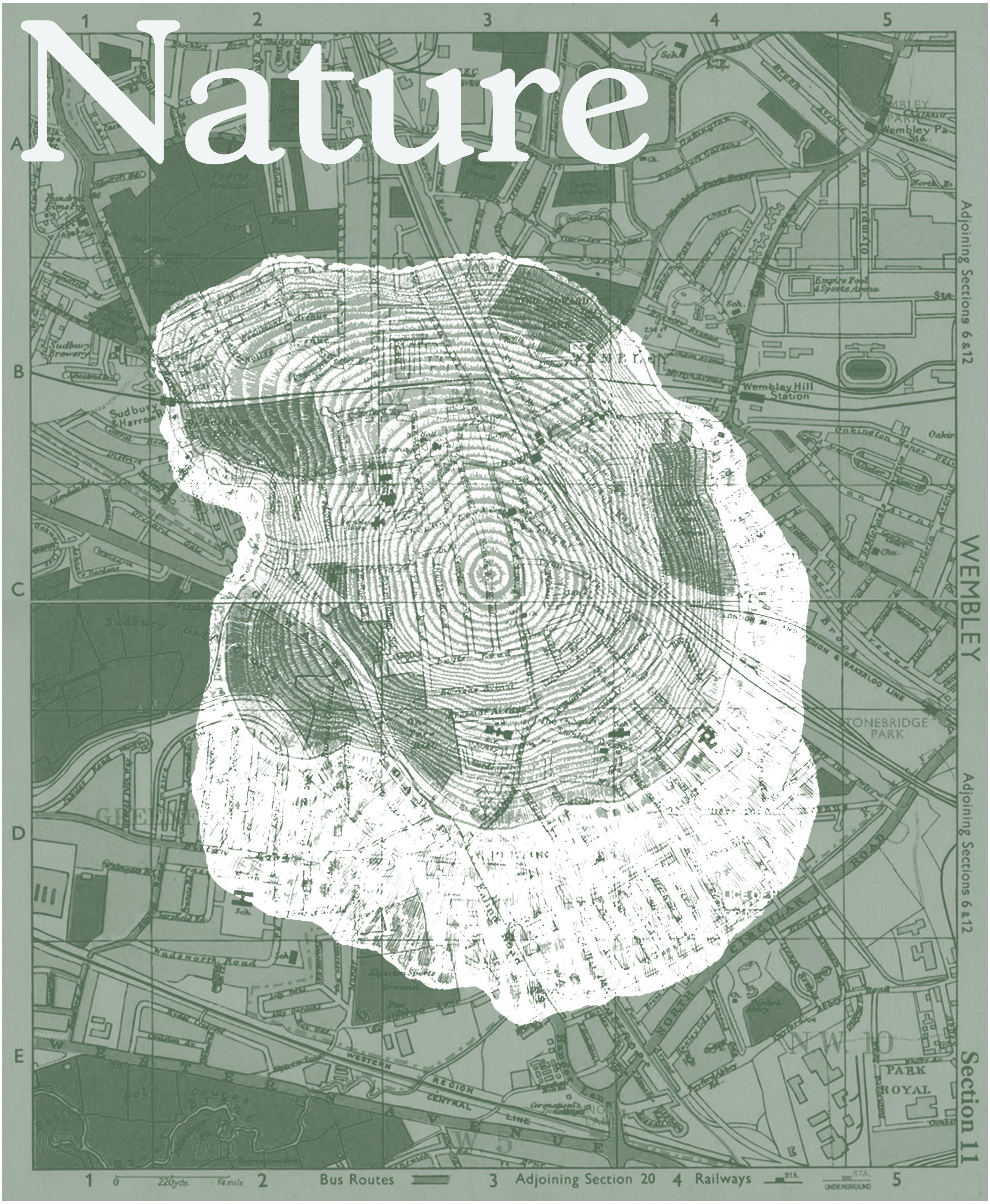
Nature



Positive+

DESIGN THINK TANK 25/6

This Think Tank investigates materials commonly used in construction. Our focus of study includes steel, concrete, timber, aluminium, clay/brick and stone. Exploring their context globally, nationally, and locally will highlight their impact on nature across the stages of extraction, manufacturing and construction. The extraction stage will examine the condition of nature before, during and after, understanding the environmental effects and how to manage them. This includes issues such as contamination, air pollution and ecosystem disruption. Manufacturing looks at the process of the in-between, from raw material processing and transportation to usable product, exploring the impact on nature, humans and the ethical implications of material production. Construction will take into consideration how each material can be implemented on site, its operational elements, and how deconstruction can take precedence over demolition. This research will provide a clear understanding not only of materials demand and use, but also of their environmental impacts throughout their methods of production.

Within the boundaries of the OPDC, our given site, a plethora of opportunities present themselves in the context of materiality due to its large scale construction projects. Containing London's largest growing industrial area, the ongoing development of HS2, and the proposed development for 25,000 new homes, shows how the emergence of development leaves minimal consideration for nature. Simultaneously, the demand for materials rises, along with the amount of waste produced. Therefore, future developments must consider the environmental consequences involved, showing how these large developments can work alongside natural systems and allow nature positive design to thrive.

Our methodology began with a site visit to provide an overview on the area of interest and the opportunities and limitations the site offers. Researching further into materials, policies and the existing site conditions, the outcomes aim to demonstrate how common virgin materials that we rely on can be substituted with nature positive ones. We propose a framework as well as additional policies which provide a clear guide to help future proposals, particularly in the OPDC, to actively contribute towards sustainability through a more critical evaluation of material choice.

CAN WE BUILD A NATURE POSITIVE BUILDING IN 2026 ?

Authors:

Amelia Heath
Rammeja Anantharajah
Stela Pletenac
Jansen Vioya-De Leon
Esin Gumus
Mohammed Yar

DTT Tutors:

Daniel Marmot (LSA)
Chris Moss (Greengage)
Morgan Taylor (Greenage)
Heidi Au Yeung(Studio Egret West)
Lucas Lawrence (Studio Egret West)

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THE PROBLEM WITH CURRENT DEVELOPMENT

New construction is continually on the rise, but what are the main motives behind it?

Is it financial gain?

Is it adhering to an identified need?

Or is it simply being carried out because there appear to be no other solutions?

This chapter examines the way in which the current construction industry operates. It explores the approach taken towards development, from initial concept and design to the construction process itself.

It is widely recognised that many developments today are largely driven by financial imperatives. Developers often claim that environmental considerations have been addressed, but is this always the case?

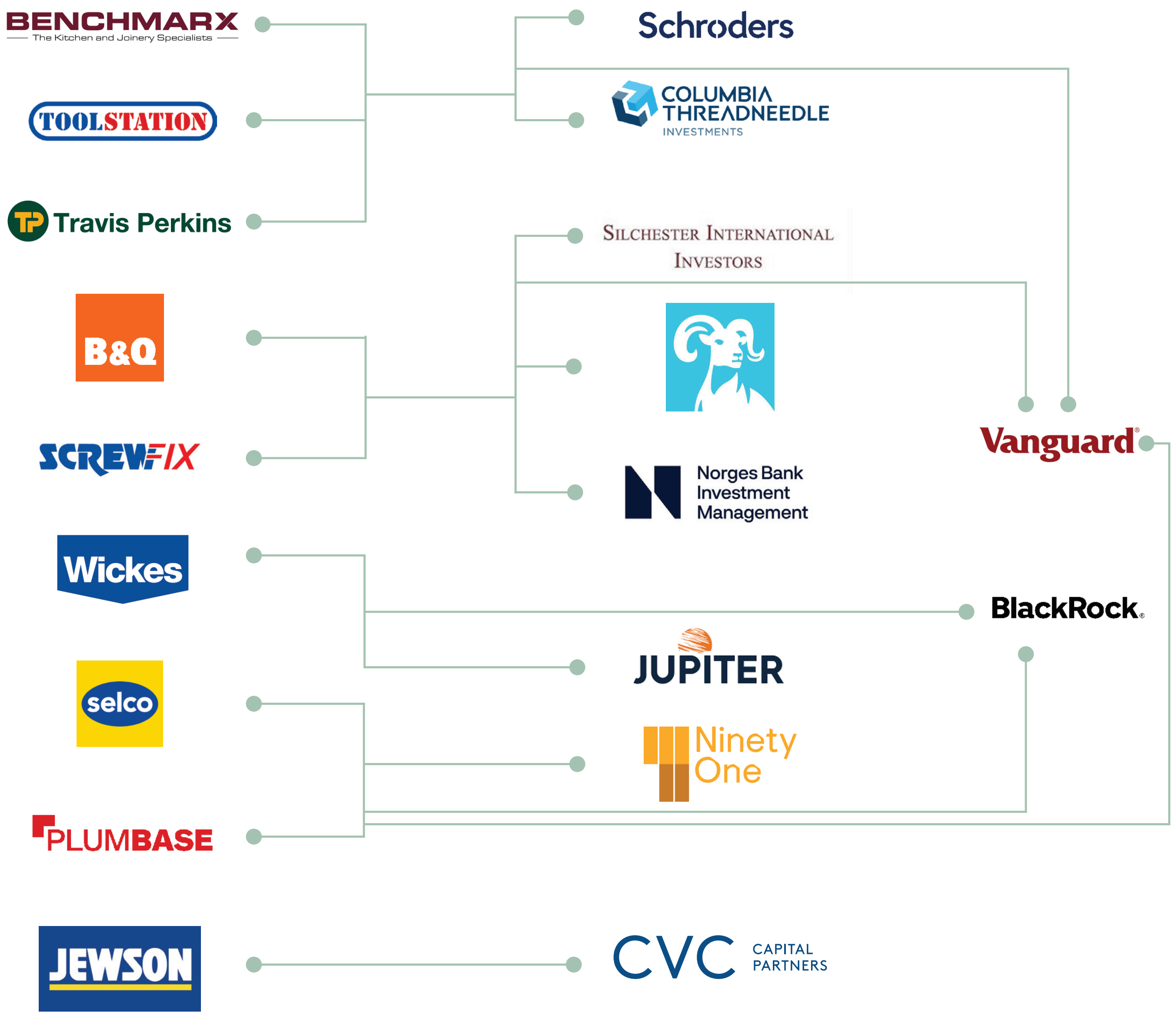
This chapter will therefore explore some of the major issues within current development practices and consider how these approaches impact the natural environment.

01

MARKET LEADERS

The construction materials market is largely dominated by a small number of major suppliers. Many well-known brands and distributors are owned by the same parent companies, resulting in a highly consolidated industry. This concentration of ownership can limit the diversity of materials readily available to designers, contractors, and developers, as supply chains are often structured around established, high-volume products.

In many cases, the primary motivation within these large organisations is commercial performance and profitability. As a result, innovation in alternative or nature-positive materials can be slower to reach the mainstream market, particularly where new products require changes to established manufacturing processes or supply chains. Consequently, the materials most easily accessible to the construction industry are often those that prioritise cost efficiency and large-scale production rather than environmental performance.



This challenge highlights the importance of developing new platforms, resources, and supply networks that support the wider adoption of sustainable and nature-positive materials within the construction sector.

COST OF MATERIALS

Global Value Chain (GVC) frameworks often present supply chains as neutral and strategic systems. However, in extractive industries, these chains are built upon colonial geographies that historically channelled raw materials from peripheries to imperial centres. Today, this division largely persists: extraction occurs in resource-rich but economically dependent regions, while higher-value processing, financial control, and decision-making remain concentrated in the Global North. Although GVC theory emphasises efficiency and governance, it often overlooks the inherited power asymmetries that shape these configurations.

EXTRACTION → PROCESSING → MANUFACTURING → TESTING AND CERTIFICATION → MARKET PRICE

EXTRACTION
- Land acquisition / quarry rights
- Resource licensing & royalties
- Labour at extraction site
- Fuel & machinery
- Explosives (if relevant)
- Environmental compliance
- Site rehabilitation obligations
- Insurance at extraction stage

PROCESSING
- Crushing / refining / sawing
- Smelting / kiln firing
- Drying / grading
- Water use
- Waste management
- Energy (electricity, gas, coke)
- Equipment depreciation
- Factory labour

MANUFACTURING
- Shaping / moulding / rolling
- Additives / binders
- Assembly
- Packaging
- Internal quality control
- Waste factor

TESTING AND CERTIFICATION
- BS EN 771-1 type standards
- Product testing (compressive strength, fire, frost, durability)
- CE / UKCA marking
- Factory Production Control (FPC)
- Third-party certification
- Technical documentation
- Ongoing compliance audits

MARKET PRICE
- Transport to distributor
- Storage
- Distributor margin
- Insurance (product liability)
- Marketing
- Sales network
- Currency risk
- Price volatility buffer

The global value chain of construction materials exposes a structural imbalance. Environmental risk and material depletion are concentrated at the beginning of the chain, while financial value accumulates towards the end. Extraction landscapes carry the ecological damage and social disruption, whereas regulatory frameworks, standards, and market control largely remain in industrialised economies. This separation between where costs occur and where value is captured reflects long-standing asymmetries embedded in global production systems.

Reconsidering how materials are sourced and circulated therefore becomes not only an environmental concern, but also an economic and political one. If the burdens of extraction are displaced while value is captured elsewhere, alternative material economies must reconnect production, value, and place.

If global value chains separate the place of extraction from the place where value is captured, rethinking material economies requires bringing these relationships closer together. Instead of relying on long and opaque supply chains that externalise environmental costs, alternative approaches look towards materials already present within local territories—whether naturally available resources, agricultural by-products, or reclaimed materials circulating within the urban fabric. Working with locally available materials can reduce transport, processing energy, and dependence on distant extraction landscapes while strengthening regional economies, knowledge systems, and craft practices.

A TYPICAL DEVELOPMENT...

23/0014/FUMOPDC:
Demolition of all existing buildings and structures and the redevelopment of the sites through construction of a building known as Block A (east site) for student accommodation (sui generis) with ancillary facilities including classrooms, flexible space and two auditoriums, and light industrial use (Class E(g)(iii)); construction of a second building known as Block B (west site) comprising residential units (use class C3) with flexible commercial uses (Class E) at ground and lower ground floor; and, associated works of landscaping, public realm improvements and other works associated with the development. The application is accompanied by an Environmental Statement. [Amended description]

What is the brief?:

The brief for this project involves a full planning application (23/0014/FUMOPDC) for a mixed-use development designed to respond to the Mayor of London's "Industrial Intensification" guidelines while providing student and residential accommodation.

What is currently on site?:

The site is located on Park Royal Road and is currently characterised by existing industrial and commercial structures that are slated for removal. It sits in a transitional urban context, bordered by Park Royal Road to the west and a cemetery to the east and south. Current site conditions include a lack of green space and significant conflicts between vehicle servicing and pedestrian movements, particularly along the eastern side of the road

What are they proposing?:

Building A: A triangular-form building designed with a three-tier facade strategy. It features a robust red/brown brick base for light industrial units, a lighter brick middle section, and a recessed aluminium fin "crown". It is intended to house Purpose Built Student Accommodation (PBSA) above the industrial ground floor.

Building B: A residential building utilising a buff or light-grey brick palette. It is designed with slim-profile aluminium store fronts on the ground floor to promote an "active frontage" and includes residential units on the upper floors

ENVIRONMENT

Ecology: The site is near the Grand Union Canal which is a vital ecological corridor. It isn't just a landmark but is classed as a Site of Metropolitan Importance for Nature Conservation

Profile: Generally flat as is typical for large-scale industrial marshlands/estate but with subtle falls toward the Grand Union Canal basin.

CLIMATE

Micro climate: London has a temperate oceanic climate. However Park Royal suffers from the Urban Heat Island (UHI) effect due to vast areas of concrete and metal roofing.

Wind: Prevailing winds are from the South-West. The large, flat roofs of neighbouring warehouses can create "wind tunnels" or turbulent down-draughts at street level.

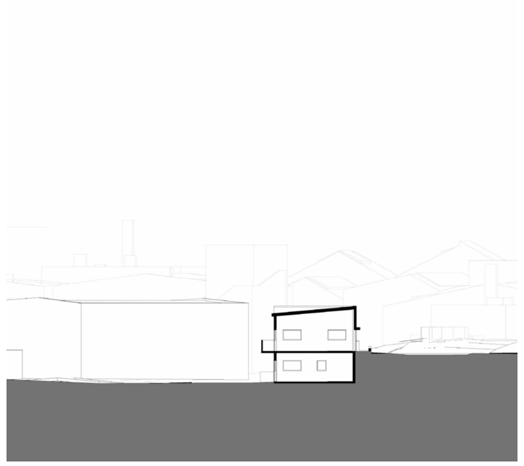
Precipitation: High risk of surface water flooding due to the high percentage of impermeable surfaces.

CIRCULATION AND CONNECTIVITY

Public Transport: Highly connected. The site is within walking distance of Park Royal (Piccadilly Line), North Acton (Central Line) and Harlesden (Bakerloo/Overground).

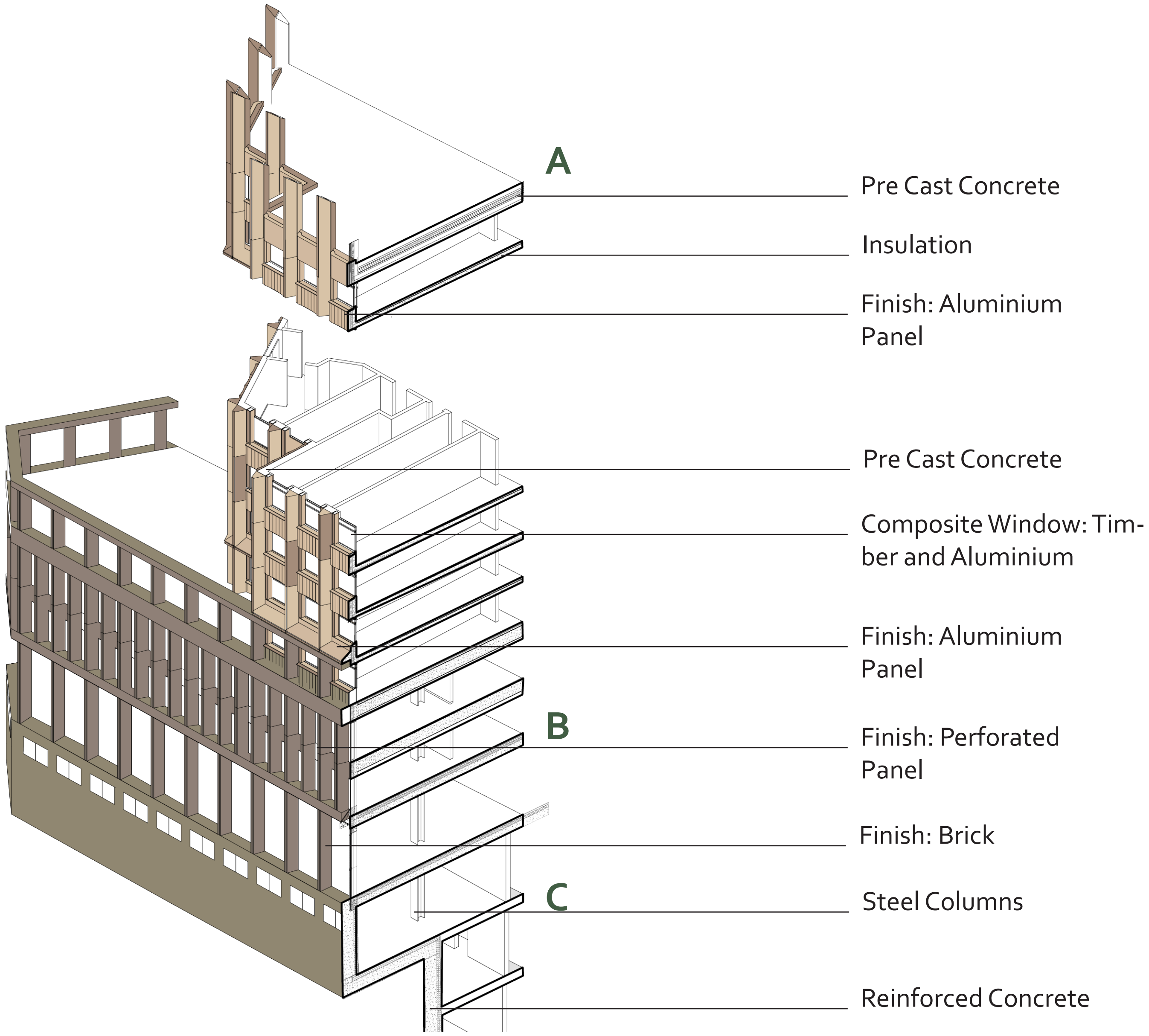
Roads: Dominated by the A40 (Western Ave) and A406 (North Circular). This creates high levels of ambient noise and pollution.

Pedestrian/Cycle: Pedestrian routes are provided however these are narrow and disrupted by nearby roadworks/equipment. There is a clear lack of cycle lanes, often shared with vehicles on the road.



Existing site section

Proposed elevation



Beyond its strategic location, this site was selected as a case study because it serves as a 'living laboratory' for exploring future research into hybrid materiality.

The proposed development utilises a complex palette of materials, including concrete, steel, brick, timber, stone, and aluminium. While project documentation states that these materials will be sourced in accordance with Environmental Product Declarations (EPDs), Whole Life Carbon (WLC) assessments, and other environmental regulations, an important question remains: can the building truly claim to have fully considered nature within its design and material choices?

This raises a broader discussion about how nature is considered within design and development, and whether it is often treated as an afterthought once financial and commercial priorities have been addressed.

WAS NATURE CONSIDERED?

NATURE POSITIVE: CONCEPT & SITE VISIT

This chapter explores the concept of nature and introduces the emerging idea of nature-positive development. By examining how built environments can move beyond simply reducing harm to actively supporting and restoring natural systems, the chapter sets the conceptual foundation for the research and design that follows.

It then presents findings from a site visit to London's largest industrial zone, the Old Oak and Park Royal Development Corporation (OPDC) area. As one of the capital's most significant regeneration projects, the OPDC represents a landscape in transition, where existing industrial activity meets ambitious plans for future development.

This evolving context provides a valuable test bed for the project, offering an opportunity to explore how nature-positive principles could be applied within a large-scale urban regeneration site. Through observations and analysis from the site visit, the chapter begins to uncover both the challenges and the opportunities for integrating nature into the future of this rapidly changing area.

02

Nature:

noun

The phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations

-Oxford Dictionary

Nature:

noun

All the animals, plants, rocks, etc. in the world and all the features, forces, and processes that happen or exist independently of people, such as the weather, the sea, mountains, the production of young animals or plants, and growth

-Cambridge Dictionary

WHAT IS NATURE?

While there are many definitions of nature, there are also numerous variables that refer to its elements, including the four realms and the abiotic and biotic components of the Earth.

After conducting a detailed analysis of these meanings, including dictionary definitions and terminology used by various organisations, we at the Nature Positive Think Tank have developed a term that brings these perspectives together to form an umbrella definition of nature.

Nature:

noun

Nature is the interconnected whole of the five categories —biodiversity, land, air, people, water — that together sustain life on Earth.

-Nature Positive Think Tank

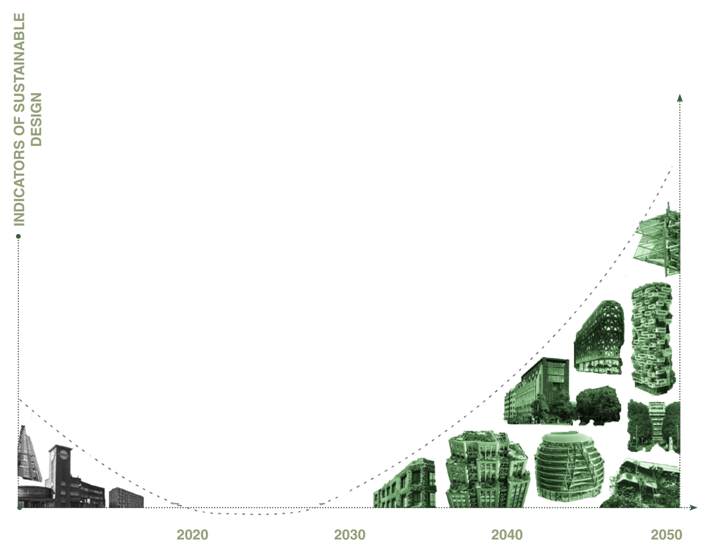
WHAT IS NATURE POSITIVE?

Nature positive is a global societal goal that seeks to halt and reverse nature loss by 2030 (measured against a 2020 baseline) and to achieve full recovery by 2050. It goes beyond simply reducing harm; it calls for measurable improvements in biodiversity, ecosystem health and the resilience of natural systems. A nature-positive future is one in which forests, soils, rivers, oceans and urban habitats are not only protected but restored—supporting thriving wildlife, stable climates, food security and human wellbeing. As biodiversity underpins everything from pollination and clean water to carbon storage and disease regulation, its recovery is fundamental to long-term planetary and economic stability.

Within the built environment, this ambition is particularly urgent. The construction sector accounts for approximately 40–50% of global material extraction, driving land-use change, deforestation, mining and habitat fragmentation across continents. The materials used in buildings—timber, steel, concrete and aggregates—are sourced through vast global supply chains that connect distant ecosystems to urban development.

At the same time, wildlife networks and ecological systems do not recognise political boundaries; habitats are interconnected through migration routes, watersheds and climate systems. Decisions made on a single site can therefore have consequences far beyond its footprint.

Designing for a nature-positive future means rethinking how we source materials, how we use land and how buildings can actively contribute to ecological regeneration rather than depletion. The built environment must shift from being a driver of biodiversity loss to becoming a restorative force within a globally interconnected system.



NET POSITIVE CONSTRUCTION BY 2030

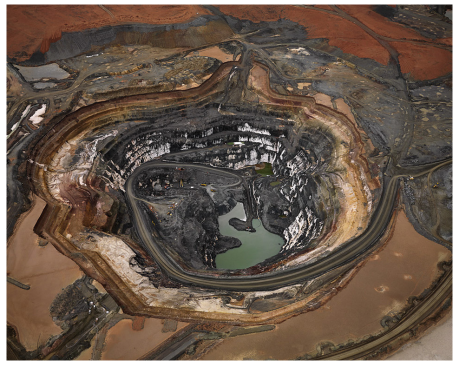
A step beyond re-use and circularity

There are well-established principles aimed at conserving the Earth's material resources with which we are all familiar. These include the re-use and adaptive re-use of existing buildings, as well as the principles of the circular economy.

While these approaches are valuable and should be applied on site, they present significant challenges when considered at the scale of a major regeneration scheme.
Adaptive re-use is grounded in the principle that buildings should be up cycled rather than demolished and replaced. There are only a finite number of structures available for retention, and even retained buildings require the introduction of new materials to meet contemporary standards and programme requirements.

However, these strategies cannot be scaled sufficiently to meet the full material demand of the wider redevelopment. Although some buildings are to be demolished and others retained, the master plan proposes a far greater volume of new construction, including dense residential neighbourhoods, mixed-use areas, and new industrial buildings. Even with maximum implementation of adaptive re-use and circular economy principles, substantial quantities of new materials will still be required.

For this reason, the focus shifts further along the supply chain, towards the extraction sites of the materials most commonly used in contemporary London construction — timber, stone, aluminium, steel, cement, and clay. These sites are frequently located in remote and ecologically sensitive regions, where extraction processes have significant impacts on land, air, water systems, and wildlife.



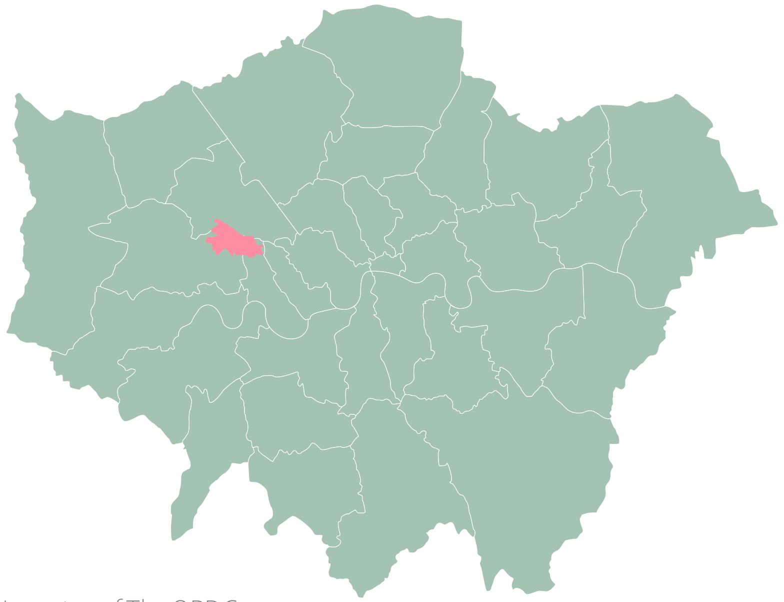
Devastating effects of material extraction on nature

THE SITE : THE OPDC
(OLD OAK & PARK ROYAL DEVELOPMENT CORPORATION)

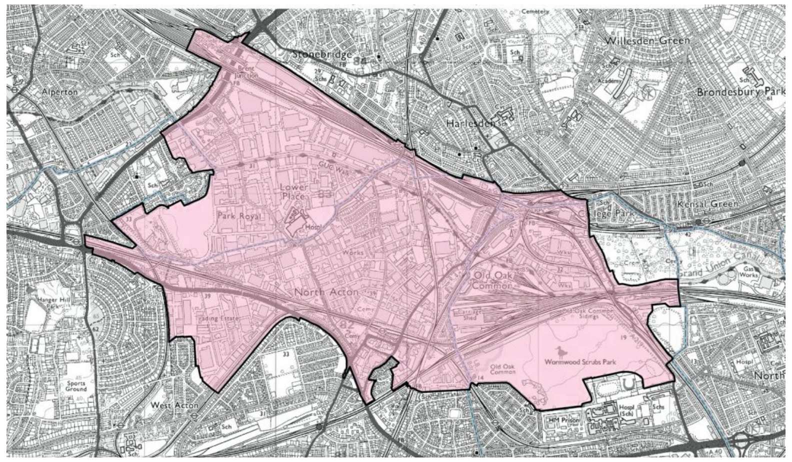
The OPDC area covers approximately 650 hectares, making it one of the largest regeneration sites in the UK. Historically characterised by railway infrastructure, depots and light industry, the area has long been fragmented and physically disconnected from the surrounding neighbourhoods. The arrival of Old Oak Common station—serving HS2, the Elizabeth Line and the Great Western Main Line—positions the site as a major new transport interchange and a strategic gateway to west London.

The adopted master plan proposes the delivery of tens of thousands of new homes, alongside substantial commercial, industrial and community space, new public realm and green infrastructure. Development is concentrated around high-density residential clusters near transport nodes, with mid-rise and industrial typologies responding to existing employment zones. New streets, bridges and open spaces are intended to reconnect previously isolated areas and integrate the site into the wider urban fabric.

However, the scale and density of the proposed development imply an extensive programme of new construction. Even where brownfield land is utilised, the transformation of this post-industrial landscape into a high-density urban quarter will require significant quantities of structural materials and infrastructure. As such, the OPDC represents not only a spatial and social opportunity but also a substantial material undertaking with far-reaching environmental implications.

