

425,780 kgCO<sub>2</sub>e

### BENEFITS

#### Biodiversity

Native Ecosystems Protected 0%

#### Ecosystem Protection

Native Ecosystems Protected 0%

#### Native Ecosystems Removed

0%

#### Biodiversity Net Impact

0%

#### Native Ecosystem Impact

0 m<sup>2</sup>

#### Native Ecosystem Restored

0 m<sup>2</sup>

#### Native Ecosystem Removed

0 m<sup>2</sup>

#### Native Planting Impact

0%

#### Native Trees Planted

8%

#### Native Trees Removed

0

#### Native Shrubs Planted

624

#### Native Perennials Planted

0 m<sup>2</sup>

#### Habitats to Protect or Restore

Biome: Temperate Broadleaf & Mixed Forests

Ecoregion: Southern Great Lakes forests

#### Water

Evapotranspiration: Average Annual Potential 1,365 mm/yr

Evapotranspiration (ETc)

#### Landscape Water Use

Total Planted Area 0 m<sup>2</sup>

Annual Baseline 0 l/yr

Maximum Water Allowance 0 l/yr

Annual Site Water Usage 0 l/yr

Reduction From Baseline 0%

#### Cooling

##### Heat Island

Severe Heat Area No

##### Shade

Broad Biome N/A\*

Total Area Shaded by Trees 605 m<sup>2</sup>

Percentage of Site Shaded by Trees 39%

Total Area of Shade Structures 0 m<sup>2</sup>

Percent of Area Shaded by Structures 0%

#### Equity

##### Overburdened and Underserved Communities

Underserved Community No

Community Engagement N/A\*

\* N/A: Not Applicable based on location or no data entered.

\*\* : Based on data entered, project will not become climate positive.

# 5.4.2 Example Private Development Landscape (After)



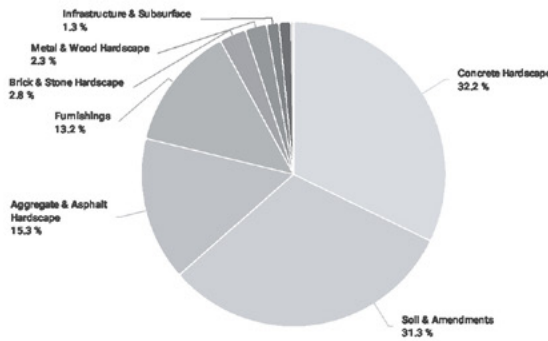
## CARBON IMPACT

**Net Impact over 60 years** **253 Metric Tons**  
 Total Embodied Emissions 278,844 kgCO<sub>2</sub>e  
 Total Biogenic (Sequestration + Emissions) 26,013 kgCO<sub>2</sub>e  
 Total Operational Emissions 0 kgCO<sub>2</sub>e  
 Total Carbon Stored 21,786 kgCO<sub>2</sub>e

## PROJECT AREA

**Site Area** **1,553 m<sup>2</sup> (0.16 ha)**  
 Planted Area 777 m<sup>2</sup> (50% of total area)  
 Emissions per Area 181 kgCO<sub>2</sub>e/m<sup>2</sup>  
 Sequestration per Area 18 kgCO<sub>2</sub>e/m<sup>2</sup>

## Project Emissions



## BENEFITS

**Biodiversity**  
 0% Existing Native Ecosystem Preserved  
 0% Biodiversity Net Impact

**Water**  
 0% Water Use Reduction from Baseline

## IMPROVEMENTS

From Baseline Project: Full Landscape  
 37% Total Emissions Reduction  
 57% Total Sequestration Increase

