Refuelling the Refuelling Station

A Replicable Retrofit Model for Motorway Service Infrastructure

at Golden Fleece, J42, M6/A6, Carlisle, UK

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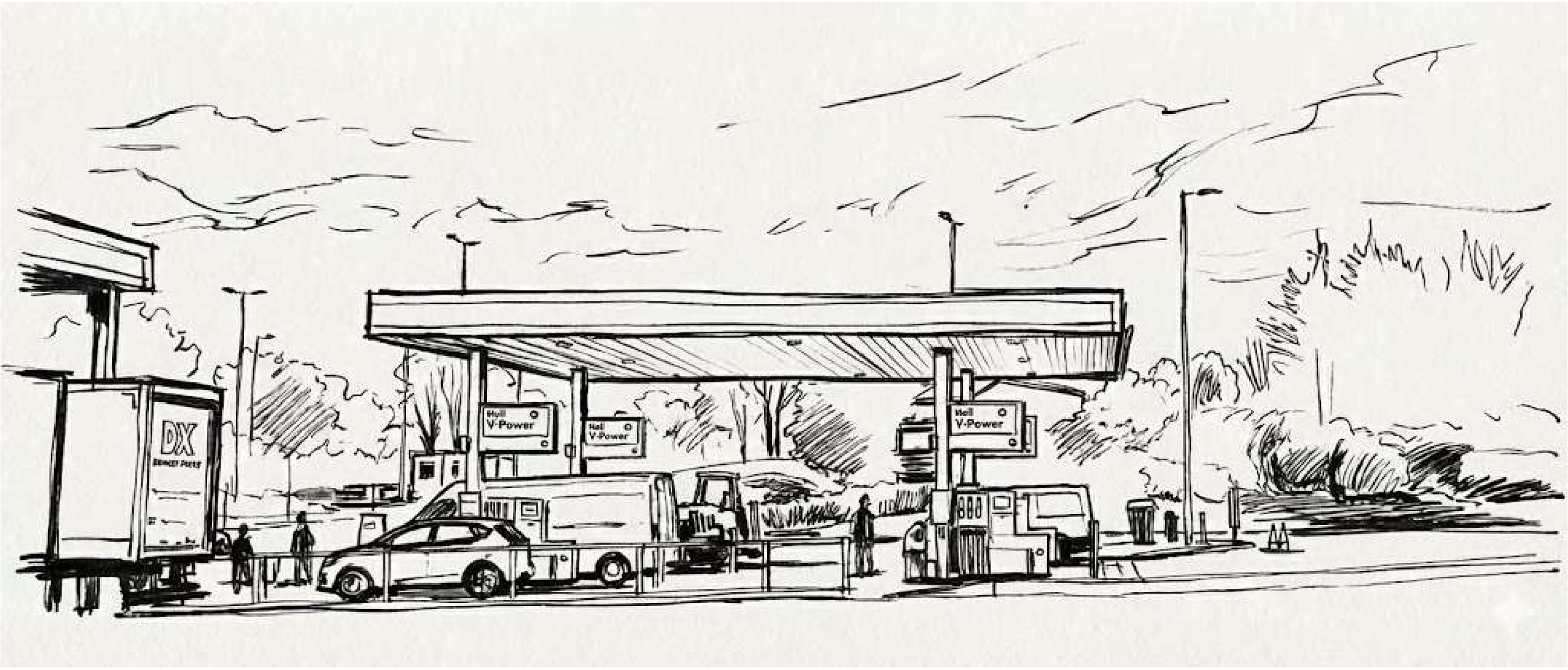

InfraVision 2026 Student Competition · Infrastructure as a System: Rethink the Future
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Abstract

Refuelling the Refuelling Station

The motorway service station is the largest piece of public infrastructure we are about to throw away and the one best positioned to become something else.

Problem.

Across Europe the motorway service station is becoming a stranded asset. Built around a five-minute transaction and a fossil supply chain, it now faces electrification, autonomous logistics, climate volatility and tightening carbon regulation at once. The default response is demolition and rebuild.

Position.

This project argues the opposite. These sites are among the most valuable retrofit stock we hold: their structural frames, heavy-duty hard standings and captive footfall are precisely what a post-carbon public infrastructure needs. Electrification does not shrink the service station — by extending dwell time from five minutes to 42 or more, it creates the very condition a public building requires.

Method.

Golden Fleece Service Station at M6 Junction 42, Carlisle, is taken as a prototype. The site sits at the intersection of three transitions: energy (the forecourt), demography (10,000+ new homes at St Cuthbert's Garden Village) and ecology (the flood-exposed River Eden catchment). Site survey recorded **1,116 ppm** CO_2 inside the retail unit — the existing model already fails its own users. The proposal treats the station as four interlocking layers rather than a building: an **energy layer** of hydrogen, vehicle and HGV charging beneath a photovoltaic canopy; a **social layer** converting extended dwell time into a community economy housed in five decommissioned oil tanks; a **water layer** turning surface runoff into a terraced public landscape that also shields pedestrians from the HGV yard; and a **material layer** retaining the steel frame and brickwork beneath a glue-free, mechanically fixed cork envelope designed for disassembly.

Outcome.

The resolved scheme is costed at £7.95 –10.40m and assessed at 680 $kgCO_2e/m^2$ — a 10% reduction against a like-for-like new build (758). It is stress-tested against five futures — severe flooding, economic downturn, the post-car era, autonomous logistics, and the preferred trajectory but under each of which the four layers degrade gracefully rather than fail.

Transfer.

Five principles are extracted: retain the skeleton; convert dwell time into social time; make water public; build dry and reversible; return consumption to the local economy. Applied across the network, retrofitting the fossil forecourt becomes the largest available public-space project of the energy transition.

5 min → 42 min

1,116 vs 413 ppm

10,000+ homes

680 vs 758 $kgCO_2e/m^2$

£7.95–10.40m

Concept Diagram

Building upon the current site conditions and integrating prospective development trends, the ultimate design objectives are formulated.

Electrification does not kill the service station. It gives it the one thing a public building needs: time.

Energy

The forecourt already owns the grid connection, the hard standing and the traffic. Electrification makes it the cheapest charging estate we have.

5 min → 40+ min dwell

Social

Twenty-five extra minutes per visitor, multiplied by existing captive footfall, is the raw material of a public building.

10,000+ new homes at St Cuthbert's

Water

Impermeable hard standing draining into a flood-exposed catchment becomes a terraced public landscape that also does the drainage.

runoff detained on site

Material

The steel frame, brickwork and decommissioned tanks stay. The new envelope is glue-free and demountable.

680 vs 758 kgCO_2e/m²

The Argument

Sixty years of five-minute design. The service station was built around a transaction that takes five minutes. Every dimension on the site follows from it — the canopy span, the parking bay, the kiosk, the queue. Electrification breaks that constant. Operators quote twenty to thirty minutes at an ultra-rapid charger; across 1.4 million measured paid sessions the average is forty-two. Same site, same traffic, eight times the dwell.

That interval is the project. Forty minutes is long enough to eat, work, wait, meet, or be taught something — long enough to justify a building rather than a kiosk. Every subsequent move in this proposal follows from it: the four layers exist because the **time** exists.

Read them as a system, not a menu. Energy pays for social; social justifies water; water protects material; material lowers the cost of all three. Remove one and the system degrades. It does not collapse.

Contents

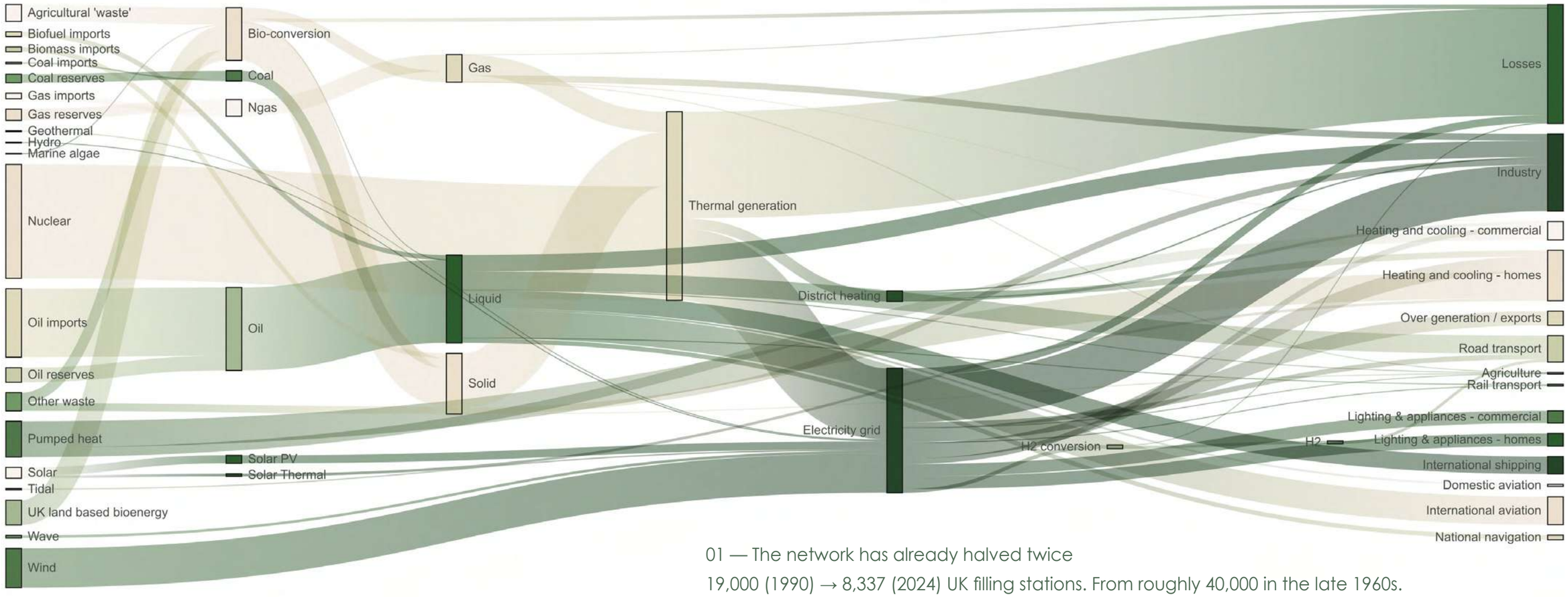
PART 00 Framing	1-3	Cover, abstract, and the central argument.
PART 01 The System Under Stress	4-8	Why the fossil forecourt is becoming a stranded asset -territory, demography, ecology.
PART 02 The Model	9-13	Four interlocking layers: energy, social, water, material.
PART 03 The Prototype	14-27	Golden Fleece resolved at building scale - masterplan to wallbuild-up.
PART 04 Resilience under Uncertainty	28-29	Five futures stress-tested against the four layers.
PART 05 Delivery, Value & Scale	30-37	Phasing, cost, carbon, governance, funding and the transferto the network.

Petrol Fill ▯ **5 min**
Rapid Charge ▯▯ **42 min**

The Transition Has a Geography

Where energy stops being a flow and becomes a place

British Energy Sankey Diagram



The diagram above describes the United Kingdom's energy system as a set of flows: extraction, conversion, loss, end use. It is the standard way the transition is drawn, and it is missing something. Flows terminate somewhere physical. For road transport, that somewhere is a forecourt.

Britain has roughly 8,300 filling stations, down from about 19,000 in 1990. Among them sit some 97 motorway service areas — spaced by regulation no more than 28 miles apart, required to open 24 hours, most of them controlled by four operators. That is not a scattering of private businesses. It is a national grid of publicly regulated sites that already holds land, grid capacity, drainage and traffic.

The energy transition will not remove these sites. It will change what they are for, and it is already changing who owns them. The question this project asks is whether that change is designed, or merely absorbed.

01 — The network has already halved twice
19,000 (1990) → 8,337 (2024) UK filling stations. From roughly 40,000 in the late 1960s.
Source: Fuels Industry UK, "Marketing and forecourts"

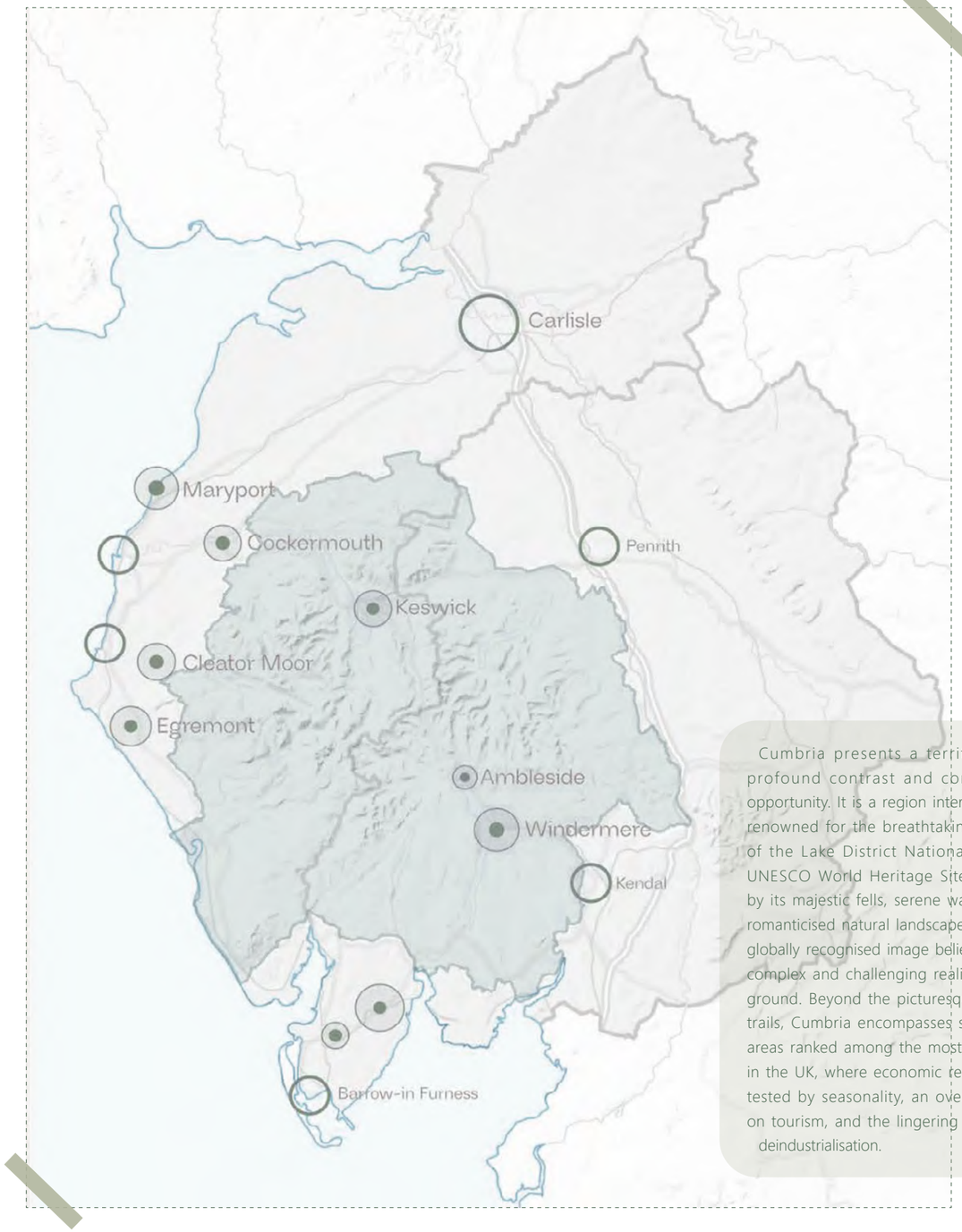
02 — The five-minute stop is over
Petrol fill ≈ 5 min | Measured average rapid-charge session = 42 min Across 1.4 million paid DC fast-charging sessions, 2020–2023. UK operators quote 20–30 min at 360 kW.
Source: US DOE / EVWATTS (2023); Roadchef (2026)

03 — The regulation is now fixed
33% (2026) → 80% (2030) → 100% (2035) ZEV mandate share of new car sales. New petrol and diesel car sales end in 2030; hybrids permitted to 2035. Penalty £12,000 per non-compliant car.
Source: UK Department for Transport, ZEV Mandate

Territory of Contradictions

Site Context & Opportunities

Cumbria: A Landscape of Contradictions and Convergence

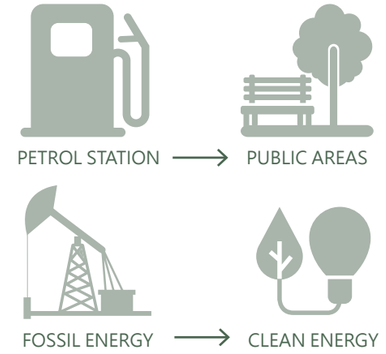


Cumbria presents a territory of profound contrast and compelling opportunity. It is a region internationally renowned for the breathtaking beauty of the Lake District National Park, a UNESCO World Heritage Site defined by its majestic fells, serene waters, and romanticised natural landscape. Yet, this globally recognised image belies a more complex and challenging reality on the ground. Beyond the picturesque tourist trails, Cumbria encompasses significant areas ranked among the most deprived in the UK, where economic resilience is tested by seasonality, an over-reliance on tourism, and the lingering legacy of deindustrialisation.

Core Objective: Building an Eco-Social Hub

A Legacy of Industry and a Blank Canvas for Regeneration

The site embodies the challenges of the 20th-century automotive era, featuring aging infrastructure, potential ground contamination, and and new energy is the trend of future development. However, these challenges are precisely its greatest opportunities. The existing structures, including the fuel canopy, the shop building, and the iconic storage tanks, are not liabilities but **potent industrial artefacts ready for adaptive reuse**. Their robust forms and significant spatial volumes offer a unique character that can be repurposed to tell a new story. Repurposing existing gas station spaces into **new public areas**, while shifting from traditional fossil fuel supply to **clean energy sources** like electricity, solar, or hydrogen, presents an opportunity to counteract decades of environmental impact. This effectively transforms a source of high carbon emissions and heat island effects into a showcase for ecological urbanism.



A Microcosm of Social Transition

The site operates at the intersection of diverse user groups: long-distance hauliers, daily commuters, tourists exploring the Lake District, and residents of surrounding communities. This convergence creates a dynamic, if currently underutilised, social space. The opportunity exists to consciously design for these overlapping communities, **fostering new forms of social exchange** in a context typically defined by transience. The planned development of up to 10,000 new homes in the area underscores the urgent need for such a community focal point, making the site a critical testbed for building social cohesion in a growing region. The presence of further education institutions, though facing challenges, provides a potential partner for innovation, skills development, and ensuring the project's long-term relevance as a centre for learning and cultural production.

User Analysis

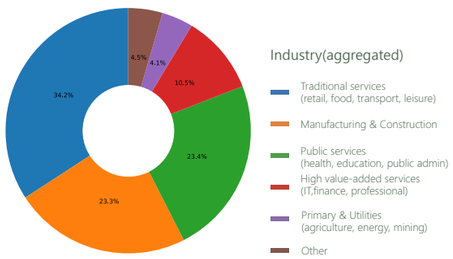
From Fossil Fuel Station to Eco-Social Catalyst

The core objective of this project is to transform the site's fundamental identity from a node of fossil fuel consumption into a prototypical Eco-Social Hub. This goes beyond simple sustainability, aiming to create a resilient system where ecological health and social well-being are mutually reinforcing. The hub will demonstrate a new paradigm for post-carbon infrastructure, where the movement of people, resources, and ideas is reconfigured around principles of regeneration, equity, and shared value creation.