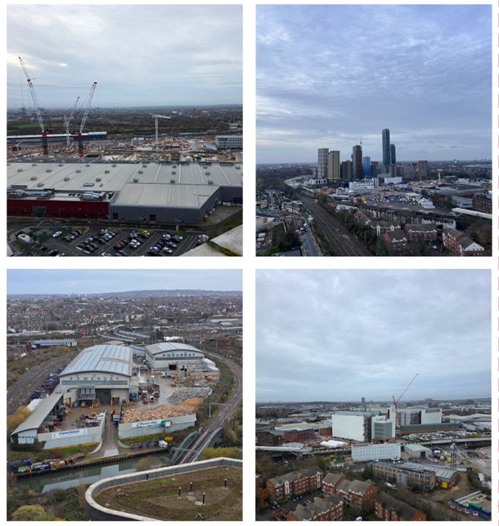


Location of The OPDC



The area of the OPDC

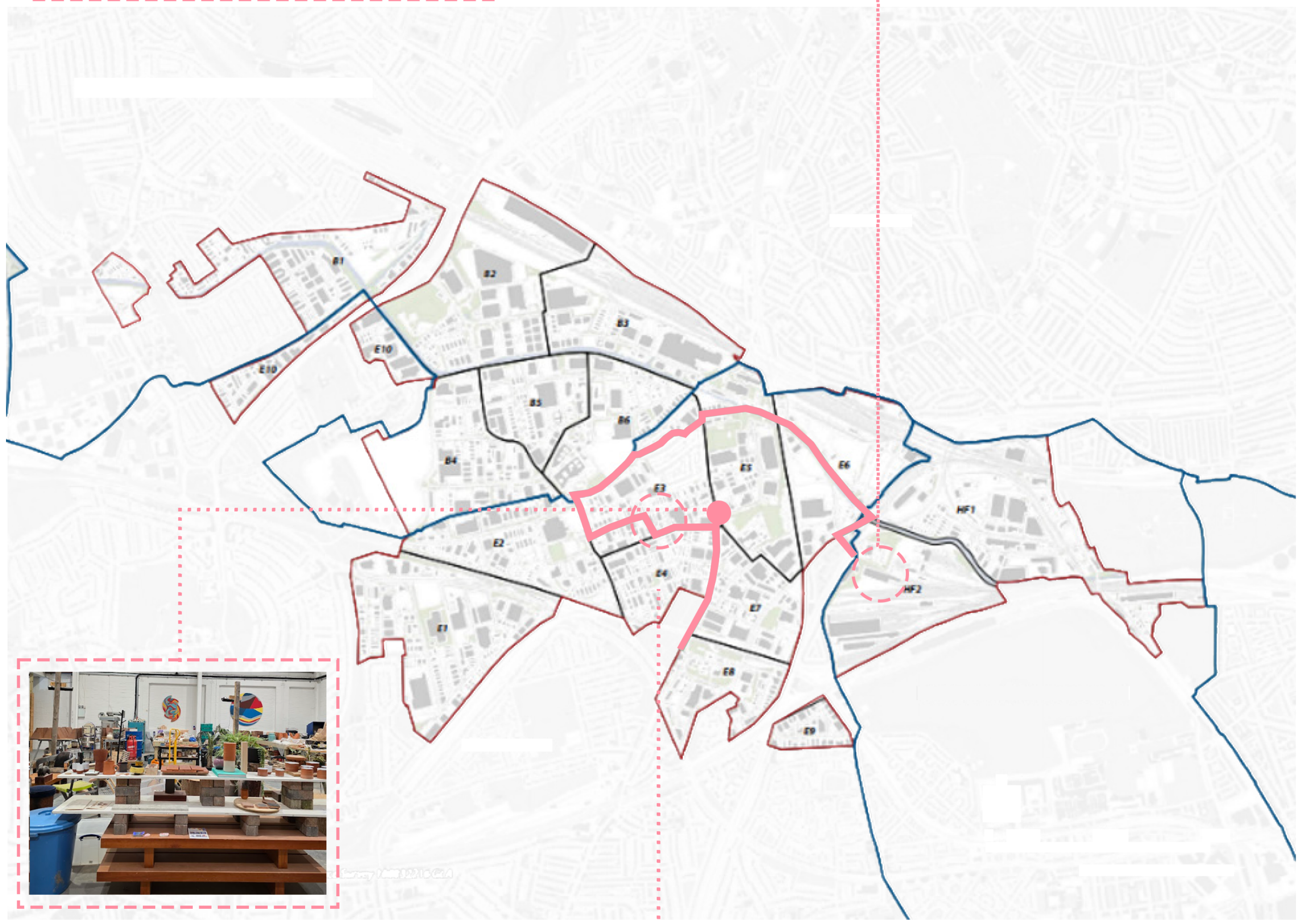
Planned works in the OPDC



During the primary research phase, a site visit was undertaken by this Think Tank through the OPDC. The visit focused on the central area of the OPDC, where the route taken allowed for a greater understanding of the area's typology, patterns of everyday activity, and the ongoing development taking place. It also provided insight into the development strategies being implemented, as well as the methods and funding mechanisms supporting these projects.

The visit further enabled an understanding of the planning and development processes within the area, including the logistics involved in obtaining planning permission. In addition, it clarified the roles and responsibilities of the various organisations involved in overseeing and delivering different types of development within the OPDC area.

ROUTE TAKEN ON SITE VISIT



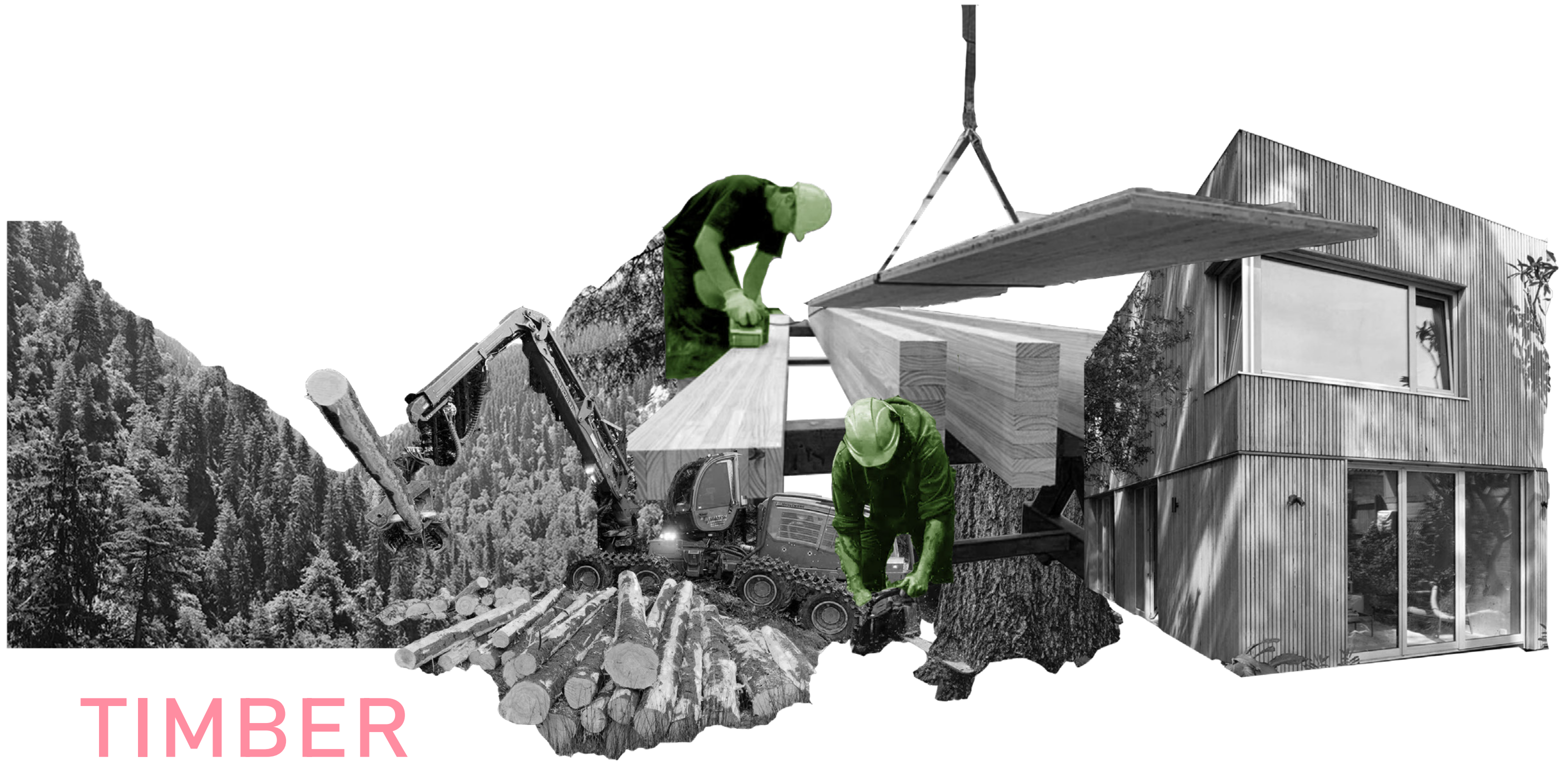
MATERIAL RESEARCH

This chapter focuses on six of the most widely used materials in the construction industry. By examining the impacts that the extraction of these materials has on their surrounding environments, it aims to provide a deeper understanding of the hidden consequences behind materials that are routinely used across the UK.

In addition to considering the materials themselves, the chapter will explore the scale of extraction sites, including their area and depth. This analysis will help to evaluate whether the volume of material produced justifies the environmental and landscape impacts created at the point of extraction.

Through this investigation, the chapter seeks to reveal the often-overlooked relationship between material demand and the physical consequences left on the land. Understanding this balance is essential when considering the long-term hidden impacts on nature.

03



TIMBER
MATERIAL RESEARCH

Timber is a fundamental construction material, particularly valued for its application in substructure components. In the UK, timber sourcing is regulated to promote responsible forestry and sustainable management. However, despite these controls, the extraction of timber inevitably has environmental and ecological impacts on the landscapes and natural habitats from where it is extracted.

This research examines the effects of timber extraction on natural sites, analysing conditions both before and after extraction. It also investigates one of the UK's largest timber extraction sites as a case study in order to identify and evaluate the environmental and ecological consequences of large-scale forestry operations.

FROM EXTRACTION TO IMPORT

Top 10 timber extraction sites:

1.United States
2.Russia
3.China
4.Brazil
5.Canada
6.Indonesia
7.Sweden
8.Germany
9.Finland
10.Latvia

Top 10 Timber Production sites in the UK:

1. Galloway forest, Southern Scotland
2. Kielder Forest, Northumberland England
3. Thetford forest, Norfolk/Suffolk England
4. Argyll forest, Southern Scotland
5. Highland region, Scotland
6. Canmore Wood Highland, Scotland
7. Queen ELizabeth Forest Park Stirling, Scotland
8. Forest Dean Gloucestershire England
9. Gwydir Forest park Wales; Eskdalemuir Forest Scotland
10. Haldon Forest, Devon England

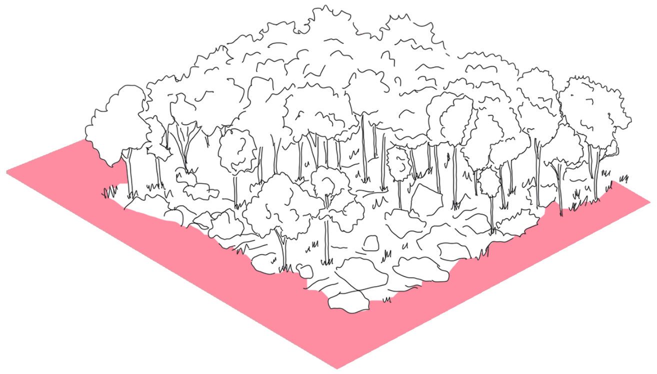
Top 5 Timber Importers to the UK

Sweden
Latvia
Germany
France
Ireland

THE MAKING OF TIMBER

0 Site before extraction

Natural forest or managed woodland, site of complex ecology.

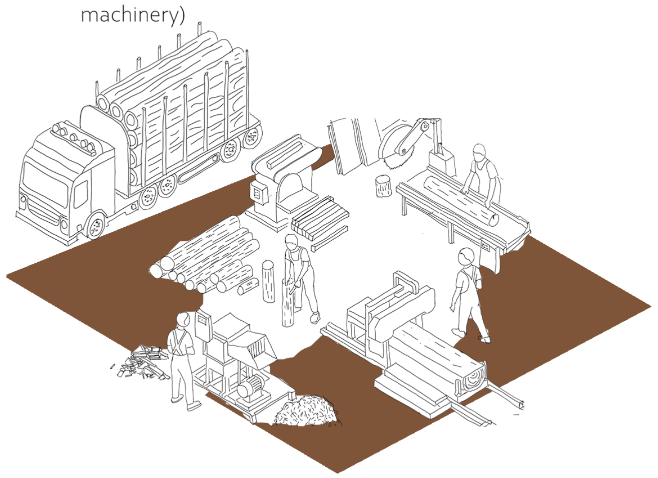


1 Site Preparation & Extraction

Trees are generally felled using mechanised harvesting, Heavy machinery causes compaction of soil. Trees are delimbed on site and cut into segments generally 3-5m in length.

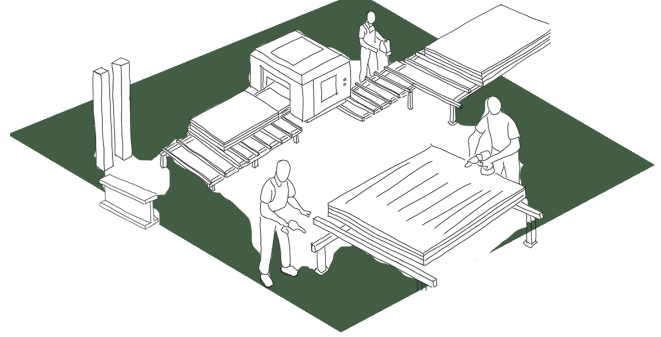
2 Processing at Sawmill (Primary)

Debarking: Outer bark is removed
Sawing: Planks, boards, or beams
Kiln: Drying
Grading: Strength and quality assessment (visual and/or machinery)



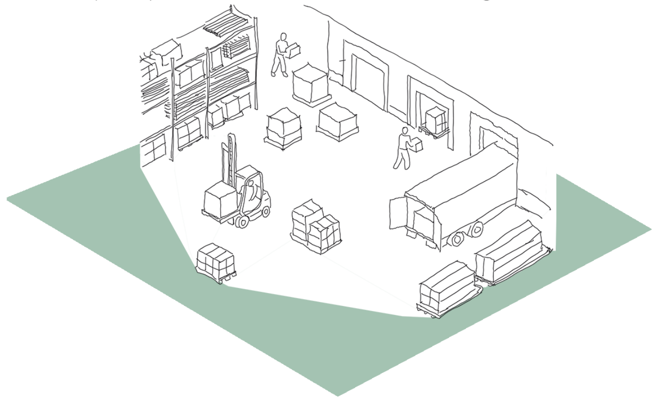
3 Engineered Timber Processing (Secondary)

Engineered timber is specialist factories
CLT (cross-laminated timber); Glulam; LVL(Laminated veneer lumber); OSB, MDF, plywood



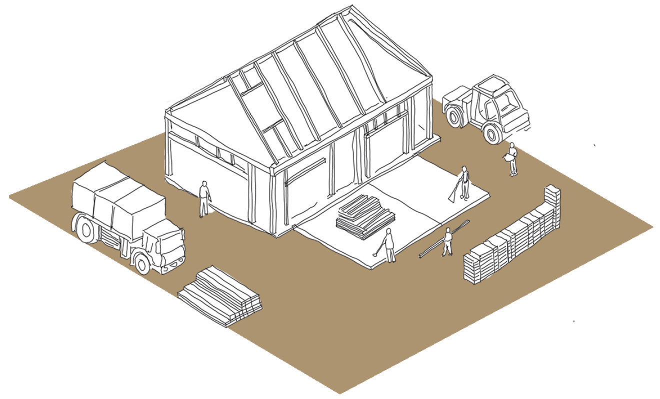
4 Storage & Distribution

Swan timber and engineered wood stored before use. It requires protection from moisture and damage.



5 Construction

Products are implemented as the project's requirements.



Dumfries & Galloway woodlands are unique for their dramatic shift from historical broadleaf forests to extensive conifer plantations, now undergoing a transformation through innovative, community-led projects like Glaisters Bridge Community Woodland and research at sites like the Woodland Laboratory, balancing economic forestry with critical biodiversity and climate goals through native tree planting and sustainable management.

BEFORE EXTRACTION

LAND

- heavily wooded region, 31% of its total area under forest and woodland cover - a large proportion are non-native, single-species conifer plantations, primarily Sitka spruce

- these plantations require restructuring to meet current sustainability, biodiversity, and landscape standards outlined in the UK Forestry Standard

AIR

- The air condition is very good

- Pollution level is very low

WATER

-Many river headwaters in Galloway are acidified due to atmospheric pollution overwhelming naturally low-buffering soils, with impacts intensified by conifer plantations and degraded peatlands—especially where conifers are planted on deep peat.

SATELLITE VIEW OF THE SITE IN 1985

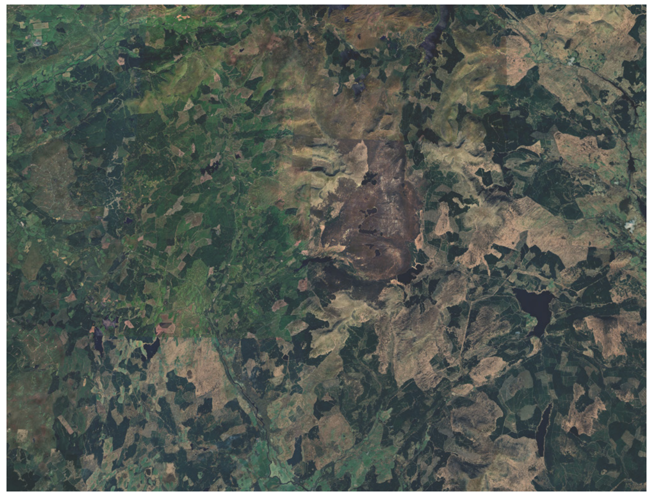
PEOPLE

- Woodlands are a vital economic resource, supporting jobs in harvesting, transport, and processing

-Residents have high levels of access to recreational forest resources, which are recognized as essential for mental and physical well-being

AFTER EXTRACTION

SATELLITE VIEW OF THE SITE IN 2026



PEOPLE

- People's condition is mixed picture, involving significant economic benefits in the forestry sector but also generating negative impacts related to community well-being, access to land, and local infrastructure disruption

- Felling operations, have been described by residents as looking like "a natural disaster,"

LAND

- Felling operations leave significant debris, deep tire treads, and tree branches on-site

- Post-harvest areas often contain unstable trees and debris, leading authorities like Forestry and Land Scotland to occasionally restrict public access for safety

AIR

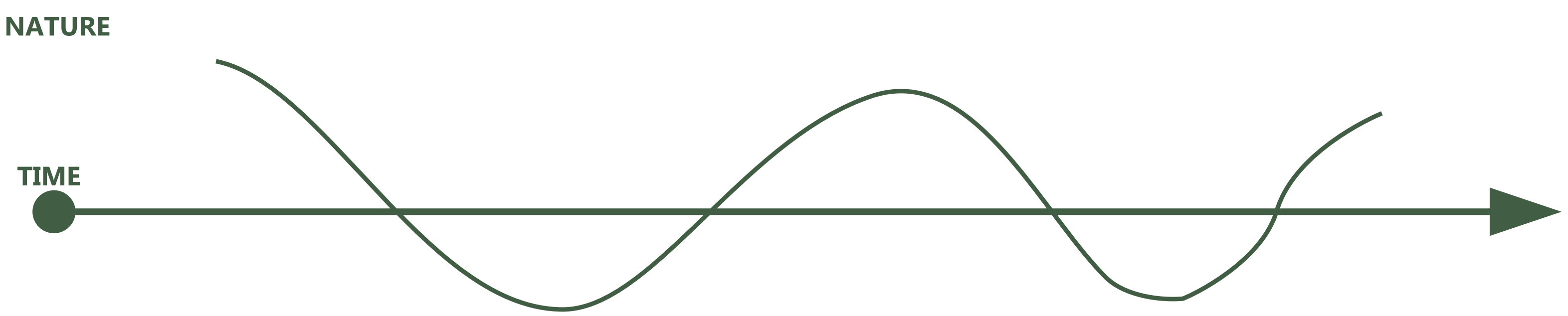
- Healthy woodlands in Dumfries & Galloway provide significant "air conditioning" benefits, felling would cause loose of this benefit

WATER

-Unmanaged or poorly executed works can lead to significant issues, such as increased sediment run-off and general site degradation, which can negatively affect local water bodies

How valuable is nature to the site?

Nature in Dumfries & Galloway woodlands is incredibly valuable, providing crucial environmental benefits like carbon storage, clean water, and biodiversity support for species like red squirrels and eagles, alongside economic benefits through forestry, tourism, and green energy, while also enhancing human health, well-being, and cultural identity through recreation, education, and its stunning landscapes, with ongoing projects focused on expanding woodland creation fairly and sustainably for future generations.



Who is responsible for protecting the environment?

D&G Woodlands Initiative: A non-profit partnership leading local projects to support trees, habitats, and people in the region.

Galloway & Southern Ayrshire Biosphere (GSAB): Manages a large UNESCO Biosphere area, working on conservation and sustainable land use.

Dumfries & Galloway Council: Supports local biodiversity plans (LBAPs) and implements local climate action. NatureScot: Scotland's nature agency, involved in national and local conservation efforts, including consultation for a potential Galloway National Park.

Landowners & Communities: Essential partners, as private landowners and local groups play a big role in habitat management.

STONE
MATERIAL RESEARCH

Stone is one of the oldest construction materials available, valued for its strength, durability and aesthetic qualities. Its compressive strength, resistance to weathering and longevity make it particularly suitable for load-bearing walls, foundations, façades and paving.

Although stone is often perceived as a natural and sustainable material, its extraction through quarrying has environmental, ecological and landscape impacts. The following research examines the impact that stone extraction has on nature and explores one of the UK's leading stone production sites in depth.

FROM EXTRACTION TO IMPORT

Top 10 stone production sites:

1. China
2. India
3. Turkey
4. Brazil
5. Italy
6. Spain
7. Portugal
8. Iran
9. Egypt
10. Vietnam

Top 10 stone production sites in the UK:

1. Glensanda Quarry
2. Mountsorrel Quarry
3. Torr works Quarry
4. Whatley Quarry
5. Bardon Hill Quarry
6. Passenham Quarry
7. Cliffe Hill QUarry
8. Dry Rigg Quarry
9. Craig y Hesg Quarry
10. Ballidon Quarry

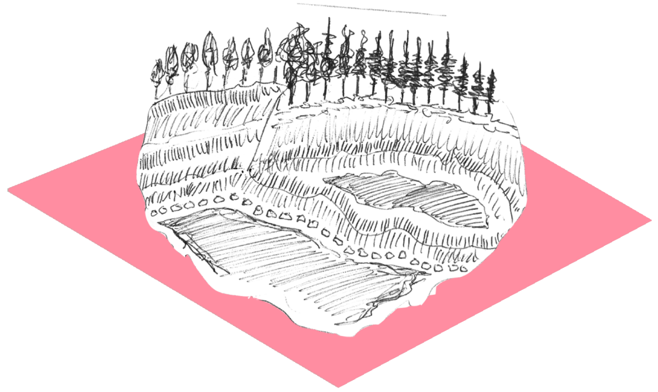
Top 5 Stone Importers to the UK

- Portugal
- Italy
- China
- Spain
- India

THE MAKING OF STONE

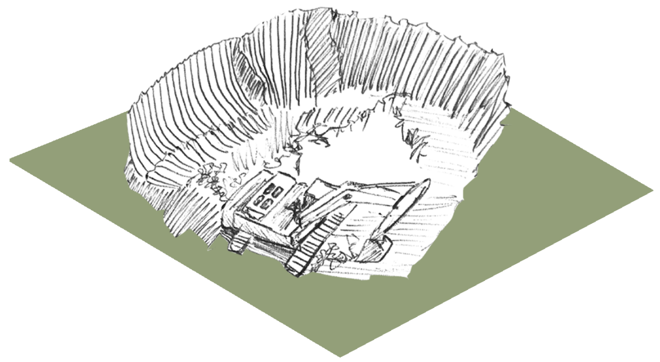
0 Site before extraction

Stone extraction site are often large hills with a generous cover of greenery and biodiversity on them.



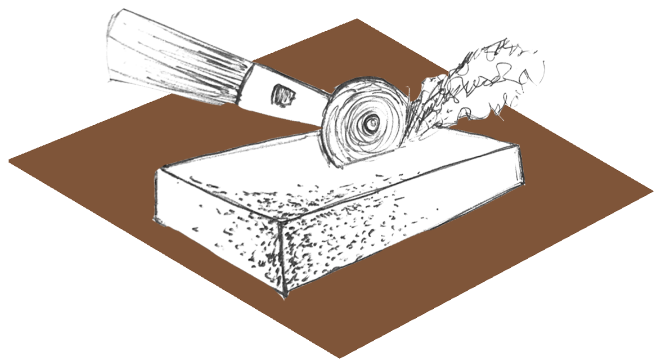
1 Blasting

Blasting is used to break large volumes of solid rock into smaller, manageable fragments. Carefully designed explosive charges are placed in drilled holes to fracture the stone efficiently while controlling vibration, noise and dust.



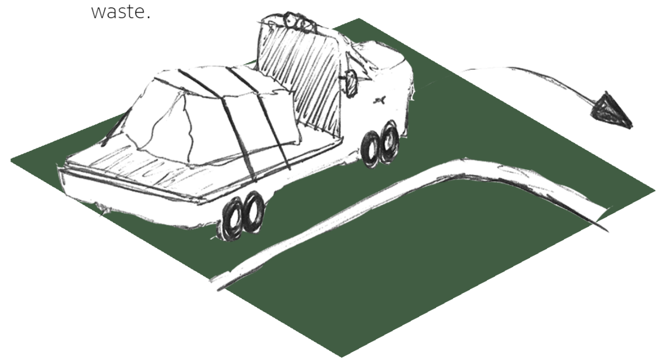
2 Cutting

For cut stone, the rock is separated using heavy cutting machinery rather than explosives, allowing precise extraction of large, intact blocks. This method minimises cracking and preserves the structural and visual quality of the stone.



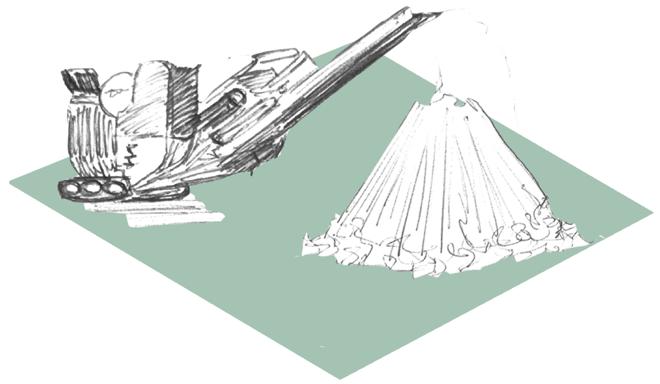
3 Transport to processing plant

Once extracted, stone is transported by heavy vehicles or conveyors to the on-site processing plant. Keeping processing close to the quarry reduces handling, energy use and material waste.



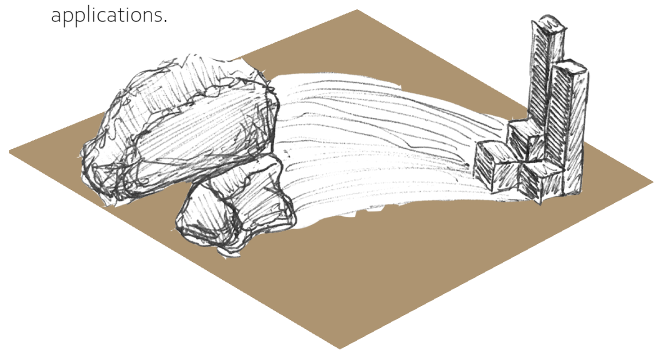
4 Crushing

Crushed stone passes through a sequence of crushers that progressively reduce its size. Primary crushing breaks down the largest pieces, secondary crushing refines the material further, and tertiary crushing is used when specific grades or fine aggregates are required.



5 Dimension cutting

Diamond drill cutting uses diamond-tipped wires or blades to slice stone blocks with high precision. This technique produces clean cuts, reduces waste, and allows stone to be shaped accurately for architectural and construction applications.



GLENSANDA QUARRY

STONE CASE STUDY

The UK is a big producer of stone, mostly crushed stone and little dimension stone like marble, limestone, etc. The Glensanda quarry produces crushed stone (granite) and is the biggest in the UK. It yields around 9 million tonnes of stone annually, of the 397 million tonnes that the UK produces.

BEFORE EXTRACTION

LAND

- Untouched by man with high ecological value, characterised by upland moorland, native woodland fragments, and coastal/marine habitats typical of Scotland's west coast

- The area supported important habitats for birds, mammals, and marine species, and formed part of a relatively intact, low-disturbance ecological landscape

AIR

- The air is completely clean, not polluted by any gases or dust

- There is no light or noise pollution

WATER

- The water is clean and the sea unpolluted with no disturbances to marine life

SATELLITE VIEW OF THE SITE IN 1986

PEOPLE

- The area is inhabited by people

- This is an area of beautiful untouched nature where tour groups sometimes come to admire its pristine beauty

AFTER EXTRACTION

SATELLITE VIEW OF THE SITE IN 2020

PEOPLE

- About 200 people work at the mines

- Human impacts are minimal due to the remote location, but there is still noise pollution, visual intrusion, and traffic present.

LAND

- Extraction at Glensanda causes large-scale modification of the mountain land form and local habitats, though impacts are spatially contained due to underground quarrying and phased restoration

AIR

- Air quality impacts are relatively limited, as dust and emissions are reduced through enclosed crushing, controlled blasting, and the absence of road haulage

WATER

- Marine water quality can be affected locally by suspended sediments from loading activities, but impacts are closely monitored and regulated to protect surrounding coastal ecosystems

How valuable is nature to the site?

Before quarrying began, the Glensanda site had moderate to high ecological value. It consisted of upland moorland, fragments of native woodland, and coastal and marine habitats typical of Scotland's west coast. Although the site was not a nationally designated nature reserve, it supported a range of important species, including birds, mammals such as otters, sea birds, and fish within nearby sea lochs. The site's main ecological value lay in its remoteness, low levels of human disturbance, and continuity of natural habitats, rather than the presence of rare species. These characteristics are increasingly scarce in the UK.

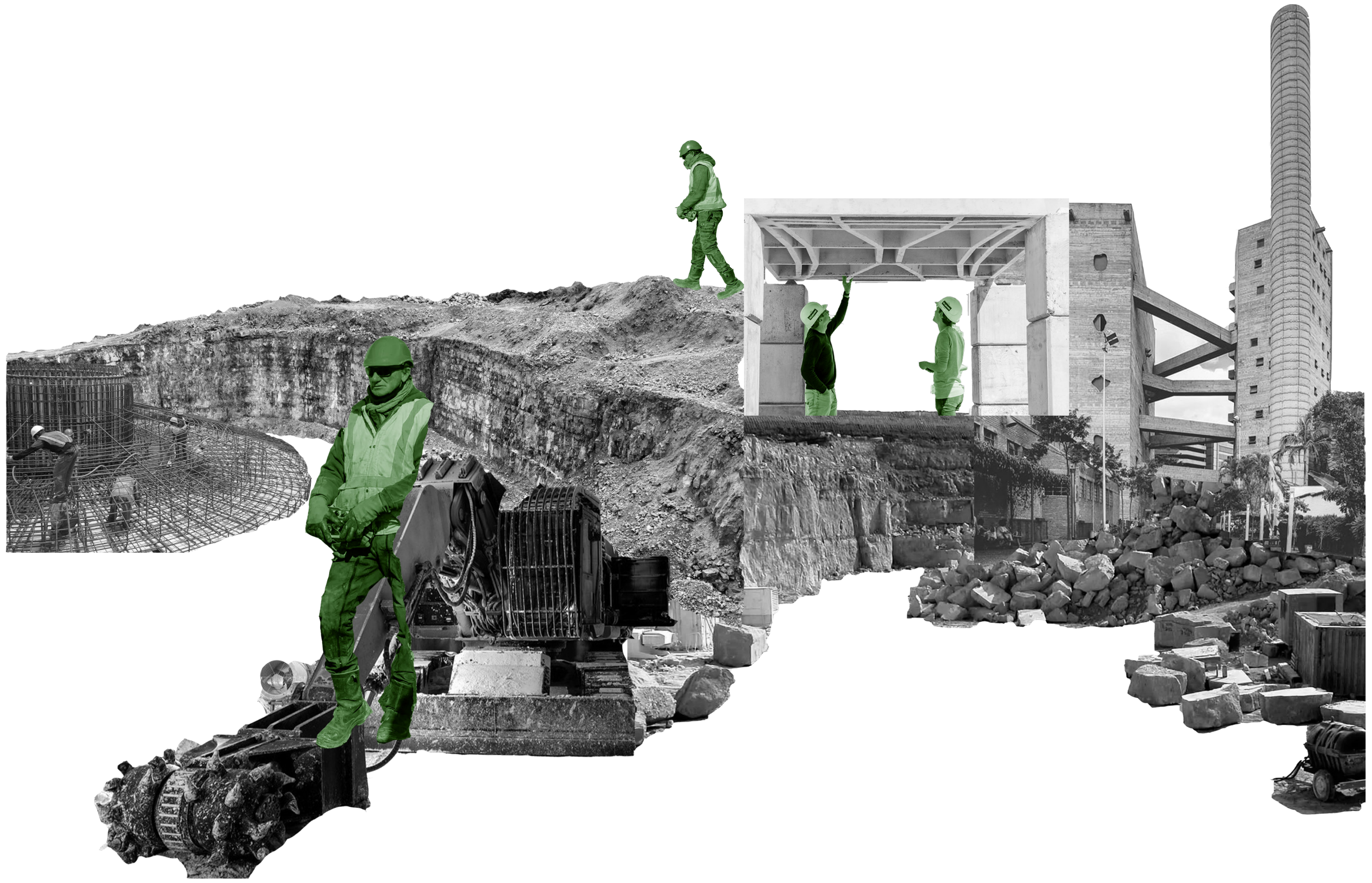
Who is responsible for protecting the environment?

Most of the responsibility lies with the owner and operator of each quarry, who are legally required to:

- Obtain planning permission
- Undertake Environmental Impact Assessments (EIAs)
- Implement mitigation, monitoring, and restoration
- Comply with environmental permits and health & safety law

They are directly liable for environmental damage arising from quarry operations.

Each quarry needs to respond to their government (depending on whether it is in Scotland, England, Wales or Northern Ireland)



CEMENT
MATERIAL RESEARCH

Cement is one of the most essential materials in the modern construction industry, forming the foundation of infrastructure development across the world. As a primary binding component in concrete and mortar, cement enables the creation of durable, versatile and structurally resilient buildings.

In the UK, cement plays a critical role in both residential and large-scale infrastructure projects. Despite its structural value and economic importance, cement production is also associated with significant environmental damage. The following research examines these impacts and explores a cement production facility within the UK to assess the environmental consequences.