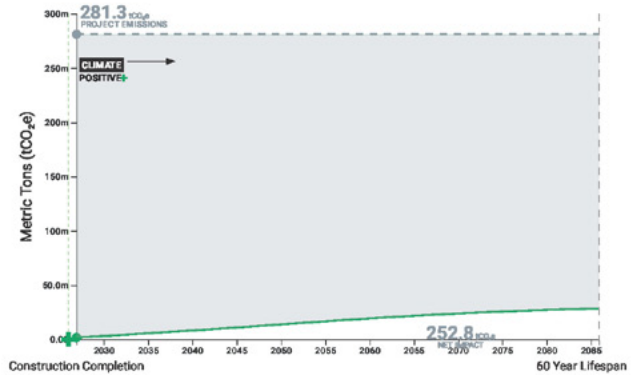
## Cooling

Not Designated Severe Heat Zone  
 60% of Project Site Shaded

## Equity

N/A\* Designated Underserved Community

## Project Impact ∞\*\* years to positive



## CARBON IMPACT

### Embodied Carbon Emissions

<b>Aggregate Asphalt Hardscape</b>	
Compacted Aggregate Base	519 kgCO <sub>2</sub> e
Compacted Aggregate Base	3,291 kgCO <sub>2</sub> e
Compacted Aggregate Base	888 kgCO <sub>2</sub> e
Compacted Aggregate Base	497 kgCO <sub>2</sub> e
Asphalt: Paving	19,958 kgCO <sub>2</sub> e
Compacted Aggregate Base	3,360 kgCO <sub>2</sub> e
Compacted Aggregate Base	10,141 kgCO <sub>2</sub> e
Compacted Aggregate Base	3,183 kgCO <sub>2</sub> e
Compacted Aggregate Base	552 kgCO <sub>2</sub> e
Compacted Aggregate Base	75 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>42,563 kgCO<sub>2</sub>e</b>
<b>Brick Stone Hardscape</b>	
Stone Steps	1,788 kgCO <sub>2</sub> e
Stone Steps	3,630 kgCO <sub>2</sub> e
Stone Curb	585 kgCO <sub>2</sub> e
Stone Curb	1,905 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>7,908 kgCO<sub>2</sub>e</b>
<b>Concrete Hardscape</b>	
Sand Setting Bed	209 kgCO <sub>2</sub> e
Sand Setting Bed	792 kgCO <sub>2</sub> e
Reinforcement for Narrow CIP	410 kgCO <sub>2</sub> e
Concrete Walls	
Cast-in-Place Concrete Subslab	2,700 kgCO <sub>2</sub> e
Reinforcement for Narrow CIP	746 kgCO <sub>2</sub> e
Concrete Walls	
Low Carbon Precast Unit: Paver	14,119 kgCO <sub>2</sub> e
Cast-in-Place Concrete Subslab	3,499 kgCO <sub>2</sub> e
Low Carbon Precast Unit: Paver	3,730 kgCO <sub>2</sub> e
Sand Setting Bed	799 kgCO <sub>2</sub> e
Reinforcement for Narrow CIP	470 kgCO <sub>2</sub> e
Concrete Walls	
Salvaged Concrete Wall	19,781 kgCO <sub>2</sub> e
Salvaged Concrete Wall	3,721 kgCO <sub>2</sub> e
Salvaged Concrete Wall	5,003 kgCO <sub>2</sub> e
Salvaged Concrete Wall	5,228 kgCO <sub>2</sub> e
Salvaged Concrete Wall	2,542 kgCO <sub>2</sub> e
Low Carbon Precast Unit: Paver	14,252 kgCO <sub>2</sub> e
Sand Setting Bed	625 kgCO <sub>2</sub> e

Low Carbon Precast Unit: Paver	11,147 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>89,772 kgCO<sub>2</sub>e</b>
<b>Exterior Lighting</b>	
Light Bollard	522 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>522 kgCO<sub>2</sub>e</b>
<b>Furnishings</b>	
Maglin Bench	23,232 kgCO <sub>2</sub> e
Maglin Picnic Table	952 kgCO <sub>2</sub> e
Maglin Chair	3,260 kgCO <sub>2</sub> e
Maglin Table	5,831 kgCO <sub>2</sub> e
Maglin Trash Receptacle	551 kgCO <sub>2</sub> e
Maglin Bench	1,884 kgCO <sub>2</sub> e
Maglin Trash Receptacle	1,102 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>36,812 kgCO<sub>2</sub>e</b>
<b>Infrastructure Subsurface</b>	
Geotextile - Nonwoven	477 kgCO <sub>2</sub> e
Maintenance Hole Cover	3,177 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>3,654 kgCO<sub>2</sub>e</b>
<b>Metal Wood Hardscape</b>	
Wood Fence	3,594 kgCO <sub>2</sub> e
Steel Fencing Fasteners (Lump Sum)	12 kgCO <sub>2</sub> e
Wood Fence	440 kgCO <sub>2</sub> e
Expanded Metal Fencing	359 kgCO <sub>2</sub> e
Steel Fencing Fasteners (Lump Sum)	85 kgCO <sub>2</sub> e
Wood Fence	513 kgCO <sub>2</sub> e
Steel Fencing Fasteners (Lump Sum)	20 kgCO <sub>2</sub> e
Metal Grates	1,002 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>6,424 kgCO<sub>2</sub>e</b>
<b>Playground Athletic</b>	
Synthetic Turf	196 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>196 kgCO<sub>2</sub>e</b>
<b>Site Elements</b>	
ADA Truncated Dome Pavers	812 kgCO <sub>2</sub> e
ADA Truncated Dome Pavers	654 kgCO <sub>2</sub> e
Wood Pergola (Shade Structure)	2,132 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>3,597 kgCO<sub>2</sub>e</b>
<b>Soil Amendments</b>	
Organic Mulch	38 kgCO <sub>2</sub> e