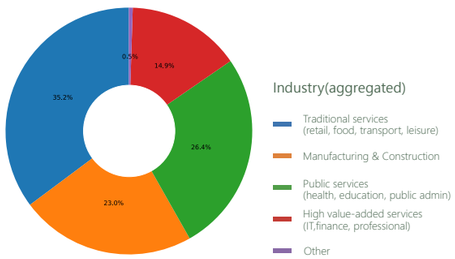
Socioeconomic Pressure

Social & Economic Layer Analysis

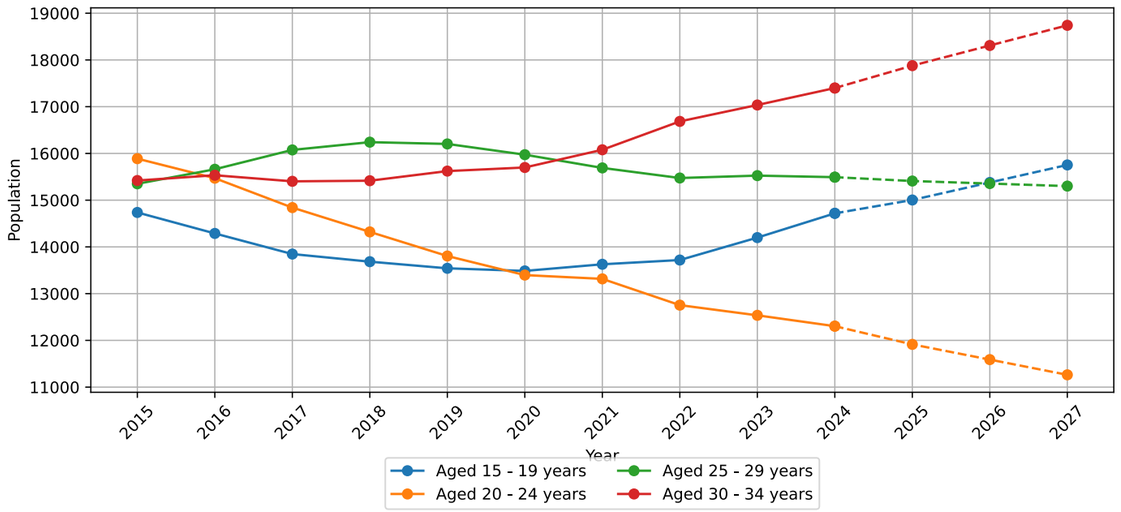
Carlisle employment by broad industry group (approx. 2001 Census)



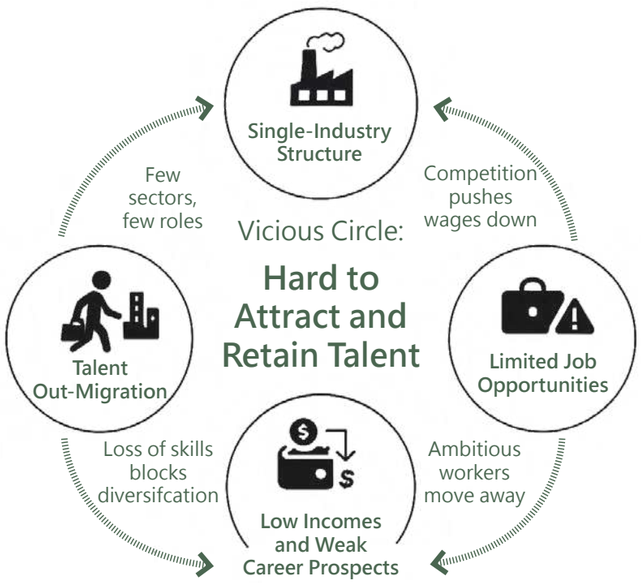
Cumberland employment by broad industry group (approx. 2024)



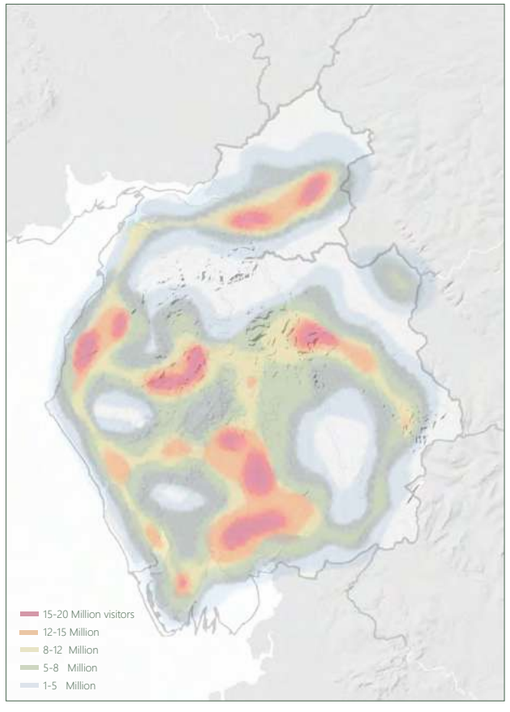
Cumberland population by age group (2015-2027, with short-term forecast)



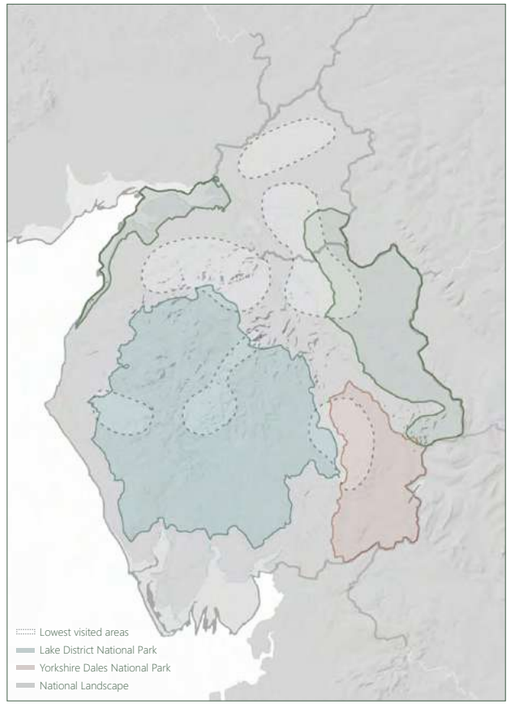
*Because Carlisle City was merged into the new unitary authority of Cumberland in 2023, we use Cumberland-level youth population to represent the wider Carlisle area.



Tourism densily heatmap of peak visiting time



Lowest vistor areas dunng of peak times

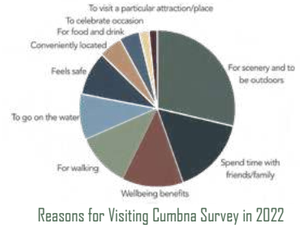


Tourism Economies Analysis

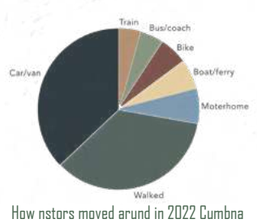
Seen through the statistics, there are way fewer visitors in the north ofCumbna, with locations such as Whitehaven and Dalston, includingCarlisle. With peak activity in the summer, a popular time for outdoor activitiesoff-peak times in certain areas like Wasdale and Eskdale, aroundspring or autumn, are diffcult to access.

According to the data on visitor movement, the most common modeof transportation is by car at 91% in 2022, with train and bus at thelowest. This can also be explored to see how public transport could bemore accessible as an option for visitors.

This information helps shape how spatial organization can increasethe visitor economy, The DMP's plan of Action includes developinga Cumbria food and drink strategy, seeing potential in Octoberfest,and capitalizing on the reputation for Michelin Star success. It alsoincludes supporting events and festivals outside of peak periods withmore wet-weather activities like an ongoing observatory project.



Reasons for Visiting Cumbna Survey in 2022



How nstors moved arund in 2022 Cumbna

Single-industry Economy: Few Job Opportunities

Figure X shows that employment in Carlisle is heavily concentrated in wholesale and retail, traditional manufacturing and the public sector (health and social work, education, public administration and defence), which together account for well over two-thirds of all jobs.

By contrast, high value-added sectors such as finance and professional business services make up only a small share of employment. This industry mix suggests a **relatively narrow and low value employment base**, with fewer high-skill, high-wage opportunities, which in turn makes it harder for the city to attract and retain young and highly qualified workers.

Low income: the Outflow of Talent

Overall, figure X indicates that while the total population of Cumberland has remained broadly stableor even grown slightly between 2015 and 2024, the number of residents aged 15-24 has beenconsistently lower than in 2015. This points to a structural loss of young people rather than generaldepopulation. Given that young cohorts are particularly sensitive to job prospects and careerprogression, such a pattern is typically associated with limited local employment opportunities, anarrow range of job types and a shortage of high-skill positions. It is therefore reasonable to arguethat Carlisle / Cumberland faces the challenge of "few job opportunities, a relatively undiversifiedemployment structure, and difficulties in retaining young talent".

From Nodes to Communities and Transportation Networks

St Cuthbert's Garden Village

St Cuthbert’ s Garden Village must deliver on the overarching vision of providing "connected villages embedded in stunning healthy landscapes within the world - class setting of the Lake District National Park, the North Pennines Area of Outstanding Natural Beauty and Hadrian's Wall World Heritage Site.
A cluster of distinct Garden Villages set in an attractive recreational, riverside and landscape setting will be well connected to Carlisle and the wider countryside.
St Cuthbert's will actively promote healthy lifestyles providing integrated communities focused around high quality homes, locally distinctive spaces and inclusive facilities. Innovation and technology will support attractive employment opportunities and exemplary low carbon living.”

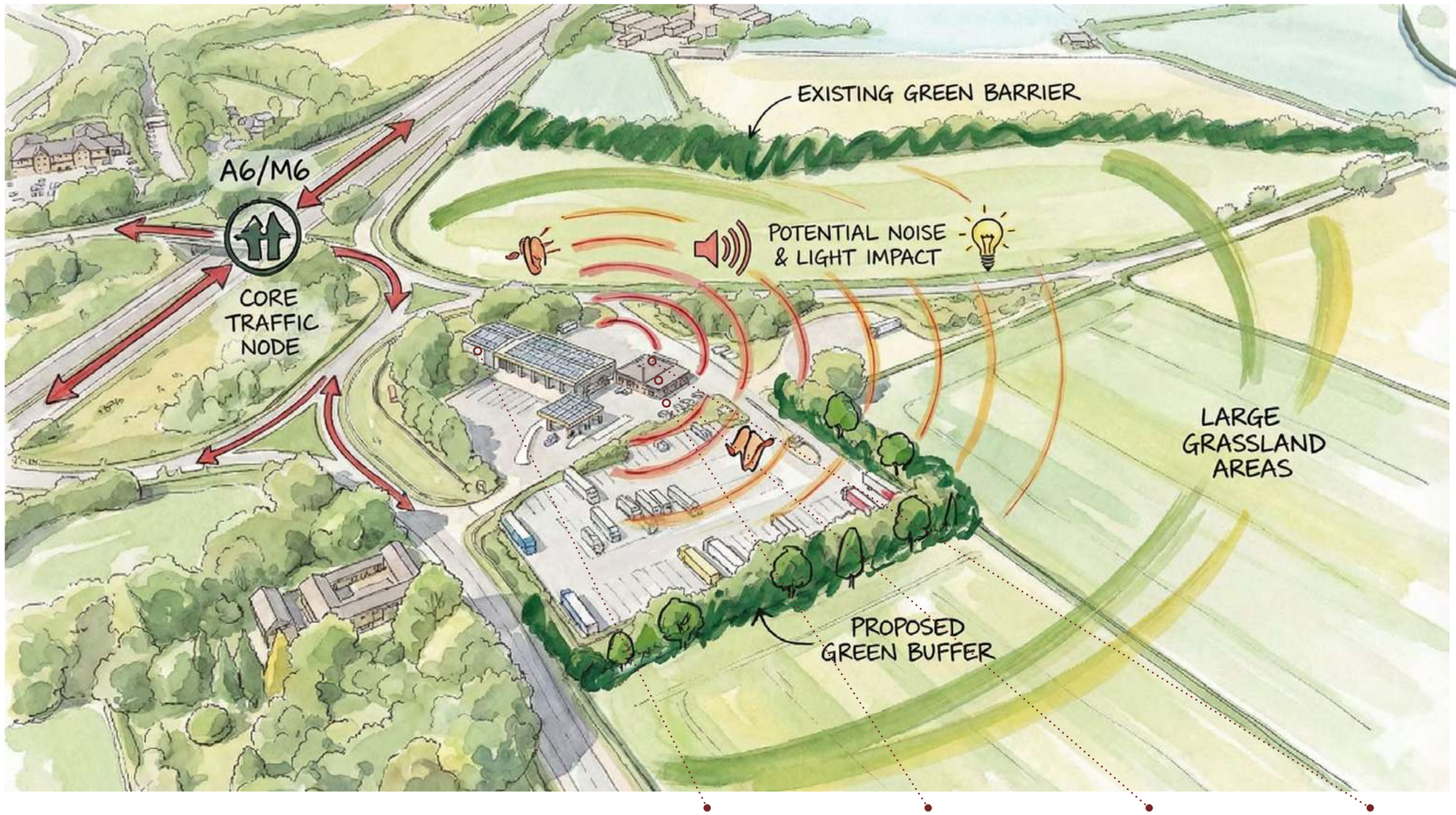
—— St Cuthbert’ s Garden Village Vision

Analyze the planned 10,000+ new homes as a major driver of change. This represents a significant test for the region's sustainability and its ability to create a new, positive identity for a growing population.

Stakeholder Power-Interest Grid

Site Diagnosis and Triple Fracture

Current Conditions



Temperature & Humidity

On-site survey and measurement data were collected and analyzed, revealing that:
Air Quality is Generally Good, with Localized Exceptions: The low PM2.5 is a positive baseline. The spikes in CO_2 and TVOC are the most critical findings.
Reuse: The existing underfloor heating is active and can be integrated into the new design.
Ventilate: The high CO_2 in the store confirms the need for better windows or mechanical ventilation.
Purify: The elevated TVOC in the tank area suggests a need for source control and air filtration in the redesign.

PM2.5 (µg/m³): 16
CO_2 (ppm): 413
HCHO (mg/m³): 0.011
TVOC (mg/m³): 0.272
Temperature (° C): 15
Relative Humidity (%): 54

PM2.5 (µg/m³): 17
CO_2 (ppm): 1116
HCHO (mg/m³): 0.009
TVOC (mg/m³): 0.033
Temperature (° C): 16
Relative Humidity (%): 52

Thermal Imaging (Spot Temps, ° C)

Min: 18.9
Cen: 28.7
Max: 35.9

Thermal Imaging (Spot Temps, ° C)

Min: 14.3
Cen: 19.1
Max: 29.6

the Eden River: Sewage

This map illustrates the monitored storm overflow sites and key river channels within the Carlisle area, with a specific focus on the River Eden

Current Discharge Status:
The **green dots** on the map represent storm overflow sites that are **currently not discharging**.

Overflow Concentration:
The path of the River Eden (highlighted in greenline) shows a concentration of overflow outlets along its course through Carlisle.

Confluence of Rivers:
The area is situated at the confluence of three rivers: the Eden, Caldew, and Petteril. The map reveals **multiple discharge points** distributed along these main river channels.

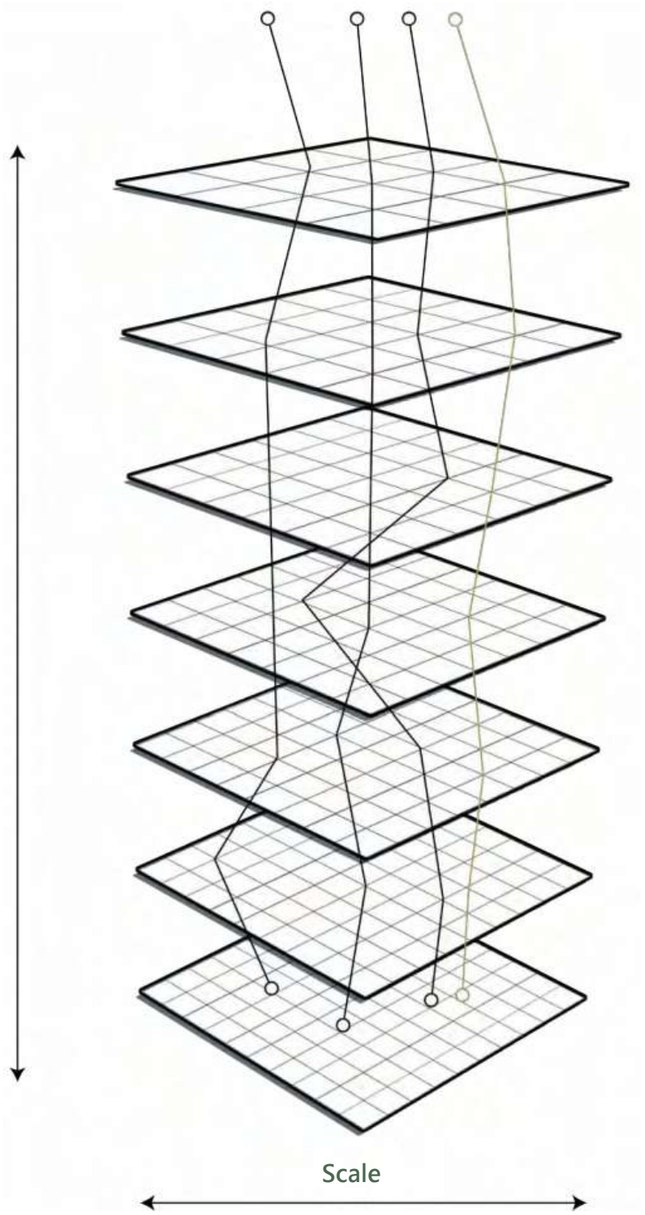
In summary, the visual analysis concludes that while some monitored sites are inactive, there is a notable presence of potential discharge infrastructure along the River Eden and its tributaries in the Carlisle area.

Core Issue:
The site is trapped in a mono-functional car-centric model, characterized by large impermeable surfaces (e.g., asphalt parking) that exacerbate rainwater runoff, potential soil contamination from its past use, and a clear disconnect from the surrounding natural ecology, particularly the nearby River Eden catchment. This represents a typical ecological fracture.

The Stack — System Framework

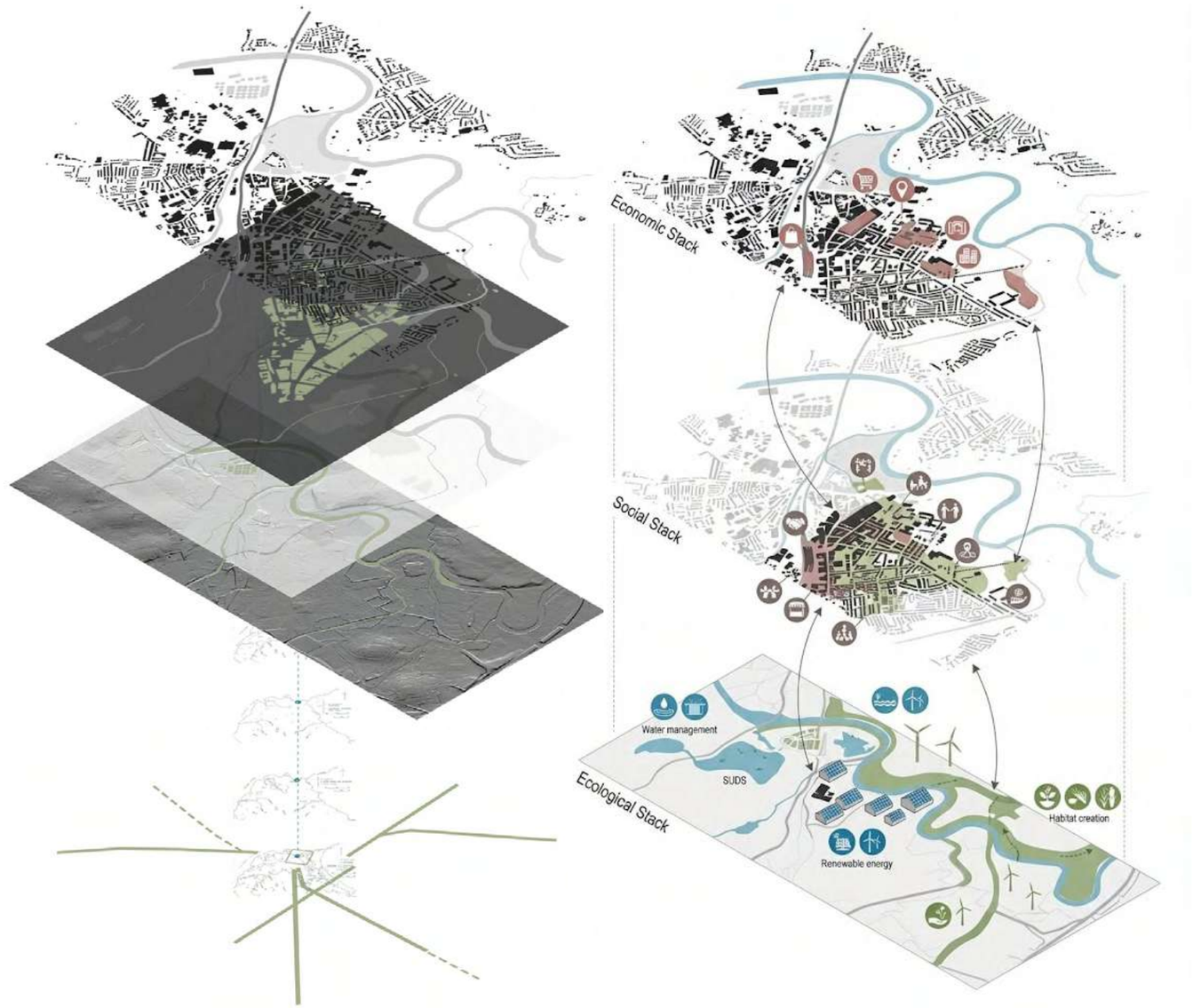
This project transforms Stack from an analytical tool into a design tool.

