HOW CAN PRODUCTIVE LANDSCAPES HELP TACKLE FOOD SCARCITY IN CITIES IN THE FUTURE

LA703 - SAMANTHA STRICKLAND

Contents

FOREWORD

The following report aims to analyse and produce a strategic design proposal for the Skelton Gate site in Leeds, West Yorkshire. The document will explore the principles produced by Arup in the 'Cities Alive - Rethinking Green Infrastructure' publication produced in 2014, which relate to the topic of Green Infrastructure and it's requirement in designs for our future.

1.0

INTRODUCTION

Population Growth, Climate Change and Food Scarcity

Population Growth

"Population growth, climate change, resource depletion, pollution and urbanisation are all major global challenges facing humankind and nowhere more than in our cities. The quality of our urban environments is particularly at risk and vulnerable. As we move towards a more sustainable future it is critical that cities adapt to and address these contemporary challenges.

By 2050, the human population will have reached 9 billion; of this, 75% are expected to be living in cities. Until then, climate change, resource scarcities, rising energy costs and a preoccupation with preventing and minimising the effects of the next natural or man-made disaster will undoubtedly shape our vision of the built environment." (Cities Alive, 2014)

Climate Change & Global Warming

The science is clear. Climate change is real. Climate change is happening now. Climate change requires immediate and ambitious action to prevent the worst effects it can have on people and wildlife all over the world. (WWF, 2020)

Climate change encompasses not only rising average temperatures but also extreme weather events, shifting wildlife populations and habitats, rising seas, and a range of other impacts. All of those changes are emerging as humans continue to add heat-trapping greenhouse gases to the atmosphere, changing the rhythms of climate that all living things have come to rely on. (Global Warming Overview, 2020)

Food Scarcity

"About 50 million people risk falling into extreme poverty this year owing to the pandemic, but the long-term effects will be even worse, as poor nutrition in childhood causes lifelong suffering. Already, one in five children around the world are stunted in their growth by the age of five, and millions more are likely to suffer the same fate if poverty rates soar." (Harvey, 2020)

"Since 2015, the number of undernourished people has continued to grow each year. Many countries are facing greater levels of food and nutrition insecurity amid shocks related to climate change, conflict, and pests, as well as income losses stemming from the COVID-19 pandemic. These shocks threaten food production, disrupt supply chains, and weaken people's ability to purchase nutritious food." (The World Food Group, 2020)

The Food Security Challenge

Food security is quickly becoming a major issue in today's society, many countries are facing challenges with hunger, while others face issues with obesity, with "1 in 3 people across the globe currently suffering from some form of malnutrition" (IFPRI, 2016).

"The prevalence rates of overweight, obesity and diet-related non-communicable diseases (NCDs) such as cardiovascular disease, stroke, certain cancers and type II diabetes (ref 2), are increasing in every region, in both developed and developing countries. Globally there are now more people who are overweight or obese than underweight, with the two combined accounting for more than half of the world population: a new normal (ref 3). The estimated cost to the world economy of disease and death from over-weight and obesity is $2 trillion'

Climate change will only make things worse as elevated levels of CO_2 reduce the nutritional content of grains, tubers and legumes, affecting key nutrients such as zinc and iron (ref 4). The estimated impact of under-nutrition on gross domestic product (GDP) is 11% every year – more than the annual economic downturn caused by the global financial crisis (ref 1).

A growing population means more mouths to feed. The expanding global population is getting wealthier, and richer people tend to eat more and demand food that is resource intensive to produce, particularly meat and dairy.