Amended Planting Soil	1,040 kgCO <sub>2</sub> e
Amended Planting Soil	4,949 kgCO <sub>2</sub> e
Organic Mulch	182 kgCO <sub>2</sub> e
Organic Mulch	1,191 kgCO <sub>2</sub> e
Amended Planting Soil	54,447 kgCO <sub>2</sub> e
Organic Mulch	397 kgCO <sub>2</sub> e
Amended Planting Soil	21,557 kgCO <sub>2</sub> e
Amended Planting Soil	3,593 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>87,394 kgCO<sub>2</sub>e</b>
<b>Total Embodied Carbon</b>	<b>278,844 kgCO<sub>2</sub>e</b>
<b>Biogenic (Sequestration + Emissions)</b>	
<b>Lawn</b>	
No-Mow Lawn / Meadow	7,995 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>7,995 kgCO<sub>2</sub>e</b>
<b>Shrubs</b>	
Deciduous Medium Shrub	2,193 kgCO <sub>2</sub> e
Deciduous Small Shrub	2,488 kgCO <sub>2</sub> e
Deciduous Small Shrub	108 kgCO <sub>2</sub> e
Deciduous Large Shrub	2,394 kgCO <sub>2</sub> e
Deciduous Medium Shrub	1,735 kgCO <sub>2</sub> e
Deciduous Small Shrub	1,575 kgCO <sub>2</sub> e
Deciduous Medium Shrub	944 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>11,437 kgCO<sub>2</sub>e</b>
<b>Trees</b>	
Deciduous Small Tree	543 kgCO <sub>2</sub> e
Deciduous Large Tree	6,038 kgCO <sub>2</sub> e
<b>Subtotal</b>	<b>6,582 kgCO<sub>2</sub>e</b>
<b>Total Sequestration</b>	<b>28,462 kgCO<sub>2</sub>e</b>
<b>Total Biogenic-Related Emissions</b>	<b>2,449 kgCO<sub>2</sub>e</b>
<b>Total Biogenic Impact</b>	<b>26,013 kgCO<sub>2</sub>e</b>
<b>Net Impact over 60 Years</b>	<b>252,830 kgCO<sub>2</sub>e</b>

<b>Habitats to Protect or Restore</b>	
Biome	Temperate Broadleaf & Mixed Forests
Ecoregion	Southern Great Lakes forests
<b>Water</b>	
<b>Evapotranspiration</b>	
Average Annual Potential	1,365 mm/yr
Evapotranspiration (ETo)	
<b>Landscape Water Use</b>	
Total Planted Area	0 m <sup>2</sup>
Annual Baseline	0 L/yr
Maximum Water Allowance	0 L/yr
Annual Site Water Usage	0 L/yr
Reduction From Baseline	0 %
<b>Cooling</b>	
<b>Heat Island</b>	
Severe Heat Area	No
<b>Shade</b>	
Broad Biome	N/A*
Total Area Shaded By Trees	930 m <sup>2</sup>
Percentage of Site Shaded By Trees	60 %
Total Area of Shade Structures	0 m <sup>2</sup>
Percent of Area Shaded by Structures	0 %
<b>Equity</b>	
<b>Overburdened and Underserved Communities</b>	
Underserved Community	No
Community Engagement	N/A*

\* N/A: Not Applicable based on location or no data entered.  
 \*\* : Based on data entered, project will not become climate positive.

# 5.4.3 Example City Park (Before)



## CARBON IMPACT

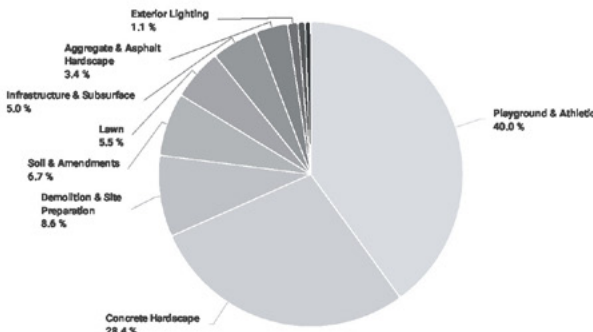
### Net Impact over 60 years

Total Embodied Emissions	604,038 kgCO <sub>2</sub> e
Total Biogenic (Sequestration + Emissions)	3,237 kgCO <sub>2</sub> e
Total Operational Emissions	0 kgCO <sub>2</sub> e
Total Carbon Stored	5,099 kgCO <sub>2</sub> e

### PROJECT AREA

Site Area	3,115 m <sup>2</sup> (0.31 ha)
Planted Area	1,775 m <sup>2</sup> (57% of total area)
Emissions per Area	206 kgCO <sub>2</sub> e/m <sup>2</sup>
Sequestration per Area	12 kgCO <sub>2</sub> e/m <sup>2</sup>

### Project Emissions



## BENEFITS

### Biodiversity

0% Existing Native Ecosystem Preserved  
0% Biodiversity Net Impact

### Water

0% Water Use Reduction from Baseline

### IMPROVEMENTS

From Baseline Project: N/A\*  
N/A\* Total Emissions Reduction  
N/A\* Total Sequestration Increase