Synergistic 'Stack' Strategy



Adaptive Reuse & Regenerative Transformation

The robust industrial legacy—fuel canopy, storage tanks, and steel frame—is treated as a valuable resource, not waste. Adaptive reuse minimizes embodied carbon and preserves historical narrative, while new interventions focus on ecological repair and clean energy integration (e.g., BIPV, EV charging).



Building on Bratton's (2016) concept of a Stack of Processes, the Infrastructure Atelier encourages students to analyse the interactions within these processes through data mapping, fostering a more holistic understanding of their chosen sites.
We propose a strategic overlay of ecological, social, and economic functions within the same spatial footprint. The existing industrial "bones" of the site provide the framework for this stack, where a single space can serve multiple communities and purposes over time, creating a resilient and efficient system.

Layer 1 — Energy

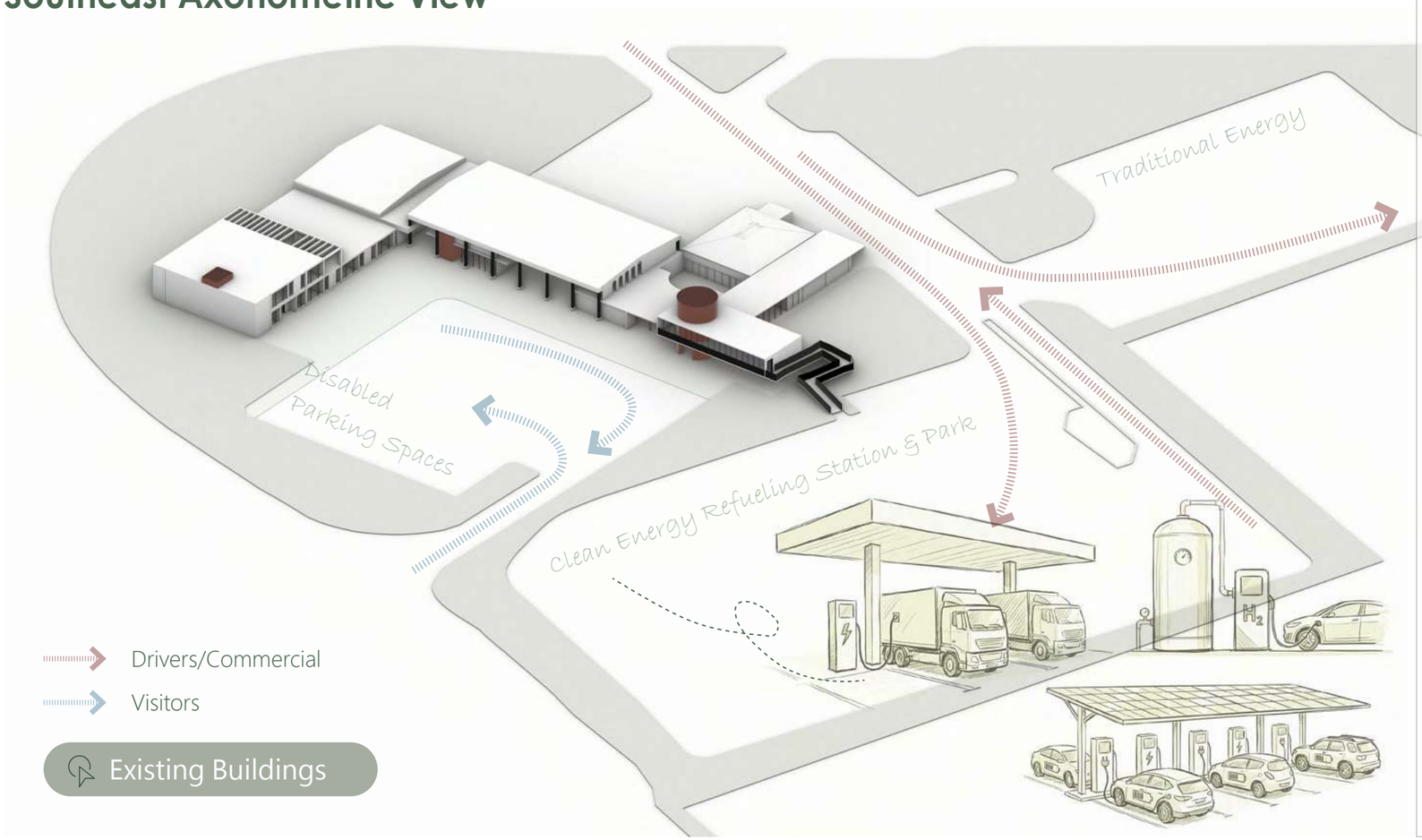
6 Fuel Storage Tanks

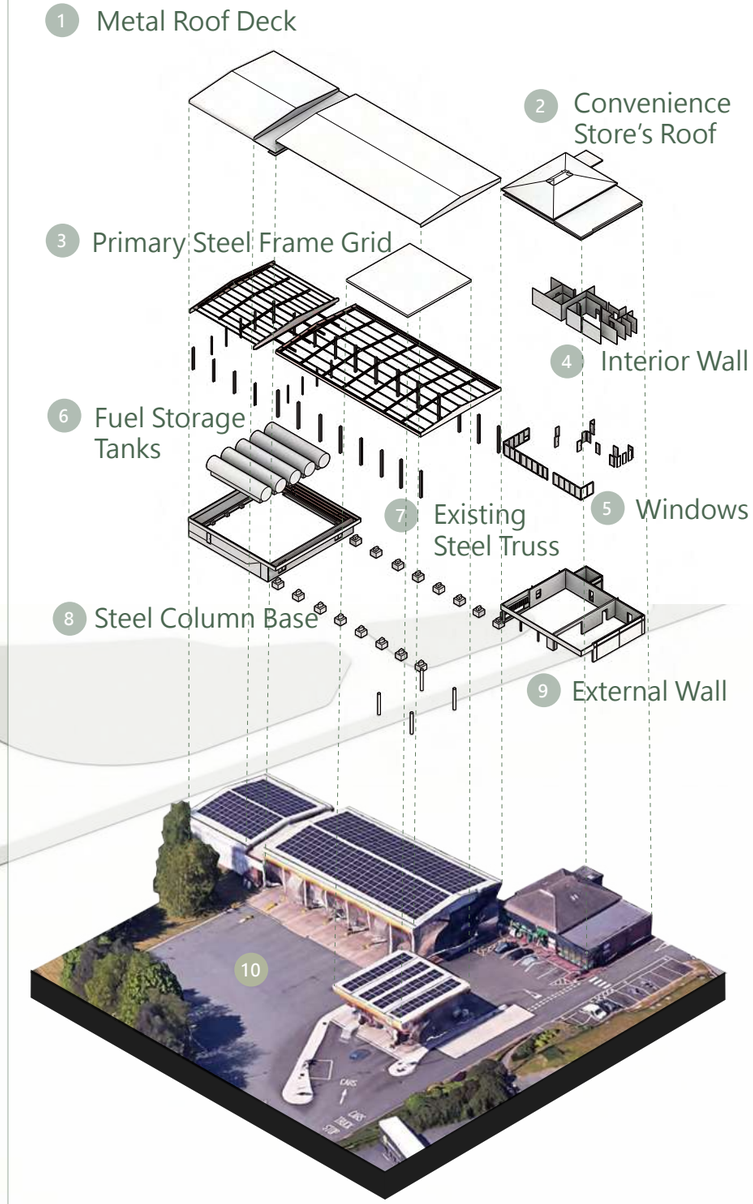
Material & Condition: Decommissioned steel tanks with significant spatial potential but requiring mandatory decontamination.
Adaptive Strategy: **Creative transformation.** After professional remediation, these unique industrial artifacts will be repurposed as iconic social spaces.

1 Metal Roof Deck

Material: Metal Sheeting + Solar Photovoltaic Panel
Adaptive Strategy: The roof deck will be replaced with a high-performance insulated composite panel system, integrated with Building-Integrated Photovoltaics (BIPV). This transforms the canopy from a shelter into a power-generating asset.

Southeast Axonometric View



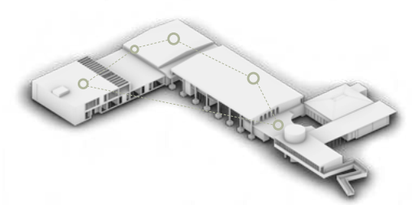
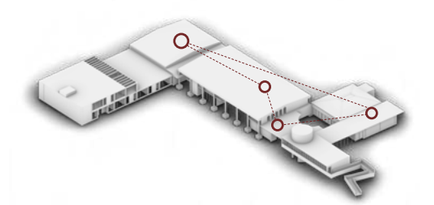
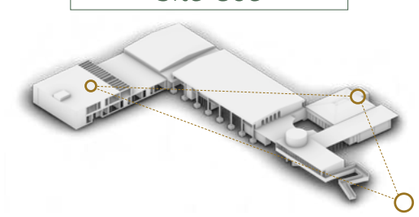
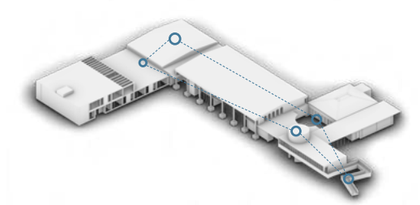
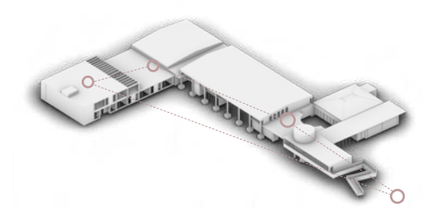


Masterplan Initiatives

① Implement clear **hierarchical and separated circulation** for different user groups.
② **Retain and enhance** existing buildings as the core, complemented by new volumes that connect and expand their utility for a community-focused future.
③ **Design robust infrastructure** that supports current logistical needs (large vehicle access) while proactively transitioning to a **clean-energy vehicle ecosystem**.

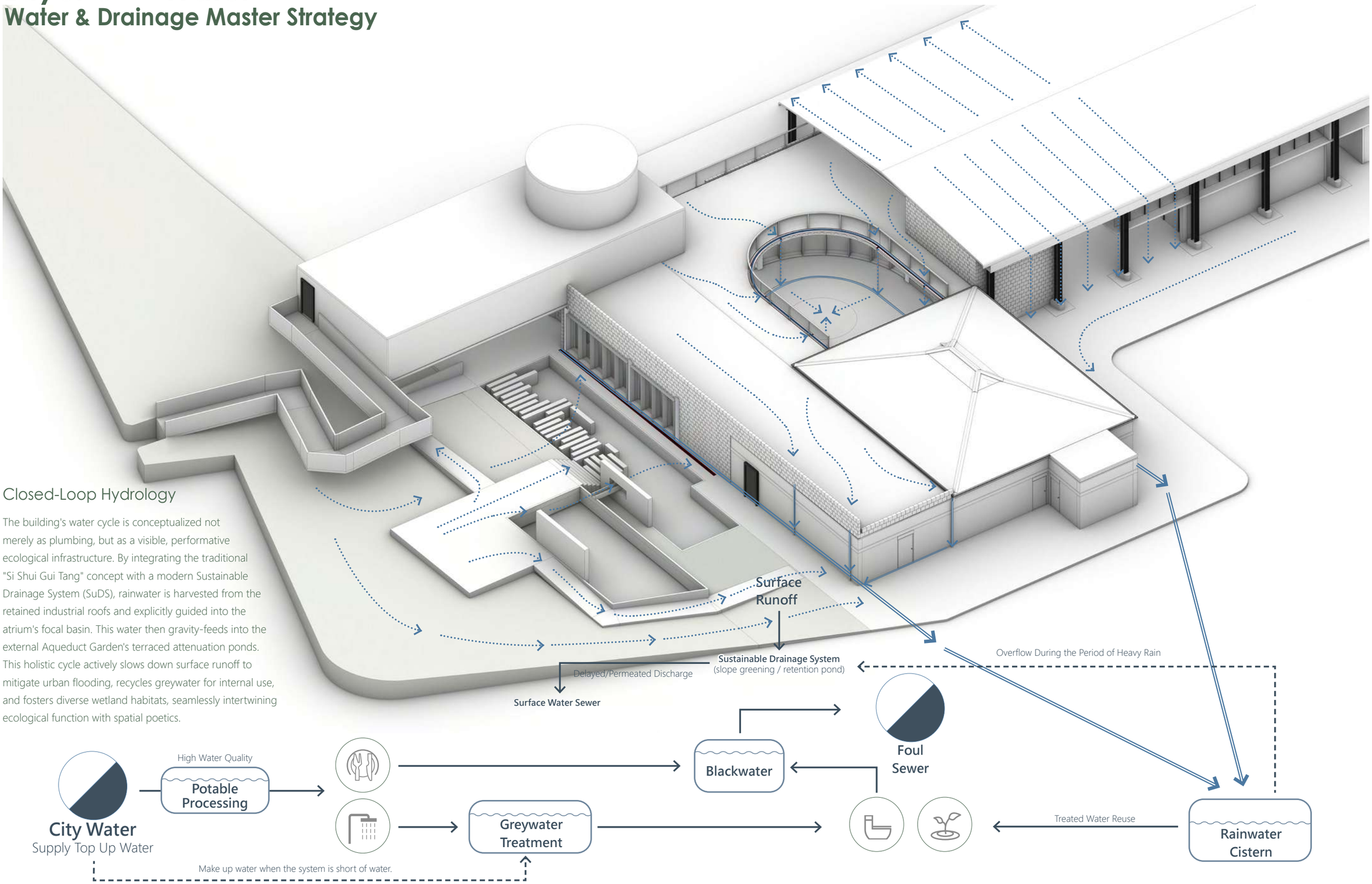
Layer 2 — Social

The former Golden Fleece service station sits at a strategic junction between the M6 and the A6, acting as a gateway to Carlisle and the wider Cumbria region. The site already brings together long-distance hauliers, daily commuters, tourists heading for the Lake District and surrounding communities. At the same time, the planned St Cuthbert' s Garden Village will add over 10,000 new homes nearby, creating a much larger local population that needs services, social spaces and everyday amenities. So, the future eco-social hub is designed for a wide range of everyday users rather than a single target group. For design purposes, users are grouped by life stage and by how they use the facilities. Each group overlaps in time, but different parts of the programme support them in distinct ways.

Young Adults & Students	New Residents & Young Families	Commuters, Drivers & Logistics Workers	Local Older Residents	Visitors & Tourists to the Lake District
Age : 18-30	Age : 25-45	Age : 25-60	Age : 60+	Age : all ages
Profile				
Young adults and students from local colleges, early-career workers and freelance creatives who look for affordable places to work, meet and spend time.	Households moving into the new housing around the site, especially St Cuthbert's Garden Village, often with children and busy working lives.	Daily car commuters on the A6 / M6, HGV drivers and servicezz staff who use the site as a regular rest, refuelling and service point.	Long-term residents of nearby villages and future retirement-age residents of the Garden Village, seeking safe, accessible places for everyday social life.	Domestic and international tourists using the M6 / A6 corridor to reach the Lake District and Scotland, often stopping briefly on their journey.
Main Facilities				
Shared Workspace & Restaurant – informal desks, Wi-Fi and meeting spots for study, remote work and group projects. **Community Activity Centre & Tank workshops** – maker spaces, music or film nights, small performances and club events. **Hotel & Book Café, roof terraces** – relaxed evening hang-out spaces and small cultural events.	**Community Activity Centre** – weekend markets, children' s workshops, parent–child activities and community meetings. **Exhibition Space and courtyard** – family-friendly exhibitions, seasonal festivals and local craft fairs. **Restaurant and upgraded convenience store** – everyday meals, meeting neighbours and quick shopping on the way home.	**Hydrogen refuelling, truck and EV charging –** fast, reliable clean-energy refuelling for commercial fleets and private vehicles. **Existing Services retrofit –** improved showers, sanitary facilities, healthy food and comfortable rest areas. **Hotel –** overnight stays for long-distance drivers, maintenance teams or visiting technicians.	**Tank Café, Book Café and courtyard –** warm, sheltered daytime spaces for meeting friends, reading and watching daily life. **Community Activity Centre –** low-intensity classes, craft groups, health-related outreach and inter-generational activities. **Ramps, lifts and clear wayfinding –** barrier-free routes connecting parking, interiors and roof gardens.	**Hotel & Book Café –** short breaks and overnight stays close to the motorway, combining rest with a sense of place. **Exhibition Space –** introducing local landscape, heritage and crafts, framing the station as a gateway to Cumbria. **Clean-energy forecourt –** EV and hydrogen refuelling integrated with legible parking and wayfinding for visitors.
Site Use				
				

Layer 3 — Water

Water & Drainage Master Strategy



Closed-Loop Hydrology

The building's water cycle is conceptualized not merely as plumbing, but as a visible, performative ecological infrastructure. By integrating the traditional "Si Shui Gui Tang" concept with a modern Sustainable Drainage System (SuDS), rainwater is harvested from the retained industrial roofs and explicitly guided into the atrium's focal basin. This water then gravity-feeds into the external Aqueduct Garden's terraced attenuation ponds. This holistic cycle actively slows down surface runoff to mitigate urban flooding, recycles greywater for internal use, and fosters diverse wetland habitats, seamlessly intertwining ecological function with spatial poetics.

Layer 4 — Material

Core Philosophy: Industrial Legacy as a Resource

The site's value lies in its robust lightweight industrial steel structure and its clear, functional logic. Retaining this "bones" of the site is not merely an economic or sustainable choice, but an act of honoring its history, transforming a symbol of fossil fuels into a framework for community and ecology.

② Convenience Store's Roof

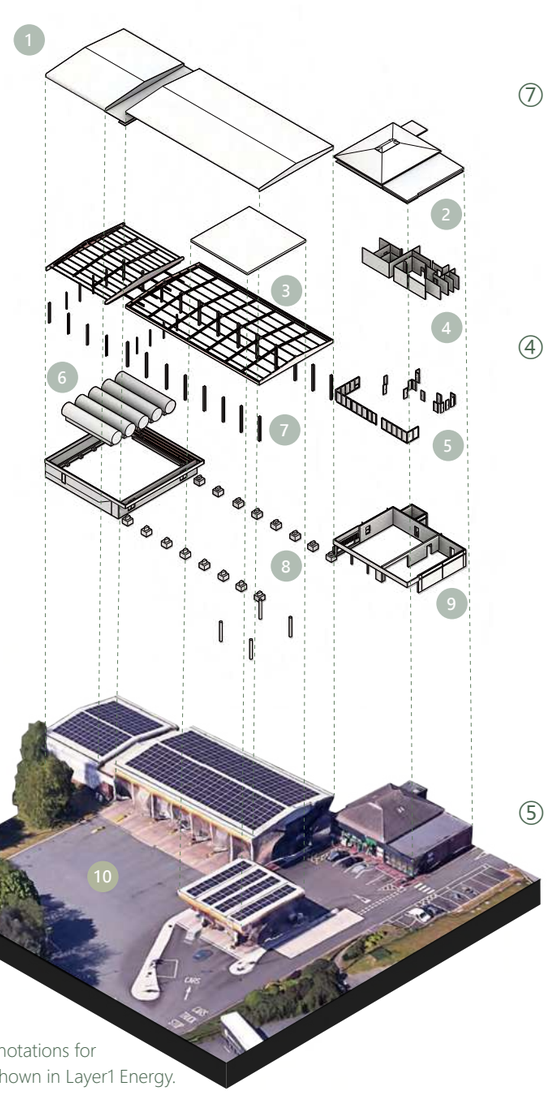
Material: Asphalt Shingles

Adaptive Strategy: Loose or damaged sections will be secured or replaced. Preserving the original roofline and materiality maintains the building's architectural character as a recognizable element of the site's history, contributing to a layered narrative rather than a complete erasure.

③ Primary Steel Frame Grid

Material & Condition: Long-span lightweight steel trusses with profiled metal sheeting. The structure is sound but shows signs of surface corrosion and poor thermal performance.

Adaptive Strategy: **Retain and reinforce.** The primary trusses will be cleaned, treated, and expressed as architectural features.



The specific annotations for ① and ⑥ are shown in Layer1 Energy.

⑦ Existing Steel Truss

Material & Condition: H-shaped steel columns forming a flexible, column-free space. Structurally sound but requiring surface treatment.

Adaptive Strategy: **Full retention**. This grid defines the spatial order and is the baseline for all new interventions. Columns will be inspected, sandblasted, and receive new fireproofing and anti-corrosion coatings.

④ Interior Wall

Material & Condition: The interior walls of the existing convenience store structure are most likely painted plasterboard (drywall) or painted masonry blockwork.

Adaptive Strategy: **Adaptive reuse.** This structure will be the solid container for new public functions (workshops, galleries). Non-load-bearing partitions will be removed to create flexible, open plans, allowing the old frame to host new community life.

⑤ Windows

Material: Aluminum Alloy Frame + Large Plate Glass

Adaptive Strategy: **Retain and reinforce.**

⑧ Steel Column Base

Material & Condition: The column bases consist of a pinned or semi-rigid connection, where the steel column is anchored to a reinforced concrete foundation via a base plate and cast-in anchor bolts.