It has been estimated that we need to produce more food in the next 35 years than we have ever produced in human history, given the projected increases in world population, and on the basis that rising incomes will continue to change diets. However, there is by good approximation no new land for agriculture (ref 5), with increasing competition from urbanisation (the world will be 70% urbanised by 2050), sea level rise reducing land availability, and the growing need for land for bioenergy, carbon capture and storage (BECCS) to remove greenhouse gases (GHGs) from the atmosphere. This implies sustainable intensification (SI) of agriculture on the land that is available (i.e. produce more without expanding the agricultural area)." (Mirjam Hazenbosch, 2021)

RESEARCH

Climate and Biodiversity Action Plan

The Climate and Biodiversity Action Plan is a document produced by the Landscape Institute to help address climate and biodiversity issues, the report aims to describe the Landscape Institutes overall mission for the next 5 years, and their four strategic areas of direction to address these key issues. These four strategies include:

- Equipping the profession to provide solutions to the emergencies

- Regulating and monitoring the sector to encourage greater sustainability

- Advocating for measures to address the emergencies with governments and industry

- Leading through our own sustainable business operations

On top of these strategies, **the LI sets to reduce its own corporate carbon footprint to net zero by 2029.** We are currently in a climate and biodiversity crisis, "In 2018 the Intergovernmental Panel on Climate Change (IPCC reported that in order to keep the rise in global temperatures below 1.5C this century, emissions of carbon dioxide would have to be cut by 45% by 2030" (Climate and Biodiversity Action Plan, 2020). The following objectives are set out for those working in the sector and with similar disciplines that can create change. Figure -- outlines the Landscape Institutes plans to reduce the impact of climate change, which includes:

1. Guidance and Training - The Landscape Institutes role is to help equip the profession with the tools and resources we need to design, create, plan, manage and promote projects that address the biodiversity and climate emergencies.

"We all, individually and professionally, have a role to play in addressing this crisis: the LI is here to support you to make a difference. As a start, I would urge every practice, whatever its area of expertise, to build a business plan with the UN SDGs at its heart."

ROMY RAWLINGS, LI HONORARY SECRETARY AND TRUSTEE

2. Regulation and Oversight - The Landscape Institute role is to be a regulator to monitor and encourage best practice, apply ethical and professional standards and duties which ensure that being a LI Chartered Member remains a prestigious, respected and authoritative role.

3. Policy and Advocacy - The Landscape Institutes role is to act as a national advocate for people, place and nature.

4. Our Own Footprint - The Landscape Institutes role is to act as a sustainable leader in it's own business operations, a charity operating in the public interest, lead by example in their own business practices, reducing their own carbon footprint, acting in a sustainable way, and ensuring that we are not setting a standard for others that we do not ourselves meet.

The action plan is merely the beginning, if the aims and objectives are followed within the sector - there is a chance for positive change. Directly controlling these areas both individually and in our professions will help us all progress in tackling the effects of climate change.
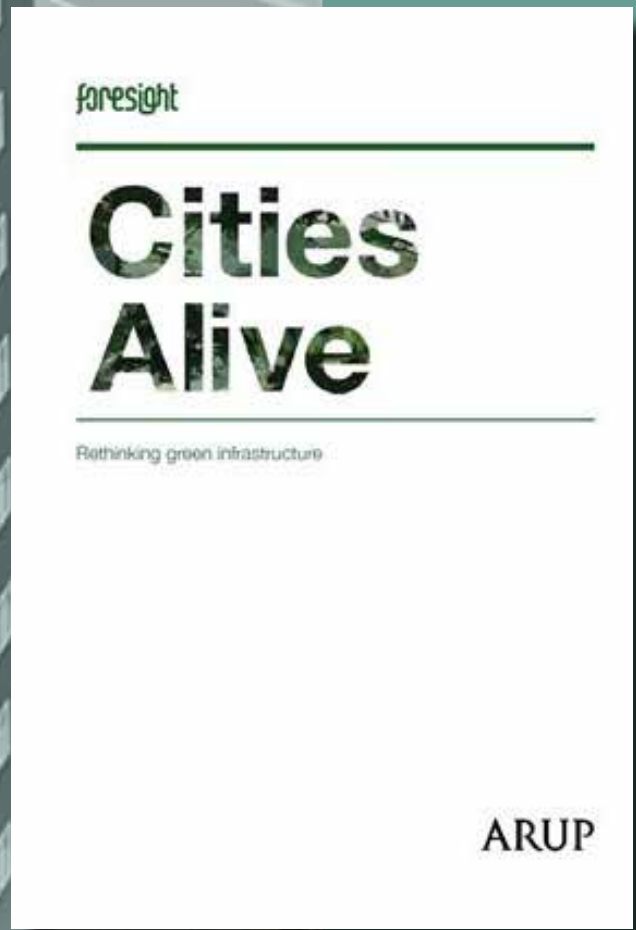
"FOOD IS MORE THAN A TRADE COMMODITY, IT IS AN ESSENTIAL OF LIFE"