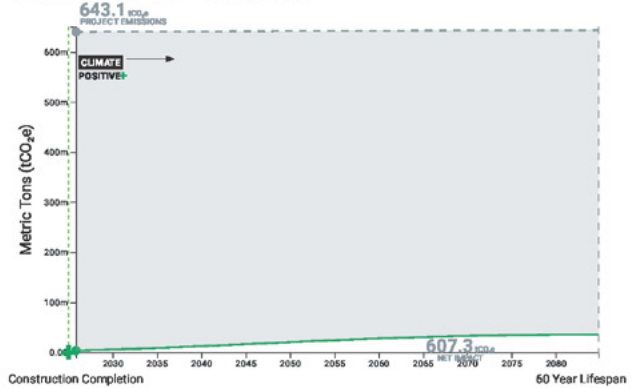
### Cooling

Not Designated Severe Heat Zone  
49% of Project Site Shaded

### Equity

N/A\* Designated Underserved Community

### Project Impact ∞\*\* years to positive



## CARBON IMPACT

### Embodied Carbon Emissions

<b>Aggregate Asphalt Hardscape</b>			
Compacted Aggregate Base	13,679 kgCO <sub>2</sub> e		
Compacted Aggregate Base	7,333 kgCO <sub>2</sub> e		
Compacted Aggregate Base	513 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>21,525 kgCO<sub>2</sub>e</b>		
<b>Concrete Hardscape</b>			
Reinforcement for Narrow CIP Concrete Walls	1,051 kgCO <sub>2</sub> e		
Reinforcement for CIP Sonotube Footing (Foundation)	1,214 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Wall	6,455 kgCO <sub>2</sub> e		
Reinforcement for Narrow CIP Concrete Walls	1,051 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Spread Footing (Foundation)	1,217 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Wall	12,930 kgCO <sub>2</sub> e		
Reinforcement for Narrow CIP Concrete Walls	2,103 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Spread Footing (Foundation)	2,634 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Sonotube Footing	2,401 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Paving	113,324 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Wall	4,328 kgCO <sub>2</sub> e		
Reinforcement for Wide CIP Concrete Walls	3,829 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Sonotube Footing	1,720 kgCO <sub>2</sub> e		
Reinforcement for CIP Sonotube Footing	927 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Mow Curb	10,142 kgCO <sub>2</sub> e		
Reinforcement for Narrow CIP Concrete Walls	1,016 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Spread Footing (Foundation)	1,176 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Wall	6,249 kgCO <sub>2</sub> e		
Cast-In-Place Concrete Wall	6,455 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>181,261 kgCO<sub>2</sub>e</b>		
<b>Demolition Site Preparation</b>			
Aggregate Base Demolition	16,716 kgCO <sub>2</sub> e		
Concrete Paving or Slab Demolition	22,854 kgCO <sub>2</sub> e		
Site Grading	2,545 kgCO <sub>2</sub> e		
Existing Tree Removal - Deciduous Small	574 kgCO <sub>2</sub> e		
Removal of Site Soil (off-haul)	8,199 kgCO <sub>2</sub> e		
Existing Tree Removal - Deciduous Medium	1,107 kgCO <sub>2</sub> e		
Concrete Wall Demolition	4,198 kgCO <sub>2</sub> e		
Concrete Wall Repair Demolition	5 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>55,197 kgCO<sub>2</sub>e</b>		
<b>Exterior Lighting</b>			
Light Pole Luminaire	7,092 kgCO <sub>2</sub> e		
<b>Furnishings</b>			
Empty Single Bottle Filler	229 kgCO <sub>2</sub> e		
Maglin 870 Backless Wall Mount Bench	302 kgCO <sub>2</sub> e		
Maglin Iconic Blue Bank	642 kgCO <sub>2</sub> e		
Maglin Picnic Table	2,855 kgCO <sub>2</sub> e		
Maglin 870 Backless Wall Mount Bench	302 kgCO <sub>2</sub> e		
Maglin 870 Backless Wall Mount Bench	302 kgCO <sub>2</sub> e		
Maglin 870 Backless Wall Mount Bench	302 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>4,833 kgCO<sub>2</sub>e</b>		
<b>Infrastructure Subsurface</b>			
Maintenance Hole Cover	31,853 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>31,853 kgCO<sub>2</sub>e</b>		
<b>Metal Wood Hardscape</b>			
Aluminum Signage	2,688 kgCO <sub>2</sub> e		
Decking Fasteners	93 kgCO <sub>2</sub> e		
Decking	1,621 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>3,402 kgCO<sub>2</sub>e</b>		
<b>Playground Athletic</b>			
Kompan Little Cow	248 kgCO <sub>2</sub> e		
EPDM Safety Surface	244,795 kgCO <sub>2</sub> e		
Kompan Barn	3,163 kgCO <sub>2</sub> e		
Kompan Villa Playhouse	618 kgCO <sub>2</sub> e		
Kompan Talk and Tumble	188 kgCO <sub>2</sub> e		
Kompan 3 Seat Steel Frame	801 kgCO <sub>2</sub> e		
Kompan Push-Up Bars	279 kgCO <sub>2</sub> e		
Kompan Stump Seating	274 kgCO <sub>2</sub> e		
Kompan Arch Tunnel	4,988 kgCO <sub>2</sub> e		
Kompan Standard Seat Swing	35 kgCO <sub>2</sub> e		
Kompan Rope Nest Seat	248 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>255,837 kgCO<sub>2</sub>e</b>		
<b>Soil Amendments</b>			
Organic Mulch	182 kgCO <sub>2</sub> e		
Amended Planting Soil	28,343 kgCO <sub>2</sub> e		
Organic Mulch	164 kgCO <sub>2</sub> e		
Amended Planting Soil	1,650 kgCO <sub>2</sub> e		
Amended Planting Soil	11,854 kgCO <sub>2</sub> e		
Organic Mulch	655 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>47,888 kgCO<sub>2</sub>e</b>		
<b>Total Embodied Carbon</b>	<b>604,038 kgCO<sub>2</sub>e</b>		
<b>Biogenic (Sequestration + Emissions)</b>			
Lawn	34,958 kgCO <sub>2</sub> e		
Moderate Management Lawn	18,409 kgCO <sub>2</sub> e		
No Mow Lawn / Meadow	16,498 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>69,865 kgCO<sub>2</sub>e</b>		