Adaptive Strategy: **Comprehensive Maintenance & Remediation**. A proactive, multi-stage approach is essential to ensure the structure's safety and longevity for its new public function.

⑨ External Wall

Material: Solid red brickwork

Adaptive Strategy: **Selective retention and upgrade.** The brick walls will be retained for their mass and character. Internal insulation will be added, and new, larger openings will be carved to improve daylighting and visual connectivity.

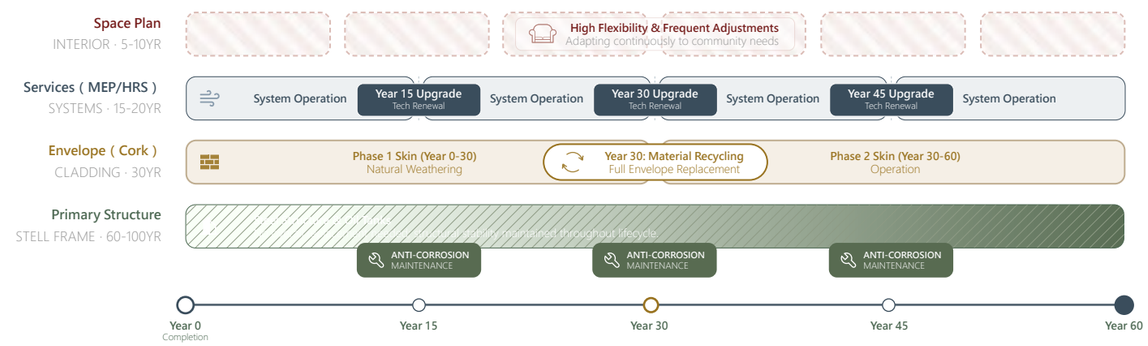
⑩ Existing Asphalt Pavement

Material & Condition: Extensive **impermeable surfaces** contributing to water runoff and heat island effect.

Adaptive Strategy: **Creative transformation.** After professional remediation, these unique industrial artifacts will be repurposed as iconic social spaces.

Building & Components Design Lives

Lifespan Breakdown



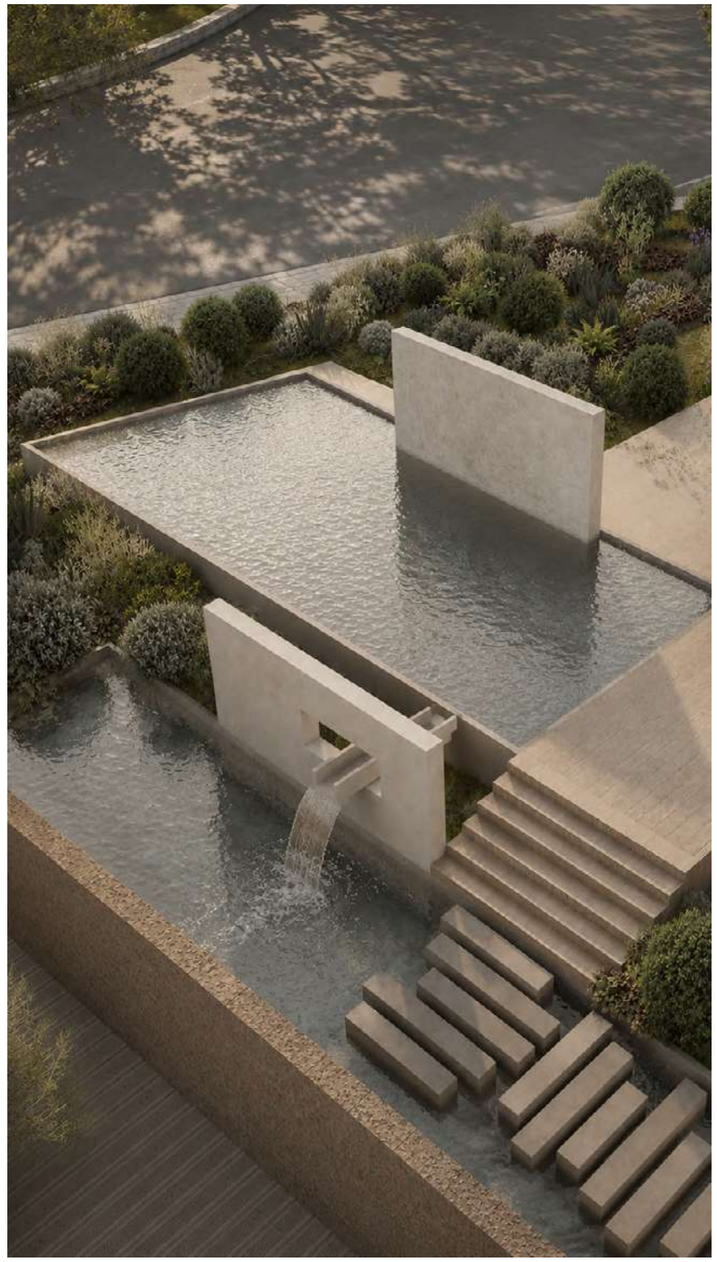
The project management strategy is based on the "Shearing Layers" concept. Different building components possess varying lifespans. The design ensures that the maintenance or replacement of short-lived elements does not disrupt the long-term primary structure.

Building System	Components	Design Life	Maintenance & EoL Strategy
Site & Primary Structure	Steel Structure	60-100 Years	Anti-corrosion maintenance every 15 years
Envelope & Skin	Cork Panels	25-30 Years	Full replacement and recycling at Year 30
Services	MEP & HRS	15-20 Years	Technology upgrades every 15 years (According to the technological iteration)
Interior Space	Partitions & Furniture	25-30 Years	High flexibility & frequent adjustments

PART3 - The Prototype

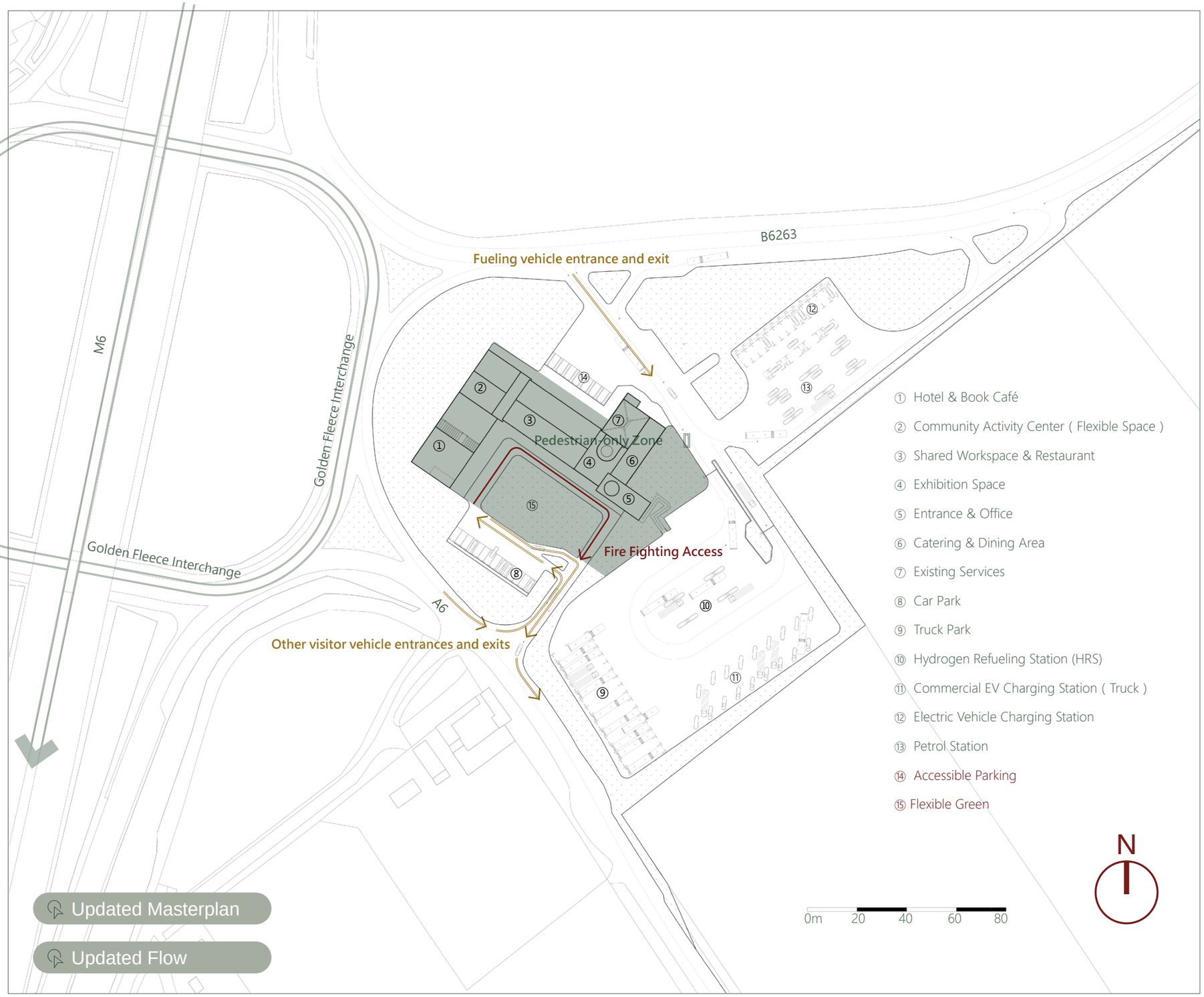
Exterior Visuals

Aqueduct Garden Visuals



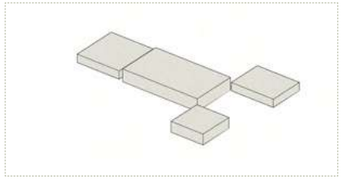
Interior Visuals

Masterplan 1:500 @ A0



Site Massing

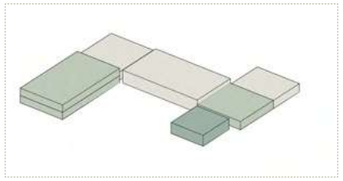
1



Existing Fabric

The existing fabric is to be retained in it’ s entirety with some alterations to create new openings and create new connections.

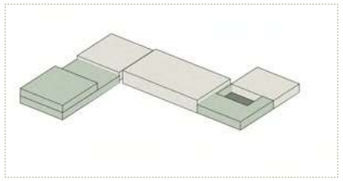
2



Construction & Demolition

Strategically removes secondary elements and adds new volumes to define the new core form.

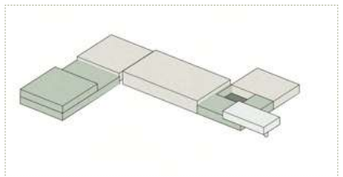
3



Massing & Volume

By incorporating atriums and terraces, the building's overall massing is reconfigured to shape a cohesive and dynamically expressive architectural volume.

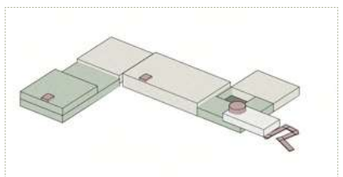
4



Balance of Facade

Refines the exterior by balancing solid walls and voids for a harmonious and functional facade.

5

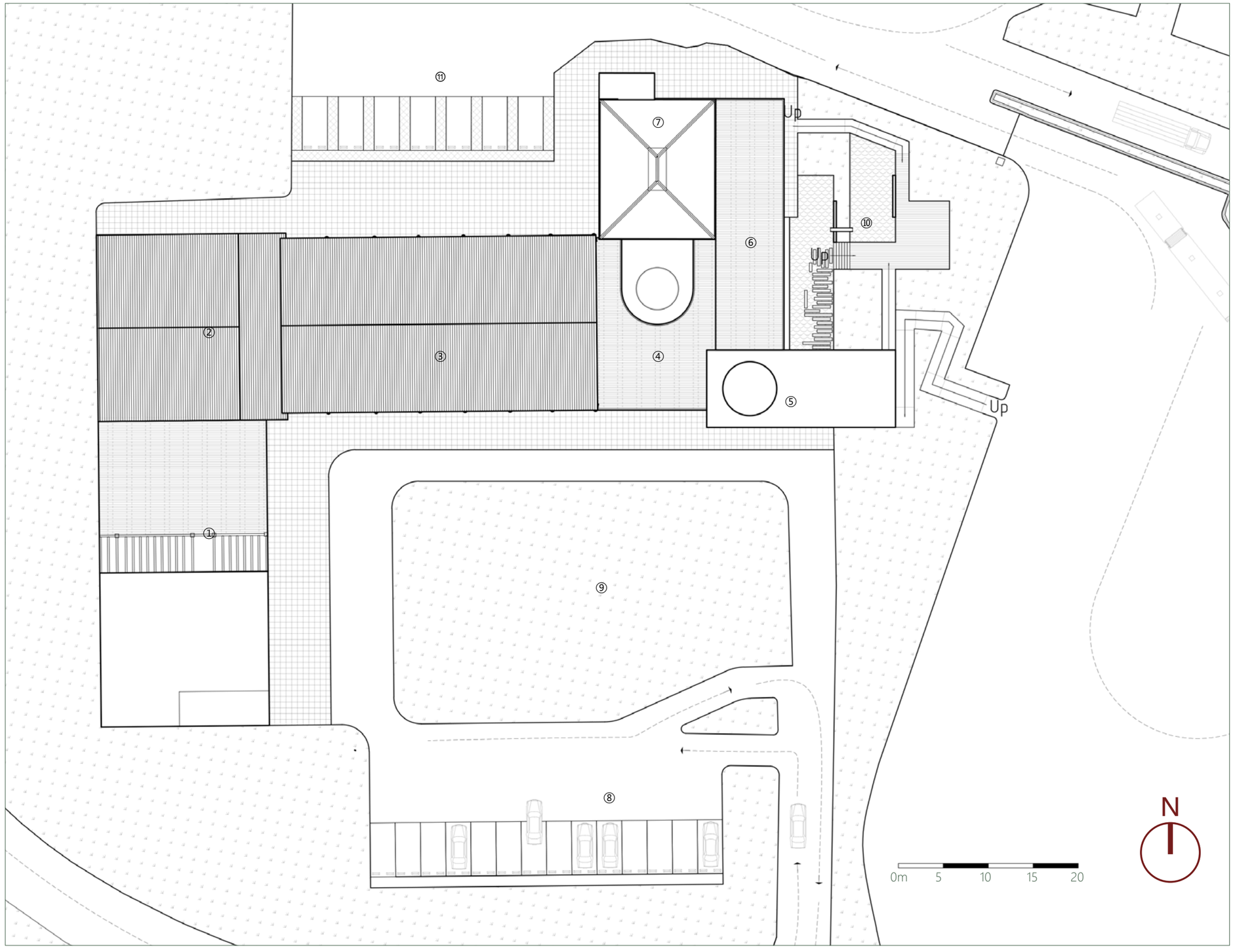


Integration & Activation

Inserts elevator, ramp and connecting bridges to activate the space and ensure full accessibility.

Existing Volume
Newly Constructed Volume
Demolished Volume
Atrium
Elevators and Ramps

Updated Site Plan 1:500 @ A3

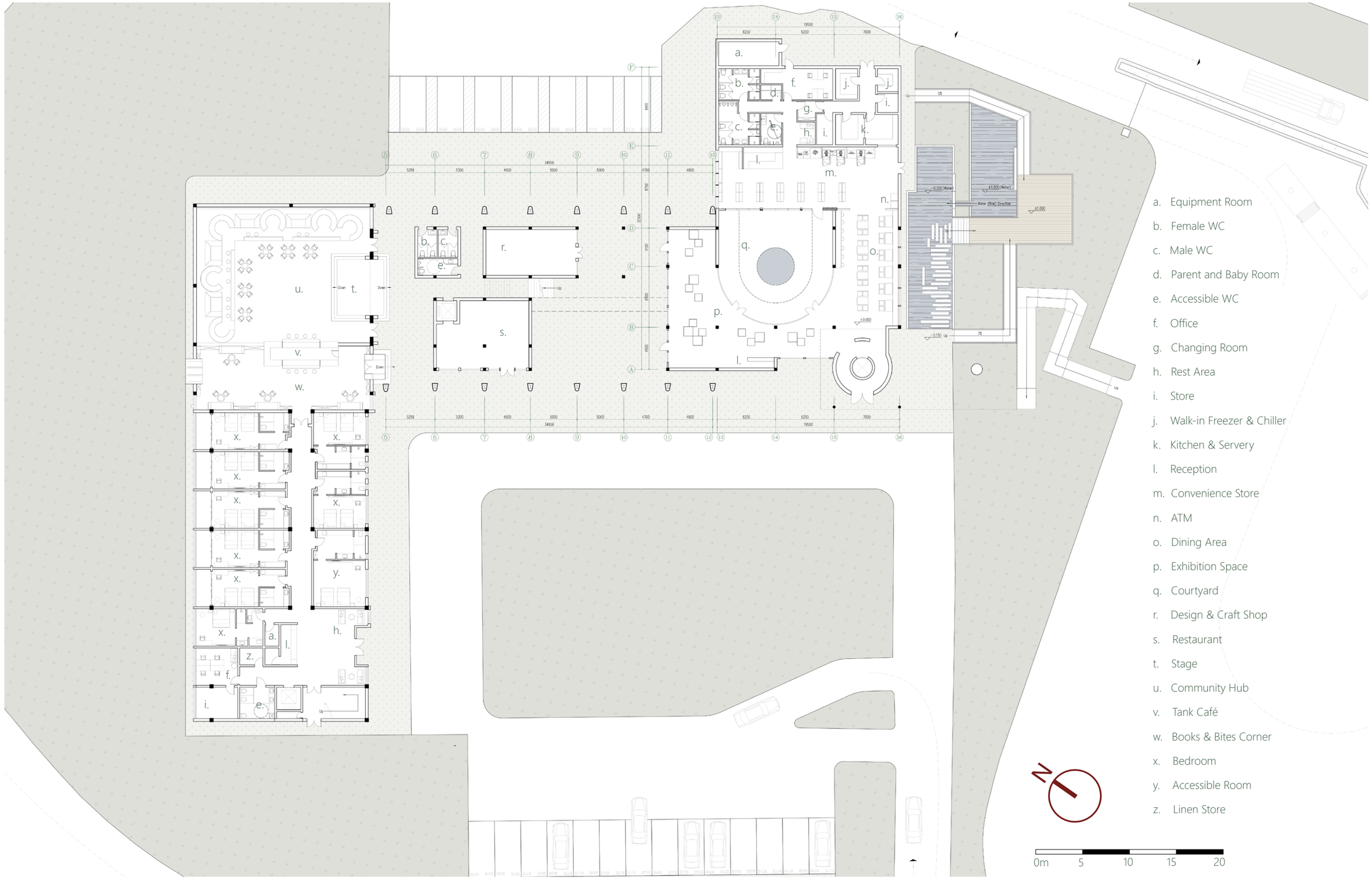


① Hotel & Book Café
② Community Activity Center
(Flexible Space)
③ Shared Workspace & Restaurant
④ Exhibition Space
⑤ Entrance & Office
⑥ Catering & Dining Area
⑦ Existing Services
⑧ Car Park
⑨ Flexible Green
⑩ Aqueduct Garden
⑪ Accessed Parking