JOHN BOYD-ORR, FIRST DIRECTOR GENERAL OF THE UN'S FOOD AND AGRICULTURE ORGANISATION AND NOBEL LAUREATE)

What is GI?

GI is the network of natural and semi-natural features, green spaces, rivers and lakes within and between our villages, towns and cities. When appropriately planned, designed and managed, these green assets have the potential to deliver many benefits – from providing sustainable transport links to mitigating the effects of climate change.

(GREEN INFRASTRUCTURE (GI) | LANDSCAPE INSTITUTE, 2020)

investing in
walkable urban
space should
be a no-brainer.

ARUP

foresight

Cities
Alive

Rethinking green infrastructure

ARUP

INTRODUCTION TO

Cities Alive - Rethinking Green Infrastructure

"COULD AN APPROACH TO PLANNING AND DEVELOPMENT THAT RECOGNISES THE SOCIAL, ENVIRONMENTAL AND ECONOMIC VALUE OF GREEN INFRASTRUCTURE NOT ONLY INCREASE ACCESS TO PUBLIC GREEN SPACE, BUT HELP MAKE URBAN AREAS MORE RESILIENT TO CLIMATE CHANGE?"

TONY JUNIPER- WHAT HAS NATURE EVER DONE FOR US?

INTRODUCTION TO

Cities Alive - Rethinking Green Infrastructure

Cities alive is a report published by ARUP which sets out a humanistic approach to designing spaces for the future, analysing various case studies around the world and explores the importance of Green Infrastructure within an urban setting by analysing the social, economic, environmental, technical and political drivers that are shaping our future cities.

As we move further and further towards a more urbanised future, there becomes a need to prepare for solutions to problems that may be yet to arise as a result. *Cities Alive - Rethinking Green Infrastructure* - sets out the idea of tackling major issues such as Climate Change, Scarcity of Resources, Pollution, Dangers to Human Health and Environmental Degration through the implementation of Green Infrastructure to create spaces which achieve a healthy balance between humans and nature.

Unfortunately many cities today fail to achieve this balance, with currently over half of the worlds population now living in urban areas with figures set to grow by 2050 (figure 1). With the implementation of well-considered GI, comes an array of economic, environmental and social benefits categorised in figure 2) that can "introduce new ideology based around an ecosystems approach that can contribute to the health, resilience and prosperity of a city".