FROM EXTRACTION TO IMPORT

Top 10 cement extraction sites:

1. China
2. India
3. Vietnam
4. United States
5. Turkey
6. Iran
7. Brazil
8. Russia
9. Indonesia
10. South Korea

Top 10 cement production sites nationally:

1. Peak District, Derbyshire
2. Cookstown, Northern Ireland
3. Rugby. Warwickshire
4. Ketton, Rutland
5. Flintshire, North Wales
6. Clitheroe, Lancashire
7. Stoke on Trent, Stafforshire
8. Aberthaw, South Wales
9. East Lothian, Dunbar
10. Buxton, Derbyshire

Top 5 Cement Importers to the UK


Spain


Turkey


Ireland

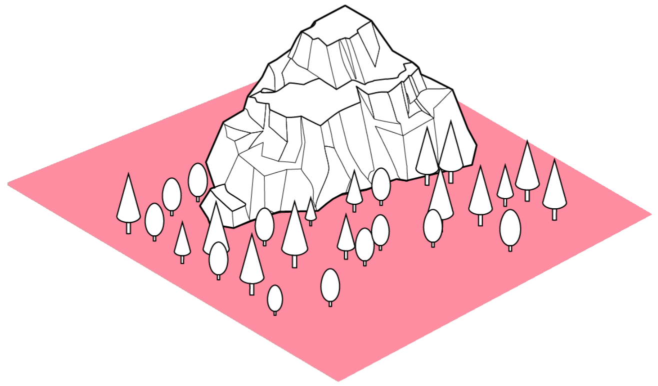

Iceland


Germany

THE MAKING OF CEMENT

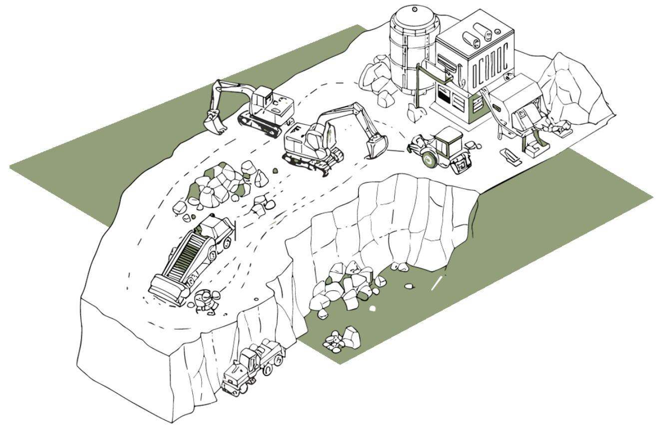
0 Site before extraction

One of the materials included in making cement is limestone. The sites where it is gathered usually sit on a wide landscape that is home to various flora and wildlife.



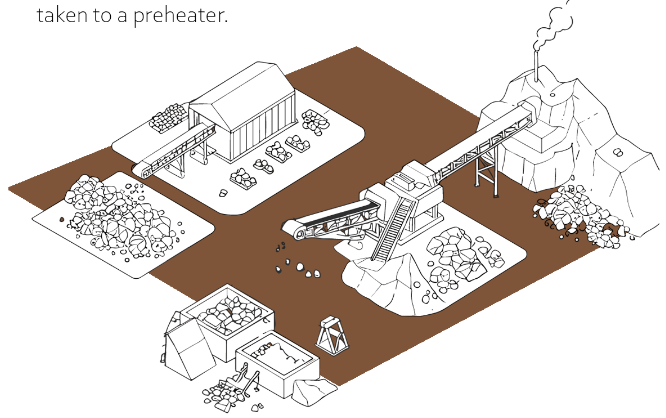
1 Site

Raw limestone is gathered and crushed. The quarry sites usually have processing plants built nearby to reduce transportation needs.



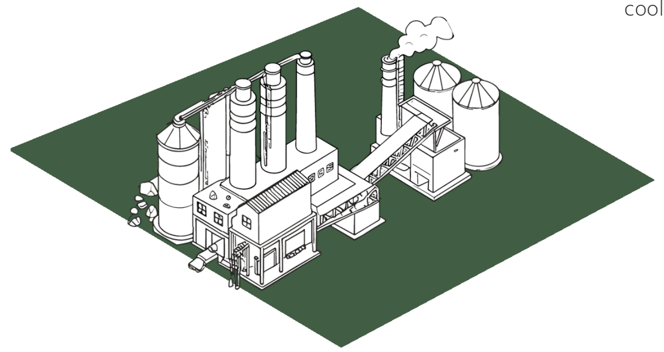
2 Crushed, Grinded & Preheated

The material is crushed and ground into a fine powder. This process includes quality testing and blending to ensure the correct mix. To remove impurities and water, the material is next taken to a preheater.



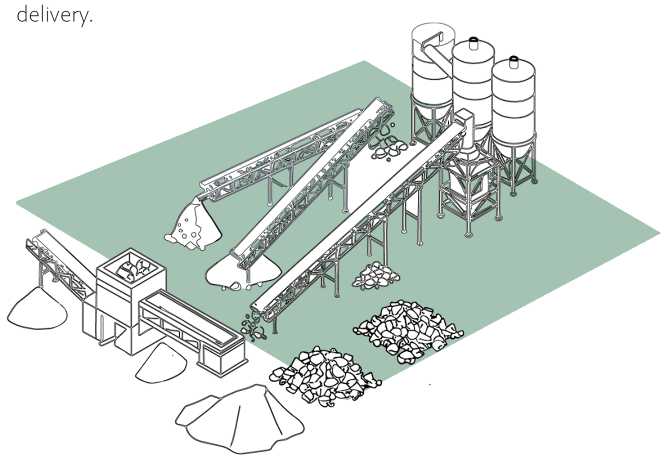
3 Cooked & Cooled

The material is then moved into a rotating kiln heated at 1450C. This process creates the main material in cement: a lump called clinker. The clinker is formed and then left to cool."



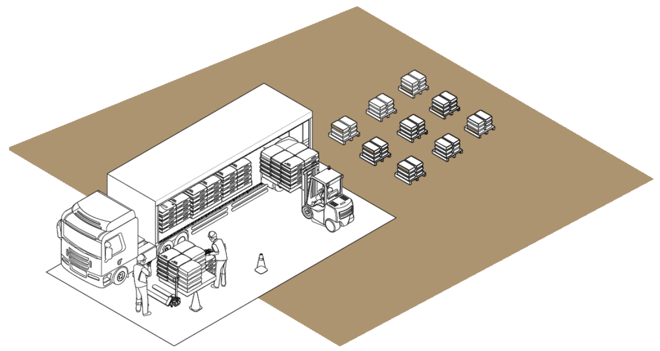
4 Mixed & Packaged

The cooled clinker is ground into a fine powder in a roller mill. Gypsum is added to the mix to control the setting time of the cement. This is the final step until the cement is packaged for delivery.



5 Shipped

The final product is shipped in bulk quantities and transported to the client .



Tunstead Quarry is one of the largest suppliers of limestone products in the UK producing 6 million tonnes per year. It has separate facilities for producing cement and chemical grade lime powder. It has its own rail connections, allowing it to send freight deliveries straight to London. This super quarry produces 98% Calcium Carbonate purity, which can be mixed with other chemical applications. For example, removing impurities during steel manufacturing.

BEFORE EXTRACTION

LAND

-The site is located near Peak District with scenic views

- It was a dry valley with U shaped ravine that had natural limestone cliffs

- This was divided into farmland and small hamlets

AIR

- The air was clear and the vast green landscape is visible from miles away

- The environment was peaceful with sounds from winds and animals as the main source of sound

- Smell is revolved around natural grassland and scent from livestock that exist in the areas

WATER

- The original valley acted as a natural sponge, feeding local springs and streams flowing down the dale

- No industrial pumps are continuously pumping, meaning wells and ponds is in its natural state

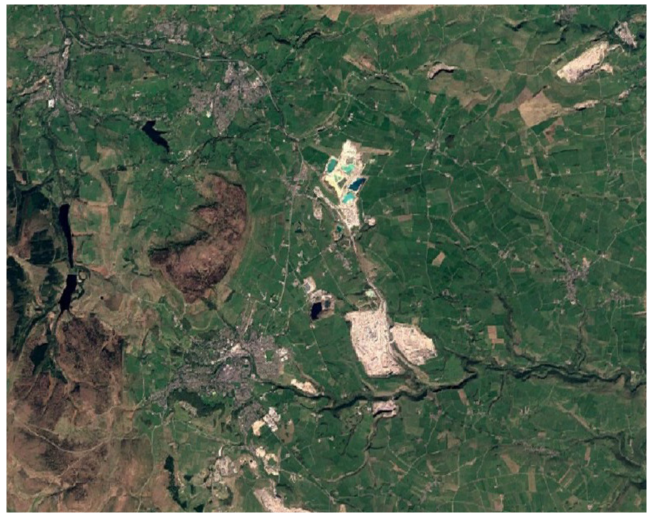
SATELLITE VIEW OF THE SITE IN 1984

PEOPLE

- It was less populated with their own farmlands

- The local economy focused on wool production and agriculture

AFTER EXTRACTION



SATELLITE VIEW OF THE SITE IN 2020

PEOPLE

- Historical connections were severed when the quarry expanded its footprint, consuming local landmarks

- For hikers, the view has shifted from a rural landscape to an industrial scar, altering the experience of the site.

LAND

- The most visible loss is the skin of the earth being peeled away, transformed into a grey industrial canyon.
- It created a deep void which is irreversible

- This drove away wildlife and severed corridors, deterring land animals from crossing the landscape

AIR

- The industrial process of crushing limestone creates significant fine dust - this affects not only animals and people but also the broader environment, as the alkaline dust settles on surrounding woodlands and alters the soil chemistry

- This is now an industrial site with mechanical and electrical machinery noises working in the background.

WATER

- It replaced fresh air with faint chemical smells from vehicles and explosives

-The quarry requires pumping the water out every day. This is to keep the valley floor dry for vehicles

- This de-watering disrupts the natural water table, drying up the surrounding lagoons

How valuable is nature to the site?

Although the original valley was farmland with typically low biodiversity, the extensive removal of topsoil has eliminated the land's ability to sequester CO2 until restoration is complete. However, the most significant negative impact is on water. The limestone originally acted as a natural filter but with mechanical pumps now working 24/7, the local water quality has been altered and the supply to nearby lagoons disrupted.

Who is responsible for protecting the environment?

Legal Regulation - The Environment Agency regulates the environmental permit applied by Tarmac. They have the power to limit operations and remedy to the environmental effects.

Planning – Tarmac is obliged to follow Derbyshire County Council and Peak District Authority under Section 106 Agreements. Including restoration plans in the future.

Natural England – Follows a Biodiversity Action Plan to support the current wildlife in the future.

Corporate Policy – Tarmac set out its own Net Zero policy.

STEEL
MATERIAL RESEARCH

Steel is one of the most widely used and structurally significant material in the modern construction industry. Known for its high tensile strength, durability and versatility, steel plays a fundamental role in enabling large-scale and complex architectural designs.

The UK primarily imports steel or the raw materials to produce it. However, steel is highly recyclable, allowing it to play an important role in circular construction practice.

Despite the UK's reliance on imports, environmental and social impacts still occur at the extraction sites where iron ore and other raw materials are mined. The following research will examine where the UK sources most of its steel from and will explore one of the largest iron ore extraction sites as a case study to access the impacts.

FROM EXTRACTION TO IMPORT

Top 10 Iron ore extraction sites:

1. Australia
2. Brazil
3. China
4. India
5. Russia
6. Iran
7. Canada
8. South Africa
9. Kazakhstan
10. United States

Top 10 steal production sites in the UK:

1. Port Talbot, Wales
2. Scunthorpe
3. Cardiff
4. Rotherham
5. Teesside
6. Skinningrove
7. Sheffield
8. Dudley
9. Bradford
10. Newport

Top 5 Steel Importers to the UK

France

Germany

China

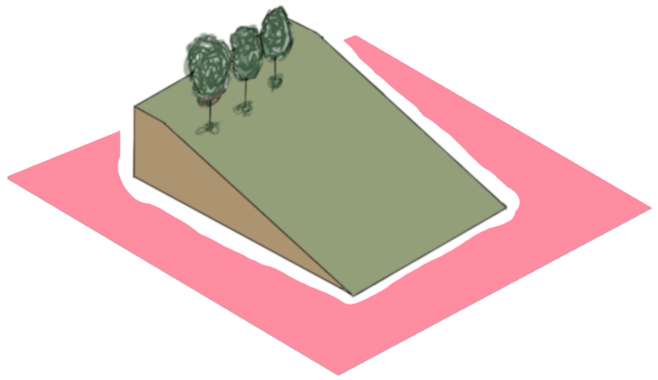
USA

Netherlands

THE MAKING OF STEEL

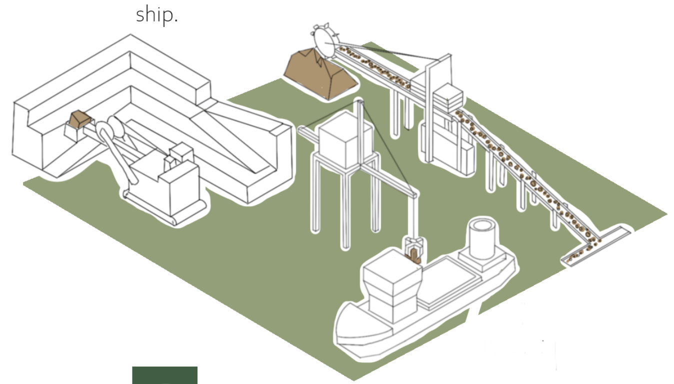
0 Site before extraction

The main raw material used in the production of steel is iron ore. Before extraction begins, these sites were iron ore orginates are often highly biodiverse, with good soil quality that supports thriving local ecosystems.



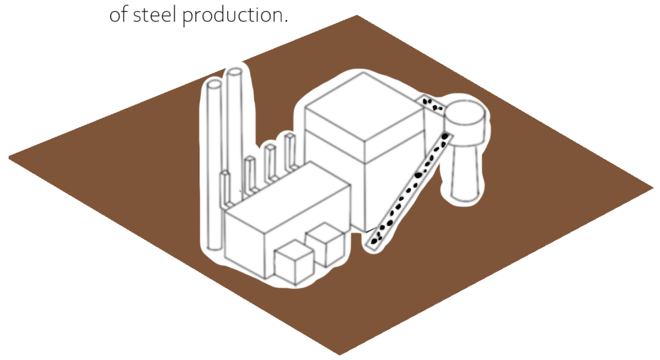
1 Raw material extraction & preperation

Iron ore is extracted from the earth through open-pit mining. The process begins with the removal of the topsoil and overburden before the iron-rich ore is excavated. The mined material is then transported to steel-making sites, usually by ship.



2 Coke making

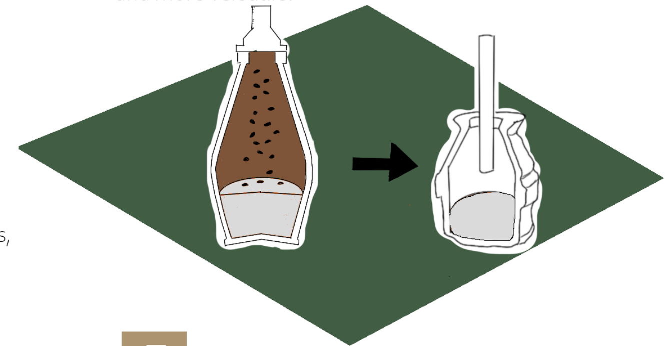
Before steel can be produced, coking coal is required to melt the iron ore. Coal is heated in a low-oxygen environment to remove volatile compounds. This process leaves behind coke, a carbon-rich fuel that burns hotter and cleaner than regular coal. The coke is then cooled and prepared for use in the next stage of steel production.



3 Steel Making

Iron ore is processed and mixed with coke and limestone. This mixture is heated in a blast furnace to temperatures of around 1,500–2,000°C, producing molten iron. As the iron melts, impurities rise to the surface as slag, which is removed. The purified iron, known as pig iron, sinks to the bottom of the furnace and is tapped off.

The pig iron is then transferred to a basic oxygen furnace, where oxygen is blown through it at high pressure to reduce the carbon content. This process produces steel, making the metal stronger and more versatile.

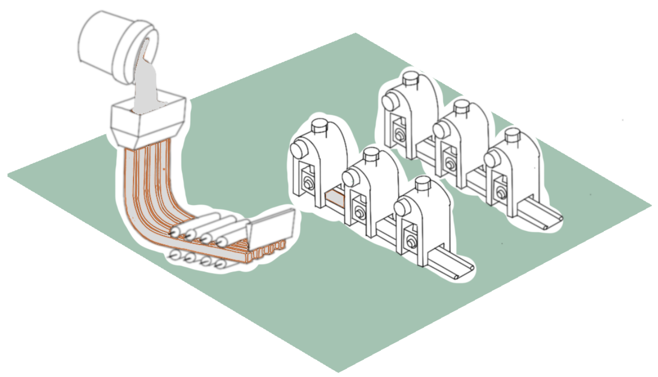


4 Casting & Forming

Steel is poured into water-cooled moulds to form slabs, billets, or blooms. Once the steel has solidified, it undergoes further shaping through either hot or cold rolling.

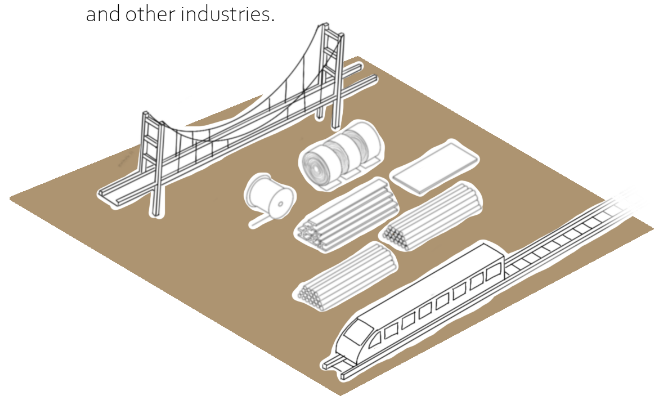
Hot rolling involves reheating the steel before it is passed through rollers to achieve the required thickness and shape.

Cold rolling is carried out at room temperature and produces steel with a smoother surface finish and more precise dimensions.



5 End Product

After the steel has been formed into the desired product, whether beams, sheets, or bars, it undergoes a series of finishing treatments that prepare it for use in construction, manufacturing, and other industries.



Canaã dos Carajás, located in north-eastern Brazil within the Carajás mountain range, is home to the world's largest iron ore mine. The site surrounds the Campos Ferruginosos National Park, an area characterised by dense rainforest and high levels of biodiversity.
To support mining operations, a 550-mile railway is present, linking the remote mountain mines to the port of Ponta da Madeira in São Luís. In 2007 alone, approximately 296 million tonnes of iron ore were extracted from the mine.

BEFORE EXTRACTION

LAND

-Dense Amazon rainforest with a unique ecosystem

- Stable soil and nutrient cycle allowing a wide range of plant life

AIR

- No industrial emissions, dust or combustion-related pollutants

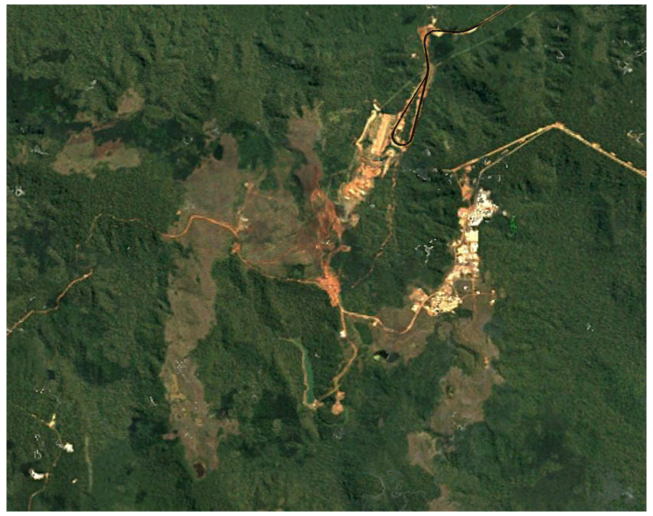
- Rainforest provided a carbon sink helping regulate the regional climate and maintain low atmospheric pollution

WATER

-Rivers were clean and free flowing

- Healthy aquatic ecosystem

- No contamination from heavy metals, chemicals, or sediment runoff



SATELLITE VIEW OF THE SITE IN 1984

PEOPLE

- Sparsely populated area, mainly by indigenous and traditional communities

AFTER EXTRACTION

SATELLITE VIEW OF THE SITE IN 2020

LAND

-Widespread deforestation has occurred to make space for the mining expansion, dam construction, and infrastructure development

- The railway used to transport iron ore has had a negative impact on the surrounding area, causing structural damage to houses located near the tracks, and the removal of some to make space

-Some of the mines are located a few hundred meters away from Campos Ferruginoses National Park (which is protected)

AIR

-Where steel mills are present in Piquiá de Baixo, 65% people suffer from respiratory problems

- Air quality decrease due to loss of vegetation and industrial process.

PEOPLE

- Mining expansion have raised land ownership disputes, particularly affecting indigenous communities whose land rights were established prior to mining

- People have been displaced to make space for mining expansion.

WATER

- Water is a concern to residents in nearby villages as they have dried up in rivers

- Rivers in Piquiá de Baixo are polluted due to nearby steel plantations

How valuable is nature to the site?

The site where the mines are is extremely valuable due to the rare, biodiversity and irreplaceable environment. The soil is iron-rich which helps support many endemic plants and animal species that can not survive elsewhere.

The surrounding rainforest is home to hundreds of species making it one of the most biologically diverse areas on Earth.

To help maintain the nature rehabilitation effets have began at Carajas focusing on restoring degraded areas of the Carajas National forest - This is done by planting more than 500,00 seedlings to help expand the native vegetation, creating new micro-habitats for wildlife – helps to restore the area back to its historical conditions.

Who is responsible for protecting the environment?

-Vale – who are the main operators and owner of the mines are responsible for the direct environmental management of the site. This includes adhering to environmental laws, reducing carbon emissions and implementing "dry mining" processes that do not use water in beneficiations. They have also taken initiatives independently to rehabilitate the native forest.

-ICMBio (Chico Mendes Institute for Biodiversity Conservation) – a federal agency that manages the Carajás National Forest - where the mines are located – oversee the environmental protection of the area.

-IBAMA (Brazilian Institute of the Environment and renewable Natural Resources) – a national authority that issues environmental licences, monitors compliance and issues fines to the mines for environmental infractions.

ALUMINIUM

MATERIAL RESEARCH

Aluminium is a widely used material valued for its lightweight properties, corrosion resistance, and high strength-to-weight ratio. It is commonly used in façades, window frames, roofing systems, and structural components within the construction industry.

The UK primarily imports aluminium; however, it is highly recyclable and can be repeatedly reprocessed without losing its essential properties. Recycling aluminium requires significantly less energy than primary production, making it an important material in sustainable and circular construction practices.

Bauxite mining, the primary method of producing aluminium, is an invasive process that can lead to significant environmental change. The following research will examine the process of aluminium production and, using one of the largest bauxite mines as a case study, will explore the environmental and social impacts that occur as a result.

FROM EXTRACTION TO IMPORT

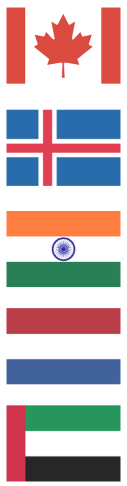
Top 10 Bauxite extraction sites:

1. Australia
2. China
3. Guinea
4. Brazil
5. India
6. Indonesia
7. Russia
8. Jamaica
9. Kazakhstan
10. Saudi Arabia

Top 10 aluminium production sites in the UK:

1. Lochaber Fort William (Scottish Highlands)
2. West midlands (Birmingham, Smethwick, Wednesbury)
3. Cumbria
4. Shropshire (Bridgnorth)
5. North East England (Teeside ,Lynemouth)
6. Manchester
7. Curham
8. South Wales
9. Cornwall / Devon
10. Herefordshire

Top 5 Aluminium Importers to the UK

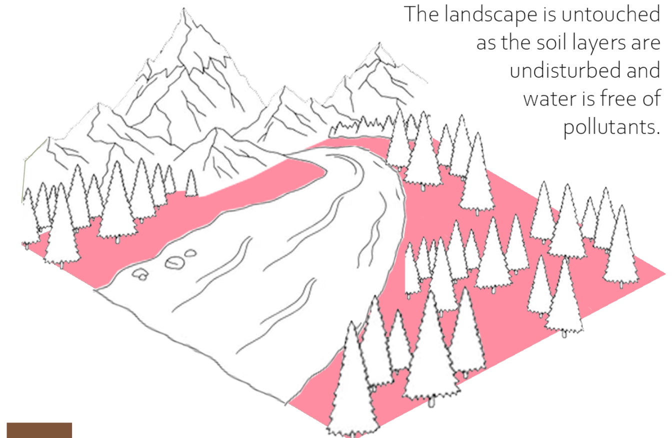


Canada
Iceland
India
Netherlands
UAE

THE MAKING OF ALUMINIUM

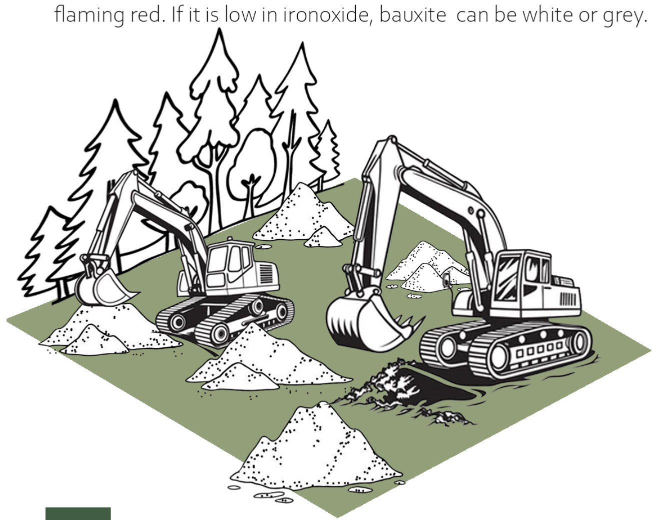
0 Site before extraction

The land is characterised by dense forests and thrives with biodiversity. The landscape is untouched as the soil layers are undisturbed and water is free of pollutants.



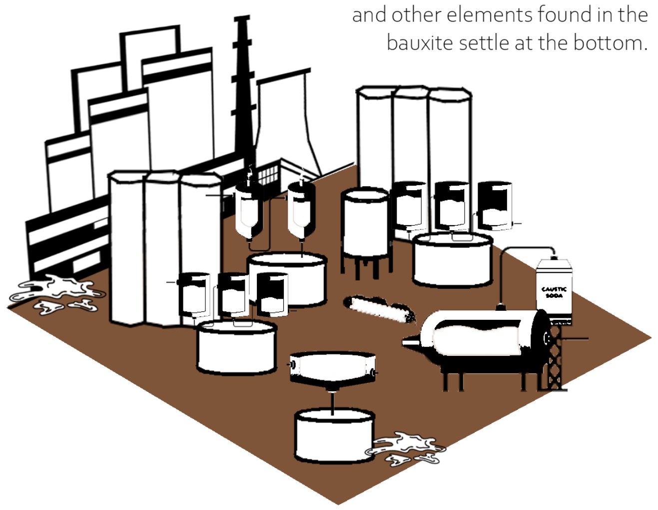
1 Bauxite Mining

Bauxite is extracted from the ground. This is the most common material in aluminium production, normally brick red, red or flaming red. If it is low in ironoxide, bauxite can be white or grey.



2 Bayer Process

The aluminium hydrate found in the bauxite is dissolved in concentrated caustic soda at high temperatures. Aluminium hydrate crystallises when the temperature is lowered, and other elements found in the bauxite settle at the bottom.

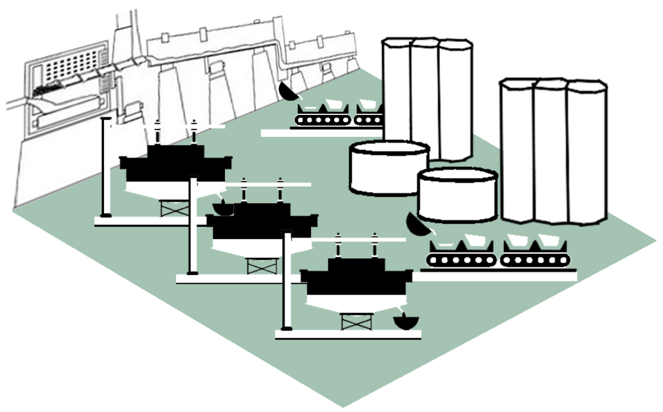


3 Filtration & Extraction

The aluminium crystals are large and easily filtered from the solution. The crystals are washed with water, dried and heated to remove the water. This produces alumina.

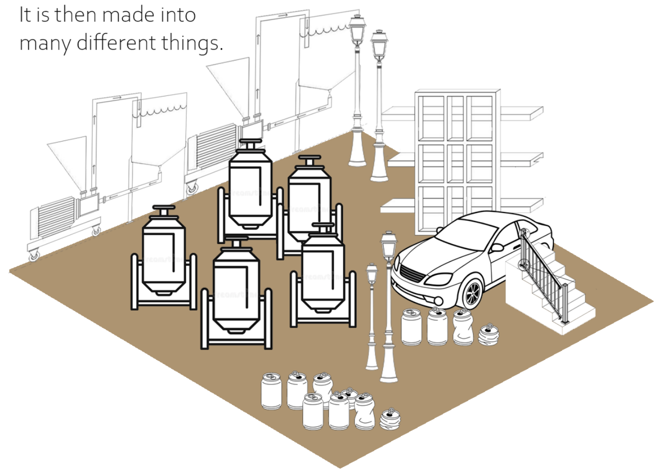
4 Smelting Process

Alumina produces aluminium through electrolysis using cryolite. In the smelter, reduction cells are hooked up to power sources. The high temperatures and conductive environment causes the aluminium to settle. Spcial vaccum buckets are used to extract the aluminium from the cells.



5 Cast House & Industry

The aluminium is taken to the cast house and put into weights. It is given different chemical compositions by mixing it with other alloying elements to increase its strength, heat transmission properties and make it denser.
It is then made into many different things.



The Sangaredi mine is the second largest bauxite producer in the world. The reserves are estimated to be 25 billion tonnes, making up a third of the world's reserves so it has significant economic importance. It has exceptional ore quality containing approximately 50% alumina. It has a green operation with a focus on corporate social responsibility (CSR), the promotion of health and safety of its employees, and the protection of the environment.

BEFORE EXTRACTION

LAND

-Savannah woodland with scattered trees

- Intact soils with stable slopes

- High biodiversity

- No industrial presence

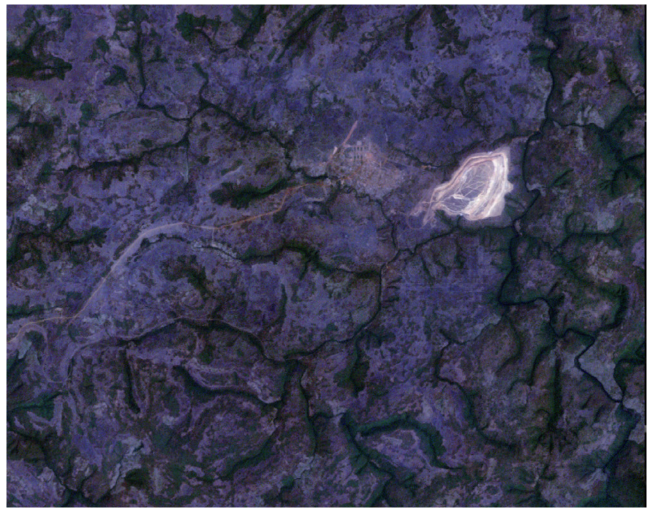
AIR

-No dust and non-polluted air

WATER

-The plateau served as a watershed feeding local rivers and streams

- Natural drainage system



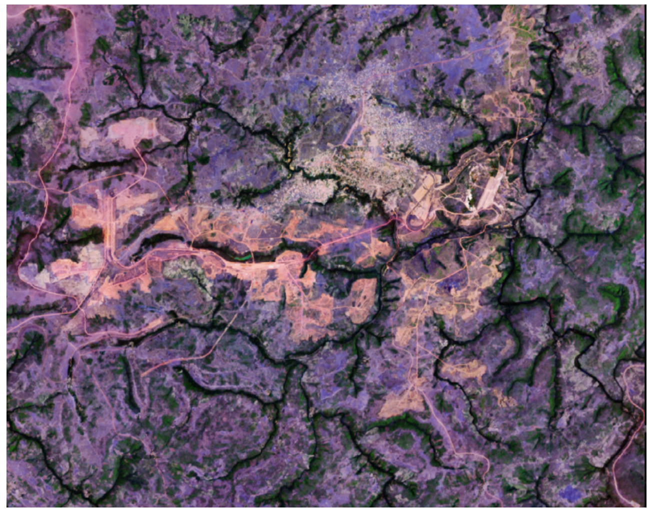
SATELLITE VIEW OF THE SITE IN 1986

PEOPLE

- Village farmland

-Community resources, such as farming, hunting and collecting firewood

AFTER EXTRACTION



SATELLITE VIEW OF THE SITE IN 2023

PEOPLE

- Health impacts from exposure to unknown radiation

- Loss of land and land dispossession, leading to unemployment, loss of livelihood and increased corruption

LAND

- Red mud produced from alumina refining process negatively affects surfaces and groundwater quality

- Soil contamination from things like oil spills

- Crop damage due to loss of soil fertility, causing food insecurity
Construction of the 135km long railway between the mine and Kansar harbour disrupting large amounts of land

AIR

- Emissions causing pollution

- Toxic dust settling on nearby infrastructure

WATER

-Surface water pollution

- Decreasing water quality due to physico-chemical and biological contamination

How valuable is nature to the site?