Marking

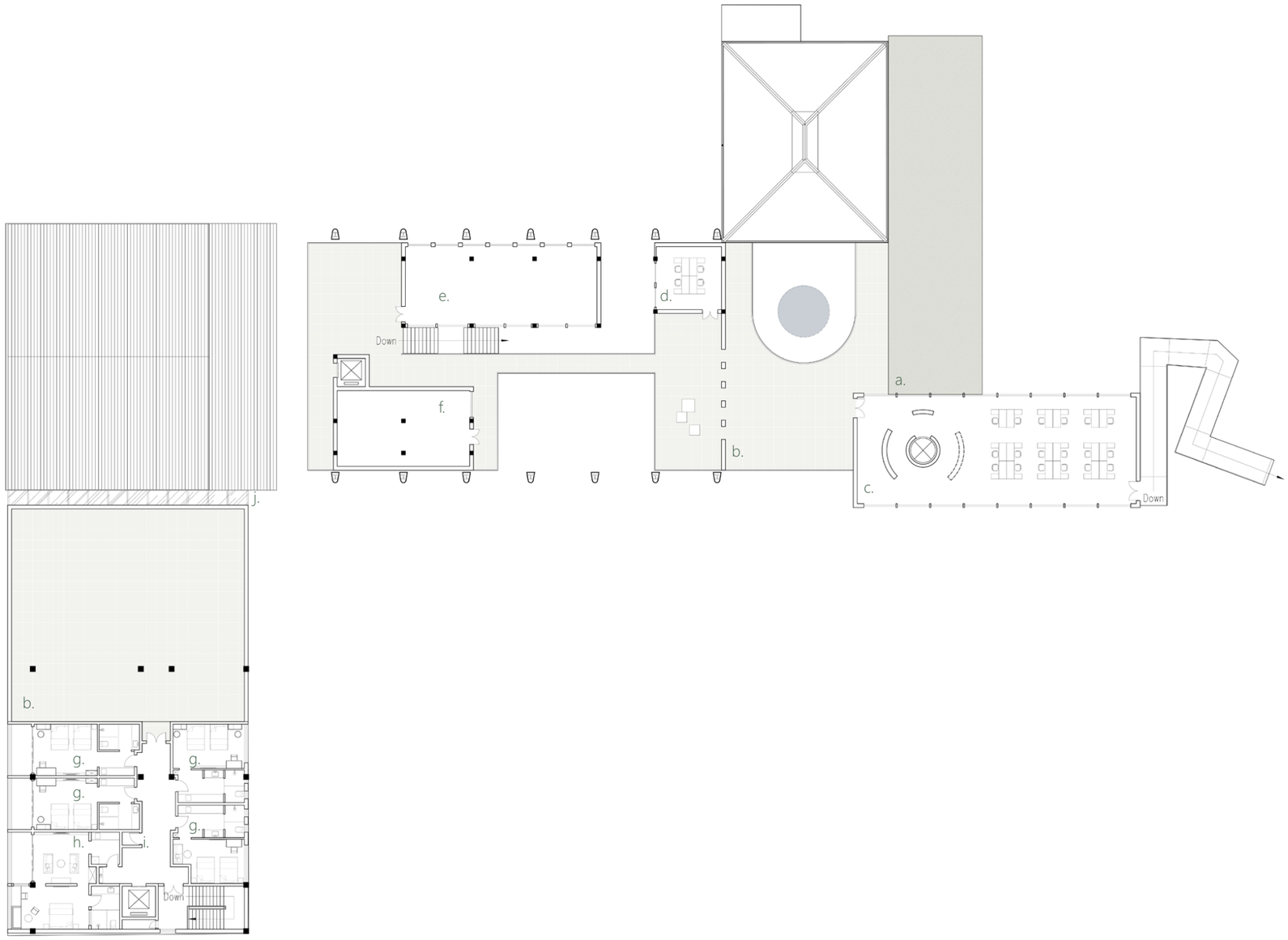
Ground Floor Plan 1:200 @ A1

GF Plan | Analysis Marking | PS1 GF Plan



First Floor Plan 1:200 @ A1

FF Plan | PS1 FF Plan | Roof Plan

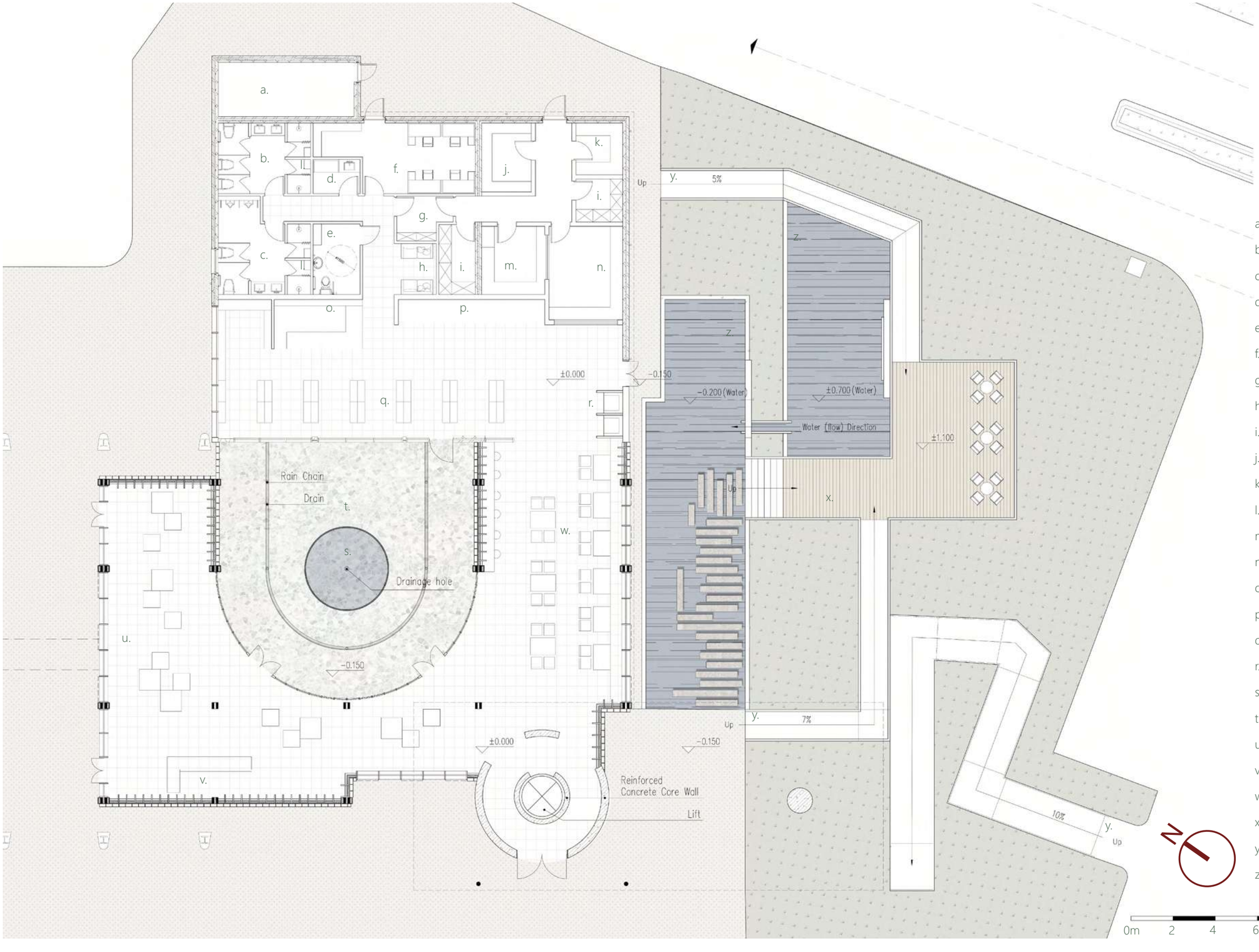


a. Green Roof
b. Roof Terrace
c. Office
d. Artist Studio
e. Community Market
f. Creative Workshop
g. Bedroom
h. Suite
i. Equipment Room
j. Roof Windows

N

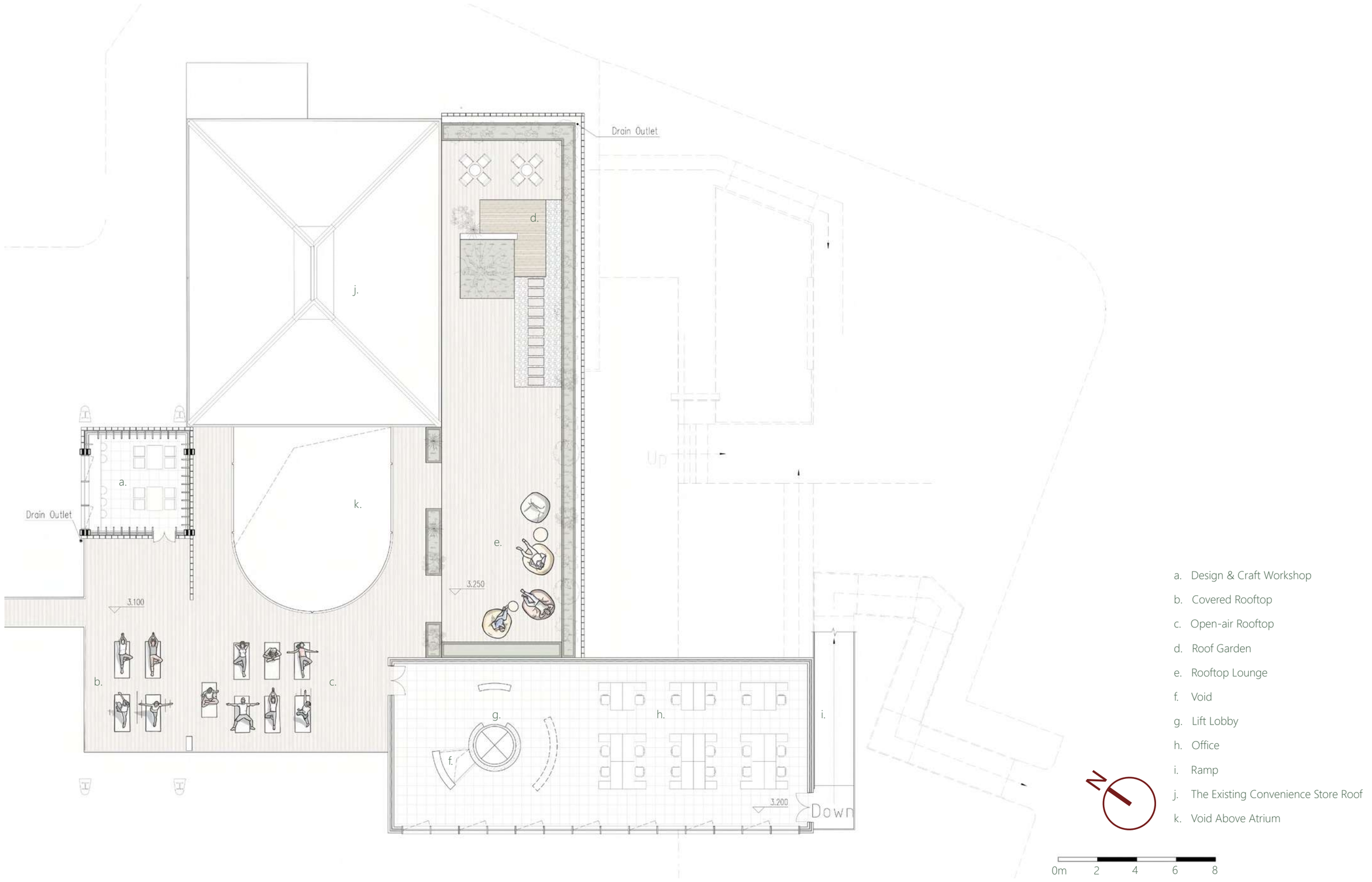
0m 5 10 15 20

Pitch Area Ground Floor Plan 1:50 @ A0



a. Equipment Room
b. Female WC
c. Male WC
d. Parent and Baby Room
e. Accessible WC
f. Office
g. Changing Room
h. Rest Area
i. Store
j. Walk-in Freezer
k. Walk-in Cooler
l. Shower
m. Cooking Area
n. Food Pickup
o. Checkout Counter
p. Coffee Maker & Beverage Dispenser
q. Convenience Store
r. ATM
s. Circular Water Feature
t. Atrium
u. Community Hub
v. Reception
w. Dining Area
x. Aqueduct Garden
y. Ramp
z. Landscape Pool

Pitch Area First Floor Plan 1:50 @ A0



a. Design & Craft Workshop
b. Covered Rooftop
c. Open-air Rooftop
d. Roof Garden
e. Rooftop Lounge
f. Void
g. Lift Lobby
h. Office
i. Ramp
j. The Existing Convenience Store Roof
k. Void Above Atrium

N

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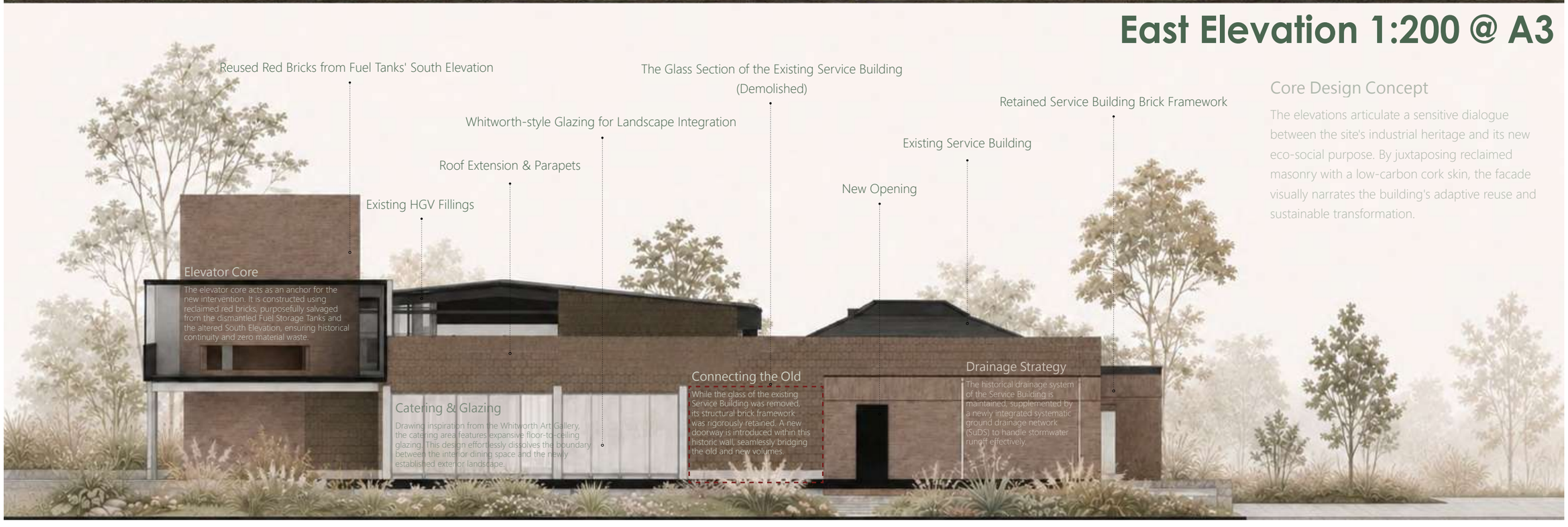
South Elevation 1:200 @ A3

East Elevation 1:200 @ A3



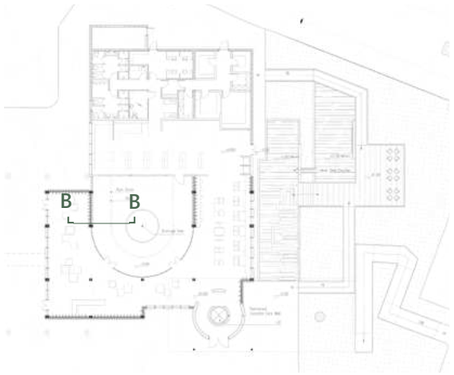
Core Design Concept

The elevations articulate a sensitive dialogue between the site's industrial heritage and its new eco-social purpose. By juxtaposing reclaimed masonry with a low-carbon cork skin, the facade visually narrates the building's adaptive reuse and sustainable transformation.

SectionA: Dining Area
Aqueeduct Garden 1:50 @ A3

Key Plan

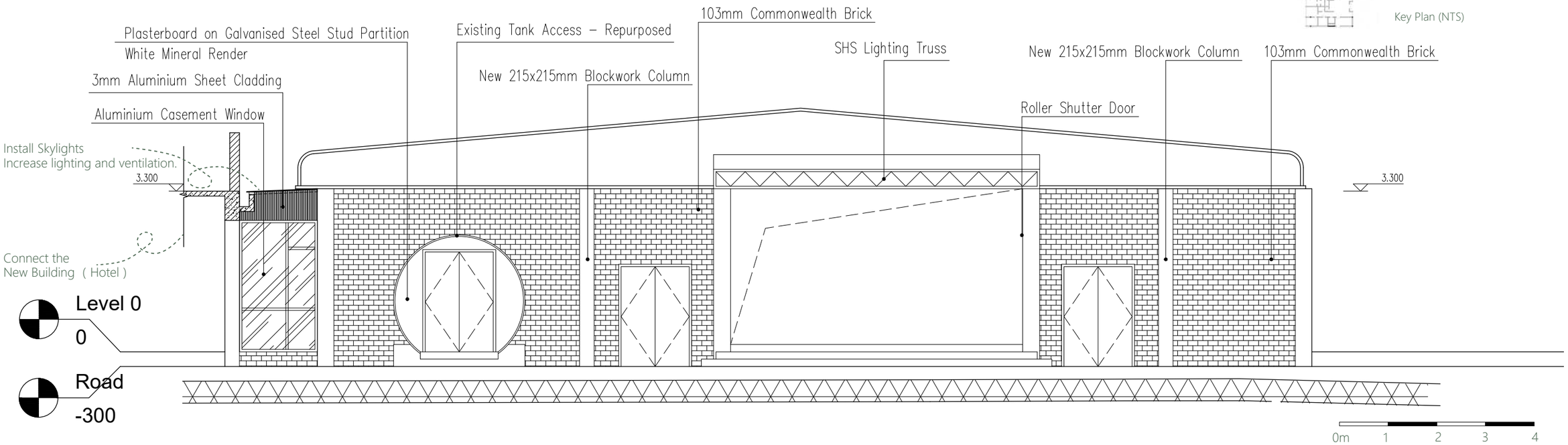
Section B: Exhibition Space
Atrium Water Garden 1:50 @ A3



Key Plan

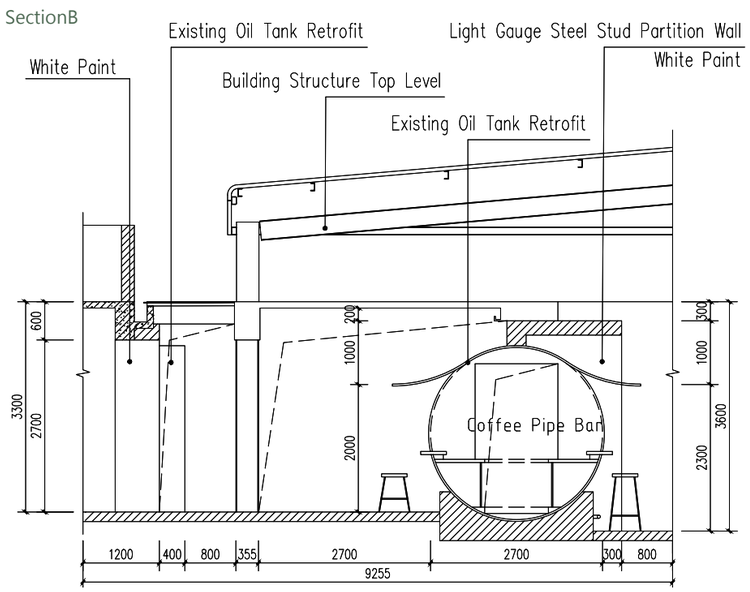
Tanks Room Reuse Plan

SecitonC 1:50 @ A1

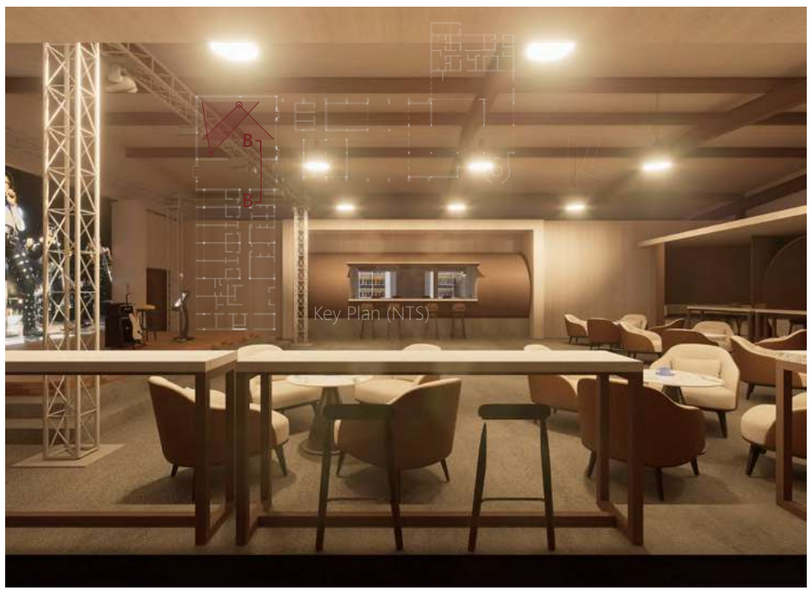


Construction Strategy

SectionB



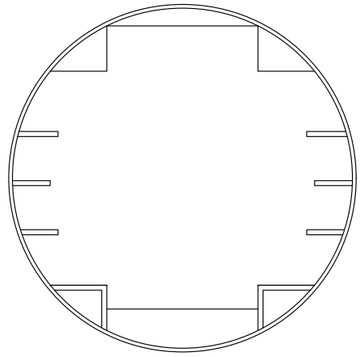
Community Hub Rendering



Tanks Room Reuse Plan

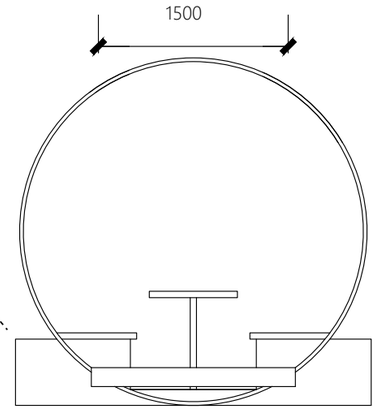
Books & Bites Corner Rendering

Tank modification strategy



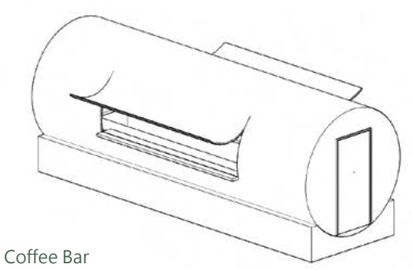
Bookshelf Zone

This design integrates storage and display seamlessly into the architecture, turning the tank wall into a focal point for knowledge and culture, where the industrial past meets quiet contemplation.