If this design approach is utilized effectively, it will provide solutions to a range of issues cities are facing today and in the future. It will have a huge effect on the way we structure and design our urban environments, in a way that will benefit human health, nature and city resilience & prosperity.
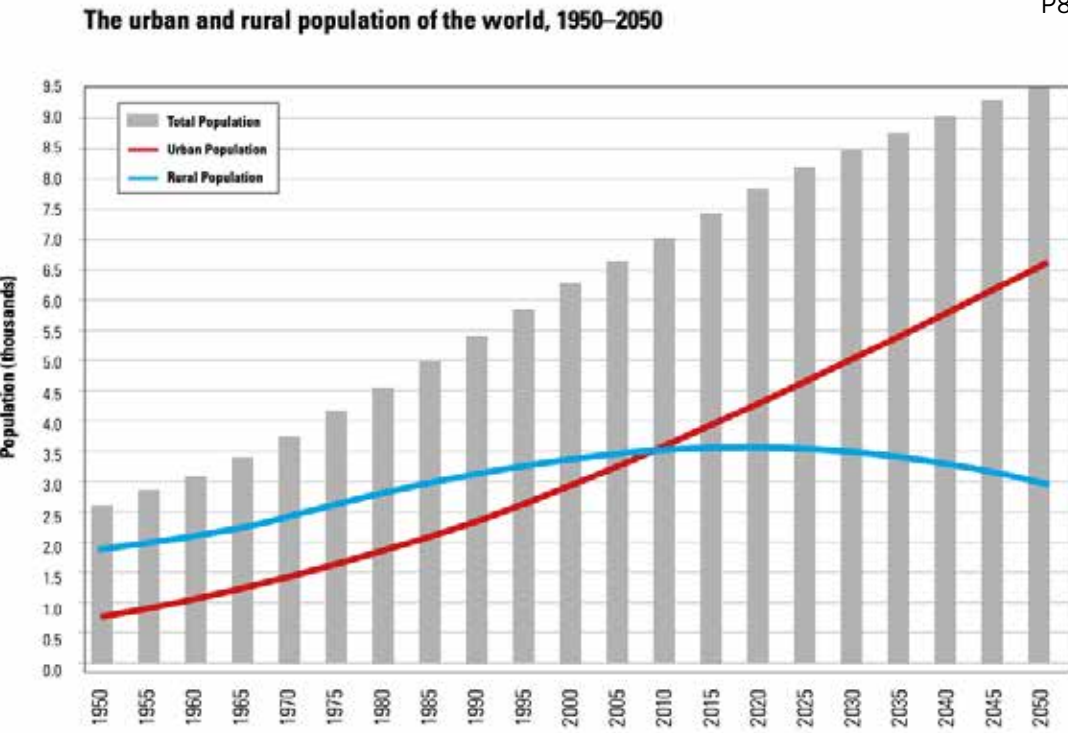

The urban and rural population of the world, 1950–2050

Figure 1

"It is imperative that new urban development avoids the mistakes of the past by taking opportunities to create exciting and challenging architecture within resilient cities that will protect the most vulnerable against climate change and social inequalities."

(C i t i e s   A l i v e ,   2 0 1 4)

SOCIAL & CULTURAL	ENVIRONMENTAL	ECONOMIC
• Encouraging Physical Activity • Improving Childhood Development • Improved Mental Health • Faster Hospital Recovery Rates • Improved Mental Health • Improved Workplace Productivity • Increasing Social Cohesion • Reduction in Crime	• Improved Visual Amenity • Enhanced Urban Micro-climate • Improved Air Quality • Reduced Flood Risk • Better Water Quality • Improved Biodiversity • Reduced Ambient Noise • Reducing Atmospheric CO2	• Increased Property Prices • Increased Land Values • Faster Property Sales • Encouraging Inward Investment • Reduced Energy Costs via Micro-climate • Regulation • Improved Chances of Gaining Planning Permission • Improved Tourist and Recreation Facilities • Lower Healthcare Costs

p.112 (Armour, 2014)
Figure 2

INTRODUCTION TO

Cities Alive - Integrating Urban Food

Cities Alive analyses the integration of urban food production and how it can present potential solutions to food scarcity in our cities. It's predicted that we will consume more food that we can possibly produce in the next few decades - meaning the importance of acting now is becoming more and more apparent. Many different types of food growing alternatives are being researched and tested, providing possible answers to issues we face today due to the current model of mass agriculture.

It's said that **"by 2050, food security may be one of the most critical factors of global geopolitics**, with its intimate ties to oil prices, transport networks, climate change and population growth." (Cities Alive, 2014). In response to these figures, movements across the globe have set out to tackle these issues through the implementation of local urban farm schemes, vertical farming, aquaculture, hydroponics, rooftop farming and more.