<b>Perennials Perennial Grasses</b>			
Perennials / Perennial Grasses	573 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>573 kgCO<sub>2</sub>e</b>		
<b>Shrubs</b>			
Deciduous Medium Shrub	3,055 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>3,055 kgCO<sub>2</sub>e</b>		
<b>Trees</b>			
Deciduous Large Tree	7,848 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>7,848 kgCO<sub>2</sub>e</b>		
<b>Trees Existing To Protect</b>			
Deciduous Medium (~16-20yrs)	1,300 kgCO <sub>2</sub> e		
Deciduous Small (~11-15yrs)	350 kgCO <sub>2</sub> e		
Evergreen Small (~11-15yrs)	15 kgCO <sub>2</sub> e		
Evergreen Medium (~11-15yrs)	110 kgCO <sub>2</sub> e		
<b>Subtotal</b>	<b>1,775 kgCO<sub>2</sub>e</b>		
<b>Total Sequestration</b>	<b>35,805 kgCO<sub>2</sub>e</b>		
<b>Total Biogenic-Related Emissions</b>	<b>29,642 kgCO<sub>2</sub>e</b>		
<b>Total Biogenic Impact</b>	<b>3,237 kgCO<sub>2</sub>e</b>		
<b>Net Impact over 60 Years</b>	<b>607,275 kgCO<sub>2</sub>e</b>		

<b>Maximum Water Allowance</b>	0 L/yr
<b>Annual Site Water Usage</b>	0 L/yr
<b>Reduction From Baseline</b>	0 %
<b>Cooling</b>	
<b>Heat Island</b>	
<b>Severe Heat Area</b>	No
<b>Shade</b>	
<b>Broad Biome</b>	N/A*
<b>Total Area Shaded By Trees</b>	1,533 m <sup>2</sup>
<b>Percentage of Site Shaded by Trees</b>	49 %
<b>Total Area of Shade Structures</b>	0 m <sup>2</sup>
<b>Percent of Area Shaded by Structures</b>	0 %
<b>Equity</b>	
<b>Overburdened and Underserved Communities</b>	
<b>Underserved Community</b>	No
<b>Community Engagement</b>	N/A*

## BENEFITS

### Biodiversity

<b>Ecosystem Protection</b>	
Native Ecosystems Protected	0 %
Native Ecosystems Removed	0 %
<b>Biodiversity Net Impact</b>	
Native Ecosystem Impact	0 %
Native Ecosystem Restored	0 m <sup>2</sup>
Native Ecosystem Removed	0 m <sup>2</sup>
Native Planting Impact	0 %
Native Trees Planted	13 %
Native Trees Removed	-5
Native Shrubs Planted	277
Native Perennials Planted	30 m <sup>2</sup>
<b>Habitats to Protect or Restore</b>	
Biome	Temperate Broadleaf & Mixed Forests
Ecoregion	Southern Great Lakes forests

### Water

<b>Evapotranspiration</b>	
Average Annual Potential	1,434 mm/yr
Evapotranspiration (ET <sub>0</sub> )	
<b>Landscape Water Use</b>	
Total Planted Area	0 m <sup>2</sup>
Annual Baseline	0 L/yr

\* N/A: Not Applicable based on location or no data entered.  
\*\* : Based on data entered, project will not become climate positive.

# 5.4.4 Example City Park (After)



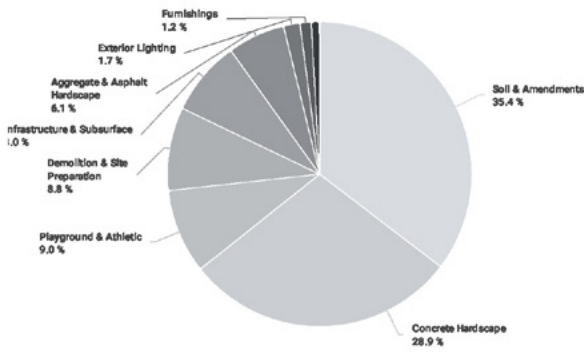
## CARBON IMPACT

**Net Impact over 60 years** **343 Metric Tons**  
 Total Embodied Emissions 402,822 kgCO<sub>2</sub>e  
 Total Biogenic (Sequestration + Emissions) 60,302 kgCO<sub>2</sub>e  
 Total Operational Emissions 0 kgCO<sub>2</sub>e  
 Total Carbon Stored 129,366 kgCO<sub>2</sub>e