It is one of the world's most biologically rich ecosystems, which is now under threat. This biodiversity includes five reptile species, 17 amphibian species, 140 bird species, 16 mammal species, and eight primate species.

Who is responsible for protecting the environment?

CBG (Compagnie des Bauxites de Guinée) has voluntarily adopted the International Finance Corporation's (IFC) Performance Standard 6 (PS6), which focuses on the preservation of biodiversity and ecosystems. Compliance with this standard is a key performance indicator of operational excellence.

CLAY/BRICK

MATERIAL RESEARCH

Brick is a vital material in UK construction, both historically and in contemporary practice. It is widely visible in architecture across the UK and is primarily made from clay, a natural raw material.

Due to its strong performance under compression, brick is particularly suitable for load-bearing walls and structural applications. Its durability and longevity have contributed to its continued use throughout British architectural history.

As brick is produced from a natural material that can be sourced within the UK, it has the potential to reduce reliance on imported construction materials. However, the extraction of clay can result in significant environmental change, including landscape disruption, habitat loss, and alterations to local ecosystems.

The following research will explore these environmental impacts and examine a UK-based case study to further understand the social and environmental effects associated with clay extraction and brick production.

FROM EXTRACTION TO IMPORT

Top 10 clay extraction sites globally:

1. United States
2. UK
3. Brazil
4. China
5. Czech Republic
6. Germany
7. India
8. Ukraine
9. Australia
10. ?

Top 10 clay production sites in the UK:

1. Desford (Leicestershire)
2. Whittlesey (Cambridgeshire)
3. Waresley (Worcestershire)
4. Ewhurst (Surrey)
5. Kirton (Nottinghamshire)
6. Lodge Lane (Somerset)
7. Grimethorpe (Yorkshire)
8. Smeed Dean (Kent)
9. Measham (Leicestershire)
10. Charnwood (Leicestershire)

Top 5 Brick Importers to the UK

- Spain
- Netherlands
- Germany
- Denmark
- Belgium

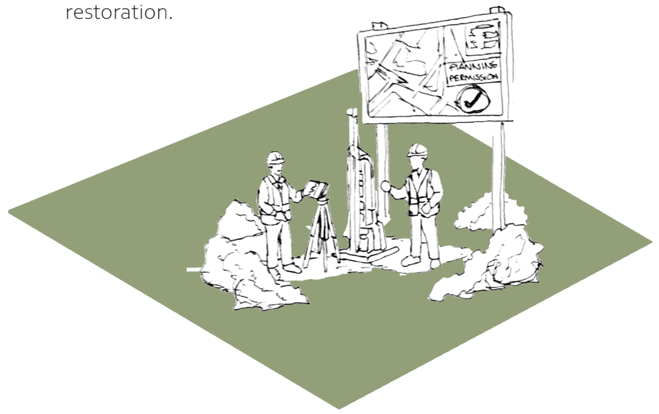
THE MAKING OF CLAY/BRICK

0 Site before extraction

The land is in its natural or current condition, typically existing as agricultural fields, woodland, or low-density scrubland. This represents the site's ecological and hydrological baseline, supporting local flora and fauna..

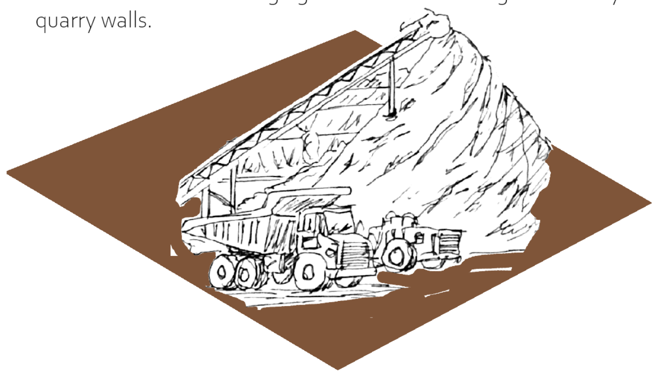
1 Exploration & Planning

Before excavation can begin, geologists and surveyors must precisely map the extent and quality of the clay deposits. This stage requires rigorous planning permission from local authorities, including mandatory environmental impact assessments. The process secures the legal right to extract, sets conditions for operation, and dictates the final plans for land restoration.



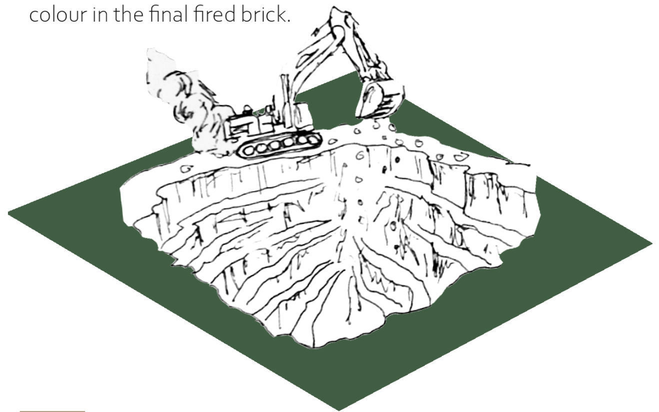
2 Quarrying (Minning)

This is the physical extraction of the raw clay and shale from the ground, typically carried out in a tiered, open-pit quarry. Large hydraulic excavators and heavy-duty machinery are used to dig the clay from the quarry faces. The primary goal is to efficiently "win" the bulk material while managing dust and maintaining the stability of the quarry walls.



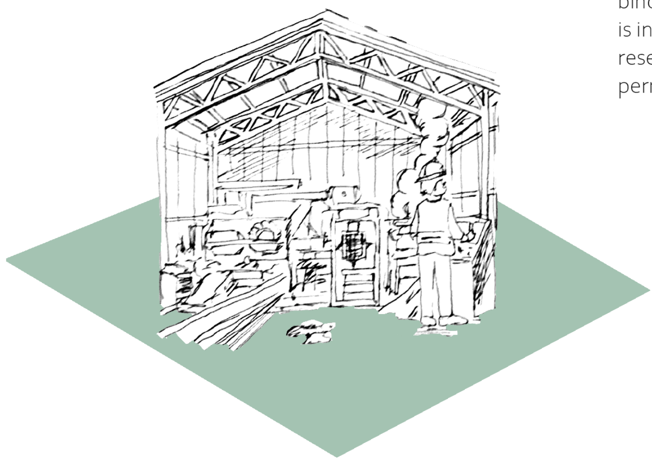
3 Transport & Stockpiling

Once excavated, the clay is transported a very short distance, often less than a mile, either by internal conveyor belts or dump trucks, to the brick factory site. The raw materials are placed into large stockpiles where different types of clay are blended. This blending ensures a consistent chemical and geological mix, which is crucial for achieving the desired strength and uniform colour in the final fired brick.



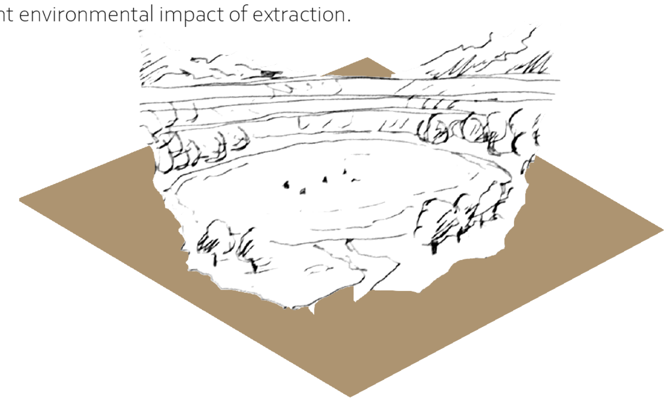
4 Crushing & Milling

At the factory, the raw clay must be prepared for moulding. The material is fed into heavy-duty crushers and mills to break down large lumps and grind the clay into a fine, consistent particle size. This ensures the material achieves maximum plasticity when water is added and prevents structural defects like cracking during the later high-temperature drying and firing processes.



5 Land Restoration

As the final step in the quarrying lifecycle, the spent quarry is subject to a legally binding restoration plan. The site is reshaped, topsoil is replaced, and new planting is introduced to return the land to an agreed beneficial use, often becoming nature reserves, wetlands, recreational areas, or agricultural land, mitigating the permanent environmental impact of extraction.



Located on the southern edge of Dartmoor in Devon, Lee Moor sits within a landscape rich in high-quality china clay (kaolin) deposits. While kaolin is best known for its use in porcelain, paper coating, and sanitary ware, its extraction at Lee Moor also supported the wider clay and brick-making industry, supplying raw material for construction and industrial uses across the region. This quarry acts as a case study for the excavation of clay.

BEFORE EXTRACTION

LAND

- Typical grassy moorlands with acidic, free-draining soils that support low-growing vegetation adapted to the climate

AIR

- The typical moorlands have impeccable air quality, catering to the existing nature and its inhabitants

WATER

- The water quality is typically low in dissolved organic carbon, and high quality as they naturally are filtered. In its natural state, untouched, the water quality has low sediment concentrations and minimal pollutants

SATELLITE VIEW OF THE SITE IN 2002

PEOPLE

- Historically, Lee Moor had Medieval inhabitation, involving mixed-farming and livestock grazing the open Moor. However there was no adequate population of inhabitation due to its use for tin-farming, and the poor living conditions. Noise and air quality was all excellent as the lands were untouched, which meant for a tranquil environment for those who traversed the area

AFTER EXTRACTION

SATELLITE VIEW OF THE SITE IN 2025

LAND

-Large open pits, steep quarry faces, and waste tips permanently alter the original moorland

- Topsoil and subsoil are removed or buried, destroying natural soil structure. This leads to habitat loss and fragmentation, particularly of heathland and grassland, leaving land unsuitable for agriculture

AIR

-Fine koalin particles (clay mineral) are released during excavation, dry mining and the crushing/screening and transport of raw material

- Dust can travel beyond the quarry boundary via wind - this affects nearby vegetation by coating leaves and reducing photosynthesis

- Machinery emissions also heavily affect air quality. Diesel-powered excavators, dump trucks, and processing plant contribute CO_2 emissions, nitrogen oxides and particles

PEOPLE

-Direct jobs include quarry workers, engineers and plant operators. Indirect jobs include transport, maintenance and general services. This is a significant contributor to the local rural economy

Noise pollution arises from excavation, processing plant and vehicle movements which can affect nearby settlements and the existing rural tranquillity.

WATER

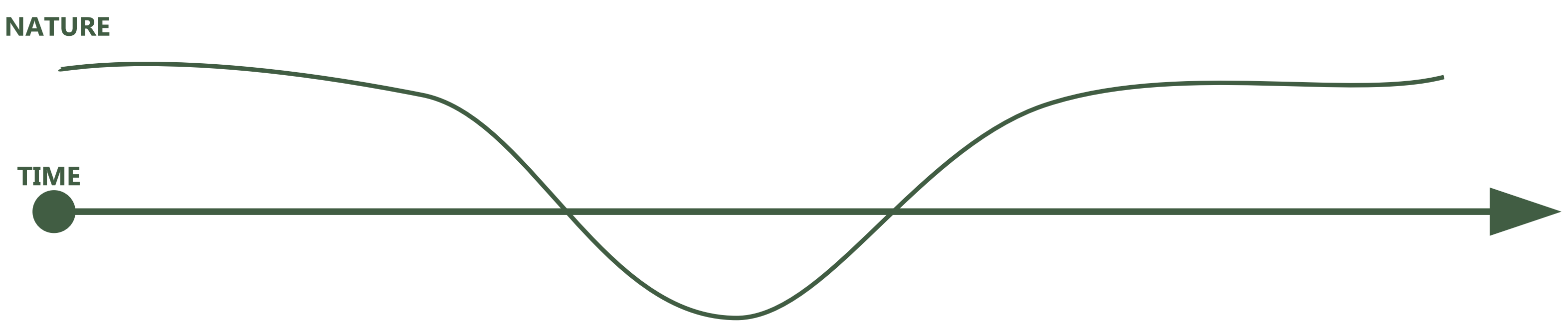
-Natural drainage patterns are permanently changed, streams are diverted into leats, channels and lagoon

- Several water pollution risks, such as clay particles being suspended in water, which increases turbidity

- Changes in water table levels may affect nearby ecosystems

How valuable is nature to the site?

The site is a haven for birds of prey and heathland specialists, including the Peregrine Falcon, Dartford Warbler, Skylark, and Golden Plover. In the water bodies and damp areas, you can find rare invertebrates like the Small Red Damselfly and the Keeled Skimmer.



Who is responsible for protecting the environment?

Primary Owners/Operators: Imerys Minerals Ltd: They own the freehold (the land) and have extracted clay here for decades.

Sibelco UK Ltd: Since 2007, Sibelco has been the primary operator extracting clay at Lee Moor under a royalty agreement with Imerys

EXTRACTION SITE VS THE OPDC

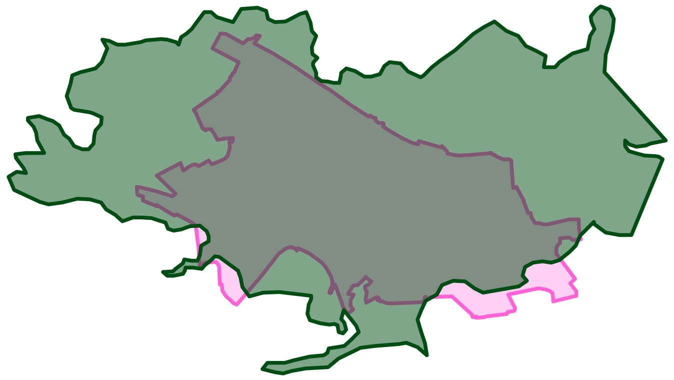
EXTRACTION SIZE AND DEPTH

Most of the materials referenced in this research are found within the OPDC area. Whether used in construction or as part of existing infrastructure, the use of these materials always has environmental and spatial impacts at their original extraction sites.

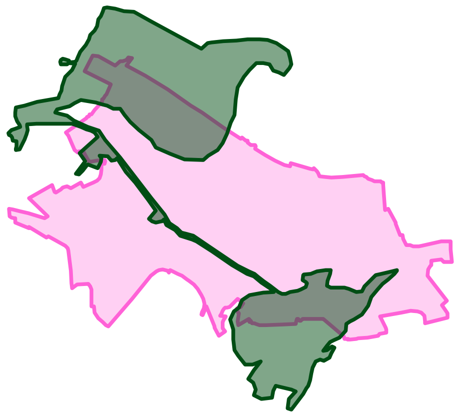
The following six diagrams compare the size of each material's extraction site (outlined in green) with the area of the OPDC (shown in pink). These comparisons clearly show that the extraction sites for some materials—such as steel, aluminium, and timber—are significantly larger than the OPDC itself.

The diagrams also compare the extraction depths of both sites, providing a clearer understanding of the variations in extraction depth verses the depth of the OPDC.

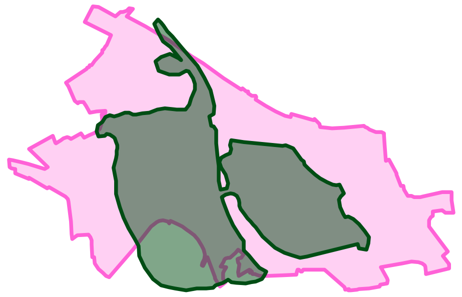
This highlights the substantial scale and importance of extraction sites, and emphasises the need for greater consideration of the environmental and spatial impacts of material extraction, not just their application within the OPDC.



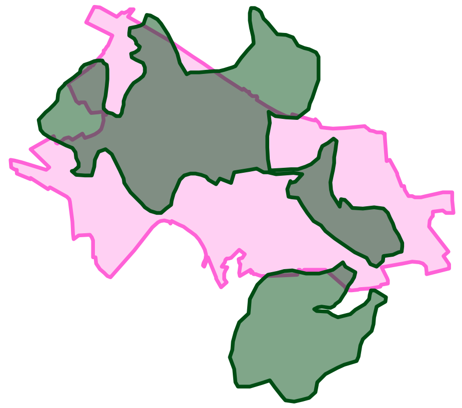
The OPDC   Galloway and Dumfries Extraction Site (Timber)



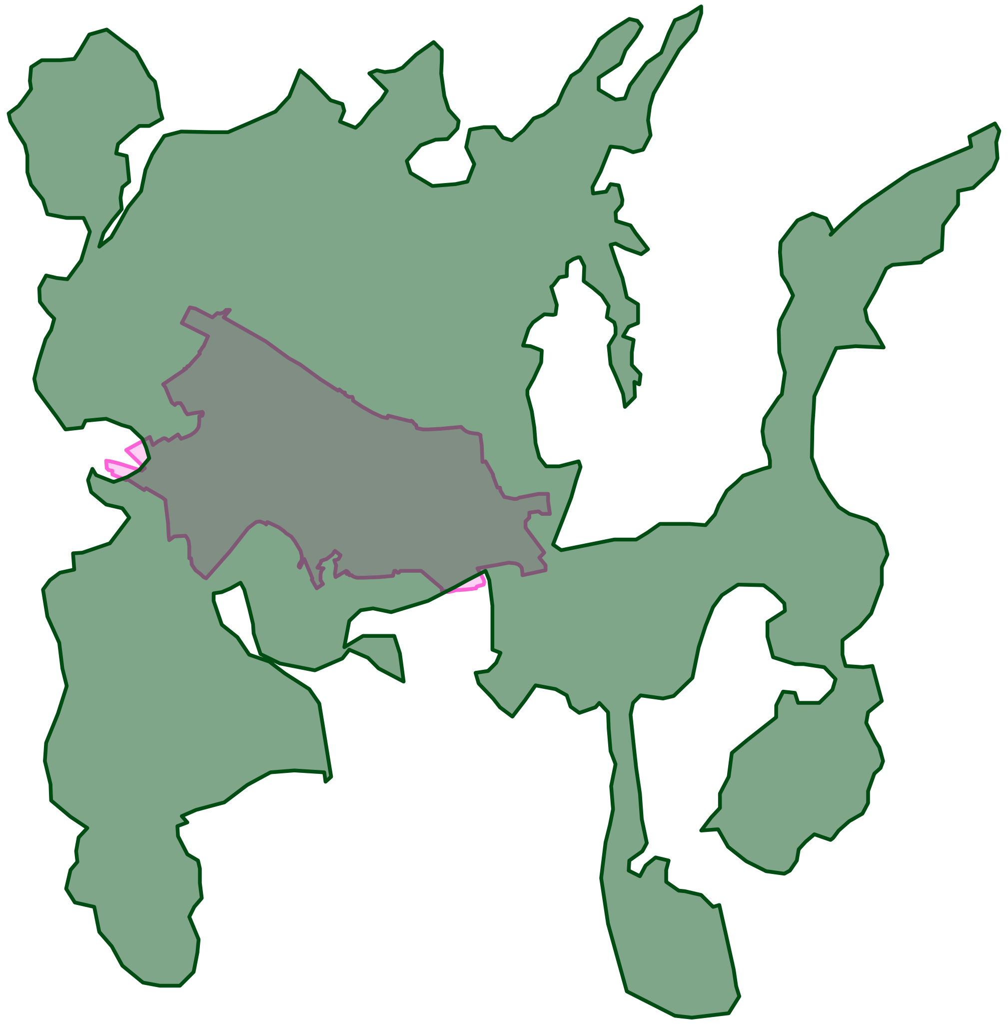
The OPDC   Glensanda Extraction Site (Stone)



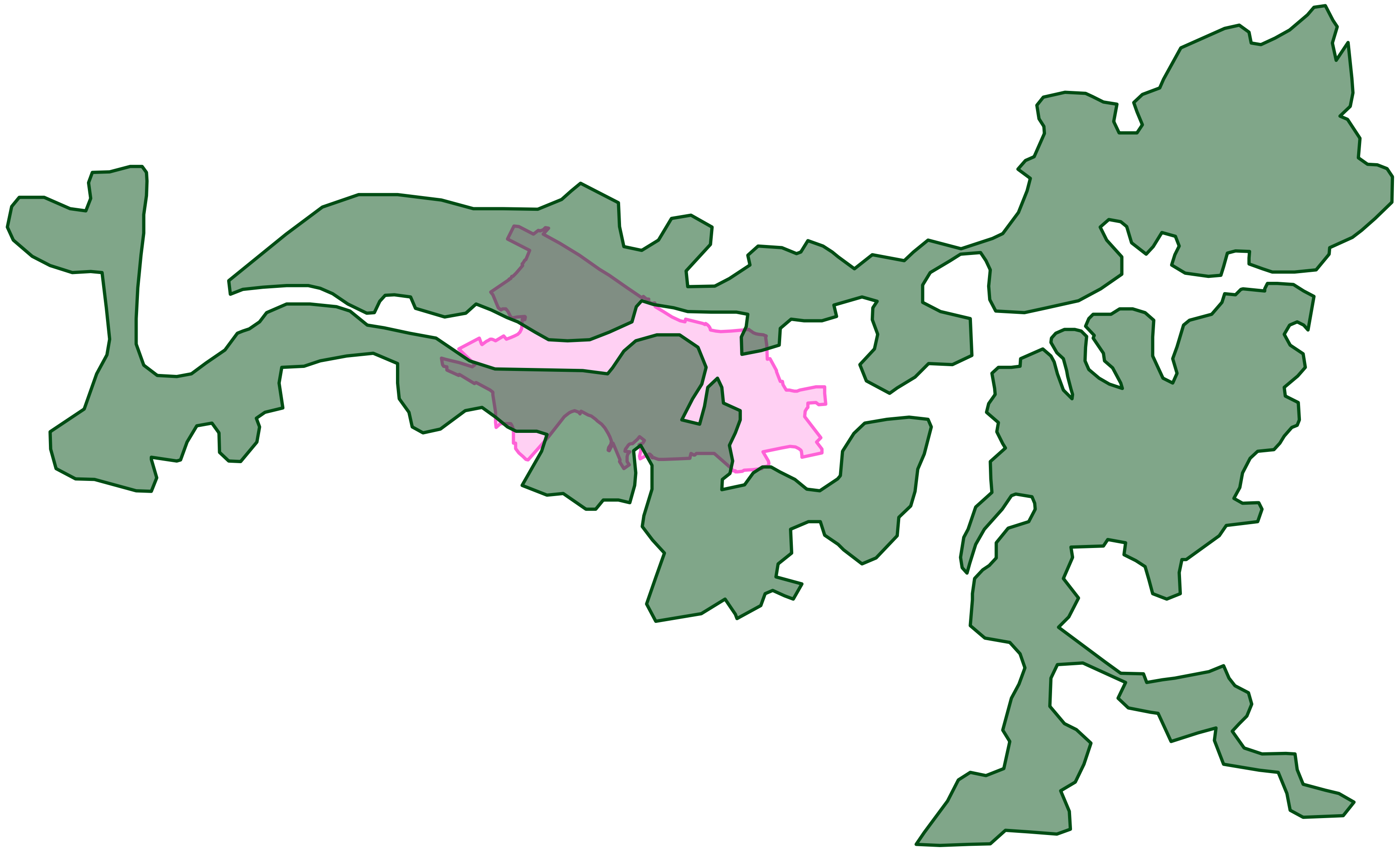
The OPDC   Tunstead Extraction Site (Cement)



The OPDC   Lee Moor Extraction Site (Clay)



The OPDC   Carajas Extraction Site (Steel)



The OPDC   Sangaredi Extraction Site (Aluminium)

EXTRACTION DEPTH

PER SQUARE METER

Through research, investigation, and comparison of the extraction sites and the OPDC, it was evident that site depth also needed to be considered.

From the comparison between the extraction site areas and the OPDC, it was concluded that there is no correlation between the size of an extraction site and the amount of material produced.

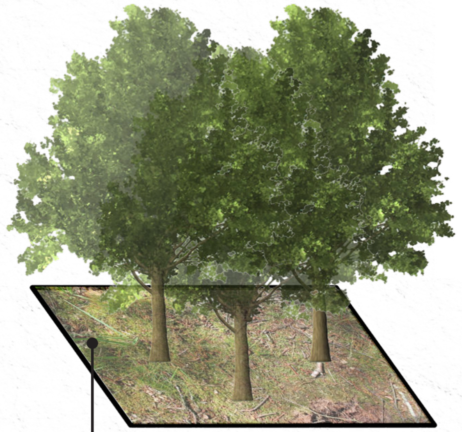
The diagrams below illustrate the amount of material produced per square metre of extraction site.

The table illustrates the quantity of material extracted per square metre across the different extraction sites.

Lowest Yielding Material ↑

Timber	36.72 kg/m²
Clay/Brick	92.75 kg/m²
Aluminium	349.21 kg/m²
Cement	1,749.36 kg/m²
Stone	2,119.29 kg/m²
Steel	3,806.40 kg/m²

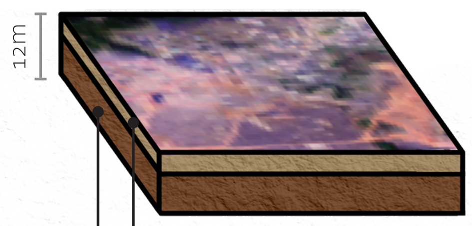
Highest Yielding Material ↓



TIMBER

Timber is extracted at surface level; as a result, the size of the extraction site is directly equivalent to the amount of material produced.

In the case of the Galloway and Dumfries extraction site, 36.72 kg/m² of timber is extracted.

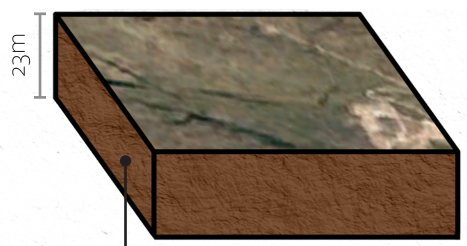


ALUMINIUM

Before bauxite (the raw material of aluminium) can be extracted, the first 1–2 metres of soil—typically iron-rich—must be removed.

Following the removal of this overburden, the bauxite zone begins, where extraction can commence.

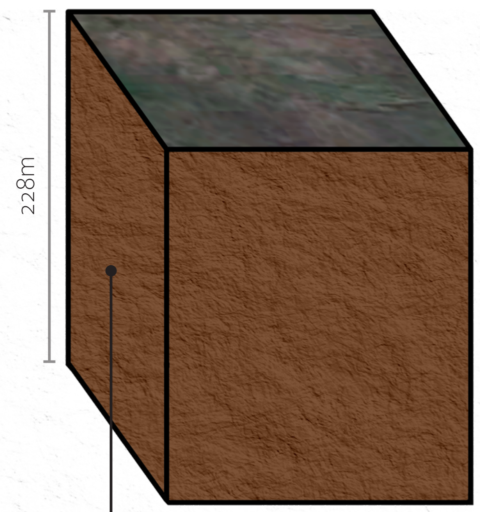
In the case of the Sangaredi extraction site, 349.21 kg/m² of material is extracted.



STONE

Stone is primarily extracted through open-pit mining, reaching depths of up to 23 metres below the surface.

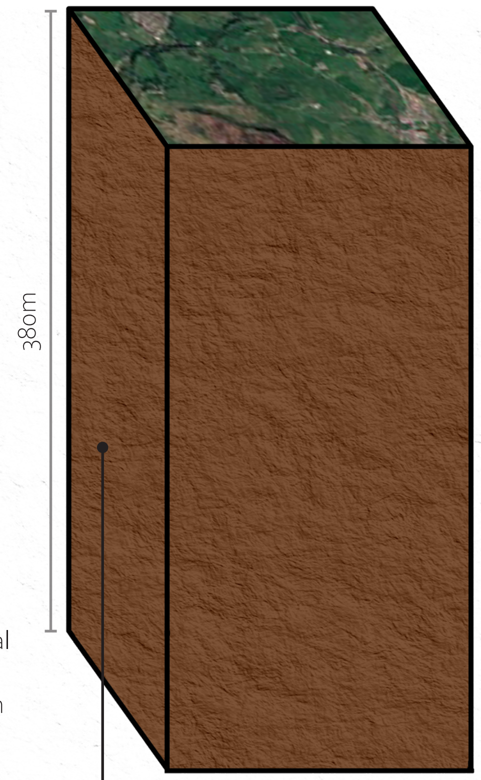
In the case of the Glensanda extraction site, 2,119.29 kg/m² of material is extracted.



CLAY

Clay extraction allows all material from the extraction site to be utilised, and extraction can reach depths of up to 228 metres.

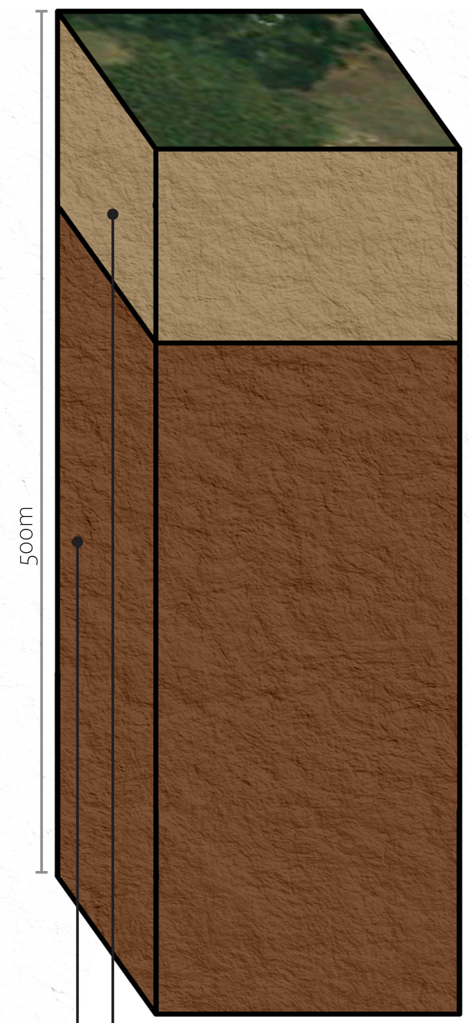
In the case of the Lee Moor extraction site, only 92.75 kg/m² of material is extracted.



CEMENT

Cement extraction allows all material from the extraction site to be utilised, while extraction can reach depths of up to 380 metres.

In the case of the Tunstead extraction site, only 1,749.36kg/m² of material is extracted.



STEEL

Before iron ore (the primary raw material for steel) can be extracted, the weathered surface layer of soil—typically extending to around 100–150 metres—is removed as overburden.

The iron ore itself occurs in deeper banded iron formations that extend well below this weathered zone by 350-400m.

In the case of the Carajás extraction site, 3,806.40 kg/m² of material is extracted.

When considering extraction sites, it is also important to account for the depth at which materials are extracted. For some materials, a clear relationship exists whereby greater extraction depths result in higher material yields. However, for others, no consistent correlation can be identified between extraction depth, site size and the quantity of material produced.

POLICY & FRAMEWORK
EXISTING

This chapter examines the existing frameworks, policies and metrics that aim to contribute towards a more nature-positive environment.

The research undertaken in this chapter provides a deeper understanding of the areas currently addressed by these policies, frameworks and metrics, while also highlighting their limitations and opportunities for improvement.

In particular, it explores gaps in current legislation and guidance where key factors may not be adequately considered to ensure that the built environment contributes positively to nature and the wider environment.

04

THE PHILOSOPHER

While 'Nature Positive' is a relatively recent concept, a number of established frameworks already exist to help reduce human impact on the environment.

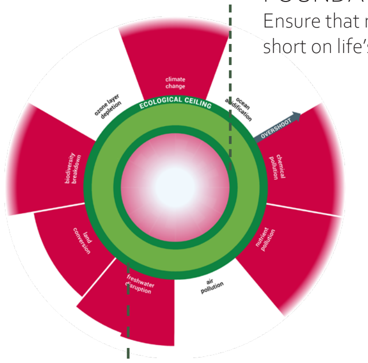
To better understand both the practical and theoretical foundations of these approaches, the Doughnut Economics model has been adopted as a guiding baseline. This framework enables us to evaluate strategies for designing within ecological limits while supporting regenerative development.

Alongside this, existing frameworks have been analysed to help develop a more robust metric for assessing and ranking building materials based on their 'Nature Positive' potential. To support this process, the UKGBC (UK Green Building Council) Embodied Ecological Impact Framework has been used as the primary reference point.