The question is whether the implementation of these food production facilities are viable within Leeds, the following document aims to analyse the Skelton Gate site, along with research and case studies to produce a masterplan of Skelton Gate as a community food production hub for West Yorkshire.

"Many commentors now predict that we will see peak food around the world in the next two decades— we will begin to consume more food than we can possibly produce. Following that, alternatives to the current model of mass agriculture will have to be found. A big potential for an alternative model lies within the idea of the natural city.."
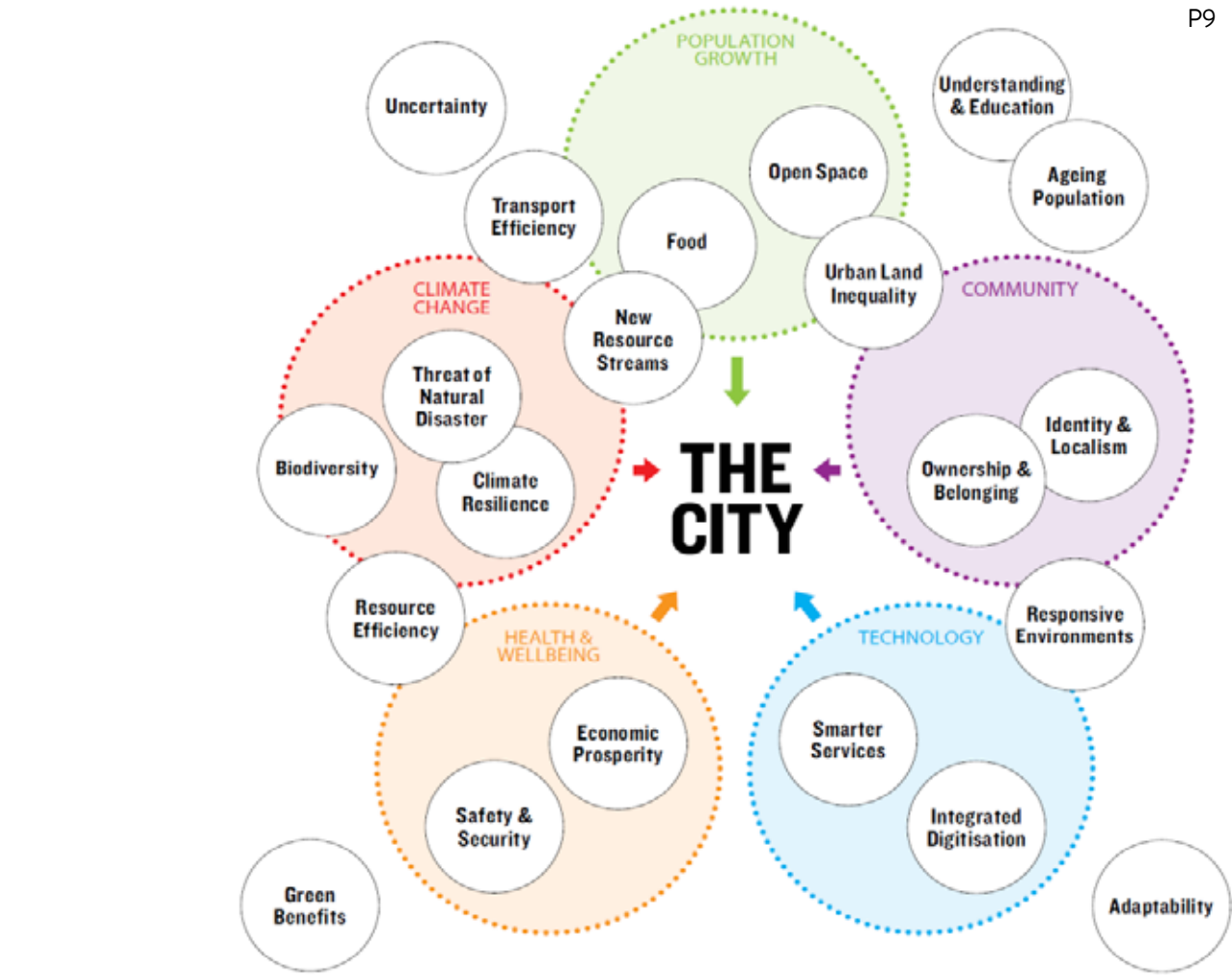
(C i t i e s   A l i v e ,   2 0 1 4)