Seating Booth Area

The curved steel shell of the original fuel tank is repurposed to create intimate, semi-enclosed seating booths.



Coffee Bar

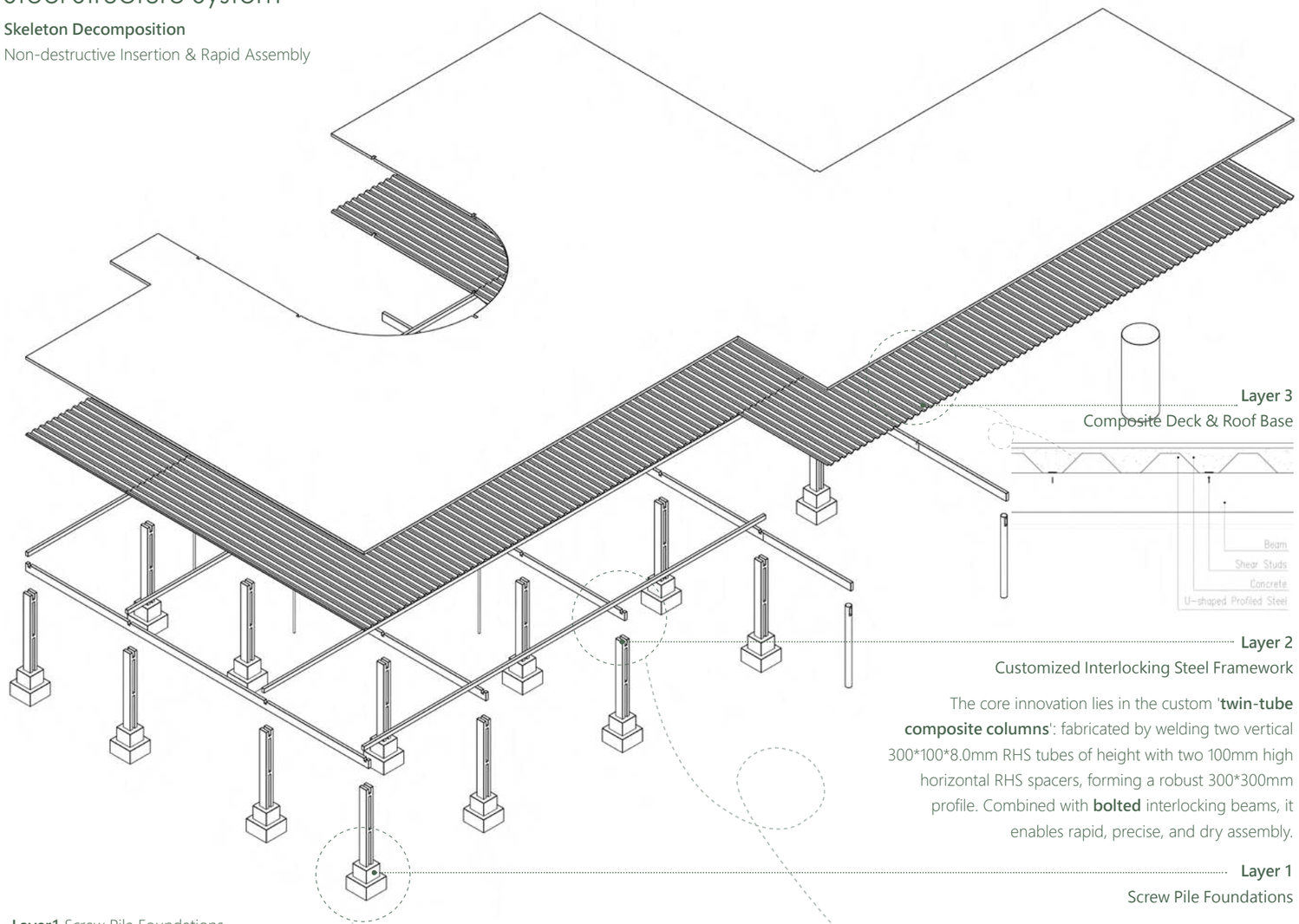
The original fuel storage tank is repurposed as a striking coffee bar. Its curved steel shell is carefully cut open, creating a large, welcoming aperture that forms the serving counter.

Structural Strategy Overview

Steel Structure System

Skeleton Decomposition

Non-destructive Insertion & Rapid Assembly



Layer 3

Composite Deck & Roof Base

Layer 2

Customized Interlocking Steel Framework

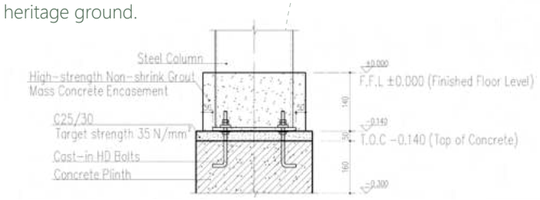
The core innovation lies in the custom '**twin-tube composite columns**': fabricated by welding two vertical 300*100*8.0mm RHS tubes of height with two 100mm high horizontal RHS spacers, forming a robust 300*300mm profile. Combined with **bolted** interlocking beams, it enables rapid, precise, and dry assembly.

Layer 1

Screw Pile Foundations

· **Layer1** Screw Pile Foundations

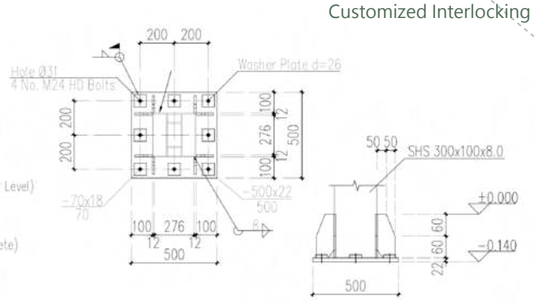
Instead of large-scale demolition of the existing hardscape, localized precise slot cutting is employed to insert the foundations. This technique drastically reduces construction waste and wet trades, acting as 'keyhole surgery' for the heritage ground.



Section through Column Base

· Layer2

Customized Interlocking Steel Framework



Detail of Column Base Plan

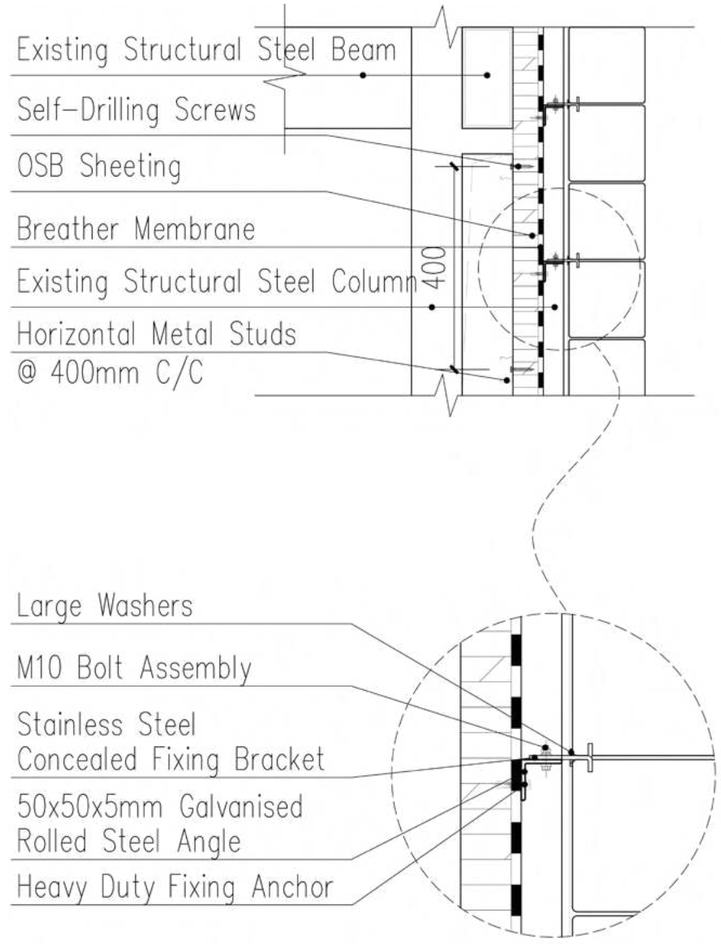
· Layer3

Composite Deck & Roof Base

Utilizing U-shaped profiled steel decking as permanent formwork, topped with poured-in-place concrete to create a high-strength composite slab. This hybrid system synergizes the tensile strength of steel and compressive strength of concrete, delivering exceptional load-bearing capacity and absolute rigidity for the roof terrace.

Exterior wall system

Cork Envelope System Detailing



Investigations on the wall detail reveal that by using specialized fasteners fixed directly into the OSB sheathing, the system eliminates the need for adhesive and intermediate timber battens. It allows for the replacement of individual weathered brisk. But Fixing directly to the OSB eliminates the ventilated cavity, demanding highly rigorous detailing of the breather membrane and internal VCL to manage moisture and prevent interstitial condensation.

Conclusion:

The direct mechanical fastening system is decisively selected. While adhesives offer a thin profile, they fundamentally contradict the project's circular economy agenda. By screwing the cork directly into the OSB substrate, an optimal balance is achieved: a minimized wall thickness equivalent to the glued option, combined with the massive environmental benefit of a "glueless" assembly. The building acts as a temporary material bank, allowing panels to be independently repaired during Stage 6 or cleanly returned to the earth as biological nutrients at the end of their 50-year lifespan.

Exploded Cork Wall

The "Perfect Wall" System

RAIN CONTROL
Deflects bulk water & ensures cavity drainage.

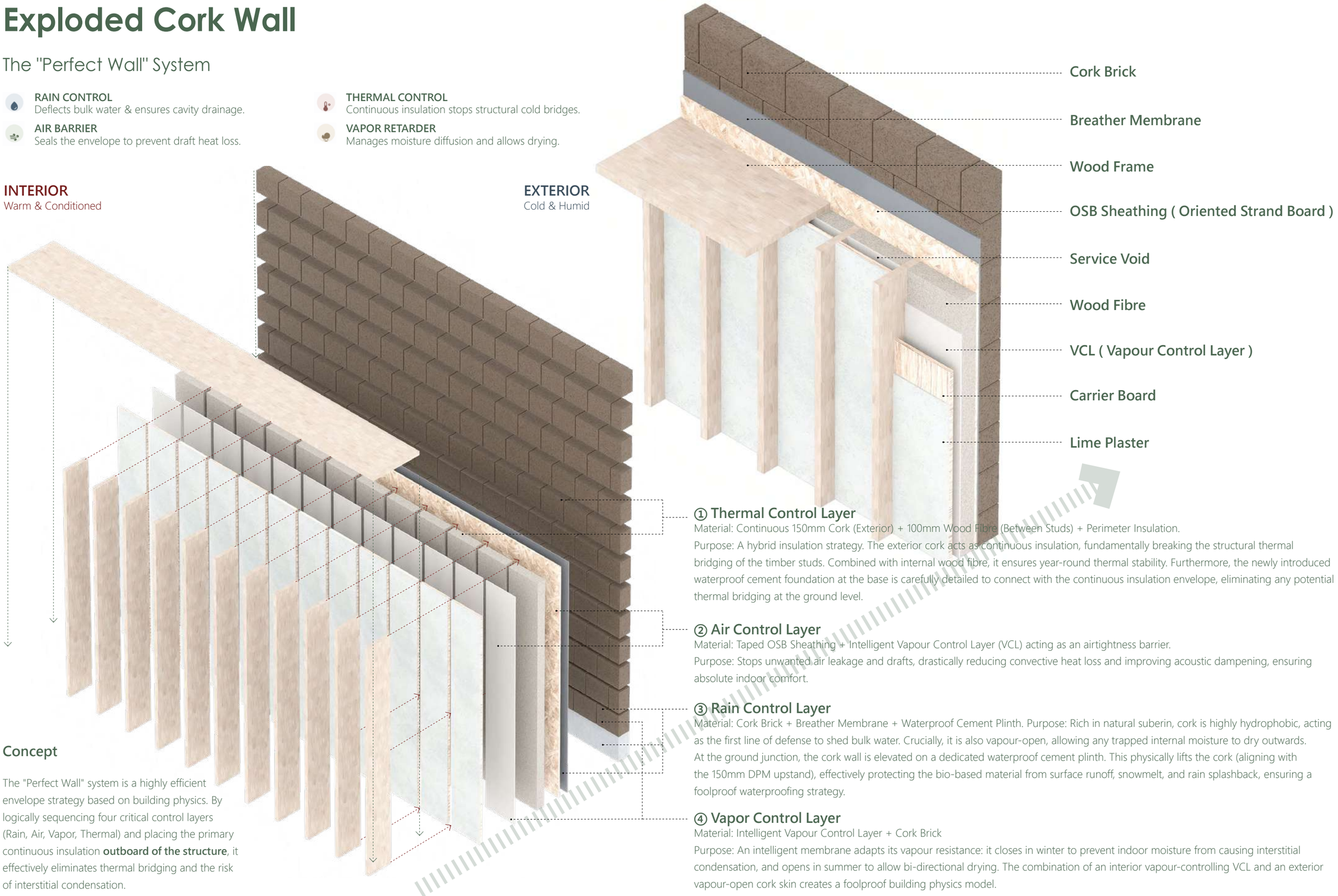
AIR BARRIER
Seals the envelope to prevent draft heat loss.

THERMAL CONTROL
Continuous insulation stops structural cold bridges.

VAPOR RETARDER
Manages moisture diffusion and allows drying.

INTERIOR
Warm & Conditioned

EXTERIOR
Cold & Humid



① Thermal Control Layer

Material: Continuous 150mm Cork (Exterior) + 100mm Wood Fibre (Between Studs) + Perimeter Insulation.
Purpose: A hybrid insulation strategy. The exterior cork acts as continuous insulation, fundamentally breaking the structural thermal bridging of the timber studs. Combined with internal wood fibre, it ensures year-round thermal stability. Furthermore, the newly introduced waterproof cement foundation at the base is carefully detailed to connect with the continuous insulation envelope, eliminating any potential thermal bridging at the ground level.

② Air Control Layer

Material: Taped OSB Sheathing + Intelligent Vapour Control Layer (VCL) acting as an airtightness barrier.
Purpose: Stops unwanted air leakage and drafts, drastically reducing convective heat loss and improving acoustic dampening, ensuring absolute indoor comfort.

③ Rain Control Layer

Material: Cork Brick + Breather Membrane + Waterproof Cement Plinth. Purpose: Rich in natural suberin, cork is highly hydrophobic, acting as the first line of defense to shed bulk water. Crucially, it is also vapour-open, allowing any trapped internal moisture to dry outwards.
At the ground junction, the cork wall is elevated on a dedicated waterproof cement plinth. This physically lifts the cork (aligning with the 150mm DPM upstand), effectively protecting the bio-based material from surface runoff, snowmelt, and rain splashback, ensuring a foolproof waterproofing strategy.

④ Vapor Control Layer

Material: Intelligent Vapour Control Layer + Cork Brick
Purpose: An intelligent membrane adapts its vapour resistance: it closes in winter to prevent indoor moisture from causing interstitial condensation, and opens in summer to allow bi-directional drying. The combination of an interior vapour-controlling VCL and an exterior vapour-open cork skin creates a foolproof building physics model.

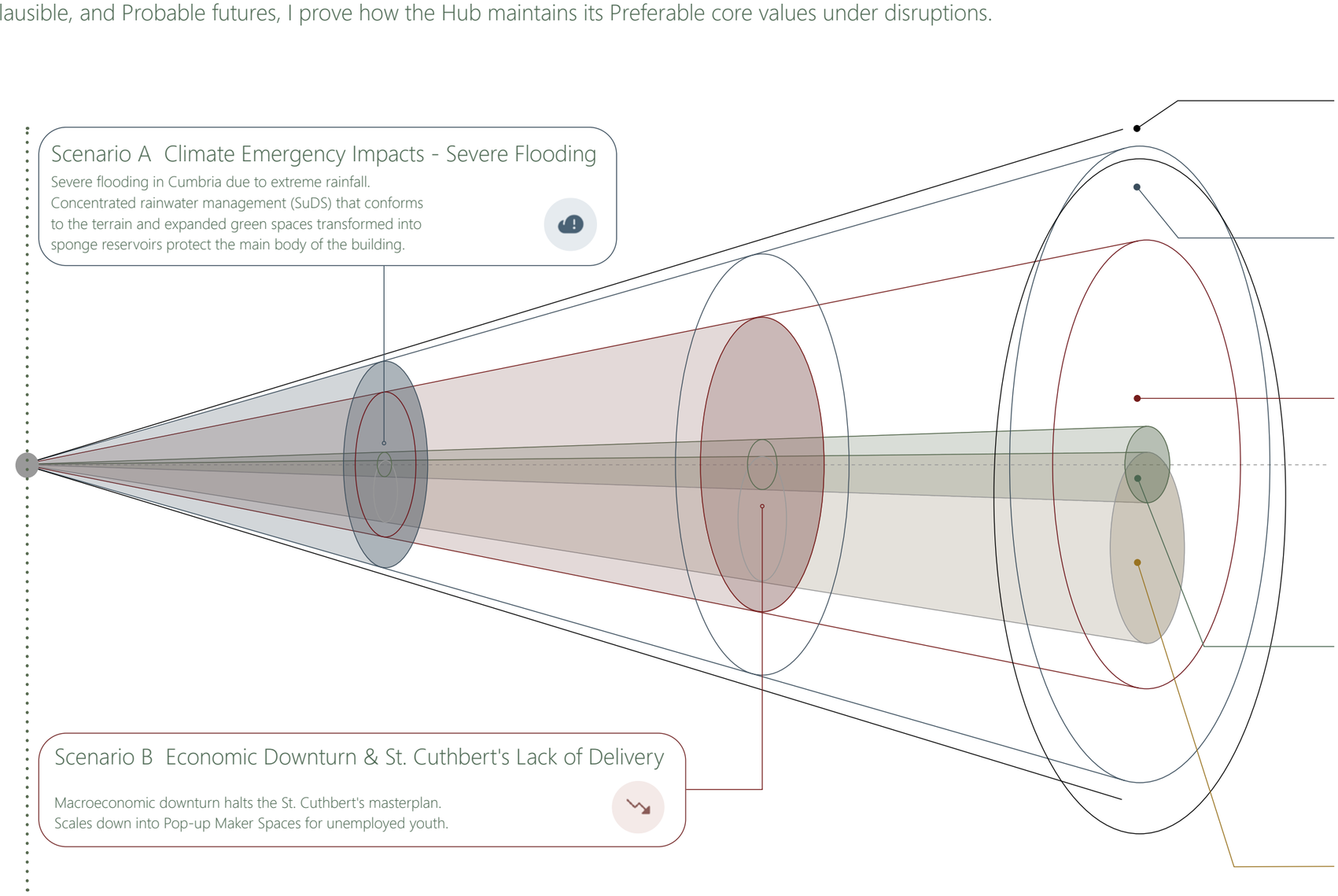
Concept

The "Perfect Wall" system is a highly efficient envelope strategy based on building physics. By logically sequencing four critical control layers (Rain, Air, Vapor, Thermal) and placing the primary continuous insulation **outboard of the structure**, it effectively eliminates thermal bridging and the risk of interstitial condensation.

Scenario Planning

The Futures Cone

To stress-test architectural resilience, this study employs Hancock and Bezold’ s Futures Cone (1994). By projecting into Possible, Plausible, and Probable futures, I prove how the Hub maintains its Preferable core values under disruptions.



Preposterous
Scenario E AI & Post-Human Logistics

Context: AI and drone swarms have completely taken over logistics, and there are no traces of human drivers on the M6 Expressway.
The space for human services has been stripped away. The machines operate silently, and the ground landscape is unreservedly ceded to wild animals and plants.

Possible
Permanent Amphibious Sanctuary. As surrounding lands submerge, the Hub completely detaches from the national grid, evolving into a self-sustaining, water-resilient micro-village.

Plausible
Hyper-local Cooperative. Fully decoupled from global logistics, the Hub transforms into a 100% community-owned micro-economy based on circular principles.