## PROJECT AREA

**Site Area** **3,115 m<sup>2</sup> (0.31 ha)**  
 Planted Area 2,323 m<sup>2</sup> (75% of total area)  
 Emissions per Area 134 kgCO<sub>2</sub>e/m<sup>2</sup>  
 Sequestration per Area 24 kgCO<sub>2</sub>e/m<sup>2</sup>

## Project Emissions



## BENEFITS

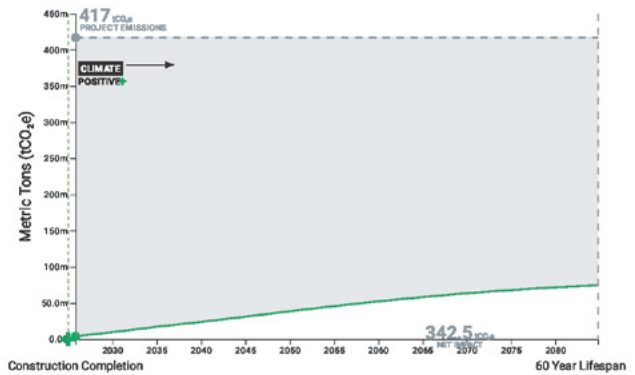
**Biodiversity**  
 0% Existing Native Ecosystem Preserved  
 0% Biodiversity Net Impact  
**Water**  
 0% Water Use Reduction from Baseline

**Cooling**  
 Not Designated Severe Heat Zone  
 74% of Project Site Shaded  
**Equity**  
 N/A\* Designated Underserved Community

## IMPROVEMENTS

From Baseline Project: Original Park Design  
 35% Total Emissions Reduction  
 113% Total Sequestration Increase

## Project Impact **CO<sub>2</sub>\*\*** years to positive



## CARBON IMPACT

Embodied Carbon Emissions	Subtotal	34,004 kgCO <sub>2</sub> e
<b>Aggregate Asphalt Hardscapes</b>		
Compacted Aggregate Base	5,929 kgCO <sub>2</sub> e	
Compacted Aggregate Base	1,988 kgCO <sub>2</sub> e	
Compacted Aggregate Base	187 kgCO <sub>2</sub> e	
Compacted Aggregate Base	4,220 kgCO <sub>2</sub> e	
Stabilized Crushed Stone Paving - 4" (100mm) Depth	8,037 kgCO <sub>2</sub> e	
Compacted Aggregate Base	4,337 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>24,698 kgCO<sub>2</sub>e</b>	
<b>Concrete Hardscapes</b>		
Cast-In-Place Concrete Paving	55,839 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Wall	4,378 kgCO <sub>2</sub> e	
Reinforcement for Wide CIP Concrete Walls	3,329 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Sonotube Footing	1,720 kgCO <sub>2</sub> e	
Reinforcement for CIP Sonotube Footing	927 kgCO <sub>2</sub> e	
Reinforcement for CIP Sonotube Footing	1,214 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Sonotube Footing	2,401 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Spread Footing (Foundation)	2,434 kgCO <sub>2</sub> e	
Reinforcement for Narrow CIP Concrete Walls	2,103 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Wall	12,930 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Spread Footing (Foundation)	1,217 kgCO <sub>2</sub> e	
Reinforcement for Narrow CIP Concrete Walls	1,051 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Wall	6,455 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Spread Footing (Foundation)	1,217 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Mow Curb	3,485 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Wall	6,249 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Spread Footing (Foundation)	1,176 kgCO <sub>2</sub> e	
Reinforcement for Narrow CIP Concrete Walls	1,016 kgCO <sub>2</sub> e	
Sand Setting Bed	390 kgCO <sub>2</sub> e	
Cast-In-Place Concrete Wall	6,455 kgCO <sub>2</sub> e	
Reinforcement for Narrow CIP Concrete Walls	1,051 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>117,030 kgCO<sub>2</sub>e</b>	
<b>Demolition Site Preparation</b>		
Existing Tree Removal - Deciduous Medium	1,107 kgCO <sub>2</sub> e	
Existing Tree Removal - Deciduous Small	574 kgCO <sub>2</sub> e	
Concrete Paving or Slab Demolition	17,134 kgCO <sub>2</sub> e	
Aggregate Base Demolition	11,805 kgCO <sub>2</sub> e	
Site Regrading	2,545 kgCO <sub>2</sub> e	
Concrete Wall Demolition	4,198 kgCO <sub>2</sub> e	
Concrete Wall Rear Demolition	5 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>34,004 kgCO<sub>2</sub>e</b>	
<b>Biogenic (Sequestration + Emissions)</b>		
Exterior Lighting		
Light Pole Luminaire	7,612 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>7,612 kgCO<sub>2</sub>e</b>	
Furnishings		
Maglin 870 Backless Wall Mount Bench	302 kgCO <sub>2</sub> e	
Maglin Picnic Table	2,855 kgCO <sub>2</sub> e	
Maglin 870 Backless Wall Mount Bench	302 kgCO <sub>2</sub> e	
Maglin Iconic Bike Rack	542 kgCO <sub>2</sub> e	
Elkay Single Bottle Filler	229 kgCO <sub>2</sub> e	
Maglin 870 Backless Wall Mount Bench	302 kgCO <sub>2</sub> e	
Maglin 870 Backless Wall Mount Bench	302 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>4,832 kgCO<sub>2</sub>e</b>	
Infrastructure Subsurface		
Maintenance Hole Cover	31,863 kgCO <sub>2</sub> e	
Geotextile - Nonwoven	385 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>32,248 kgCO<sub>2</sub>e</b>	
Metal Wood Hardscapes		
Aluminum Signage	2,655 kgCO <sub>2</sub> e	
Decking Fasteners	93 kgCO <sub>2</sub> e	
Decking	789 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>3,549 kgCO<sub>2</sub>e</b>	
Playground Athletic		
Kompan Talk and Tumble	189 kgCO <sub>2</sub> e	
Engineer Fiber Mesh Safety Surface	25,792 kgCO <sub>2</sub> e	
Kompan Barn	3,163 kgCO <sub>2</sub> e	
Kompan Villa Playhouse	518 kgCO <sub>2</sub> e	
Kompan 3 Seat Steel Frame	801 kgCO <sub>2</sub> e	
Kompan Rope Nest Seat	248 kgCO <sub>2</sub> e	
Kompan Standard Seat Swing	35 kgCO <sub>2</sub> e	
Kompan Little Cow	248 kgCO <sub>2</sub> e	
Kompan Arch Tunnel	4,083 kgCO <sub>2</sub> e	
Kompan Push-Up Bars	279 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>36,299 kgCO<sub>2</sub>e</b>	
Soil Amendments		
Amended Planting Soil	8,287 kgCO <sub>2</sub> e	
Amended Planting Soil	120,189 kgCO <sub>2</sub> e	
Organic Mulch	655 kgCO <sub>2</sub> e	
Organic Mulch	290 kgCO <sub>2</sub> e	
Amended Planting Soil	1,650 kgCO <sub>2</sub> e	
Amended Planting Soil	11,854 kgCO <sub>2</sub> e	
Organic Mulch	182 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>143,117 kgCO<sub>2</sub>e</b>	
<b>Total Embodied Carbon</b>	<b>402,822 kgCO<sub>2</sub>e</b>	