The Doughnut Model

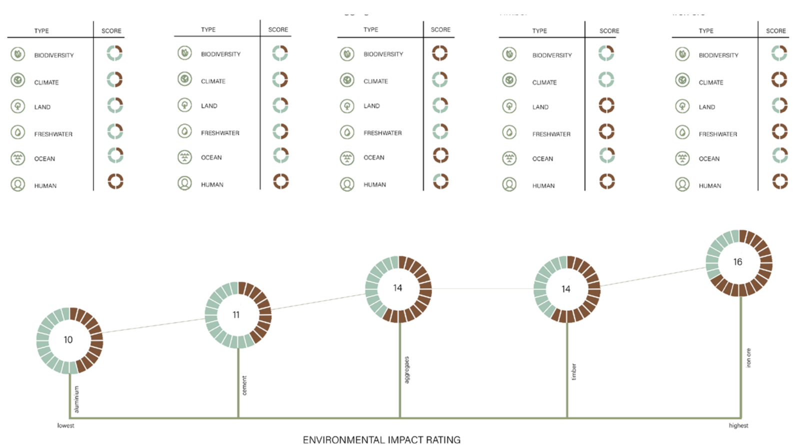
The Doughnut Economics model serves as a non-static, living framework that is constantly evolving to reveal gaps in our current systems. It provides a visual roadmap for what it means for humanity to thrive in the 21st century, offering the mindset required to reach that goal through two concentric rings.

Ultimately, the framework aims to design economies that meet human needs without overshooting the planet's ecological limits. Falling short of the inner ring signifies a lack of life's necessities, whereas exceeding the outer ring indicates that human activity is actively damaging Earth's vital life-support systems.



UKGBC Embodied Ecological Impacts Framework

The Embodied Ecological Impacts section highlights that the environmental impact of materials extends beyond carbon emissions alone. It notes that buildings and infrastructure occupy approximately 1% of the Earth's surface, meaning it is insufficient to focus solely on the construction site when assessing the global ecological impacts of materials. Instead, the full lifecycle of materials must be considered, particularly the extraction stage. Global biodiversity populations have declined by 69% since 1970; however, if extraction practices accounted for their environmental consequences, this trend could be reversed, creating opportunities for nature-positive outcomes.



Alongside this, initiative will be taken to highlight the importance of avoiding extraction methods that push ecosystems beyond their capacity to recover, encouraging more responsible material choices and processes. At the same time, consideration will be given to how materials used for housing and infrastructure support human wellbeing.

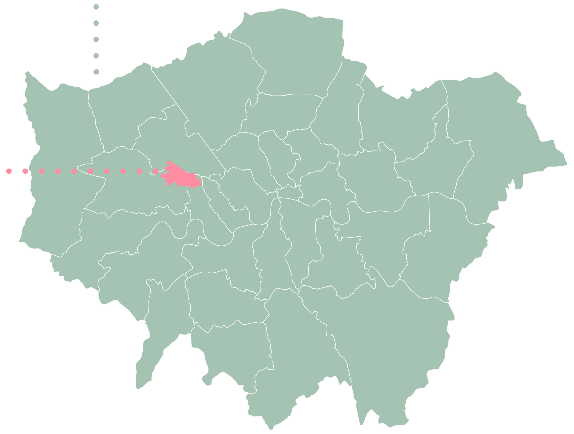
By balancing these environmental and social factors, this think tank aims to develop an approach that ensures both local communities and natural ecosystems can thrive.

CURRENT FRAMEWORK AND POLICIES

A key part of our initial research involved identifying the legislation and policies that influence how we build and how development contributes to the environment.

The following have been identified across a range of scales to demonstrate the range of regulations and guidance that must be considered when undertaking any development.

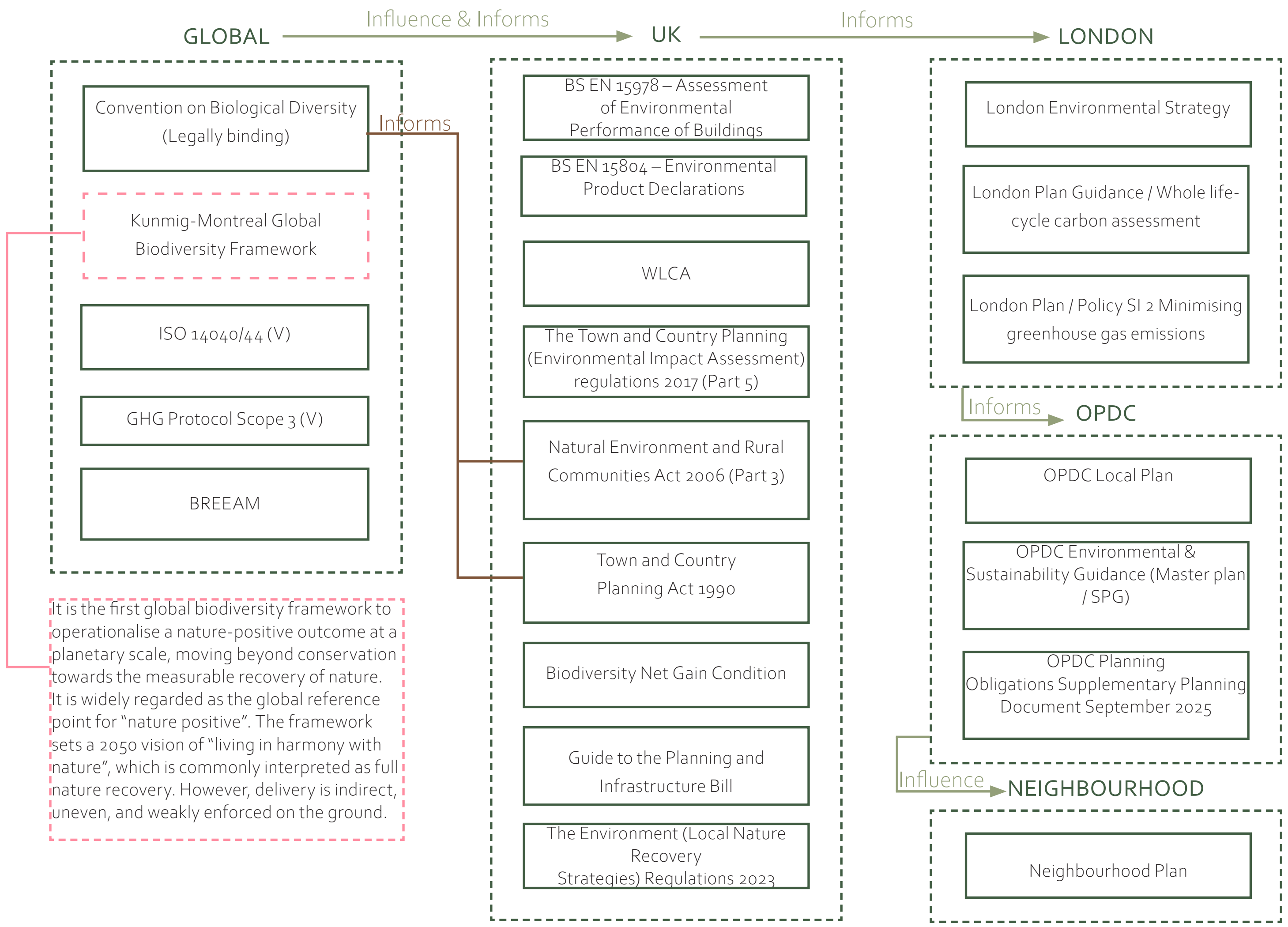
Some of these are mandatory, while others provide voluntary frameworks that support more environmentally responsible practices:



LIMITATION IN CURRENT POLICIES

Many of the policies that influence the way we design operate across different scales and often overlap. However, there are limitations that restrict the extent to which these policies can fully contribute to supporting nature. These include the hierarchy within the planning and legislative system, where one piece of legislation may override another that could potentially have greater environmental significance. In addition, certain policies contain loopholes or provisions that mean they are not always mandatory in practice.

As part of this Think Tank research process, these scenarios were explored and analysed in order to identify the current gaps within existing policy and legislative frameworks.



The analysis of how these policies are related helped us identify areas where policy intervention is necessary as a first step towards a nature-positive design. These policies were studied in depth to ensure that the policy created as part of this Think Tank enables relevant and effective application, allowing for a nature-positive building.

SCHEDULE 14 Section 98

BIODIVERSITY GAIN AS CONDITION OF PLANNING PERMISSION

PART 1

BIODIVERSITY GAIN CONDITION

1 In the Town and Country Planning Act 1990, after section 90 insert—

"Biodiversity gain

90A Biodiversity gain in England

Schedule 7A (biodiversity gain in England) has effect."

2 In that Act, after Schedule 7 insert—

"SCHEDULE 7A Section 90A

BIODIVERSITY GAIN IN ENGLAND

PART 1

OVERVIEW AND INTERPRETATION

Overview

1 (1) This Schedule makes provision for grants of planning permission in England to be subject to a condition to secure that the biodiversity gain objective is met.

(2) Paragraphs 2 to 12 have effect for the purposes of this Schedule.

Biodiversity gain objective

2 (1) The biodiversity gain objective is met in relation to development for which planning permission is granted if the biodiversity value attributable to the development exceeds the pre-development biodiversity value of the onsite habitat by at least the relevant percentage.

(2) The biodiversity value attributable to the development is the total of—

(a) the post-development biodiversity value of the onsite habitat,

(b) the biodiversity value, in relation to the development, of any registered offsite biodiversity gain allocated to the development, and

(c) the biodiversity value of any biodiversity credits purchased for the development.

(3) The relevant percentage is 10%.

(4) The Secretary of State may by regulations amend this paragraph so as to change the relevant percentage.

The primary focus is placed on the development site as a result, there is no reference to potential disturbances to biodiversity at extraction sites associated with material extraction.

In addition, the percentage targets outlined in this policy is vague and there is limited guidance on how these targets should be achieved in practice.

2023 No. 341

The Environment (Local Nature Recovery Strategies) (Procedure) Regulations 2023

Involvement of supporting authorities and other persons in the preparation of a local nature recovery strategy

4.—(1) A responsible authority must take reasonable steps to involve all supporting authorities for its local nature recovery strategy in the preparation of the local nature recovery strategy.

(2) The responsible authority must, in particular—

(a) ensure the supporting authorities are provided with such information pertaining to the local nature recovery strategy as the responsible authority considers relevant;

(b) ensure that supporting authorities are aware of how they may contact the responsible authority; and

(c) have regard to any opinions expressed by the supporting authorities in relation to the local nature recovery strategy.

(3) The responsible authority must take reasonable steps to involve such persons and organisations as appear to the responsible authority to be appropriate in the preparation of its local nature recovery strategy.

(4) The responsible authority must consider—

(a) how it intends to involve the supporting authorities, persons and organisations in the preparation of its local nature recovery strategy;

(b) which aspects of the statement of biodiversity priorities(**1**) for the strategy area in respect of which it intends to involve the supporting authorities, persons or organisations; and

(c) which aspects of the local habitat map(**2**) for the strategy area in respect of which it intends to involve the supporting authorities, persons or organisations.

(5) The responsible authority must keep under review—

(a) the persons and organisations it considers are appropriate to involve;

The Environment Regulation only provides guidance for development and informs local plans. Due to jurisdiction it has, it is not mandatory and does not apply directly to individual projects. Despite addressing several important issues, the influence does not reach the required levels.

2017 No. 407

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

PART 5

Environmental objectives and programmes of measures

The environmental objectives

13.—(1) The environmental objectives referred to in regulation 12 are, subject to regulations 14 to 19, the following objectives for the relevant type of water body or area.

(2) For surface water bodies, the objectives are to—

(a) prevent deterioration of the status of each body of surface water;

(b) protect, enhance and restore each body of surface water (other than an artificial or heavily modified water body) with the aim of achieving good ecological status and (subject to paragraph (3)) good surface water chemical status, if not already achieved, by 22nd December 2021;

(c) protect and enhance each artificial or heavily modified water body with the aim of achieving good ecological potential and (subject to paragraph (3)) good surface water chemical status, if not already achieved, by 22nd December 2021;

(d) aim progressively to reduce pollution from priority substances and aim to cease or phase out emissions, discharges and losses of priority hazardous substances.

(3) The objectives in paragraph (2)(b) and (c) are to be read as though they referred to achieving good surface water chemical status—

(a) in relation to substances 2, 5, 15, 20, 22, 23 and 28 in the table of priority substances, by 22nd December 2021;

(b) in relation to substances 34 to 45 in the table of priority substances, by 22nd December 2027.

Town and Country Planning Act 1990

1990 CHAPTER 8

PART VIII

SPECIAL CONTROLS

CHAPTER I

TREES

General duty of planning authorities as respects trees

197 Planning permission to include appropriate provision for preservation and planting of trees.

It shall be the duty of the local planning authority—

(a) to ensure, whenever it is appropriate, that in granting planning permission for any development adequate provision is made, by the imposition of conditions, for the preservation or planting of trees; and

(b) to make such orders under section 198 as appear to the authority to be necessary in connection with the grant of such permission, whether for giving effect to such conditions or otherwise.

While it assigns responsibility for environmental elements at the development site (such as vegetation and water), it does not impose any requirements on extraction sites. By overlooking these locations, it creates a loophole where no responsibility is assumed.

In analysing existing policies, we observed that none of those reviewed address extraction sites. Their main focus is on the development site, with no consideration of how material sourcing can be supported. Important themes such as climate change and biodiversity are acknowledged; however, this is limited to the development site and fails to consider the origins of these materials or the wider environmental implications these material have.

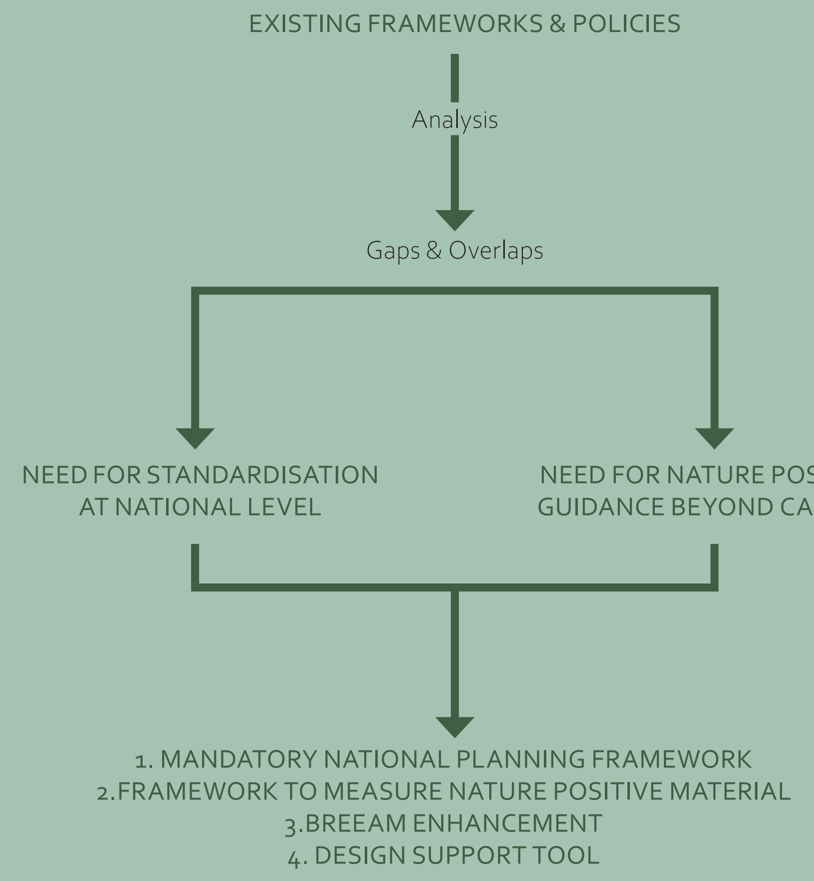
This research revealed a clear gap within existing policies. It demonstrates the need for a new policy that supports the aim of becoming nature positive by improving extraction sites and material sourcing.

POLICY & FRAMEWORK
PROPOSED

Following the review of existing policies and frameworks, several significant limitations were identified. These gaps highlight the need for new approaches that support the transition towards a more nature positive development.

To address these, a process of analysis and insight were undertaken to identify effective solutions that could contribute to the delivery of a more nature-positive buildings.

This chapter outlines the range of methods and proposals developed by this Think Tank, presenting the strategies designed to respond to the identified gaps and support a more holistic approach to nature-positive construction.



05

A NEW PLANNING LEGISLATION

THE EXTRACTION SITES AND MATERIAL SOURCING REGULATIONS 2026

As part of this Think Tank, we have introduced a new national planning policy that combines the strengths of existing policies and addressed their limitations, enabling future development to contribute more effectively to nature-positive outcomes.

The full policy and material analysis can be found in the appendix.

Interpretation

1. For the purposes of this section -
   a. "Nature Positive" is defined as by reference to the Kunming-Montreal Global Biodiversity Framework, adopted under the Convention on Biological Diversity in 2022. This establishes a global societal goal to: halt and reverse biodiversity loss by 2030, relative to a 2020 baseline, and achieve the full recovery of nature by 2050.
   b. "Nature loss" includes the qualitative and quantitative definition so more green and blue spaces with thriving biodiversity are the goal.

Overview

1. Nature positive materials are defined by -
   a. Those that contribute to reversing nature loss by having a low environmental effect on the extraction site the material originates from.
   b. Recycled.or reused from the development site.
   c. Nature positive materials include -

Stone | Timber | Cement | Clay / Brick

CHAPTER I
EXTRACTION SITES AND MATERIAL SOURCING

1. Circular economy

Re-use on site | Re-cycle

2. Extract local materials;

50km from site | Select transport methods that minimise emissions | Consider recycling plants first

3. Know where specific materials come from;

Location of origin | Produce document of findings (features of extraction sites that have environmental effects) | Analyse EMPs of related extraction sites

4. Use materials efficiently;

Re-cycle | Limited virgin material | Document of material choice (e.g. substitutions for nature positive materials where possible / why non nature positive materials will not affect the environment) | Developer ensures material choice analysis and completeness

5. The extraction site should be rehabilitated following extraction activities;

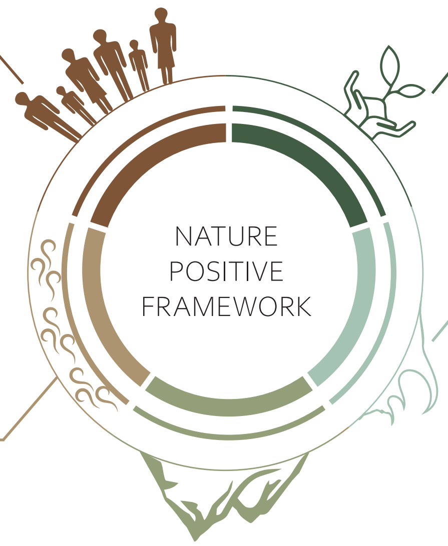
Planning permission will be refused if extraction sites fail to go back to its original state | Consider features in extraction sites (e.g. preservation of trees / restoration of soil or water sources affected) | Projects that incorporate certified nature positive materials are eligible for a government tax incentive

A NEW FRAMEWORK TO MEASURE

THE NATURE POSITIVE RANKING FRAMEWORK

This Think Tank proposes a new framework that can be applied to any materials. The framework focuses on assessing and sourcing materials based on their ability to contribute positively to nature, while considering a broader range of environmental impacts across the material life cycle.

This new framework considers five key elements: people, biodiversity, air, water, and land. By assigning an impact score to each category per material, it becomes possible to assess how the sourcing of a material relates to a nature-positive outcomes across a broader range of environmental considerations.



PEOPLE

This metric considers the range of social impacts experienced by people at the extraction site before, during and after the extraction process. It assesses the quality of life of local communities, as well as those who visit the area, as part of the overall evaluation. In addition, the knock-on effects of extraction activities on people living near the site and those working directly on-site are also taken into account within this assessment.

Impact score:

0:No impact/ changes to peoples social life
1:Low Impact
2:Moderate Impact
3:Large Impact
4:Severe impact resulting in the displacement, job loss, instability etc.

BIODIVERSITY

This metric considers the wider habitat context of the extraction area before, during and after the extraction process.

Impact score:

0:No impact on biodiversity at any stage
1:Low Impact
2:Moderate Impact
3:Large Impact
4:Severe impact with no possibility of rehabilitation

WATER

This metric considers the effects on water at the extraction site before, during and after extraction, examining water use, contamination, water security, and the resulting impacts on both people and nature.

Impact score:

0:No impact to water source/ water bodies
1:Low Impact
2:Moderate Impact
3:Large Impact
4:Severe impact resulting in loss of marine life, pollution, lack of water security etc.

AIR

This metric considers the impact of the extraction site on air quality before, during and after extraction. It also examines the wider effects on nature and natural resources, as well as the broader implications these impacts have at a wider scale.

Impact score:

0:No impact on air quality - remains as is
1:Low Impact
2:Moderate Impact
3:Large Impact
4:Severe impact resulting in pollution, respiratory heath issues, reduction in air quality etc.

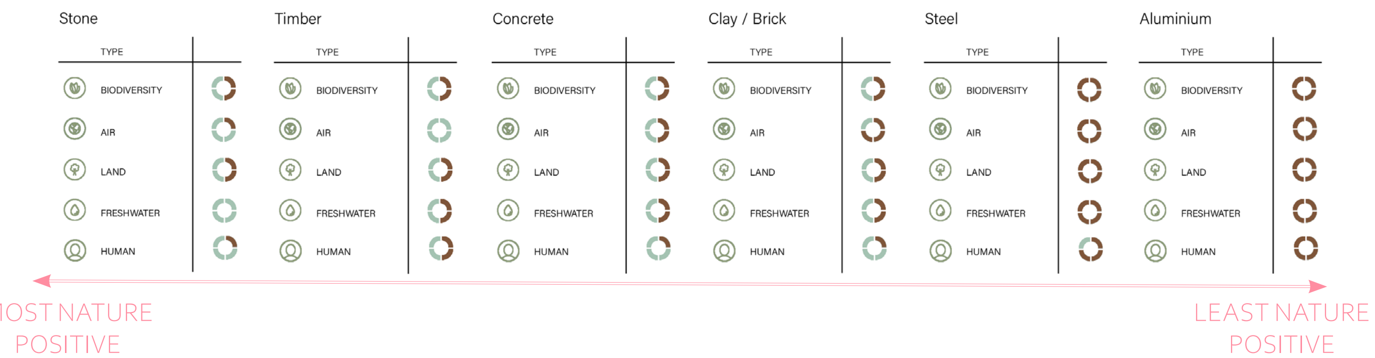
LAND

This metric considers land use before, during and after extraction, with a particular focus on whether the land is able to regenerate once the extraction process has been completed. It also takes into account the amount of land required to produce a given quantity of material, as well as the wider environmental effects associated with this land use.

Impact score:

0:No impact on land
1:Low Impact
2:Moderate Impact
3:Large Impact
4:Severe impact on land with no possibility of regeneration.

Using this new framework, the materials researched as part of this think tank has been ranked to determine which materials are the most nature-positive. The results are as follows:



PROPOSED BREEAM ENHANCEMENT

RETHINKING BREEAM

BREEAM is used to specify and measure the sustainability performance of buildings, ensuring that sustainability goals are met and maintained over time.

While the environmental impacts of the site are included, the framework does not adequately consider where resources originate from, nor the ecological and social impacts associated with extraction, which are equally important factors.

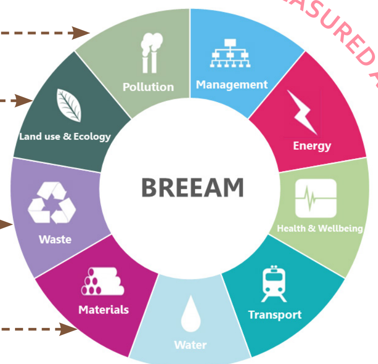
Due to these limitations, this Think Tank proposes the addition of further criteria to the existing framework in order to enhance its effectiveness.

The Advantages and Disadvantages of BREEAM

BREEAM assessments use recognised performance measures to evaluate a building's specification, design, construction and operation. While achieving BREEAM accreditation provides many benefits, including improved environmental performance and recognised sustainability standards, there are also limitations within the framework.

	POSITIVES	NEGATIVES	
ECONOMIC	encourages sustainable design	sometimes focused on operational energy	ECONOMIC
	supports climate and Net-Zero targets	does not always reflect local context	
	biodiversity preservation	additional costs so expensive to achieve	ENVIRONMENTAL
	clear sustainability framework	complex and time-consuming	
ENVIRONMENTAL	increase property value	'box-ticking' criticism	
	attracts investors and tenants	higher rents or increase in property prices	
	enhanced marketability and competitiveness	may exclude small local suppliers	SOCIAL
	reduces operational costs	voluntary scheme; impact varies	
	access to government grants and incentives		
SOCIAL	improves user health and well-being		
	increases comfort and productivity		

CATEGORIES MEASURED AS PART OF BREEAM



Within the areas already covered by BREEAM, this Think Tank proposes the addition of criteria within four key categories of BREEAM.

By introducing additional considerations into these sections, greater attention can be given to the origins of construction materials and the environmental and social conditions associated with their extraction.

Suggested additions include:

2 Concept Design | 3 Developed Design

Wst 07	**Material Sourcing**	**Locally Sourced Materials** 80% of materials on site are reused, leaving 20% waste	2 Concept Design	Design Team	2
		Recycled Materials 90% of the whole building is constrcuted from recycled materials	2 Concept Design	Design Team	2
Pol 06	**Extraction Site Pollution**	**Reduction of Transport Miles** 60% of materials in the buildingare from sites within 50km from the site.	2 Concept Design	Design Team	2
		Site Specification Produce an Extraction Site Pollution Assessment to show the potential pollution impacts and how this is managed and mitigated.	3 Developed Design	Design Team	1
Man 05	**Nature Positive Sourced Materials**	**Nature Positive Materials** 60% of whole building is constructed from nature positive materials	2 Concept Design	Design Team	2
		Virgin Materials Choice Less than 20% of the building is made from virgin aluminium and steel	2 Concept Design	Design Team	2
LE 06	**Extraction Site Selection**	**Sustainability Policies** 80% of extraction sites specified have EMPs or sustainability policies	2 Concept Design	Design Team	2
		Recover Invest in aiding the extraction site's (of the materials sourced) rehabilitation after extraction activities	3 Developed Design	Design Team	1

The competitive nature of BREEAM accreditation within the construction industry provides a strong incentive for innovation and improvement. Introducing these additional criteria would encourage developers to; go beyond minimum requirements, consider broader sustainability impacts, promoting a competitive drive within the sector to deliver buildings that are better for both the environment and society and serves an educational purpose, highlighting the concept of nature positive development .

A NEW DECISION SUPPORT TOOL

THE ROADMAP TO NATURE POSITIVE DESIGN

To support the future of nature-positive design, this Think Tank has developed a decision-support tool for designers and developers to encourage responsible material selection and design strategies.

The primary aim is to deliver nature positive development. By using this tool, factors such as extraction sites and material sourcing (which are often overlooked) can be considered from the outset to inform and influence design decisions.

Reliance on virgin materials must be reduced. Even small changes in practice—such as sourcing materials locally or using recycled materials—can make a meaningful difference.

IS THE BUILDING NEEDED?

Not all buildings are needed. This should always be the first question, as some buildings are not built to meet a specific need.

The UK has thousands of empty properties across the UK.

New buildings = New environmental cost

YES → CAN AN EXISTING BUILDING ON SITE BE ADAPTED AND RETROFITTED WITHOUT REQUIRING ANY NEW MATERIALS?

NO → NO NEED FOR CONSTRUCTION

☐ Can the concept of demountability be applied?
☐ Can the building be modified to meet the desired use without sourcing additional materials off-site?

If **yes** for both continue to the next stage of the tree.

YES → USE THE MATERIALS AVAILABLE ON SITE TO ADAPT AND RETROFIT THE BUILDING FOR THE INTENDED USE

NO → CAN ALL REQUIRED BUILDING MATERIALS BE SOURCED WITHIN A CIRCULAR ECONOMY?

AIM: Keep materials in use by repairing, reusing and remanufacturing them, or safely returning them to the biosphere. This helps eliminate waste and reduces the reliance on virgin materials.

☐Can the required building materials be sourced/made from recycled/waste materials (locally, regionally, nationally or globally)?

If **yes** for both continue to the next stage of the tree.

Where local options are not available, recycled materials sourced from further away are still preferable to using new raw materials.

YES → RELY SOLELY ON THESE BUILDING MATERIALS AS THE PRIMARY CONSTRUCTION MATERIAL.

NO → CAN BUILDING MATERIALS BE SOURCED LOCALLY?

AIM: Source materials as close to the project site as possible. This will vary between sites to best suit the local area and climate.

☐Can the required building materials be sourced within 50 km of the site?
If

If **yes** for both continue to the next stage of the tree.

YES → USE THE LOCALLY SOURCED MATERIAL AS THE PRIMARY CONSTRUCTION MATERIAL.

NO → CONSIDERATION MUST BE GIVEN TO THE CHOICE OF MATERIALS USED.

USE MATERIALS FROM THE NATURE-POSITIVE MATERIAL HANDBOOK TO SELECT CONSTRUCTION MATERIALS.

To provide additional resources, this Think Tank has developed a handbook listing a range of nature-positive materials that can be considered for construction.

The ultimate goal is to promote and encourage more nature-positive design. This decision tree guides designers by offering simple steps, helping to avoid overcomplicating the process and ensuring that nature is considered from the very start of the design process, from concept through to completion.

NATURE POSITIVE MATERIAL HANDBOOK

The Nature Positive Material Handbook has been developed by the Nature Positive Design Think Tank as an additional resource to support developers and designers. It provides a curated list of construction materials that can be considered during the design and development process, prioritising options that minimise impacts on nature and the wider environment.

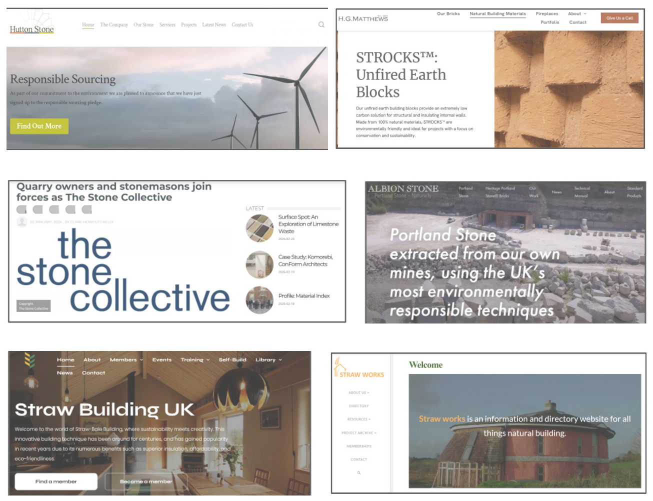
06

The material handbook is proposed as a practical tool for rethinking how materials are selected in construction. Instead of prioritising cost or efficiency alone, it proposes a different hierarchy of material choices based on their relationship to extraction.

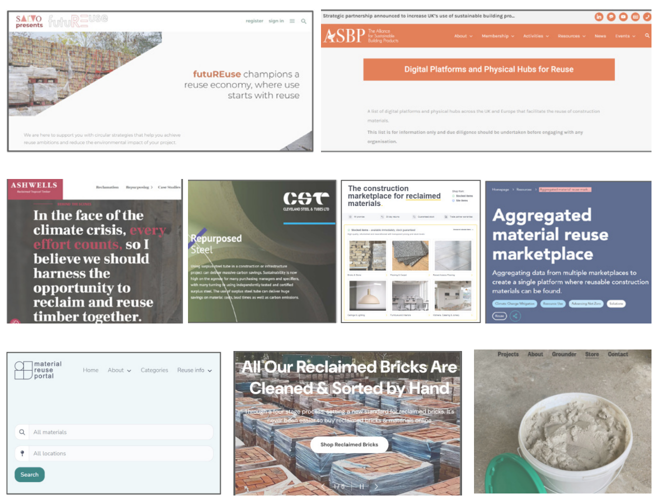
At the top of the pyramid is the most nature-positive option: retaining and reusing the existing building wherever possible. If reuse is not feasible, the next priority is secondary circular materials—reclaimed, recycled, and salvaged components that already exist within the built environment.

Primary extracted materials are used only as a last resort. While this approach may not always be the cheapest or most efficient in conventional terms, it reframes the question of material choice.
Rather than asking what is easiest to build with, we ask what causes the least new extraction.