The Projected Future
The 'default' extrapolated 'baseline' 'business as usual' future

Probable
Scenario C Post-Car Era & Tech Shif

Context: Autonomous transit drastically reduces M6 truck traffic. Hardscaping removed, landscape fully handed over to nature.Fossil Era Relic Park. Reclaimed by nature, the industrial tanks transition into a purely cultural museum and eco-resort, memorializing the carbon age.

Preferable
Scenario D The Eco-Social Hub

Context: The new community was completed on schedule, and the transition to green energy was smooth.
Functions exactly as designed. The Hub becomes a national benchmark and "Green Book" standard for retrofitting fossil fuel service stations across the UK, proving that infrastructure can heal rather than harm.

Scenario A Climate Emergency Impacts - Severe Flooding

Severe flooding in Cumbria due to extreme rainfall.
Concentrated rainwater management (SuDS) that conforms to the terrain and expanded green spaces transformed into sponge reservoirs protect the main body of the building.

Scenario B Economic Downturn & St. Cuthbert's Lack of Delivery

Macroeconomic downturn halts the St. Cuthbert's masterplan.
Scales down into Pop-up Maker Spaces for unemployed youth.

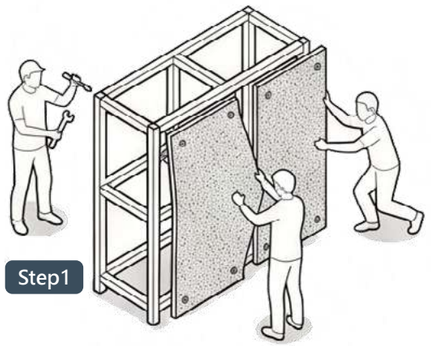
TIME

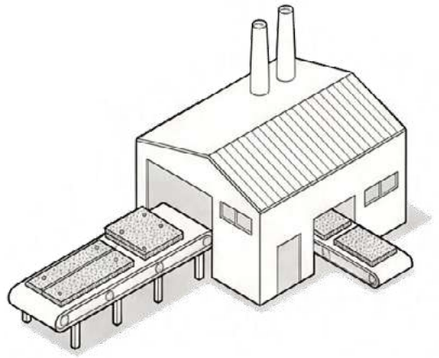
Year 0 Completion — Year 20 — Year 40 — Year 60 — FUTURE

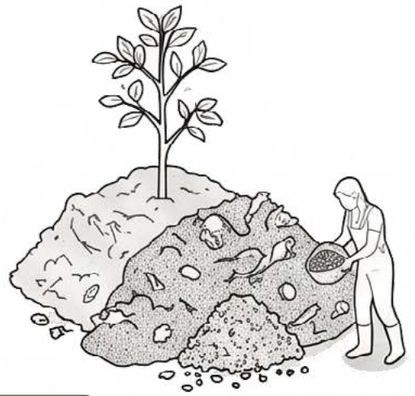
Circularity & Maintenance

Material Circularity: The Second Life of Cork

From Architectural Skin to Ecological Fertilizer



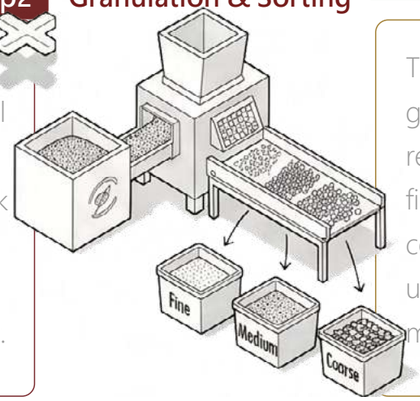




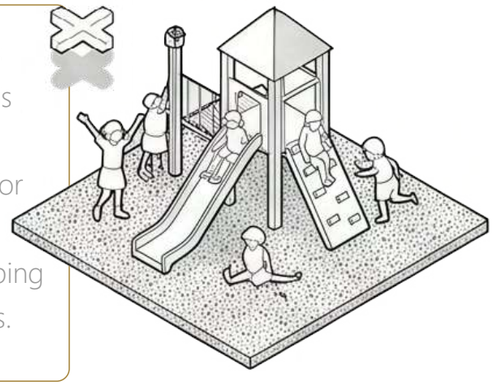
Non-Destructive Disassembly → **Step2 Granulation & Sorting** → **Step3 Downcycling & Repurposing** → **Step4 Ultimate Composting**

Guided by the BIM Material Passport, maintenance teams use simple hand tools to unbolt the mechanical fixings. The cork panels are easily detached from the steel framework without structural damage.

The dismantled panels are transported to a local facility where they are granulated back into cork grains. Without chemical adhesives, the sorting process is highly efficient.



The granulated cork is given a second life. It is repurposed as loose-fill thermal insulation for community lofts or used as impact-absorbing mulch for playgrounds.



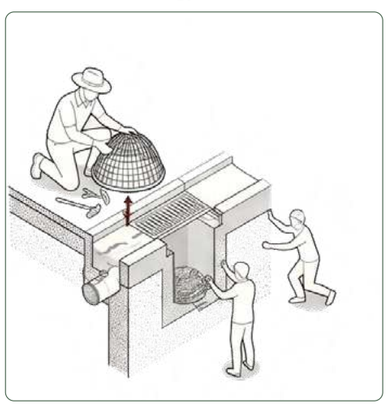
At the very end of its usable life, the 100% natural cork dust can be integrated into the Hub's Aquaduct Garden or local farms as a compostable soil conditioner, completing the biological cycle.

Facilities Management

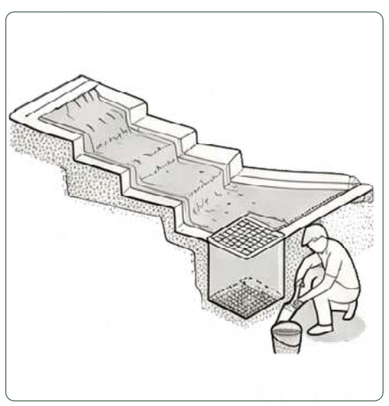
Resilient Maintenance for a Rainy Climate

Maintenance Strategy Breakdown

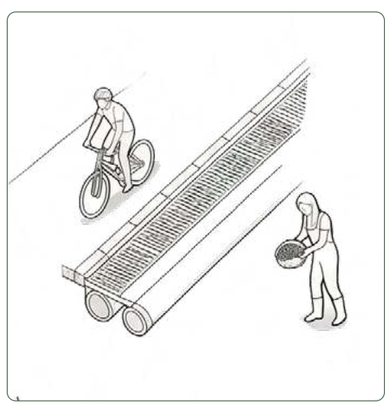
Cumbria's frequent heavy rainfall and substantial autumn leaf fall pose a significant clogging risk to the Sustainable Drainage Systems (SuDS). This project integrates the ease of Facilities Management (FM) into its initial design, establishing a three-tier defense system.



① Primary Filtration: Leaf Guards
Design: Stainless steel mesh leaf guards are installed over all roof gutters and the upper inlets of the Aqueduct Garden.
Action: Prevents large debris and autumn leaves from entering the underground pipe network, keeping them on the surface where they can be easily swept away by groundskeepers.



② Mid-point Sedimentation: Silt Traps
Design: Specially designed 'Silt Traps' (catch basins) are positioned at the bottom of each water-stepping terrace before water enters the main attenuation tank.
Action: Slows down the water flow, allowing heavy silt and soil to settle at the bottom. FM staff can simply lift the access cover and vacuum out the sediment twice a year.

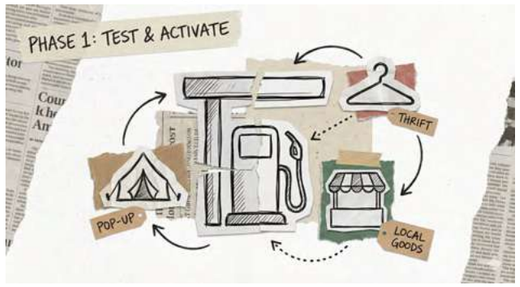


③ Accessible Maintenance Access
Design: The entire drainage route is mapped alongside the pedestrian pathways, avoiding hidden pipes beneath heavy structural foundations. Clear, flush-mounted access hatches are provided.
Action: Ensures that if a blockage does occur, maintenance crews can use high-pressure jetting equipment safely and directly without disrupting the daily operation of the Hub.

PART5 - Delivery, Value & Scale

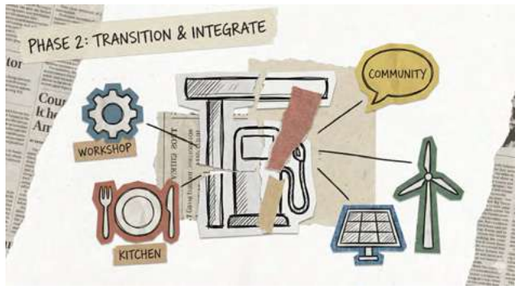
Installment delivery: Test → Transition → Sustain

Three Stages of Development



Phase 1: Equitable Access & Inclusivity

Test the community's needs with low-cost, flexible interventions like pop-up markets in the parking lot. This ensures the project serves everyone fairly from the start.



Phase 2: Creative Community Catalyst

Establish permanent arts workshops and creative spaces.
Use local crafts and culture to activate the community, strengthen its identity, and turn the site into a vibrant social hub.

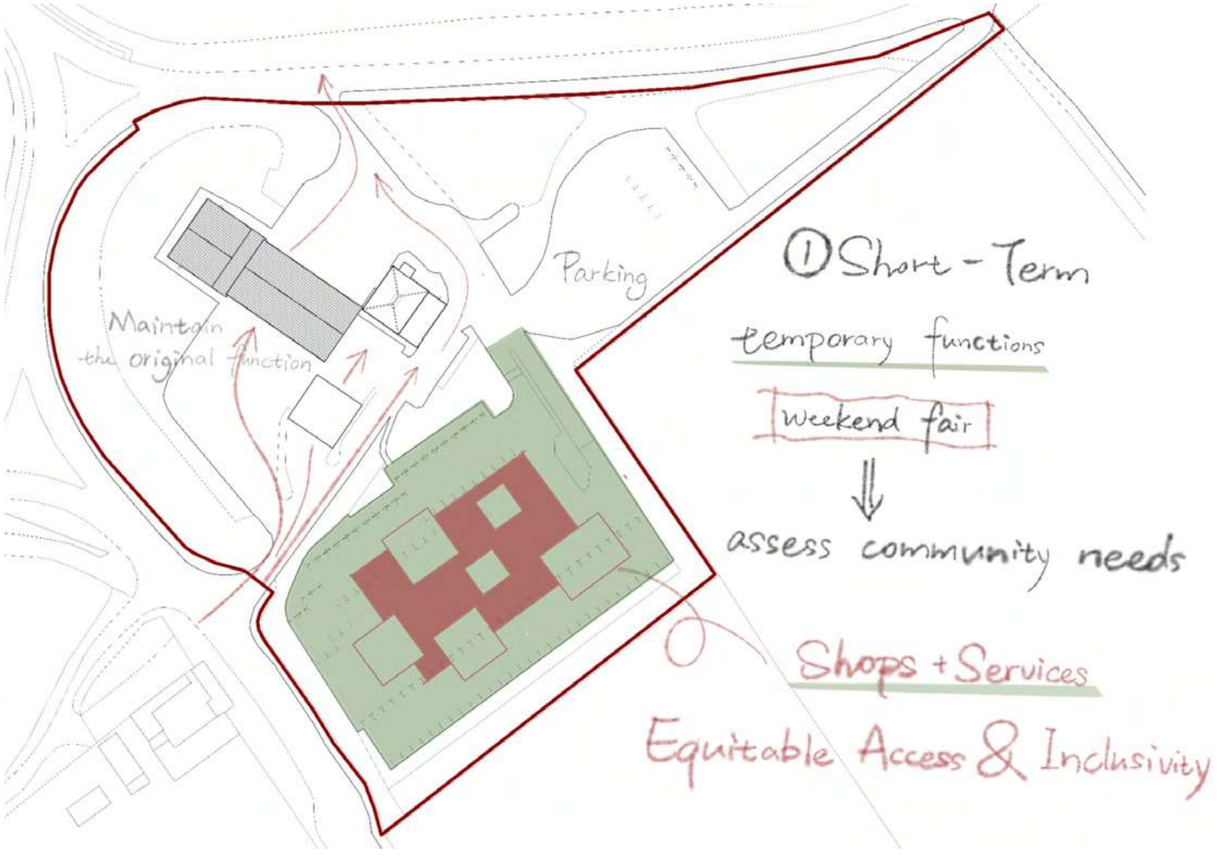
Phase 3: Regenerative Transformation

Evolve into a self-sustaining model. Integrate clean energy, address legacy pollution, create local jobs, and deepen ecological connections to build a resilient community ecosystem.

Development Plan

Short-Term | Test & Activate

Strategic Intent: To initate community engagement with minimal risk and investment validating future needs while maintaining essential services.
Core Action: Introduce low-cost, flexible temporary functions (e. a weekend fain in underutilized areas like the parking lot.
Key Principle: Equitable Access & Incusivity. This phase s designed to isten and learmn, ensuring the project serves a broad community from the outset.
Site Strategy: The original fuel station function is maintained, ensuring no loss of service during the testing period.



Construction Sequence

Cost

Total building works cost (excl. external works, fees and contingency):

Element	Type	Area (m²)	Rate low (£/m²)	Rate high (£/m²)	Cost low (£)	Cost high (£)
Hotel - internal	New build	972.3	£1,900	£2,600	£1,847,370	£2,527,980
Hotel - roof terrace	New build	315.1	£1,000	£1,400	£315,100	£441,140
Community Activity Centre (flexible space)	Retrofit (oil tank cleaned and reused)	393.0	£2,100	£2,500	£825,300	£982,500
Shared workspace & restaurant -internal	New build (under existing canopy)	350.8	£1,900	£2,400	£665,520	£841,920
Shared workspace & restaurant -terrace	New build	331.1	£1,100	£1,500	£364,210	£496,650
Exhibition space - internal	New build	520.6	£1,800	£2,300	£937,080	£1,197,380
Exhibition green roof terrace	New build	203.7	£1,200	£1,700	£244,440	£346,290
Existing services - retrofit	Retrofit (including strip-out)	326.2	£2,400	£3,000	£782,880	£978,600
External access ramp	New build (external works)	64.9	£800	£1,200	£51,920	£77,880

£6.03million – £7.89million (2025 prices, UK).
Low estimate ≈ £6,034,820 , High estimate ≈ £7,890,340

Hotel – New Build
Assume a mid-range hotel specification in Manchester, with new build rates of £1,900–2,600/m² for internal GIA. The roof terrace is priced at £1,000–1,400/m², reflecting structure, waterproofing, paving and balustrades at roughly 50–55% of the internal fit-out cost.

Community Activity Centre – Retrofit (tanks room)
The community activity centre reuses an existing oil-tank shed. The shell is retained, but specialist cleaning and retrofit works are required. A retrofit uplift is applied, giving an overall rate of £2,100–2,500/m², slightly above a comparable new-build flexible hall to reflect decontamination and working within the existing envelope.

Shared Workspace & Restaurant – New Build under existing canopy
This block is a new build inserted under an existing retained canopy. Typical Manchester rates for workspace/restaurant new build are reduced by around 10% to account for the reused canopy, giving £1,900–2,400/m² for internal areas. The external terrace, which supports outdoor dining, is priced at £1,100–1,500/m² (paving, balustrades and limited services).

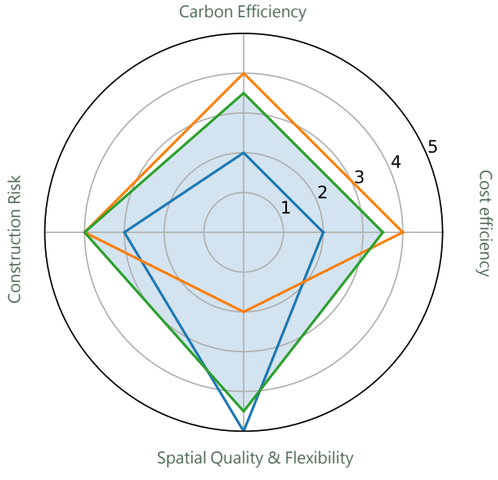
Exhibition Space – New Build with green roof
The exhibition hall is costed at £1,800–2,300/m², in line with gallery-type spaces. The intensive green roof terrace above is more complex than a simple roof deck, with build-up, planting and drainage, and is assumed at £1,200–1,700/m², approximately 60–70% of the internal rate.

Existing Services – Retrofit
The existing services block requires substantial strip-out and reconfiguration of plant, risers and service routes. It is treated as a heavy retrofit at £2,400–3,000/m², reflecting demolition, re-routing of services and integration with the new scheme.

External Access Ramp
The new external concrete ramp with handrails is treated as part of external works at £800–1,200/m², covering structure, finishes and edge protection.

	Cost low (£)	Cost high (£)
Location factor	0.98	0.98
Works value	5.91m	7.73m
Current TPI(2025)	100	100
Forecasted TPI(2027)	103	103
Adjustment	+3%	+3%
Current BCI(2025)	100	100
Forecasted BCI(2030)	106	106
Adjustment	+6%	+6%
External works(12%)	0.71m	0.93m
Risk allowance(20%)	1.32m	1.73m
Total cost	7.95m	10.40m

Balanced performance of the mixed new-build & retrofit strategy



Qualitative scores (0–5) comparing three scenarios across cost, carbon, construction risk and spatial quality.

- All New Build
- All Retorfit
- Mixed Stratregy

Summary

Building works	£6.03m – £7.89m
+ External works (12%)	£0.71m – £0.93m
+ Risk allowance (20%)	£1.32m – £1.73m
+ TPI/BCI adjustment	+3% / +6%
Total	**£7.95m – £10.40m**

Carbon

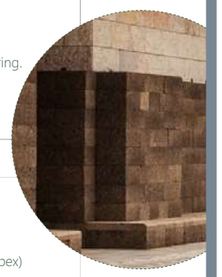
	$kgCO_2e/m^2$
Demolish and rebuild	≈ 1,000
Like-for-like new build	758
This proposal (adaptive reuse)	**680**

Material Focus: Cork

01 | Cork Properties & Site-Specific Fit

PROS & ADVANTAGES

- λ ≈ 0.040 W/mK
  Excellent natural thermal insulation.
- Inherently beautiful, requires no chemical plastering.
- Superior acoustic dampening; carbon-negative.



CONS & LIMITATIONS

- Higher initial material & logistical costs (High Capex)
- Visual weathering & color fading over prolonged exposure.

CARLISLE
SITE-SPECIFIC JUSTIFICATION

Carlisle has three typical characteristics: **coldness, frequent rain and dampness, and great noise due to its proximity to a hub**. Cork can precisely address each of these pain points.

Acoustic
Porosity absorbs high-frequency traffic noise from M6/A6.

Thermal Mass
Combats Northern England's harsh winters efficiently.

Vapour-Open Skin
Crucially wraps the heritage brickwork, preventing interstitial condensation and mould typical of impermeable PIR boards.

Structural Adaptability
Natural elasticity wraps the existing steel frame perfectly, accommodating thermal expansion without adding heavy dead loads.

02 | Cost-Lifecycle & Construction Assessment

The Long-term Economic Value

While initial imported material costs exceed standard PIR insulation, it proves highly economical over its entire lifecycle.

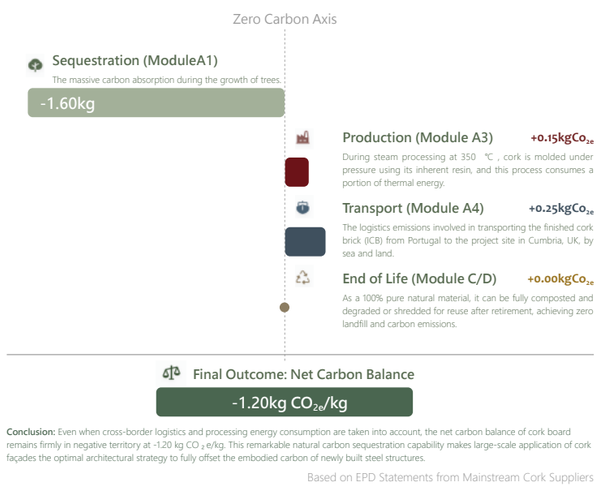
Construction Phase Acceleration

Serves as an integrated layer, eliminating complex sub-frames, wet plastering, and paint, thus accelerating the schedule.

Opex Reduction (30-Year Phase)

Requires zero repainting over decades and drastically reduces winter heating bills due to superior thermal mass.