Lawn		
No-Mow Lawn / Meadow	3,931 kgCO <sub>2</sub> e	
No-Mow Lawn / Meadow	3,090 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>7,021 kgCO<sub>2</sub>e</b>	
Perennials Perennial Grasses		
Perennials / Perennial Grasses	920 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>920 kgCO<sub>2</sub>e</b>	
Shrubs		
Deciduous Medium Shrub	4,362 kgCO <sub>2</sub> e	
Deciduous Large Shrub	13,445 kgCO <sub>2</sub> e	
Deciduous Medium Shrub	9,543 kgCO <sub>2</sub> e	
Deciduous Small Shrub	8,750 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>36,199 kgCO<sub>2</sub>e</b>	
Trees		
Deciduous Large Tree	13,887 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>13,887 kgCO<sub>2</sub>e</b>	
Trees Existing To Protect		
Deciduous Small (~11-15yrs)	350 kgCO <sub>2</sub> e	
Deciduous Medium (~16-20yrs)	1,300 kgCO <sub>2</sub> e	
Evergreen Small (~11-15yrs)	15 kgCO <sub>2</sub> e	
Evergreen Medium (~11-15yrs)	110 kgCO <sub>2</sub> e	
<b>Subtotal</b>	<b>1,775 kgCO<sub>2</sub>e</b>	
<b>Total Sequestration</b>	<b>74,451 kgCO<sub>2</sub>e</b>	
<b>Total Biogenic-Related Emissions</b>	<b>14,149 kgCO<sub>2</sub>e</b>	
<b>Total Biogenic Impact</b>	<b>60,302 kgCO<sub>2</sub>e</b>	
<b>Net Impact over 60 Years</b>	<b>342,521 kgCO<sub>2</sub>e</b>	

<b>Water</b>	
Evapotranspiration	
Average Annual Potential Evapotranspiration (ETp)	1,434 mm/yr
Landscape Water Use	
Total Planted Area	0 m <sup>2</sup>
Annual Baseline	0 L/yr
Maximum Water Allowance	0 L/yr
Annual Site Water Usage	0 L/yr
Reduction From Baseline	0 %
<b>Cooling</b>	
Heat Island Severe Heat Area	No
<b>Shade</b>	
Broad Biome	N/A*
Total Area Shaded by Trees	2,290 m <sup>2</sup>
Percentage of Site Shaded by Trees	74 %
Total Area of Shade Structures	0 m <sup>2</sup>
Percent of Area Shaded by Structures	0 %
<b>Equity</b>	
Overburdened and Underserved Communities	No
Underserved Community	N/A*
Community Engagement	