PRIMARY EXTRACTED MATERIALS



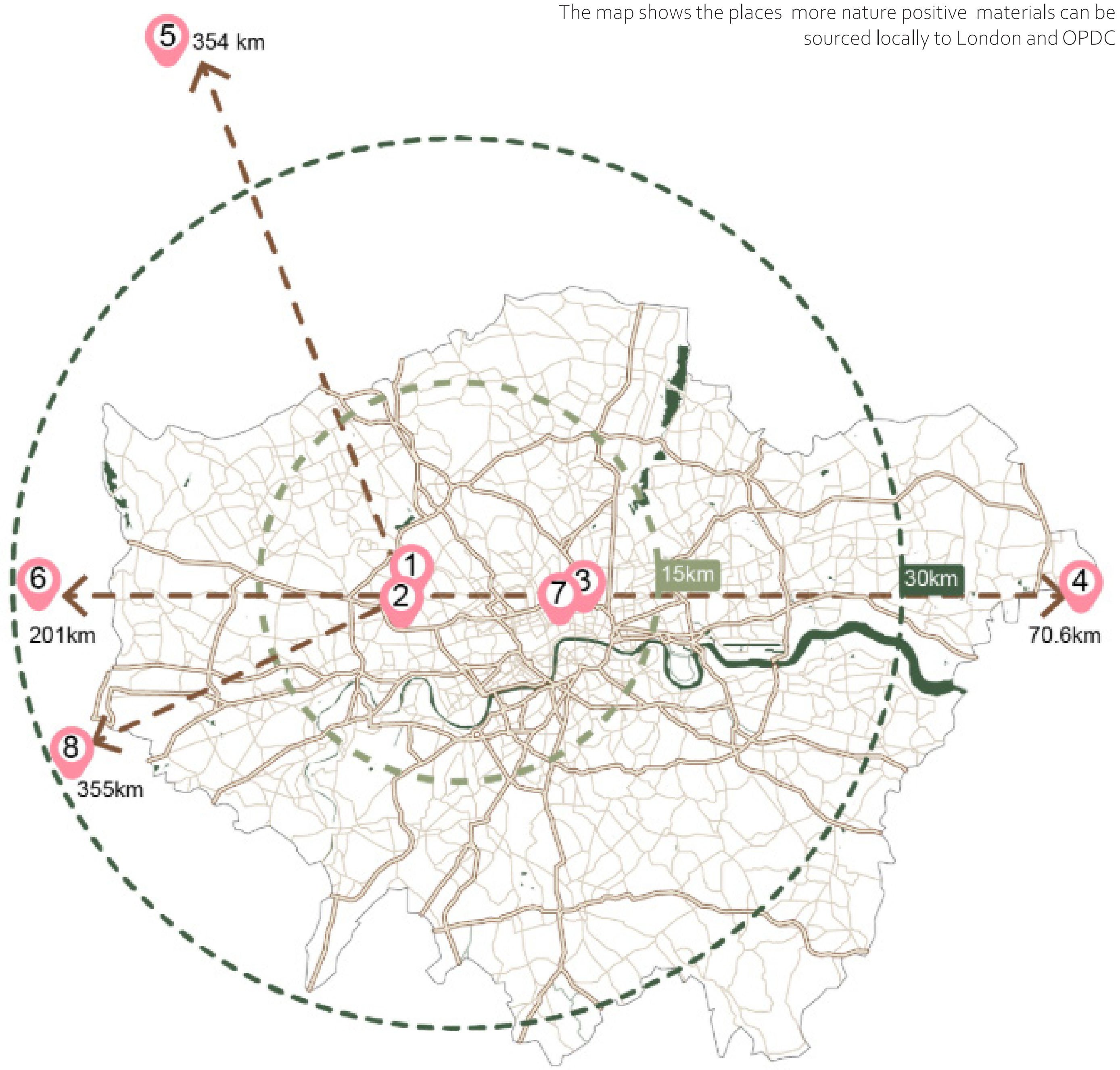
SECONDARY CIRCULAR MATERIALS



MATERIAL HANDBOOK

The transition towards circular and bio-regional material economies is not purely theoretical. Platforms such as Material Index, Material Reuse Portal, and other reuse networks already facilitate the circulation of reclaimed and recycled construction materials. At the same time, projects such as Minerva Works demonstrate how these systems are beginning to operate within the OPDC area. The challenge therefore lies less in the availability of alternative materials than in shifting priorities within design and construction practices to make their use the norm rather than the exception.

The map shows the places more nature positive materials can be sourced locally to London and OPDC



1. POWDERDAY - Recycled aggregate concrete
2. MINERVA WORKS - Reclaimed materials
3- ALUK DESIGN STUDIOS - Recycled aluminium
4- ASHWELLS RECLAIMED TIMBER
5- CLEVELAND STEEL & TUBES
6- ALUK - Recycled aluminium
7- PARKSIDE - Recycled stone
8- MIKE WYE - Recycled insulation

MATERIAL HANDBOOK

PRIMARY EXTRACTED MATERIALS
MATERIALS EXTRACTED FROM THE EARTH

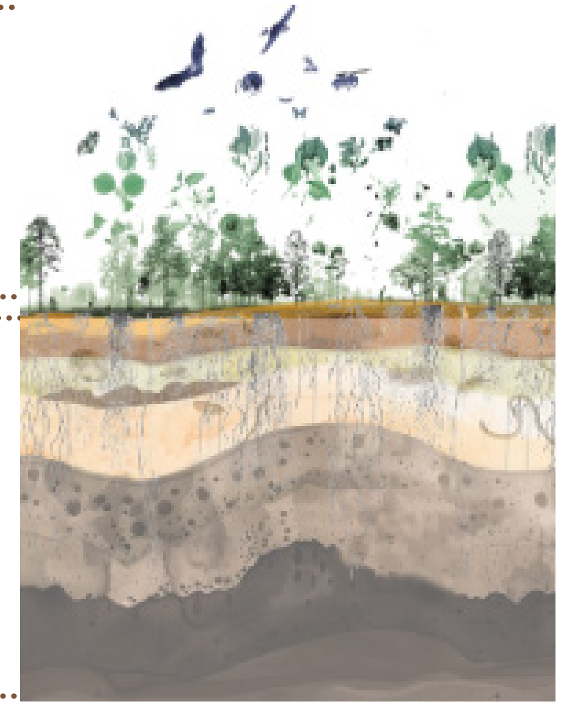
Primary materials are extracted directly from the earth or harvested from living systems. While some of these resources, such as timber, hemp, or straw, are renewable, their extraction and processing can still disrupt ecosystems. For this reason, primary materials should only be considered when certain conditions are met: they are regeneratively sourced, locally harvested, require minimal processing, and contribute to biodiversity recovery rather than ecological degradation. Under these principles, primary materials become a carefully managed resource rather than a default option for construction.

TIMBER
HEMP
STRAW
BAMBOO
CORK
MYCELIUM

Harvested from living systems
Renewable but not impact-free

STONE
CLAY / EARTH
ALUMINIUM
STEEL
COPPER
GYPSUM
LITHIUM

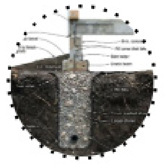
Deeply disruptive to ecosystem



SUBSTRUCTURE


Stone on top of screw pile


Stone

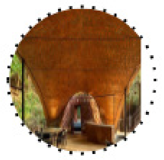

Rubble trench


Stone toper

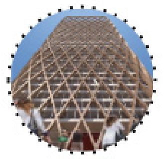

Stabilised rammed earth

SUPER STRUCTURE


Bamboo


Brick


Straw Bale


Timber


Rammed earth


Cork

ACCESSORIES & SKIN


Lime / Clay plaster


Natural cladding


Natural insulation materials


Wooden windows and doors

SECONDARY CIRCULAR MATERIALS
MATERIALS USED IN CIRCULAR

Secondary circular materials differ fundamentally from primary extracted resources. These materials already exist within the built environment and therefore do not require new land disturbance or resource extraction. Rather than digging into landscapes, circular construction draws from the city itself, recovering materials from existing buildings and urban waste streams through reuse, reclamation, and recycling. In this way, material sourcing shifts from extraction-based supply chains to urban material cycles.

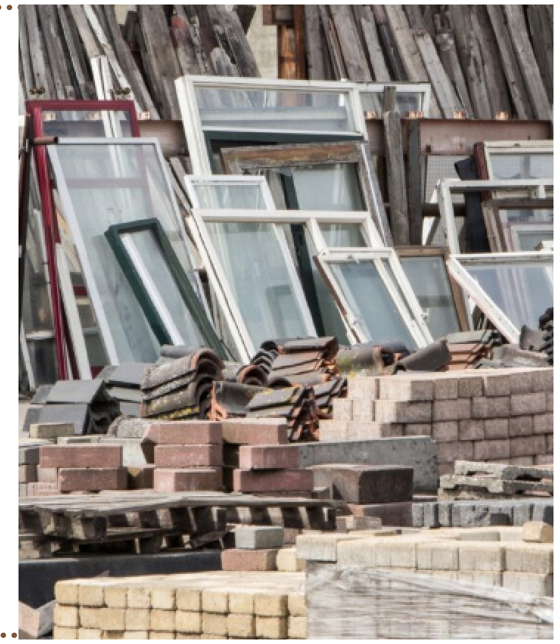
However, circularity is not only about using recycled content. It also requires designing buildings so that their components can be recovered, reused, and kept in circulation over time. Buildings should therefore be understood as temporary assemblies of materials and future material banks for the built environment.

RECLAIMED

TIMBER
STONE
BRICK
STEEL
BUILDING ELEMENTS

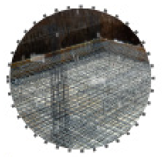
RECYCLED

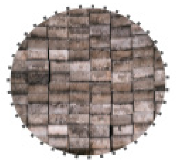
ALUMINIUM
STEEL
BRICK
CONCRETE
COPPER
GLASS
AGGREGATE



SUBSTRUCTURE


Recycled aggregate / crushed concrete / recycled foam glass aggregate


Recycled steel reinforcement


Reused concrete block


Gabion wall foundation with demolition waste / recycled aggregate


Reclaimed stone


Reclaimed steel pile foundation

SUPER STRUCTURE


Reclaimed steel profiles


Reclaimed brick


Reclaimed stone


Reclaimed timber


Hybrid reuse systems


Reclaimed precast concrete

ACCESSORIES & SKIN


Reused brick wall


Reused plastic


Recycled aluminum window and door

MATERIAL HANDBOOK

THE NEW LONDON STOCK BRICK

Large quantities of London Clay are excavated each year during basement construction, infrastructure works and major development projects. Much of this material is currently treated as waste, while new buildings continue to rely on imported aggregates and newly extracted construction materials.

In the OPDC area, the construction of the HS2 station alone is producing significant volumes of excavated clay, while the demolition of existing buildings will generate large amounts of brick and concrete waste.

The New London Stock Brick proposes a circular alternative: a family of bricks produced from excavated London clay combined with recycled demolition aggregates and urban waste streams. Two bricks are manufactured as compressed earth blocks requiring little or no firing, while a third brick is lightly fired using waste heat from local data centres. Together they form a locally sourced, circular reinterpretation of the traditional London stock brick.

External Structural Compressed Earth Brick

Internal Insulative Compressed Earth Brick

External Structural Fired Earth Brick

The material compositions shown below represent adaptable mix ranges rather than fixed recipes. The bricks are designed to accommodate locally available waste streams, allowing the proportions of recycled aggregates and organic additives to vary depending on what materials are available.

A dense compressed earth brick designed for structural external walls. Stabilised with small amounts of lime and reinforced with recycled mineral aggregates, it provides load bearing capacity while reusing locally available demolition waste.

Brick make-up:

- London clay	50-60%
- Crushed brick/concrete aggregate	30-45%
- Sand	3-8%
- Lime	6-8%

A lightweight compressed earth brick designed for interior partitions and infill. Organic additives such as coffee grounds and natural fibres increase porosity, improving thermal and acoustic performance while utilising urban organic waste streams.

Brick make-up:

- London clay	50-70%
- Crushed brick/concrete aggregate	15-25%
- Dried coffee grounds	10-12%
- Chopped straw or hemp	0-5%
- Recycled paper/card pulp	0-5%

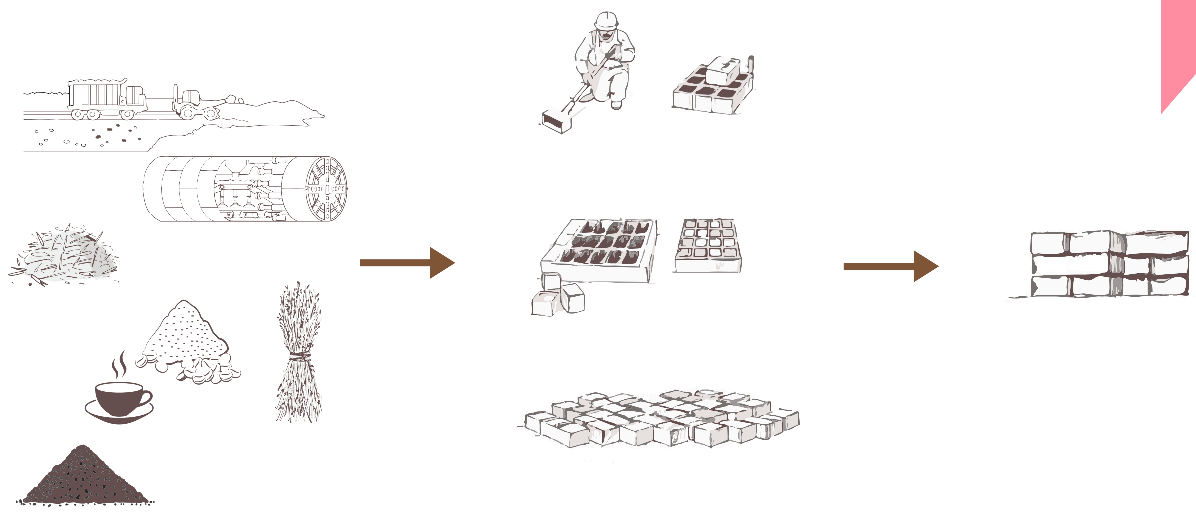
A partially fired earth brick intended for exposed external applications. The brick is fired at significantly lower temperatures than conventional clay bricks, using waste heat from local data centres to provide additional durability and weather resistance.

Brick make-up:

- London clay	50-70%
- Crushed brick/concrete aggregate	30-45%
- Dried coffee grounds	0-10%
- Sand	3-8%

MATERIAL HANDBOOK

The making of Compressed Earth New London Stock Bricks

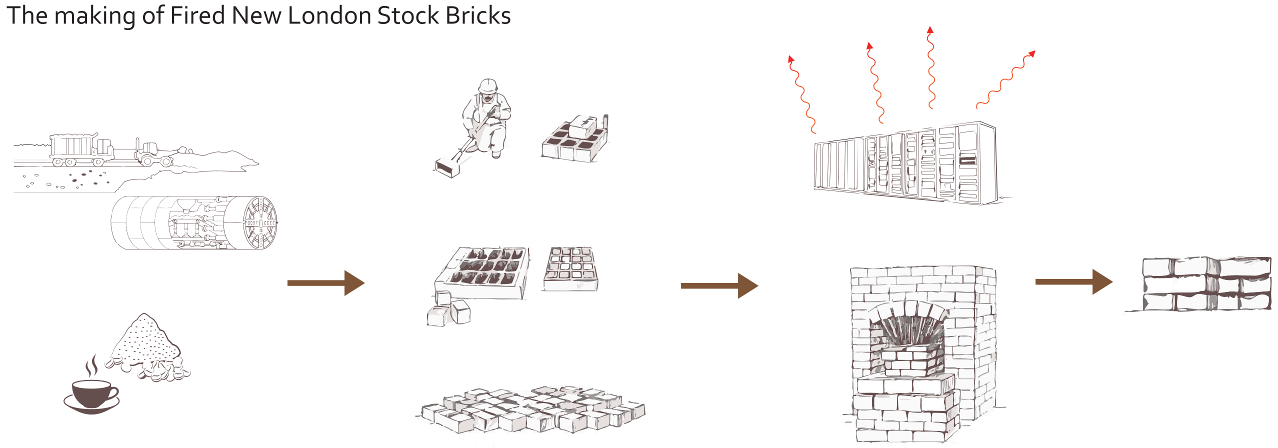


Local urban and agricultural waste like HS2 clay, used coffee grounds, crushed brick and concrete, straw and hemp is collected.

Waste materials are combined and compressed into brick or block sizes (as required).

The New London Stock Brick is ready to be used. Assembled using a clay mortar at the end of the building's life the bricks can be easily disassembled and reused.

The making of Fired New London Stock Bricks



Local urban and agricultural waste like HS2 clay, used coffee grounds and crushed brick and concrete is collected.

Waste materials are combined and compressed into brick or block sizes (as required).

Firing to 200 deg. C in kilns powered by waste heat energy from local data centres.

The New London Stock Brick is ready to be used. Assembled using a lime mortar at the end of the building's life the bricks can be easily disassembled and

The New London Stock Brick is designed for both circular production and circular reuse. When laid using clay or lime-based mortars, masonry can be dismantled at the end of a building's life, allowing bricks to be reused or crushed and returned as aggregate for new bricks. In this way buildings become temporary material banks rather than sources of construction waste.

THE POTENTIAL OF NATURE POSITIVE DESIGN

Concluding the research undertaken as part of this Think Tank, this chapter reflects on the potential of what a nature positive design could look like within our chosen test bed: The OPDC.

Focusing on a single typology would not adequately demonstrate the full design potential of a nature positive approach. Therefore, the two primary typologies—residential and commercial—have been explored. These typologies provide an opportunity to illustrate how buildings within the OPDC could be designed to support and enhance natural systems while meeting the functional needs of an urban environment.

Alongside the reconsideration of building typologies, urban space itself has also been re-evaluated to better respond to the needs of current society. Particular attention has been given to how space can be used more efficiently and purposefully, ensuring that the built environment is optimised to support both human activity while upholding ecological value.

Through these explorations, the chapter presents a series of design propositions that demonstrate how future development within the OPDC could integrate nature positive principles, offering a vision for a more resilient, biodiverse, and socially responsive urban landscape.

While the following designs are grounded to a specific site, the strategies that have been explored in this report can be transferable, demonstrating how similar approaches can be implemented in other urban settings.

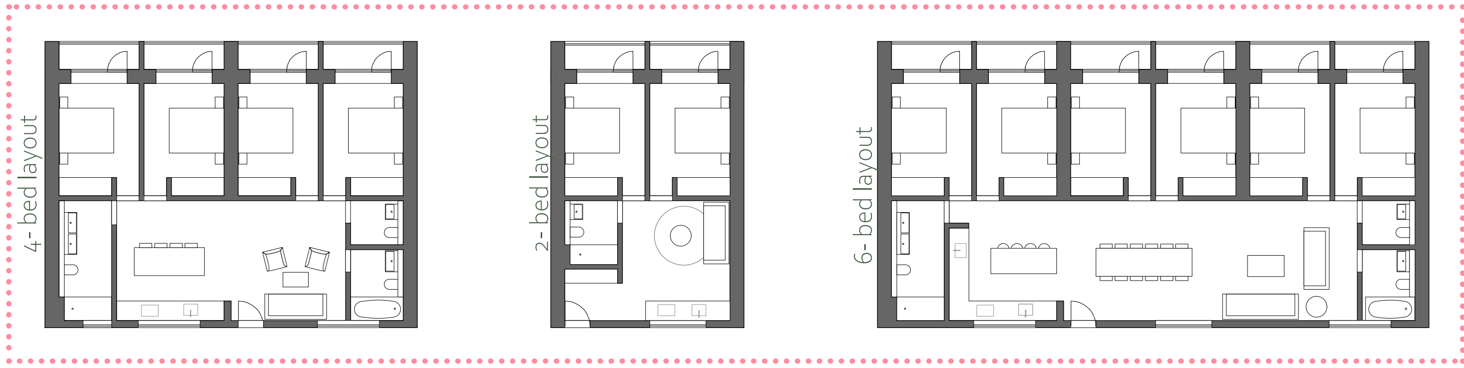
07

PROPOSED NATURE POSITIVE RESIDENTIAL DESIGN

PROPOSED GROUND FLOOR PLAN

RESIDENTIAL DESIGN

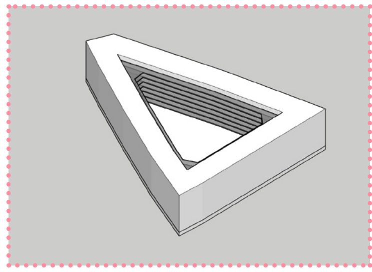
COMMUNAL LIVING WITH SHARED AMENITIES



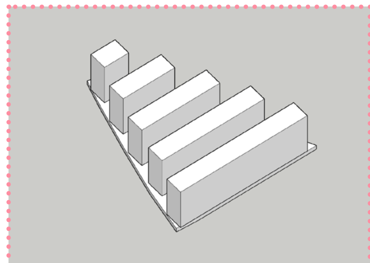
This proposal integrates the concept of communal living, with shared amenities centred on high-quality living around communal kitchens and lounges.

This approach ultimately delivers the same quality and quantity of housing within a smaller footprint, thereby reducing the demand for materials.

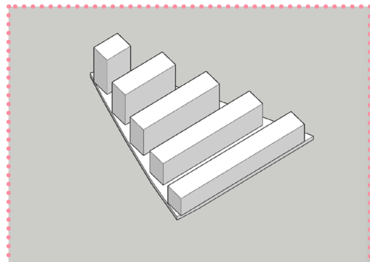
ITERATIVE MASSING



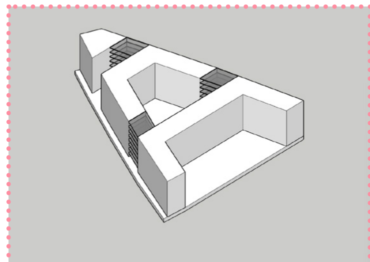
This initial form establishes a continuous, hollow triangular boundary that maximizes the site's edge while creating a large, protected central courtyard for resident privacy.



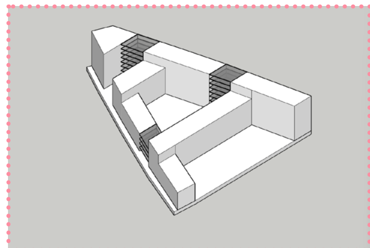
The design shifts to a series of detached, parallel blocks that improve cross-ventilation and solar access, though it breaks the cohesive sense of a singular "shared" community.



Building on the second phase, these bars are further articulated into smaller segments, creating more porous pathways and "pinch points" for potential communal interaction.

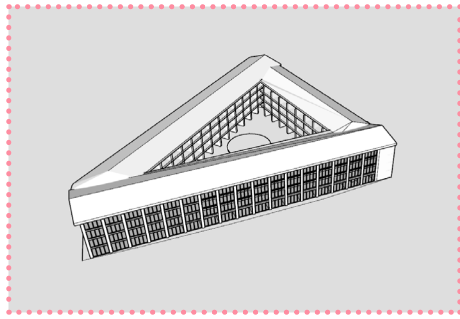


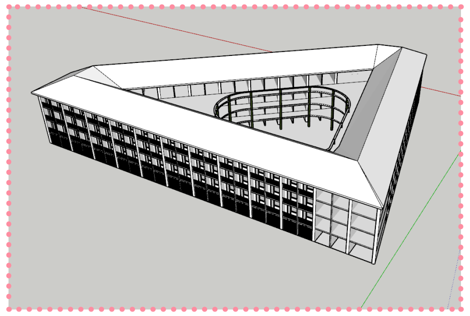
The massing returns to a semi-enclosed form, reintroducing a courtyard but with varying building heights and open corners to balance community enclosure with natural light.



The most complex iteration, this model uses strategic gaps and bridges to link the shared living modules, creating a high-density, interconnected network that prioritises communal flow and green pockets.

FURTHER DEVELOPMENT



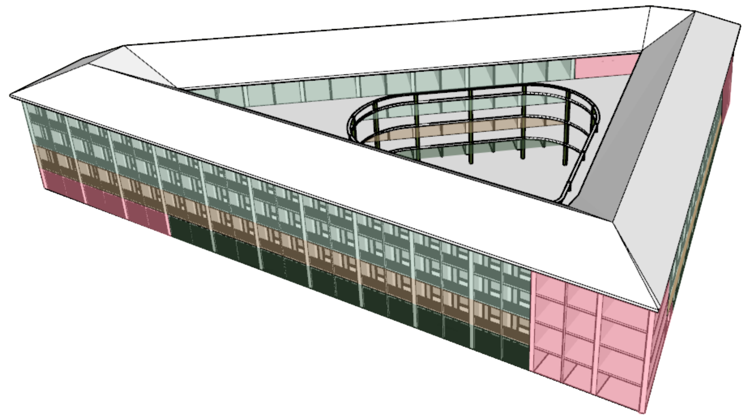


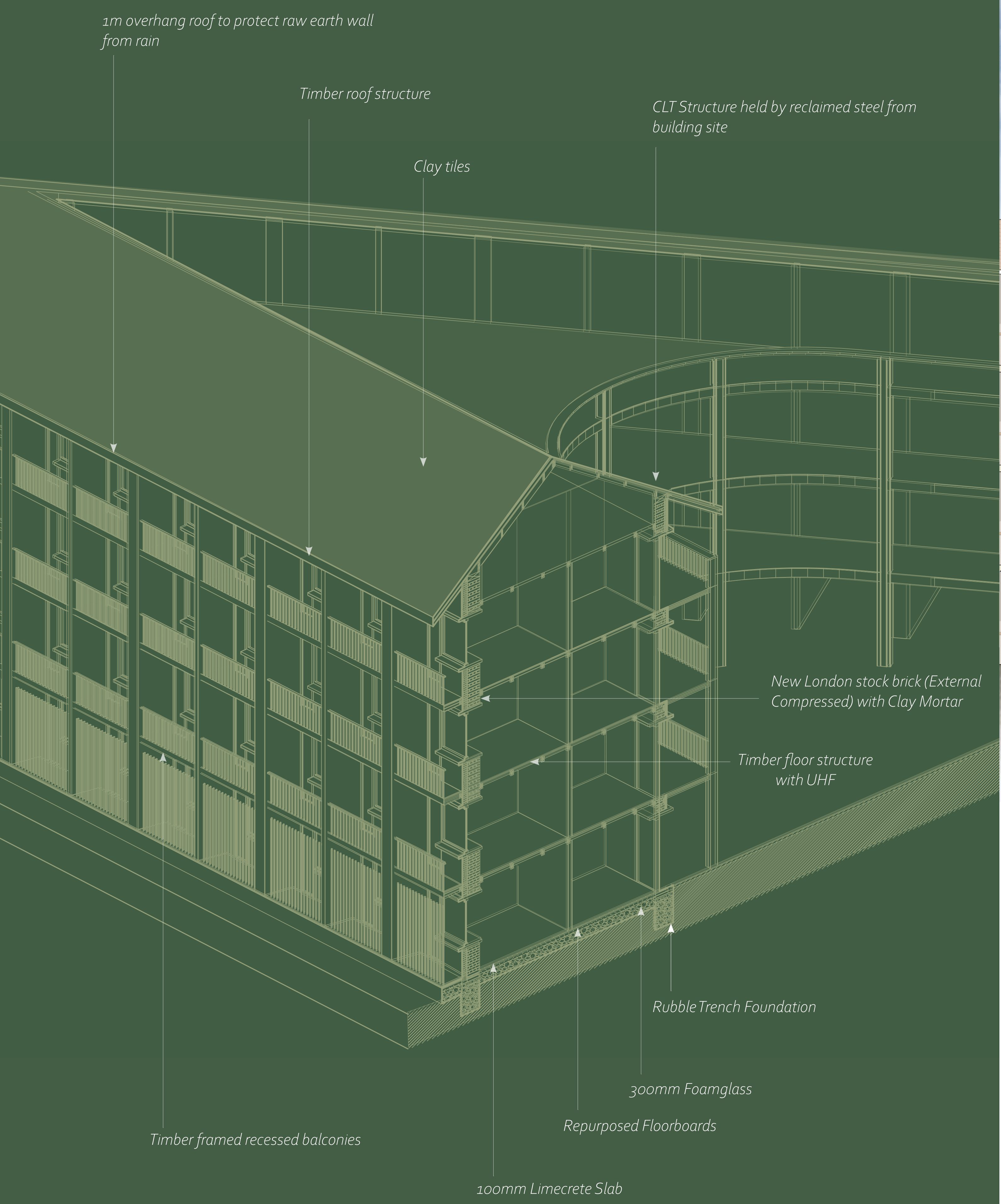
The final design utilises a refined perimeter massing to maximize floor area while ensuring every unit benefits from optimal solar orientation and natural light access. Standing at four storeys, the block is constructed from structural raw brick to ground the nature-positive philosophy in durable, low-carbon materials.

FINAL DESIGN

The pink-coded zones act as the building's social heart, housing shared communal workspaces, workshops, and studios for all residents. These areas, alongside the ground floor, integrate essential facilities like a laundrette, bike storage, and plant rooms to support a high-density, collaborative environment.

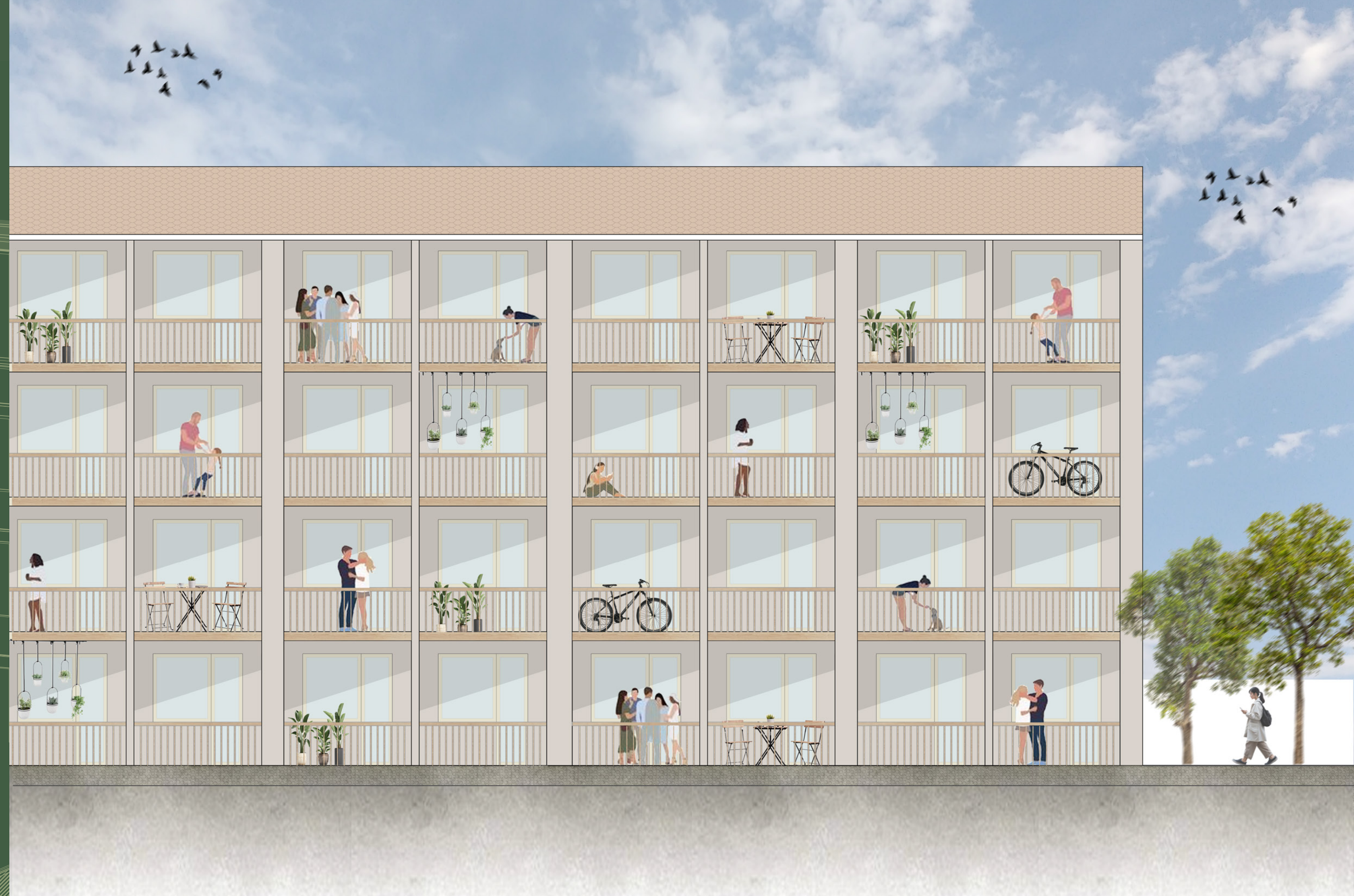
Communal spaces
Family flats
Communal living
Accessible flats

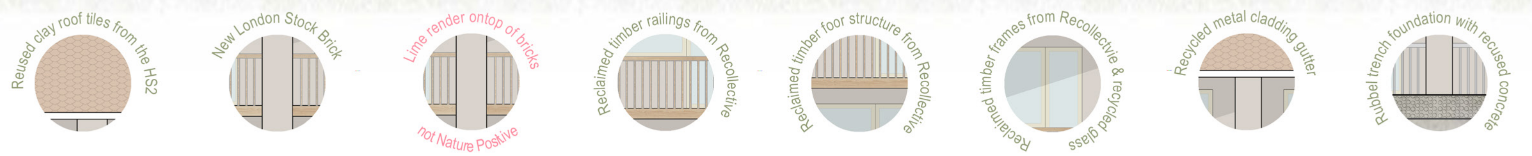


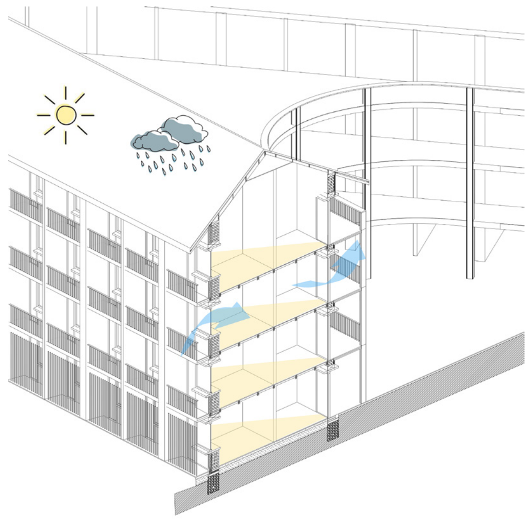


PROPOSED ELEVATION

RESIDENTIAL DESIGN





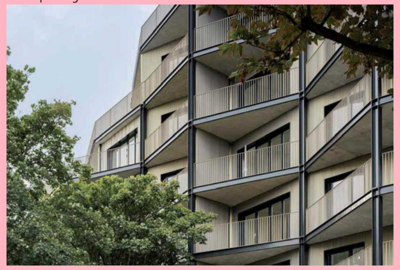


The building is designed to be more nature positive by minimising reliance on mechanical systems by maximising natural light and ventilation. Mechanical and electrical services can account for up to 40% of the materials in a building and often rely on resource-intensive materials such as plastics and metals. To reduce this dependency, the building uses a shallow 9-metre plan which allows natural daylight to reach all occupied spaces. Windows on both sides of each unit enable effective cross-ventilation, reducing the need for mechanical cooling and ventilation. Rainwater is collected from the roof and reused for WC flushing and irrigation of gardens, further reducing the building's infrastructure intensity and reliance.