03 | Carbon Assessment & Bar Chart Data

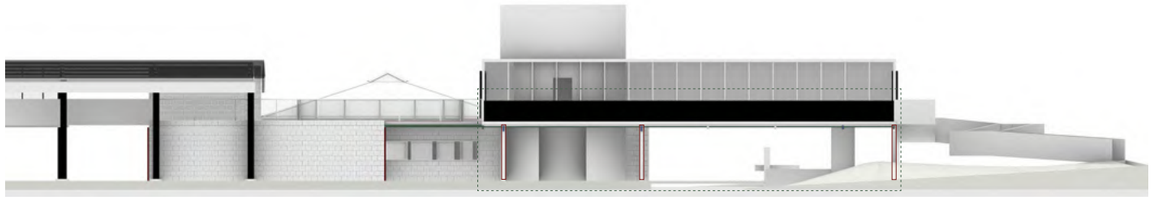


Conclusion: Even when cross-border logistics and processing energy consumption are taken into account, the net carbon balance of cork board remains firmly in negative territory at -1.20 kg CO_2 e/kg. This remarkable natural carbon sequestration capability makes large-scale application of cork façades the optimal architectural strategy to fully offset the embodied carbon of newly built steel structures.

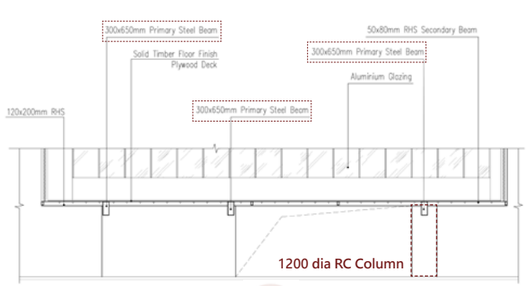
Based on EPD Statements from Mainstream Cork Suppliers

Value Engineering & Carbon Reduction

The structural resolution for the large-span pitch area underwent critical optioneering to balance spatial ambition, ecological responsibility, and economic viability. Moving away from the intrusive concrete pillar (Option A) and the financially heavy, 650mm deep beams of Iteration 1 (Option B), the final design (Option C) reflects a mature engineering synthesis. By accepting two slender intermediate steel columns, the primary beam depth is optimized to approximately 400mm. This minor spatial compromise radically reduces structural steel tonnage, significantly lowering Capital Expenditure (CAPEX) and embodied carbon, while ensuring generous headroom for services—proving that structural intelligence is fundamental to sustainable and economically resilient architecture.

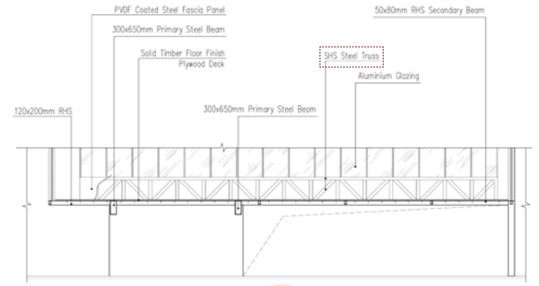


Option A | 1200mm Concrete Pillar



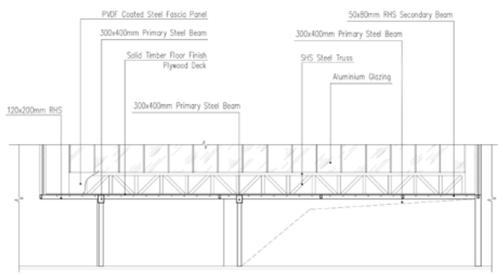
This scheme is characterized by a massive, monolithic 1200mm diameter concrete pillar positioned directly in the center of the pitch area. It acts as the primary central load-bearing element supporting a heavy traditional roof structure, visually dominating the space with a brutalist, heavy aesthetic.

Option B | Iteration 1 - Clear Span with Deep Beams



This iteration features a completely column-free central space. The structural load is bridged by exceptionally deep primary steel beams (e.g., 610 UB), supported directly by the end steel columns and the masonry elevator core. Externally, the facade mullions integrate with the structural framing to form a bridge-like SHS steel truss, presenting a highly engineered, long-span industrial character.

Option C | Final Optimization - Iteration 2



Building upon Option B, the finalized scheme introduces two strategically placed, slender steel columns (e.g., 200x200 SHS) acting as a spatial threshold in front of the masonry core. By utilizing these columns to extend and support the primary beams, the structure effectively transforms into a continuous span. This avoids the complexity of adding a denser secondary beam grid while allowing the primary beam depth to be significantly reduced.

Pros
By introducing these two strategically placed intermediate pillars, the structural load path transforms into a continuous span. Extending the primary beams via these pillars slashes the primary beam depth to a highly efficient ~400mm (e.g., 406x178 UB). This masterclass in value engineering yields the most cost-effective solution (Lowest CAPEX), saves massive embodied carbon, and maintains a clean structural ceiling soffit.

Cons
Introduces columns into the floor plan, though these are carefully integrated as a spatial threshold framing the structure, minimizing architectural disruption.

Stakeholders and Governance

Existing Owner

The current owner–operator of the Golden Fleece service station is the primary client. As a roadside infrastructure business with thin profit margins, their priorities are to future-proof the site, diversify revenue streams and refresh the image of the station.

1. Future-proofing through clean energy

The existing petrol station is currently a node of fossil-fuel consumption with high carbon emissions and heat-island effects.

The proposal shifts the site towards a clean-energy hub, integrating EV and truck charging, hydrogen refuelling and BIPV canopies, in line with national decarbonisation and the project' s goal of becoming an Eco-Social Hub.

2. Diversified and more resilient income

Today the service station functions almost only as fuel + convenience retail. After the retrofit, six main components – Hotel & Book Café, Community Activity Centre, Shared Workspace & Restaurant, Exhibition Space, Existing Services retrofit and the external ramp / landscape links – generate multiple income streams (rooms, food and drink, co-working, events, exhibitions, local markets).

These programmes extend activity from early morning to late evening and across weekdays and weekends, improving turnover per square metre of land.

3. Younger, more vibrant brand

The robust industrial structures – canopy, steel tanks, brick service building – are reused as visible design features rather than demolished, turning "old petrol infrastructure" into a distinctive identity for the site.

New public terraces, roof gardens and night-time lighting help the station read as a contemporary eco-social hub that attracts younger users and creative communities, instead of a purely functional drive-through stop.

Summary of the Stakeholder Meeting

INFRASTRUCTURE ACCESS INEQUALITIES	SOCIO-ECONOMIC DEMOGRAPHIC CHALLENGES	IDENTITY, PLACE ECONOMIC FOCUS	EDUCATION, PLANNING DEVELOPMENT STRATEGY
The rampant spread of tax-immune second homes is hollowing out permanent residencies, contributing absolutely nothing to the local economy while ruthlessly shredding community cohesion.	The blatant refusal of affluent groups to live alongside lower-income residents creates an arrogant class barrier, reducing the vision of "mixed-income communities" to an absolute farce.	The booming tourist district functions merely as a "passive landscape" to be consumed by outsiders, with its massive economic windfalls perfectly bypassing locals and failing entirely to generate any sustainable community value.	Despite recent financial investments, abysmal talent retention and a poorly-ranked local university ruthlessly expose the sheer futility of the region's educational strategies and developmental blind spots.

Management Table

Actor	Actor	Operates	Benefits	Carries risk
Site operator	Land, forecourt, hotel	Energy, hotel, F&B	Diversified revenue	Capital, occupancy
Local authority	Public realm easement	—	Regeneration, jobs	Grant exposure
Community trust	Tank Room lease	Workshops, market	Space, artisan income	Programme viability
Energy provider	Charging assets	Charging network	Throughput	Grid, utilisation
National Highways	Access, signage	—	Network resilience	—

No single actor carries the whole scheme. The operator funds what it can monetise; the public bodies fund what they already intend to fund elsewhere; the community holds what only it can run. The retrofit is deliverable because it is divisible.

Business Model and Fund Structure

User & Operations Management

DEMOGRAPHICS

01 | The Shift in Demographics

▸ **ORIGINAL USERS**

· Long-distance Drivers (Depend on the road M6/A6)
· Daily Commuters
· Pass-by Tourists

Features: High liquidity, singular purpose, and minimal community engagement.

▸ **FUTURE/TARGET GROUP**

· **New Residents & Families**: St Cuthbert's 10,000+
· **Local Older Residents (60+)**: Elders from the surrounding villages teach handicrafts.
· **Young Adults & Students**: Local youth and creative workers
· **Eco-Tourists**: Green energy users

All Ages (0 to 60+)

BUILDING USE

02 | Building Use

- Eco-Social Hub
- Community Catalyst
- Clean Energy Gateway

OPERATION TIME

03 | Opening Hours

24h / 7d EV & HGV Refueling	07:00 - 23:00 Hotel, Rest & Café
09:00 - 18:00 Community & Workshops	Weekends Pop-up Markets

PROGRAMME

04 | Programme & Activities

Tank Room
Arts & Crafts passing down, Maker Space.

Shared Workspace & Dining
Remote Work, Community Gatherings, Coffee Pipe Bars

Exhibition Space
Local culture, family-friendly activities

Landscape / Courtyard
Sheltered play
SuDS Promotion and Advocacy

The Regenerative Loop

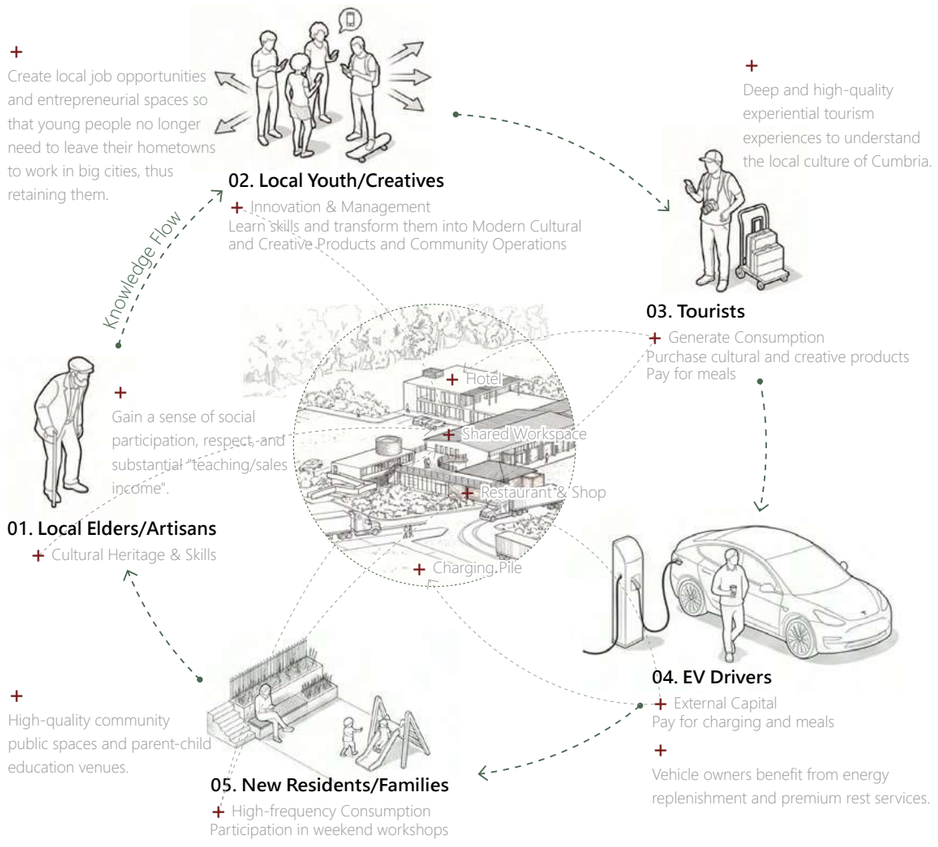
Capital Feedback Concept

The Eco-Social Hub is not merely a physical transformation, but an incubator for the community economy.
By introducing a **Front Shop, Back Factory** model, local elders (traditional artisans) pass down their skills in the repurposed Tank Room.
Local youth integrate these techniques with modern design, managing brand operations and cultural events.
Meanwhile, stopping tourists, long-distance drivers, and new residents consume, experience, and purchase local creative products.

The generated economic **revenue** is **directly used to**:
1 increase artisans' income,
2 provide local employment opportunities for the youth (retaining talent),
3 maintain the daily operations of the Hub's internal landscape (such as rain gardens) and public facilities.

Ultimately, this forms a virtuous ecosystem characterized by cultural confidence and economic self-sufficiency.

Tourists' Consumption + Community Events
REVENUE
↓ £
Artisan Income + Youth Employment + Landscape Maintenance



Fund Structure

Capital Stack

Source	Share	Instrument	Rationale
Operator equity	~35%	Balance sheet	Replaces capex the operator must spend on charging anyway
Public / growth funding	~25%	Grant	Aligned with St Cuthbert's Garden Village infrastructure obligations
Green debt	~30%	Senior loan	Secured against energy and hotel revenue
Community shares	~10%	Community benefit society	Tank Room and workshop programme

Indicative structure. Percentages illustrate the funding logic, not a committed offer.

Revenue Lines

The project's revenue is generated through five primary streams: Hotel accommodations, Charging facilities, Workspace rentals, Food and Beverage (F&B) sales, and hosting Events/markets.

Hotel Formula:
Number of rooms × Room rate × Occupancy rate × 365
Charging Formula:
Number of charging stations × Daily frequency × Gross profit per charge
Workspace Formula:
Number of desks × Monthly rent × Occupancy rate × 12
F&B Formula:
Number of seats × Table turnover rate × Average spend per customer × Operating days
Events / market Formula:
Number of events × Venue fee

The community components are not expected to repay capital. They are funded by the commercial components and by public money that is already committed to the area. This is the trade the model makes explicit.

Global & Local Supply Chains

Every motorway service area is, by definition, a site with heavy-vehicle access already built, tested and paid for. What makes it a good forecourt makes it a cheap construction site — and, later, a cheap disassembly site.

Global & Local Supply Chains

Map1 | Macro Scale

ROUTE A
The Low-Carbon Journey of Cork

Pre-fabrication: The cork boards are standardized cut and edge chamfered in the factory in Portugal and packed into standard bricks.
Transportation route: Given the extremely high carbon emissions from long-distance road transportation, cork will be prioritized for **sea freight**. It will be shipped from a Portuguese port to the Port of Liverpool in northwest England or another nearby port, and then transported by heavy goods vehicle (HGV) onto the M6 motorway, directly arriving at the base located beside the M6 J42 exit.

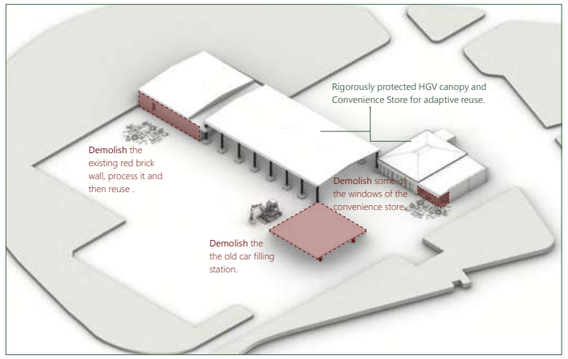
Map2 | Micro Scale

ROUTE B
Local Sourcing of Steel Structure

Pre-fabrication: To reduce the embodied carbon emissions of heavy construction materials, steel structural components (such as H-shaped steel beams and steel columns) will be prefabricated, welded at the nodes and coated with anti-corrosion layers at local steel processing plants around the site, such as Cumbria Steel Fabrications Limited.
Transportation route: Steel components were divided into modules suitable for loading onto flatbed trucks and transported by road "**door-to-door**" all the way to the construction site via the well-developed northern motorway network in the UK (A7 to M6).

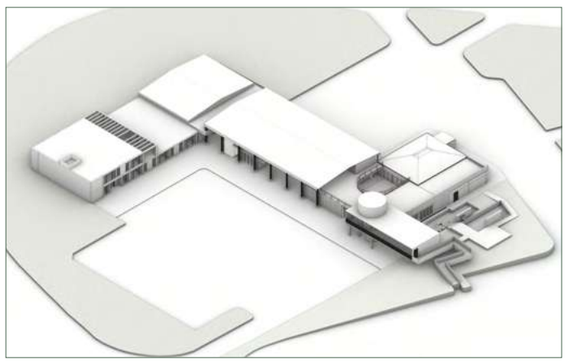
Macro Construction Sequence

Step 1



Site Clearance & Selective Demolition
Safely removing contaminated tanks and the old car filling station while rigorously protecting the HGV canopy and store for adaptive reuse.
20t Crawler Excavator engaged in soil remediation and underground tank extraction.

Step8



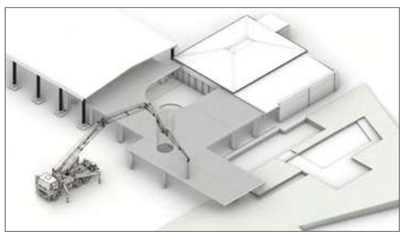
Eco-greening & Internal Finishes · Masterplan Completion
Complete the wooden flooring inside the room and the crushed stone paving in the atrium. Introducing diverse planting to finalize the resilient community hub. The camera zooms out slightly to encompass both the finalized Eco-Social Hub and the concurrently completed adjacent New Hotel.
All construction machinery demobilized. Handover and site cleaning in progress.

Step 2

Mechanical Intervention
Mini-excavator for localized trenching (600*600mm) to protect existing hardstanding integrity. Ready-mix concrete delivery directly to trench-poured footings.

Groundworks & Topography
Casting new foundations, laying SuDS pipe networks, and grading the adjacent sloped topography.

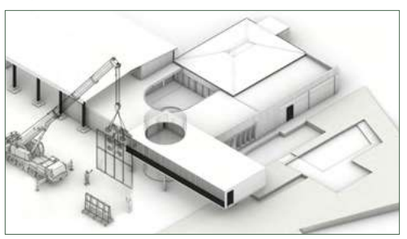
Step 4



Mechanical Intervention
Mobile concrete pump with a 36m placing boom, delivering concrete to the first-floor composite deck.

Secondary Steel & Floor Slabs
Installation of secondary steel beams and metal decking (Comflor) on the first floor, followed by concrete slab pouring via pump trucks.

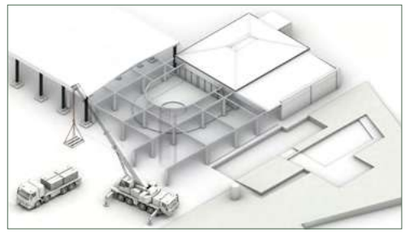
Step 6



Mechanical Intervention
Bring back the mobile crane. **80t mobile crane** equipped with a vacuum suction lifter for precise glass installation. MEWPs utilized for manual cork panel fastening.

Cork Envelope & Glazing
Workers mechanically fixing expanded cork panels to the wall using screws. Concurrently, large-scale aluminium frames and glazing are fitted into the structural openings.

Step 3



Mechanical Intervention
80t All-Terrain Mobile Crane (e.g., Liebherr LTM 1080). Outriggers fully extended (6.5m* 6.3m span) with 1.0m * 1.0m heavy-duty steel spreader pads to protect existing slab. Active working radius: 15m - 25m.

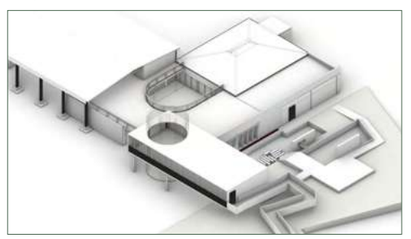
Primary Structure & Core
Raising the new primary steel framework and masonry elevator core to establish spatial volumes.

Step 5

Mechanical Intervention
Remove the heavy crane. **Mobile Elevating Work Platforms** (MEWPs / Scissor Lifts) utilized for rapid, scaffold-free wall panel assembly.

Wall Substructure & Weatherproofing
Erecting timber frames with wood fibre insulation, sealed swiftly by OSB and breather membranes.

Step 7



Mechanical Intervention
Mobile crane operating at max outreach (25m) for lifting lightweight roofing substrates and HVAC plant equipment.

Roof Infrastructure & Hardscaping
Finalizing roof greening preparations and the hard landscape features of the Aqueduct Garden.

Five Principles for Transfer

	Principles	Brief Elaboration	Pages
01	Retain the skeleton	The frame, the hard standing and the grid connection are the asset. Everything else is negotiable.	13 , 24 – 25, 26
02	Convert dwell time into social time	Charging replaces a five-minute transaction with forty. Programme the interval.	10 – 11, 17 – 18, 35
03	Make water public	Drainage is the cheapest public space available. Put it above ground.	12, 22 – 23
04	Build dry and reversible	Mechanical fixing, no adhesives. The envelope is a material bank, not future waste.	27, 29
05	Return consumption to the local economy	Retail leaks value out. Workshops and local supply chains keep it in.	6, 18, 35 – 36

These five moves are site-agnostic. They apply wherever a grid connection, heavy-duty hard standing and captive footfall already coexist.

Scale & Closing

Golden Fleece has no special properties. A grid connection, heavy-duty hard standing, captive footfall — these are the defining conditions of every motorway service area in the network.

Great Britain has around 97 of them, spaced by regulation no more than 28 miles apart, open 24 hours, most controlled by four operators. A replicable model does not need to convince eight thousand owners. It needs to convince four boardrooms.

The retrofit of the fossil forecourt is not a building project. It is a network project.

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