## BENEFITS

<b>Biodiversity</b>	
Ecosystem Protection	
Native Ecosystems Protected	0 %
Native Ecosystems Removed	0 %
<b>Biodiversity Net Impact</b>	<b>0 %</b>
Native Ecosystem Impact	0 m <sup>2</sup>
Native Ecosystem Restored	0 m <sup>2</sup>
Native Ecosystem Removed	0 m <sup>2</sup>
Native Planting Impact	0 %
Native Trees Planted	23 %
Native Trees Removed	5
Native Shrubs Planted	2,925
Native Perennials Planted	30 m <sup>2</sup>
<b>Habitats to Protect or Restore</b>	
Biome	Temperate Broadleaf & Mixed Forests
Ecoregion	Southern Great Lakes Forests

\* N/A: Not Applicable based on location or no data entered.

\*\* : Based on data entered, project will not become climate positive.

# References and Resources



## 6.1 ASLA Guides

There are a series of guides that the American Society of Landscape Architects (ASLA) has produced as part of their mandate to support climate resiliency. This list is simply a starting point and is by no means an exhaustive list of all the resources that are out there.

Decarbonizing the Design Process: <https://www.asla.org/decarbonizingdesignprocess.aspx>

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Decarbonizing Specifications: <https://www.asla.org/decarbonizingspecifications.aspx>

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Collaborating with Industry Partners on Climate Action and Biodiversity: <https://www.asla.org/conversationguide.aspx>

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Towards Zero Emission Business Operations: <https://www.asla.org/towardszero.aspx>

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Navigating Environmental Product Data: <https://www.asla.org/navigatingdata.aspx>

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Product Manufacturers with Environmental Product Data: <https://www.asla.org/epds.aspx>

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WORKS with Nature Low Carbon Adaptation Techniques for a Changing World: <https://www.asla.org/workswithnature.aspx>

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Evaluating the Climate Impacts of Projects Through BIM and Related Platforms: Guidelines for Project Performance Data Take Off: <https://www.asla.org/focus-areas/climate-biodiversity-action/practice-and-operations-guides/evaluating-the-climate-impacts-of-projects-through-bim-and-related-platforms>

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ASLA Climate Action Plan (2022 – 2025): [https://www.asla.org/focus-areas/climate-biodiversity-action/climate-and-biodiversity-action-plan-\(2026-2030\)/climate-action-plan-\(2022-2025\)](https://www.asla.org/focus-areas/climate-biodiversity-action/climate-and-biodiversity-action-plan-(2026-2030)/climate-action-plan-(2022-2025))

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ASLA Climate and Biodiversity Action Plan (2026-2030): [https://www.asla.org/focus-areas/climate-biodiversity-action/climate-and-biodiversity-action-plan-\(2026-2030\)](https://www.asla.org/focus-areas/climate-biodiversity-action/climate-and-biodiversity-action-plan-(2026-2030))

## 6.2 Pathfinder Guides

Pathfinder itself has a very comprehensive set of resources and user guides to provide additional guidance on how to use the platform and what to consider throughout the design process.

Design Toolkit:	<a href="https://climatepositivedesign.org/education/design-toolkit/">https://climatepositivedesign.org/education/design-toolkit/</a>
Pathfinder 3.2 Methodology and Data Sources Report:	<a href="https://climatepositivedesign.org/education/methodology-report/">https://climatepositivedesign.org/education/methodology-report/</a>
Pathfinder User Guide:	<a href="https://climatepositivedesign.org/wp-content/uploads/2025/10/CPD_Pathfinder-3.2_User-Guide.pdf">https://climatepositivedesign.org/wp-content/uploads/2025/10/CPD_Pathfinder-3.2_User-Guide.pdf</a>
Case Studies:	<a href="https://climatepositivedesign.org/education/case-studies/">https://climatepositivedesign.org/education/case-studies/</a>

## 6.3 Additional Resources

Carbon Conscience White Paper and Additional Research:	<a href="https://www.carbonconscience.sasaki.com/research/">https://www.carbonconscience.sasaki.com/research/</a>
Carbon Conscience - Tutorials:	<a href="https://www.carbonconscience.sasaki.com/product-resources#tutorials">https://www.carbonconscience.sasaki.com/product-resources#tutorials</a>
Carbon Leadership Forum:	<a href="https://carbonleadershipforum.org/">https://carbonleadershipforum.org/</a>
One Click LCA – Construction LCA Glossary:	<a href="https://oneclicklca.com/en/resources/articles/construction-lca-glossary">https://oneclicklca.com/en/resources/articles/construction-lca-glossary</a>
Carbon Smart Materials Palette:	<a href="https://www.materialspalette.org/palette/">https://www.materialspalette.org/palette/</a>
Architecture 2030 – A Decarbonization Framework for Planning, Landscape and Infrastructure:	<a href="https://www.architecture2030.org/wp-content/uploads/Decarbonization-Framework-for-Planning-Landscape-and-Infrastructure.pdf">https://www.architecture2030.org/wp-content/uploads/Decarbonization-Framework-for-Planning-Landscape-and-Infrastructure.pdf</a>

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