PROPOSED RESIDENTIAL DESIGN

PRECEDENT STUDY
DOCKLEY APARTMENTS

Built on a former industrial site in Southwark, the scheme ranges from four to nine storeys and combines housing with active ground-floor uses such as shops, cafés, and food producers within the adjacent railway arches. The development draws inspiration from European collective housing models, prioritising communal space and social interaction. Homes are arranged around a shared courtyard with play areas, and residents access their apartments through wide external galleries that overlook the courtyard and connect to planted roof terraces. This emphasis on shared outdoor spaces, gallery circulation, and community-oriented design makes it a relevant reference for our project.



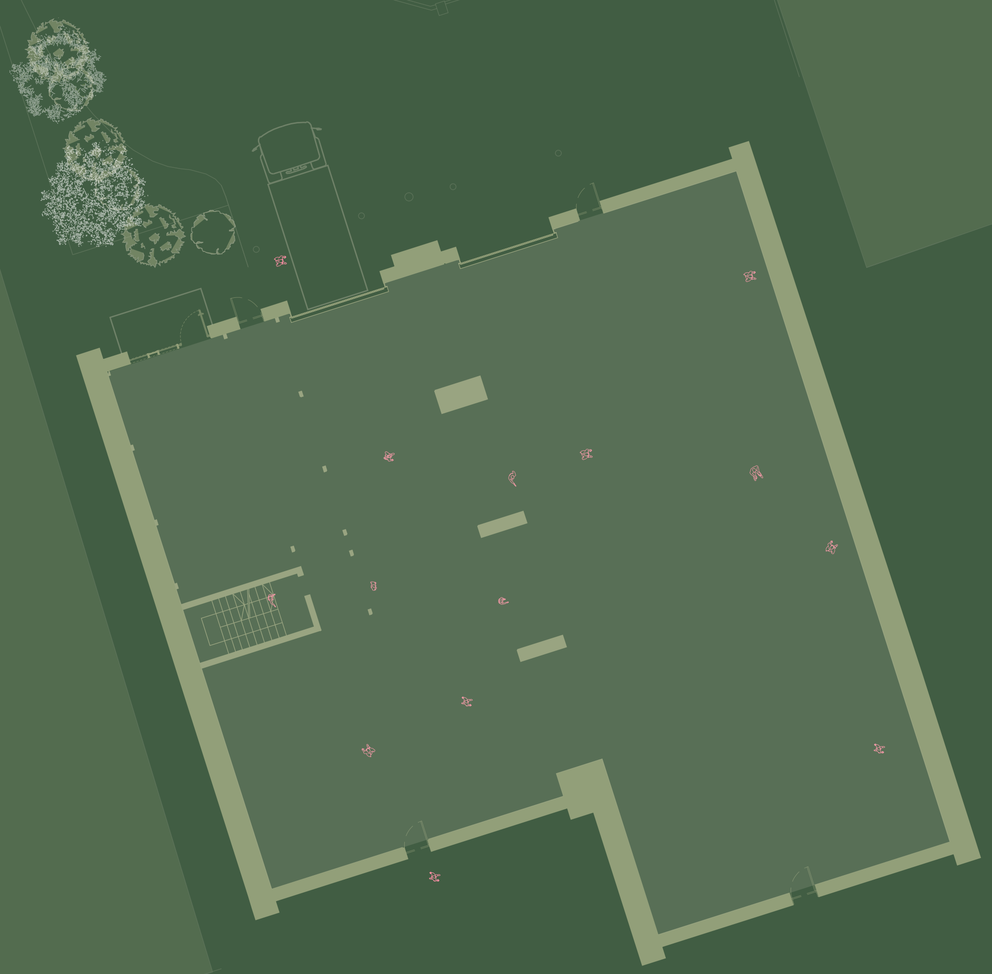
PRECEDENT STUDY
A HOUSE FOR ARTIST

Located in Barking, London, this project combines public facing spaces with artists' studios and housing.

It offers flexible living and working spaces for 12 artists and their families, with a focus on community engagement and sustainability.

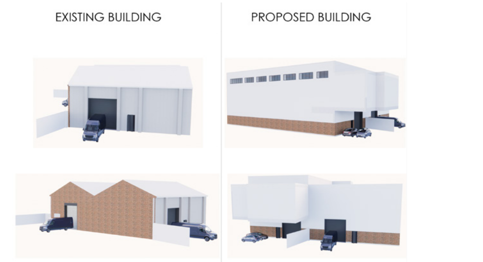
This project takes inspiration form this to provide communal living as the core concept of this project.

PROPOSED NATURE POSITIVE INDUSTRIAL DESIGN



PROPOSED GROUND FLOOR PLAN

THE CONCEPT
INDUSTRIAL DESIGN

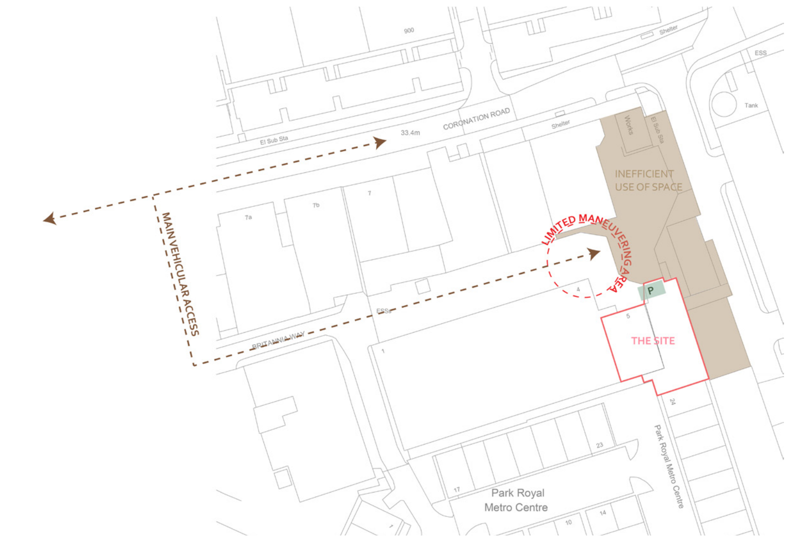


USING SPACE EFFICIENTLY

Throughout the study of the OPDC area, it was identified that space is not being utilised to its full potential.

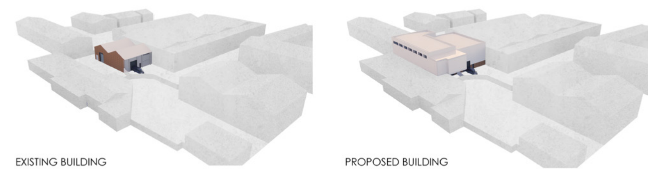
Many sites do not consider the full development potential available to them, resulting in inefficient use of land.

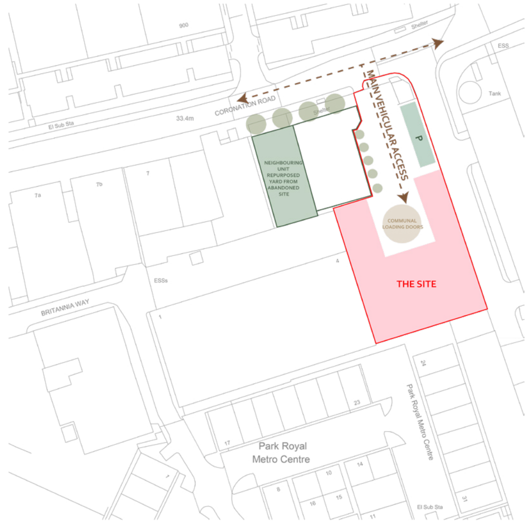
As part of a nature-positive redesign for industrial typologies, we have focused on using space more efficiently while returning underutilised land either to the community or for residential development.

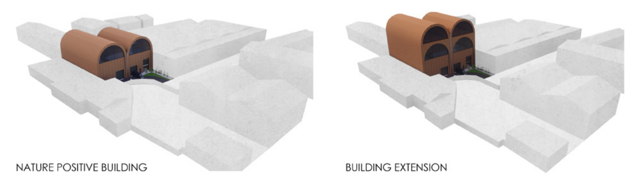


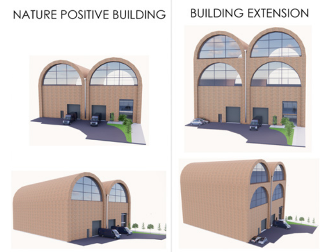
This is an existing example of an industrial expansion that took place within the OPDC. Due to the lack of planning at the early stages of the project, there is a significant amount of wasted space, restrictions for vehicles, and no consideration of material availability, resulting in developments that appear uniform and repetitive.

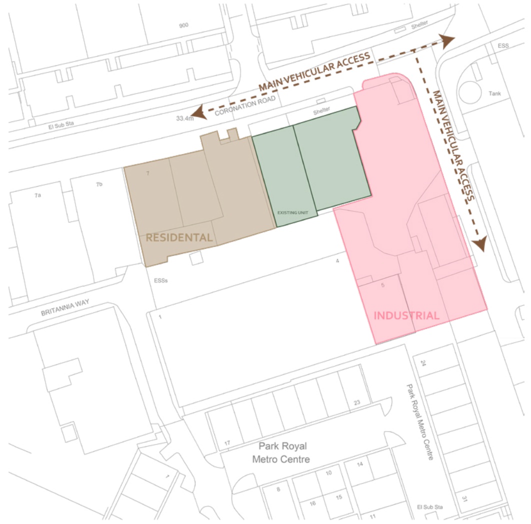
By reconsidering and redesigning the layout to eliminate unused areas, there are greater opportunities to utilise the site footprint more effectively.











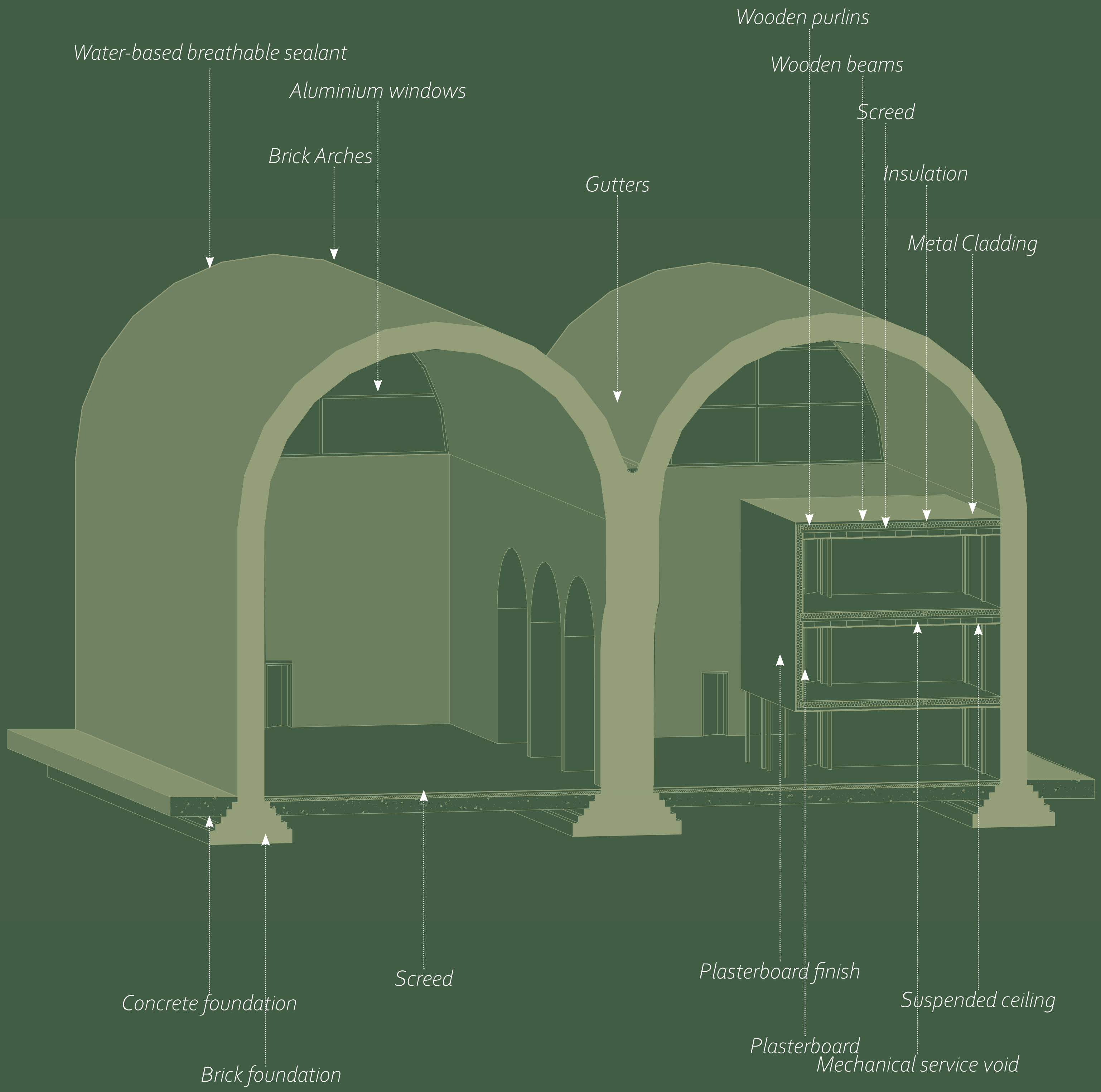
Reconsidering the use of space allows industrial areas to function more effectively by allocating designated zones for the various activities required for commercial businesses to operate efficiently.

In addition, the design incorporates the use of waste materials as one of the primary construction resources. This approach has been identified as a nature-positive strategy, as it reduces reliance on virgin materials and promotes the reuse of existing resources.

The nature-positive industrial design has also been tested to incorporate opportunities for expansion, allowing for increased internal floor space while maintaining the same site footprint.

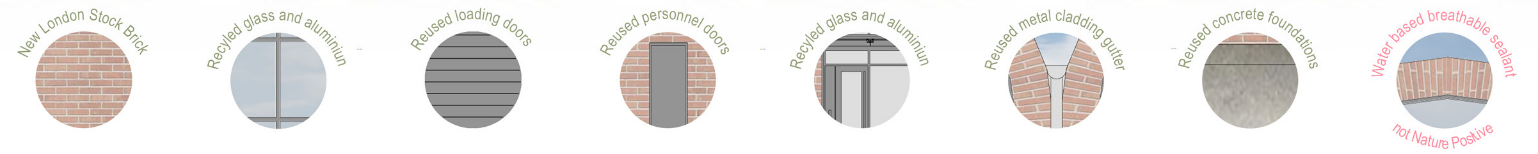
Although the OPDC test bed represents one of London's largest industrial areas, space for continuous vertical expansion is limited. As a result, alternative approaches have been explored, including horizontal expansion strategies. These trials aim to identify potential design solutions that could work within the dense urban context of central London and potentially be applied to similar sites elsewhere.

PROPOSED SECTION
INDUSTRIAL DESIGN



This redesign proposes a new nature-positive industrial building that prioritises local material reuse and resource efficiency. Central to the proposal is the use of a newly developed London stock brick, manufactured using clay excavated from the nearby HS2 construction site. By sourcing material that is both local and derived from a waste stream, the project significantly reduces reliance on virgin resources while embedding the building within the material landscape of its surrounding context.

PROPOSED ELEVATION
INDUSTRIAL DESIGN



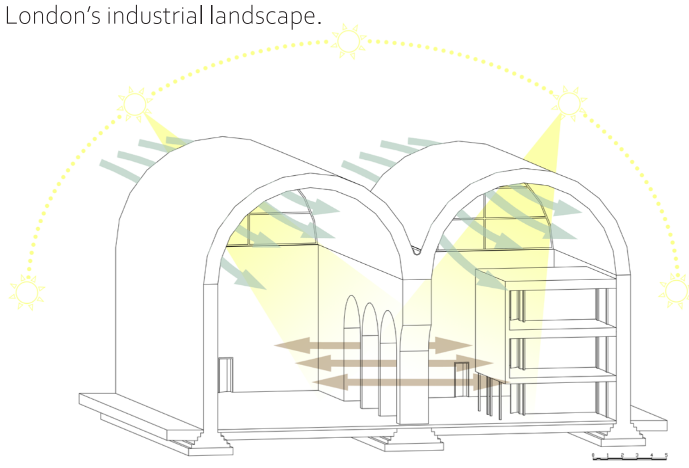
Utilising a material that is both locally sourced and reclaimed allows the development to minimise its environmental impact while creating a distinctive and durable industrial environment in which commercial activities can thrive. The approach demonstrates how industrial architecture can support economic productivity while responding positively to environmental challenges.

Where additional materials are required, the design prioritises reuse and recycling. Elements such as steel and aluminium — which are traditionally considered less nature-positive due to their impacts on nature at their respective extraction sites — have been reclaimed from the existing on-site structures or sourced through recycled supply chains. This strategy further reduces the building's material footprint and reinforces a circular approach to construction.

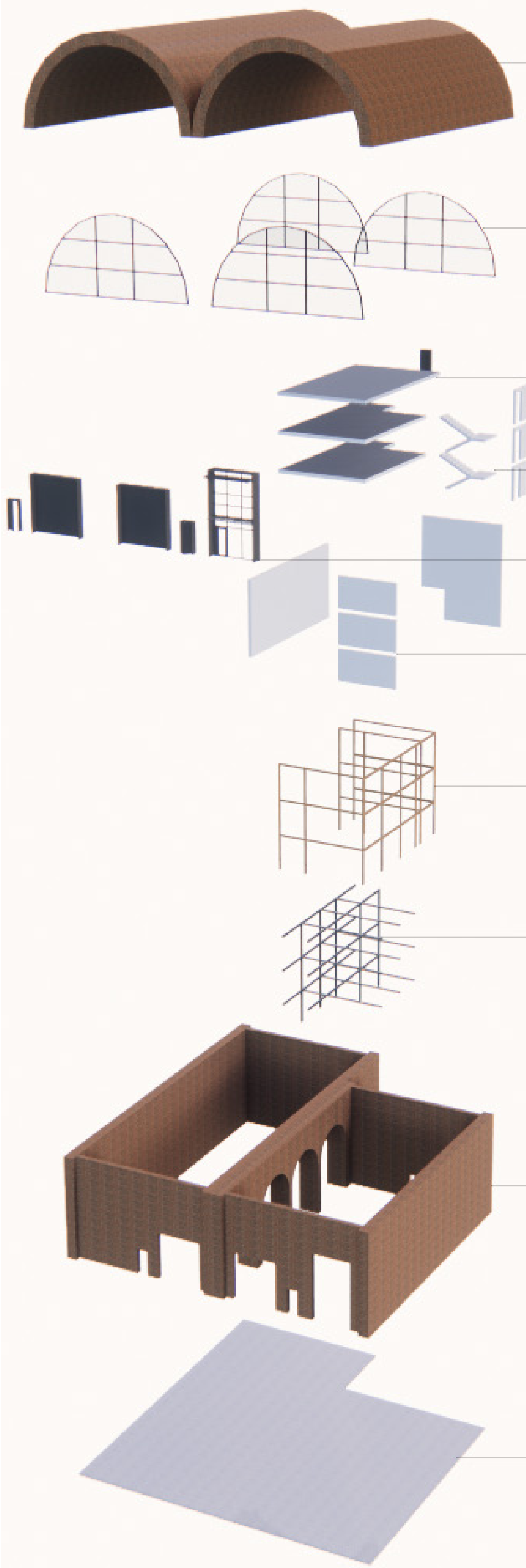
Adaptability forms a key principle of the design. The building has been conceived to support future economic growth, allowing the space to evolve alongside changing industrial demands. Internally, the structure adopts a largely open-plan layout, with structural brick arches providing the primary spatial division. This flexible arrangement enables occupants to configure and adapt the internal environment to suit a wide range of operational needs over time.

Environmental performance is also embedded within the architectural strategy. The building incorporates passive ventilation and cooling principles, reducing reliance on mechanical and electrical systems that often require additional materials which are deemed less nature positive.

Together, these strategies demonstrate how industrial buildings can be re-imagined to support both economic productivity and environmental responsibility, creating resilient, adaptable spaces for the future of London's industrial landscape.



THE MATERIALS
INDUSTRIAL DESIGN



BRICK ROOF
Made from HS2 clay on site

ALUMINIUM WINDOW FRAMES
Source recycled aluminium within 50km of the site

GLASS
Source recycled glass within 50km of the site

FLOOR BUILD UPS
Source from within 50km of the site

CONCRETE STAIRS
Reuse from existing building
Source recycled concrete within 50km of the site

LOADING DOORS AND PERSONELL DOORS
Reuse from existing building

WALL BUILD UPS
Source recycled materials within 50km of the site

TIMBER STRUCTURE
Source recycled materials within 50km of the site

STEEL STRUCTURE
Reuse from existing building
Source recycled steel within 50km of the site

BRICK STRUCTURE
Made from HS2 clay on site

NHL (NATURAL HYDRAULIC LIME)MORTAR
Made from a sustianble combiner used from inpurities in clay
Sourced within 50km of the site

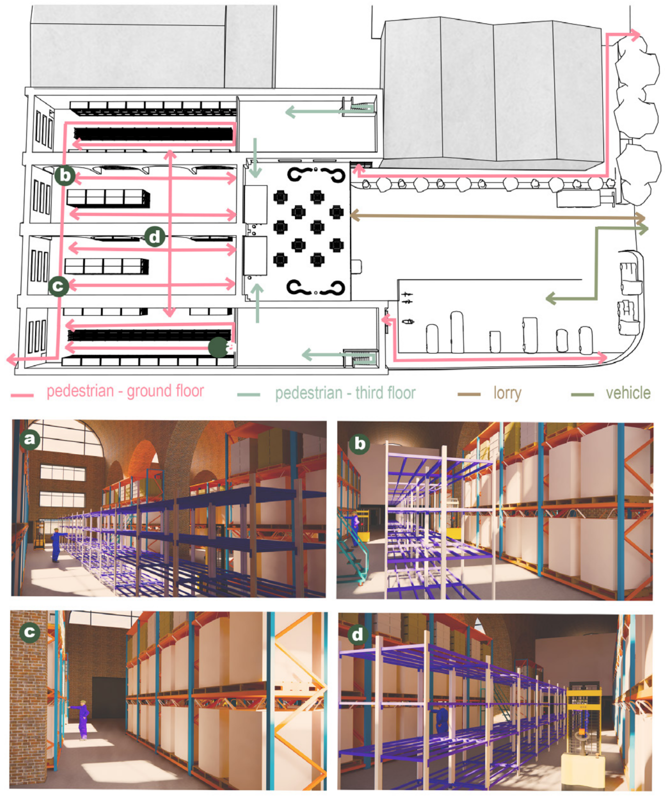
CONCRETE FOUNDATIONS
Reuse from existing building
Source recycled concrete

In line with the proposed guidance and legislation set out within this Think Tank, the building has been designed with the principles of the circular economy in mind.

A key example of this approach is the sourcing and production of bricks using clay excavated from the nearby HS2 site. In addition, several building elements have been reused from structures that previously existed on the site, further reducing the need for new materials.

Although the proposal significantly reduces the use of virgin materials, a small number are still required within the design. In this particular example there is no nature-positive alternatives for certain components. Where these materials have been necessary, efforts have been made to minimise their use and prioritise recycled or reclaimed sources wherever possible.

ADAPTABILITY
INDUSTRIAL DESIGN

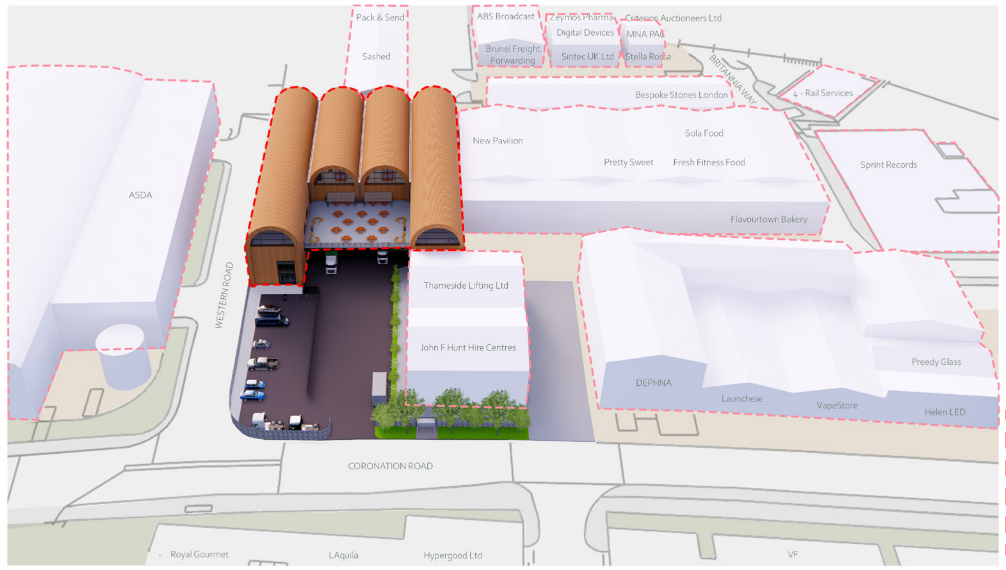


INTERNAL SPACE

The layout inside the commercial building is illustrated in the diagram to represent a typical layout option.

Due to the generous internal heights achieved by the brick arches, the building gains a key operational advantage, allowing for the installation of high-level racking systems. When arranged systematically, these systems enable occupants to use the space in a logical and efficient manner.

The layout of the proposed design remains adaptable, allowing the internal arrangement to change depending on the needs of different tenants and the specific use of the building.



SURROUNDING TYPOLOGY

By utilising space to its maximum potential, additional areas can be returned to industrial use.

This diagram demonstrates the different opportunities and new functions that can be introduced across the site.

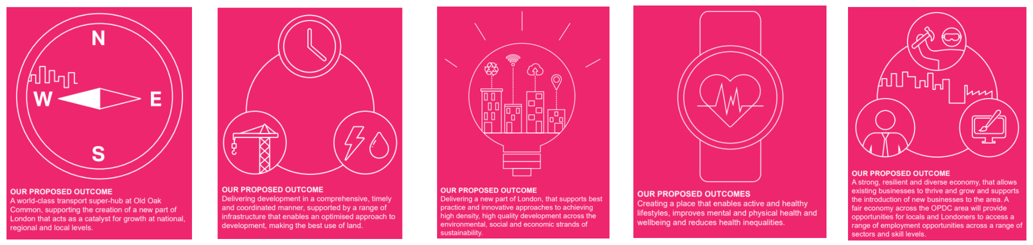
The new development offers:

- A larger communal yard
- A larger interior warehouse space
- A larger internal office
- Communal well-being balcony

Highlighting the different industrial development plots.

The improvements to the industrial site can be repeated to the other plots, creating a dense and well connected area allowing industry to thrive and work together, linking to the policies in the **Local Plan**.

Categories adhered to on the OPDC Local Plan:



SP1 - Catalyst for Growth

SP10 - Integrated Delivery

SP2 - Good Growth

SP3 - Improving Health and Reducing Health Inequalities

SP5 - Economic Resilience

PROPOSED INDUSTRIAL DESIGN

PRECEDENT STUDY
Lumbini Museum, Kenzo Tange

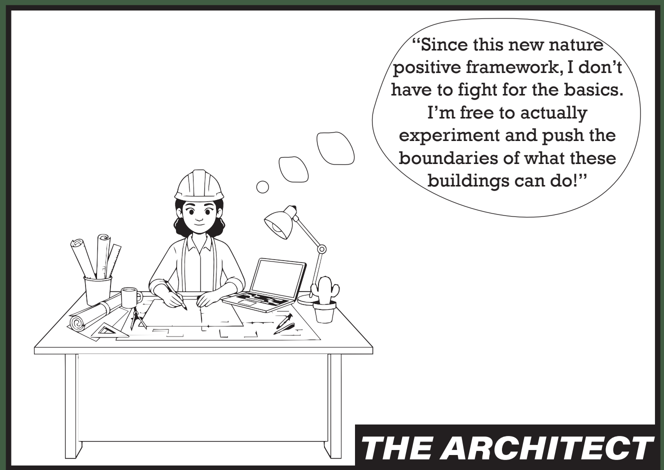
The arches are a key element in our industrial warehouse design where the New London Stock brick from the HS2 is the dominant architectural feature. The double arches can also be seen through the vertical extension of the warehouse. Similar to the Lumbini Museum, which reflects the history of the Buddha and his birthplace, this industrial warehouse is enriched in the history of the OPDC by reusing its own material, creating a sense of place and local identity.

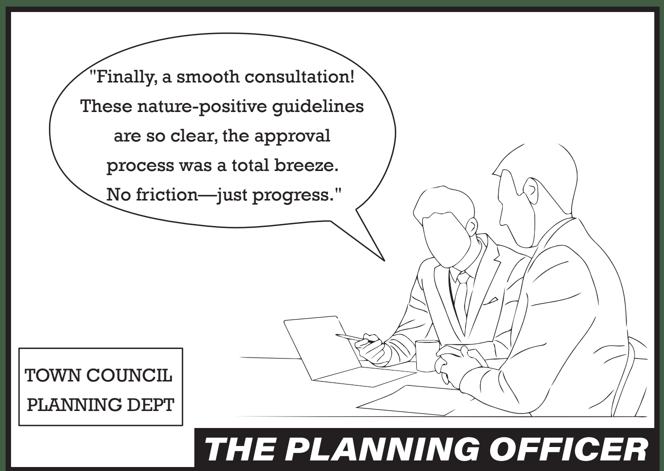
PRECEDENT STUDY
Florentia Village

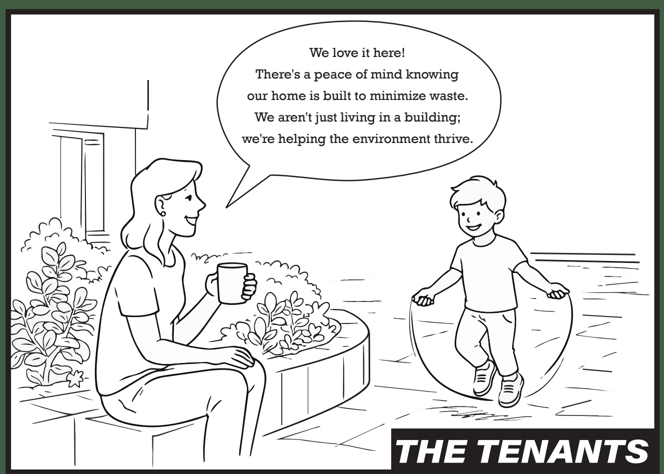
Florentia is a multi-use light industrial estate designed for modern makers, incorporating a shared balcony that fosters collaboration and interaction between the tenants. This communal space creates an environment where creativity can coexist naturally within the community.

The proposed industrial; area within the OPDC has industrial units on the ground floor which benefit from direct vehicle access, supporting efficient movement for loading and deliveries. Above, the shared balcony provides a space where workers can eat, talk and relax, allowing collaboration to continue beyond the workspace.

NATURE POSITIVE IN REALITY







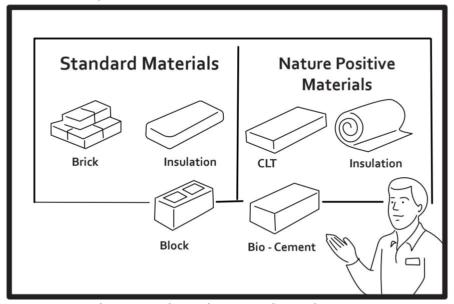
To help illustrate what the reality may be when a nature-positive building, concept, or material is introduced into modern society, a number of scenarios have been developed to demonstrate the possibilities of building in a nature-positive way.

These scenarios explore how everyday life and design decisions may evolve, helping to shift public perception of nature-positive principles while also increasing awareness and understanding of the concept.

1.New couple wants to buy a house

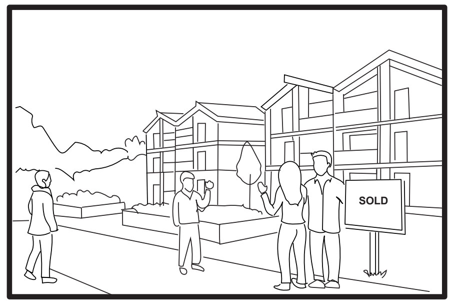

2. New to the area and does not want to be in Isolated Apartments.


3.Talks to local Estate Agents offering Nature Positive homes



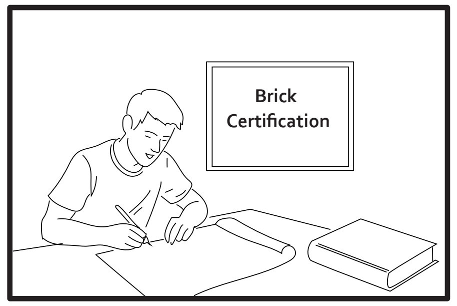
4. .Researching and Understanding the Nature Positive Materials

5. Finalising paperworks for the Estate Agents



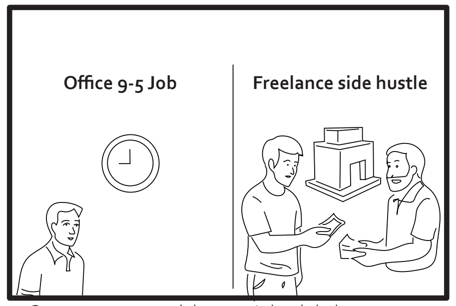
6. Moves in to the New Co-Housing Block

1. Joined an Apprenticeship Scheme

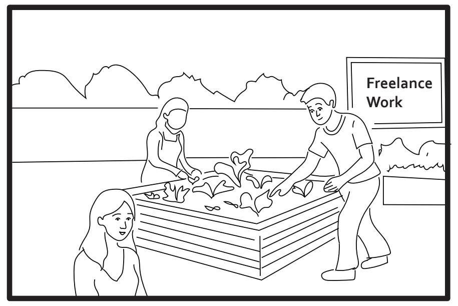


2. Studying for the Brick Certification

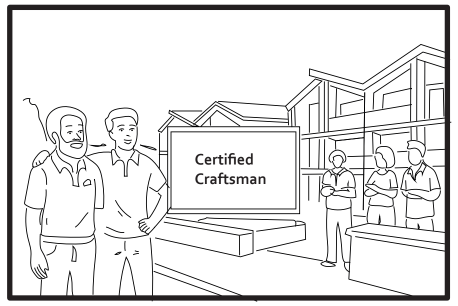

3. Finalising technical specs of the Brick



4. Continuing to work his 9-5 Job while keeping up with his side hustle



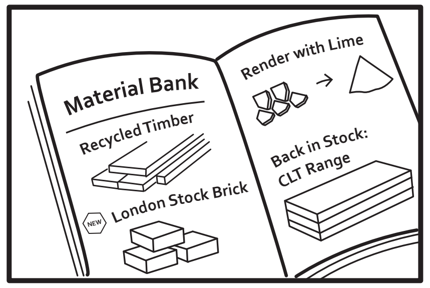
5. Community engagement with his colleagues



6. Overseas the built project with the community craftsmen

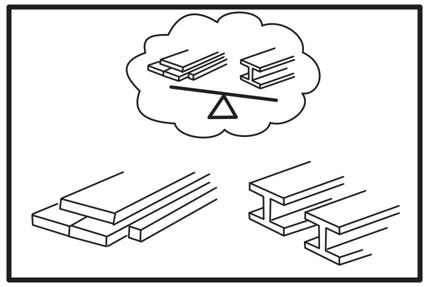
BRICK INTO INDUSTRY

1. Runs to Local Screwfix

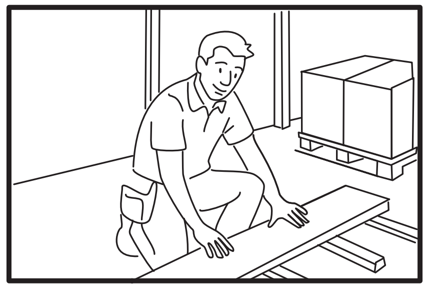


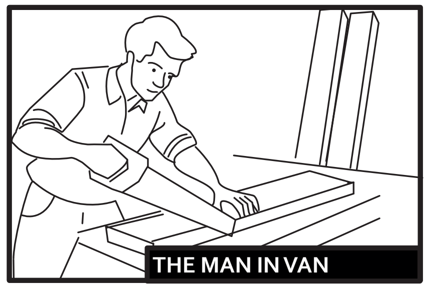
2. Finds Material Catalogue similar materials to his project


3.Curious about the Nature Positive Range


4. Thinks about the impact it has on the environment and cost.

5. Approves the Nature Positive Catalogue


6. Choosing to buy an Reclaimed Materials that lessens harm on the environment.

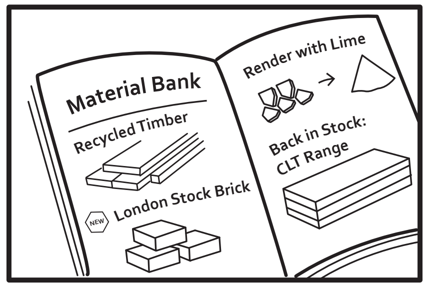


1. Working on a Project

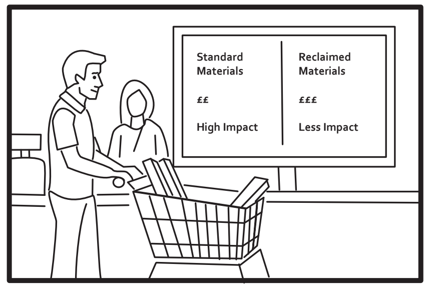

2. Runs out of Building Materials

3.Drives to his Local B&Q


4. 3.Noticed the advertisement on the Nature Positive Catalogue



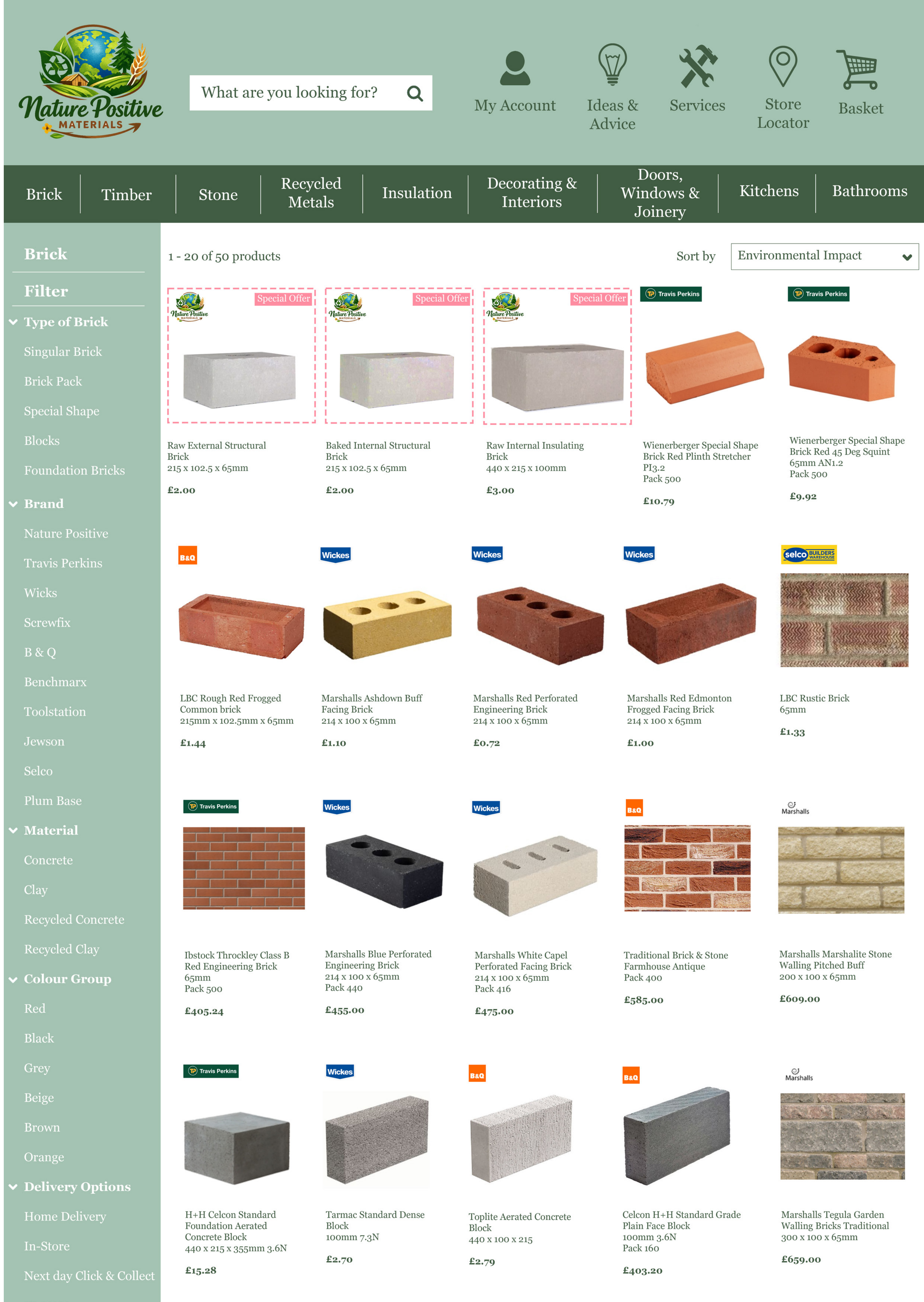
5. Sees the Nature Positive range



6. Sees prices comparison on In store Materials vs. Nature Positive Materials online

Nature-positive design will not only influence designers, developers, and buyers, but will also have a significant impact on contractors and material purchasers.

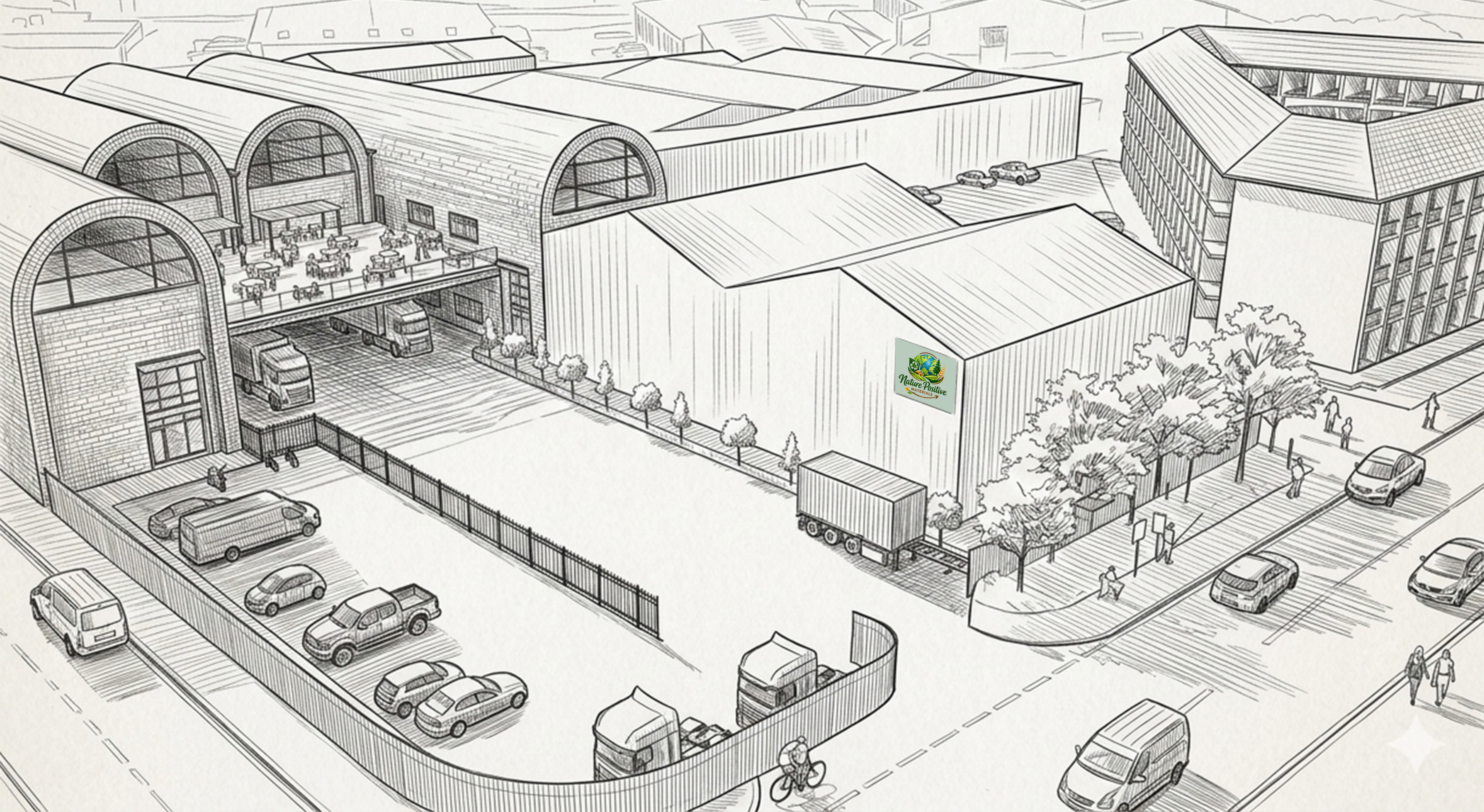
As highlighted earlier in the report, material choices are often limited to those offered by mainstream suppliers. However, with the introduction of the Nature Positive Materials platform (shown to the right), builders and contractors are provided with a dedicated resource where they can compare materials, costs, and environmental impacts. This enables more informed decision-making and supports the wider adoption of nature-positive construction practices.



CAN WE BUILD A NATURE POSITIVE BUILDING IN 2026?

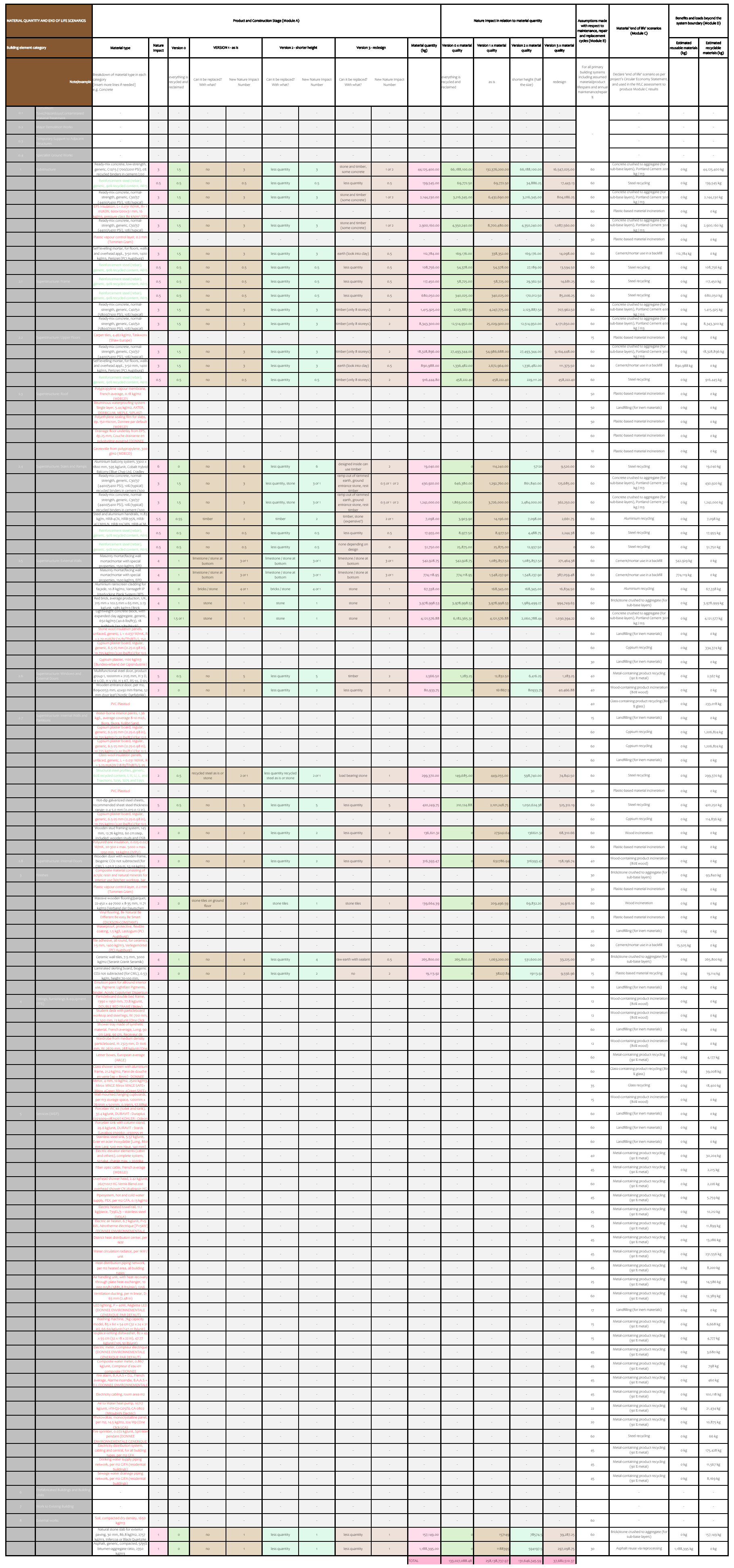
NO. BUT -

We can design towards a more nature-positive building by applying the methods and principles discussed in this Think Tank.



APPENDIX & BIBLIOGRAPHY

APPENDIX 1: METHODOLOGY TO RATING MATERIALS



METHODOLOGY

We analysed the Whole Life Carbon Assessment of our case study to see the amount of materials used. From our nature impact ratings, we numbered the materials in order from lowest to highest. Our results were as follows:

Stone - 1
Timber - 2
Cement - 3
Brick / Clay - 4
Steel - 5
Aluminium - 6

In order to calcuate what the nature impact is depending on what materials are used, we created 4 versions for our case study:

Version 1 - with recycled materials
Version 2 - As it is
Version 3 - Shorter height
Version 4 - Redesign

For each version, we discussed if the material can be replaced to a lower nature impact material, and worked out the new rating. Multiplying the ratings by the amount of material used in the case study gave us the nature impact of the material. Comparing this shows which version of the design is the most nature positive.

LIMITATIONS

This study only considers the six materials we researched. Therefore, some materials used in the case study have been ignored. Most of these are fittings, furnishings and wall build ups (e.g. plasterboard and insulation). We believe the materials we researched are key and will provide an accurate result for the data we are collecting.

Some of the materials are already recycled meaning its nature impact rating is less. To incorporate this information, the percentage recycled related to the percentage of the nature impact number. For example, 90% recycled steel equals 10% of 5, so the nature impact number would be 0.5.

To work out vision 1 with recycled materials, we used the highest potential recycled content in a recycled material:

Stone - 100%
Timber - 100%
Cement - 50%
Brick / Clay - 25%
Steel - 90%
Aluminium - 100%

MATERIAL QUANTITY AND END OF LIFE SCENARIOS		Product and Construction Stage (Module A)										Nature Impact in relation to material quantity			
Building element category		Material type	Nature Impact	Version 0	VERSION 1 - as is		Version 2 - shorter height		Version 3 - redesign		Material quantity (kg)	Version 0 x material quality	Version 1 x material quality	Version 2 x material quality	Version 3 x material quality
Note/example		Breakdown of material type in each category [Insert more lines if needed] e.g. Concrete		everything is recycled and reclaimed	Can it be replaced? With what?	New Nature Impact Number	Can it be replaced? With what?	New Nature Impact Number	Can it be replaced? With what?	New Nature Impact Number		everything is recycled and reclaimed	as is	shorter height (half the size)	redesign
1	Substructure	Ready-mix concrete, low-strength, generic, C12/15 (1700/2200 PSI), 0% recycled binders in cement (220	3	1.5	no	3	less quantity	3	stone and timber, some concrete	1 or 2	44,125,400.00	66,188,100.00	132,376,200.00	66,188,100.00	16,547,025.00
		Reinforcement steel (rebar), generic, 90% recycled content, A615	0.5	0.5	no	0.5	less quantity	0.5	less quantity	0.5	139,545.00	69,772.50	69,772.50	34,886.25	17,443.13
		Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical)	3	1.5	no	3	less quantity	3	stone and timber (some concrete)	1 or 2	2,144,230.00	3,216,345.00	6,432,690.00	3,216,345.00	804,086.25
		Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical)	3	1.5	no	3	less quantity	3	stone and timber (some concrete)	1 or 2	2,900,160.00	4,350,240.00	8,700,480.00	4,350,240.00	1,087,560.00
		Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)	3	1.5	no	3	less quantity	3	earth (look into clay)	0.5	112,784.00	169,176.00	338,352.00	169,176.00	14,098.00
		Reinforcement steel (rebar), generic, 90% recycled content, A615	0.5	0.5	no	0.5	less quantity	0.5	less quantity	0.5	108,756.00	54,378.00	54,378.00	27,189.00	13,594.50
2.1	Superstructure: Frame	Reinforcement steel (rebar), generic, 90% recycled content, A615	0.5	0.5	no	0.5	less quantity	0.5	less quantity	0.5	117,450.00	58,725.00	58,725.00	29,362.50	14,681.25
		Reinforcement steel (rebar), generic, 90% recycled content, A615	0.5	0.5	no	0.5	less quantity	0.5	less quantity	0.5	680,050.00	340,025.00	340,025.00	170,012.50	85,006.25
		Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical)	3	1.5	no	3	less quantity	3	timber (only 8 storeys)	2	1,415,925.00	2,123,887.50	4,247,775.00	2,123,887.50	707,962.50
		Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical)	3	1.5	no	3	less quantity	3	timber (only 8 storeys)	2	8,343,300.00	12,514,950.00	25,029,900.00	12,514,950.00	4,171,650.00
		Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical)	3	1.5	no	3	less quantity	3	timber (only 8 storeys)	2	18,328,896.00	27,493,344.00	54,986,688.00	27,493,344.00	9,164,448.00
		Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)	3	1.5	no	3	less quantity	3	earth (look into clay)	0.5	890,988.00	1,336,482.00	2,672,964.00	1,336,482.00	111,373.50
		Reinforcement steel (rebar), generic, 90% recycled content, A615	0.5	0.5	no	0.5	less quantity	0.5	timber (only 8 storeys)	2	916,444.80	458,222.40	458,222.40	229,111.20	458,222.40
2.4	Superstructure: Stairs and Ramps	Aluminium balcony system, 3300 x 1800 mm, 595 kg/unit, Cobalt Hybrid Balcony (Blue Chyp Ltd, Cradley	6	0	no	6	less quantity	6	designed inside can use timber	2	19,040.00	0	114,240.00	57120	9,520.00
		Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical)	3	1.5	no	3	less quantity, stone	3 or 1	ramp out of rammed earth, ground entrance stone, rest	0.5 or 1 or 2	430,920.00	646,380.00	1,292,760.00	861,840.00	125,685.00
		Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical)	3	1.5	no	3	less quantity, stone	3 or 1	ramp out of rammed earth, ground entrance stone, rest	0.5 or 1 or 2	1,242,000.00	1,863,000.00	3,726,000.00	2,484,000.00	362,250.00
		Steel and aluminium handrails, 11.83 kg/m, HRB-4CN, HRB-35N, HRB-4CCMHLN, HRB-35CMN, HRB-4CM,	5.5	0.55	timber	2	timber	2	timber, stone (expensive?)	2 or 1	7,098.00	3,903.90	14,196.00	7,098.00	2,661.75
		Reinforcement steel (rebar), generic, 90% recycled content, A615	0.5	0.5	no	0.5	less quantity	0.5	less quantity	0.5	17,955.00	8,977.50	8,977.50	4,488.75	2,244.38
		Reinforcement steel (rebar), generic, 90% recycled content, A615	0.5	0.5	no	0.5	less quantity	0.5	none depending on design	0	51,750.00	25,875.00	25,875.00	12,937.50	0
2.5	Superstructure: External Walls	Masonry mortar/facing wall mortar/mortar with special properties, 1500 kg/m3, EPD	4	1	limestone / stone at bottom	3 or 1	limestone / stone at bottom	3 or 1	limestone / stone at bottom	3 or 1	542,928.75	542,928.75	1,085,857.50	1,085,857.50	271,464.38
		Masonry mortar/facing wall mortar/mortar with special properties, 1500 kg/m3, EPD	4	1	limestone / stone at bottom	3 or 1	limestone / stone at bottom	3 or 1	limestone / stone at bottom	3 or 1	774,118.95	774,118.95	1,548,237.90	1,548,237.90	387,059.48
		Aluminium rainscreen cladding for façade, 10.8 kg/m2, Vantage® IP Interlocking Plank System (BTS	6	0	bricks / stone	4 or 1	bricks / stone	4 or 1	stone	1	67,338.00	0	168,345.00	168,345.00	16,834.50
		Red brick, average production, UK, 215 mm x 102.5 mm x 65 mm, 2.13 kg/unit, 1485 kg/m3 (Brick	4	1	stone	1	stone	1	stone	1	3,978,998.53	3,978,998.53	3,978,998.53	1,989,499.27	994,749.63
		Lightweight concrete block, with expanded clay aggregate, generic, 650 kg/m3 (40.6 lbs/ft3), 18	3	1.5 or 1	stone	1	stone	1	stone	1	4,121,576.88	6,182,365.32	4,121,576.88	2,060,788.44	1,030,394.22
2.6	Superstructure: Windows and External Doors	Multifunctional steel door, product group 1, 1000mm x 2125 mm, H 3 D, H 3 OD, H 3 VM, H 3 KT, RS 55, D 65	5	0.5	no	5	less quantity	5	timber	2	2,566.50	1,283.25	12,832.50	6,416.25	1,283.25
		Wooden entrance door, per m2, 809x2053 mm, 42x92 mm frame, 52 mm door leaf (Nordic Dørfabrikk)	2	0	no	2	less quantity	2	less quantity	2	80,933.75	0	161867.5	80933.75	40,466.88
		Structural steel profiles, generic, 60% recycled content, I, H, U, L, and T sections, S235, S275 and S355	2	0.5	recycled steel as is or stone	2 or 1	less quantity recycled steel as is or stone	2 or 1	load bearing stone	1	299,370.00	149,685.00	449,055.00	598,740.00	74,842.50
		Hot-dip galvanized steel sheets, recommended sheet steel thickness range: 0.4-3.0 mm (0.015-0.12 in),	5	0.5	no	5	less quantity	5	less quantity	5	420,249.75	210,124.88	2,101,248.75	1,050,624.38	525,312.19
		Wooden stud framing system, 145 mm, 12.76 kg/m2, 60 cm step, included: wooden studs and OSB	2	0	no	2	less quantity	2	less quantity	2	136,621.32	0	273242.64	136621.32	68,310.66
2.8	Superstructure: Internal Doors	Wooden door with wooden frame, biogenic CO2 not subtracted (for CML), 1.03 X 2.09 m, 52.59 kg/m2	2	0	no	2	less quantity	2	less quantity	2	316,393.47	0	632786.94	316393.47	158,196.74
		Massive wooden flooring/parquet, 22-450 x 44-7000 x 8-35 mm, 11.71 kg/m2 (Verband der Deutschen	2	0	stone tiles on ground floor	2 or 1	stone tiles	1	stone tiles	1	139,664.39	0	209,496.59	69,832.20	34,916.10
		Ceramic wall tiles, 7.5 mm, 3000 kg/m2 (Seranit Granit Seramik)	4	1	no	4	less quantity	4	raw earth with sealant	0.5	265,800.00	265,800.00	1,063,200.00	531,600.00	33,225.00
		Laminated skirting board, biogenic CO2 not subtracted (for CML), 0.53 kg/m, height 70-100 mm,	2	0	no	2	less quantity	2	no	2	19,113.92	0	38227.84	19113.92	9,556.96
		Natural stone slab for exterior paving, 30 mm, 86.8 kg/m2, 2757 kg/m3, Infercoa or Black Quartzite	1	0	no	1	less quantity	1	less quantity	1	157,149.00	0	157149	78574.5	39,287.25
		Asphalt, generic, compacted, 5/95% bitumen-aggregate ratio, 2350 kg/m3	1	0	no	1	less quantity	1	less quantity	1	1,188,395.00	0	1188395	594197.5	297,098.75
											TOTAL	133,027,088.48	258,138,737.97	131,646,345.59	37,682,510.37

VERSION 1:
as it is with substitutions
258,138,737.97

VERSION 0:
everything recycled
133,027,088.48

VERSION 2:
shorter height with substitutions
131,646,345.59

VERSION 3:
redesign
37,682,510.37

HIGH NATURE IMPACT → LOW NATURE IMPACT

INITIAL CONCLUSIONS

From our research, it is obvious that the building as it is has the highest impact on nature. It is interesting to see that the number for recycling all materials is the second highest impact, showing the positive impact of recycling on the environment. Using less material and lower nature impactful materials is the second lowest, showing there needs to be more thought into designing large developments as they exhaust the extraction sites. The lowest nature impact is redesigning the building. This is an obvious conclusion as making a smaller building and using as many material substitutions as possible will create a more nature positive building.

POSSIBILITY

This research made aware that some materials cannot be substituted when the building is tall. Stone would be too heavy and timber would not be supportive enough for the structure of the building, and these are the two lowest nature impact materials. In other cases, limitations to using the nature positive materials are fire-related and due to regulations. Therefore, it is hard to make a nature positive building, however, there are definitely substitutions that can be made, but the lowest numbers come from recycling and making the building smaller, as expected. Despite this obvious conclusion, it is interesting to see how much of a difference substituting only a few material makes. As our aim is to become nature positive, all contributions to this is a success to our policy and its goals.

APPENDIX 2: PROPOSED PLANNING POLICY

THE EXTRACTION SITES AND MATERIAL SOURCING REGULATIONS 2026

PART I
General

Interpretation

1. For the purposes of this section -

    a. "Nature Positive" is defined as by reference to the Kunming-Montreal Global Biodiversity Framework, adopted under the Convention on Biological Diversity in 2022 This establishes a global societal goal to: halt and reverse biodiversity loss by 2030, relative to a 2020 baseline, and achieve the full recovery of nature by 2050.
    b. "Nature loss" includes the qualitative and quantitative definition so more green and blue spaces with thriving biodiversity are the goal.

Overview

1. Nature positive materials are defined by -

    a. Those that contribute to reversing nature loss by having a low environmental effect on the extraction site the material originates from.
    b. Materials that are recycled.
    c. Materials that are reused from the development site and contribute to the mitigation of waste.
    d. Nature positive materials include -
        i. Stone
        ii. Timber
        iii. Cement
        iv. Clay / Brick

2. Gaps within existing policies have been revealed, and, for the purpose of this schedule;

    a. Makes provision for grants of planning permission in England to be subject to the consideration of the impact of extraction sites and material sourcing as it considers appropriate for taking action to improve the environment.
    b. The objective is met in relation to development for which planning permission is granted if the consideration of extraction sites and material sourcing is.
    c. Duty to conserve and enhance biodiversity, as followed on from other planning permission documents.

3. The Embodied Ecological Impacts framework supported the investigation of nature positive materials, and;

    a. Extends beyond carbon emissions.
    b. It is insufficient to focus solely on the construction site.
    c. A new framework found in Appendix A notes how the conclusion for nature-positive materials has been obtained.

4. Development plan documents must (taken as a whole) include information on the stat including its extraction site and mode of transport.

CHAPTER I
EXTRACTION SITES AND MATERIAL SOURCING

1. Circular economy;

    a. Re-use everything on site.
    b. Re-cycle all materials into the new building.

2. Extract local materials;

    a. 50km around the building site.
    b. Transport methods are selected to minimise emissions from material transportation.
    c. Recycling plants should be considered first.

3. Know where specific materials come from;

    a. Look into their location of origin.
    b. Look into the Environmental Management Policies (EMPs) of the extraction sites related to the materials specified in the design.
    c. Look at other existing sustainable policies that exist.
    d. Produce a document of findings;
        i. A description of any features of the extraction site that prevents or reduces and, if possible, offset likely significant adverse effects on the environment.
        ii. An indication of the main reason for the chosen extraction site, taking into consideration the effects of the site on the environment.
        iii. Any additional information that is specific to the characteristics of the extraction site that are likely to be affected.

4. Use materials efficiently;

    a. Use recycled materials where possible.
    b. Where possible, use no or limited virgin material.
    c. Produce a document of material choice;
        i. A description of the materials that will result in waste and how these will be recycled and reused in the development site.
        ii. Which materials will be substituted for nature positive materials where possible.
        iii. Which materials will remain as not nature positive and why this decision will not affect the environment at the development site and;
        iv. Why this decision will not affect the environment at the extraction site.
        v. Which materials used will contribute to the mitigation of, and adaption to, climate change.
        vi. Include the information reasonably required for reaching a reasoned conclusion on the significant effects of the extraction sites of the specified materials on the environment, taking into account assessment.
    d. In order to ensure completeness and quality of the material choice;
        i. The developer must ensure that the material choice has been analysed and the document is prepared to completion, and;
        ii. Must be accompanied by the developer outlining their awareness of the environmental effects in the extraction sites

5. The extraction site should be rehabilitated following extraction activities;

    a. If the material specification uses extraction sites that fail to go back to its original state, planning permission will be refused.
    b. Features in the extraction sites that need to be considered include -
        i. The preservation or planting of trees.
        ii. The restoration of soil.
        iii. The restoration of the status of nearby water sources affected, including surface water.

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