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FIGURE 3 - DRIVERS FOR CITIES ALIVE

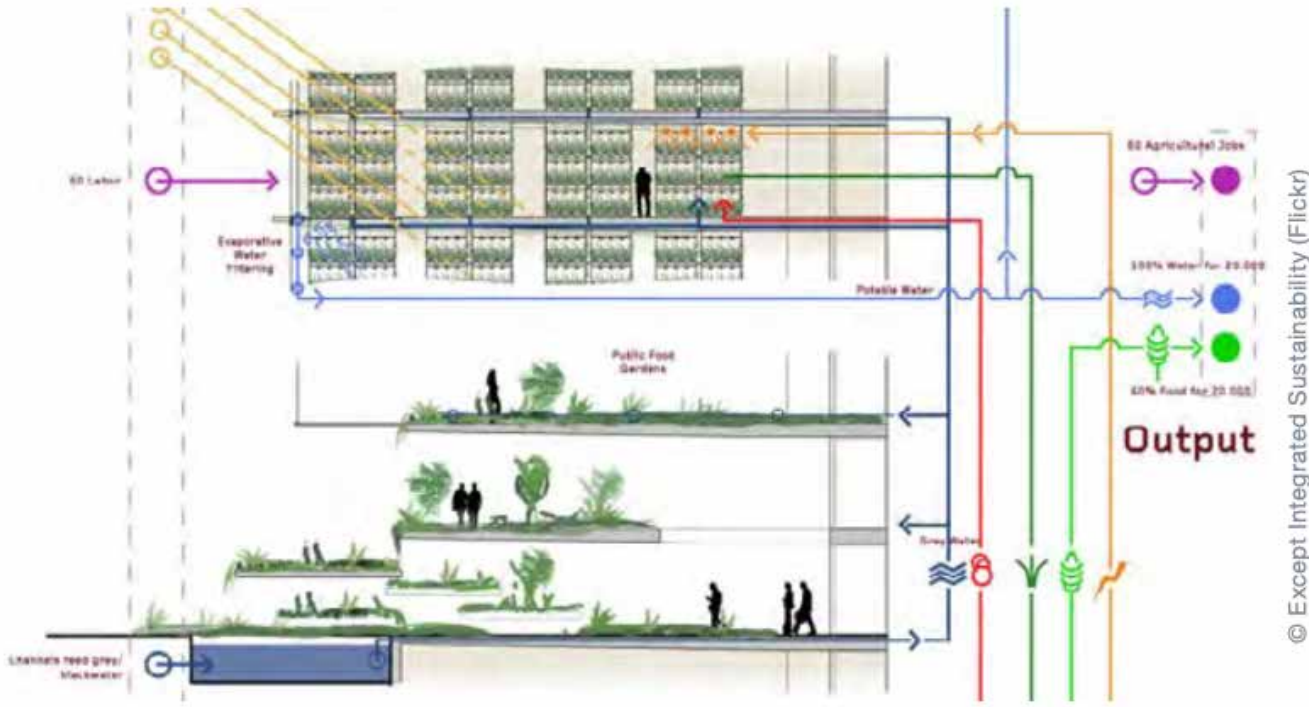P10

© Except Integrated Sustainability (Flickr)

FIGURE 4 - WAYS VERTICAL FARMING CAN MAXIMISE AVAILABLE URBAN SPACE

FIVE KEY REQUIREMENTS

Cities Alive - Rethinking Green Infrastructure

Cities Alive: Rethinking Green Infrastructure sets out five key requirements for the future design of our cities, if followed correctly will put us on the correct path towards a smarter and more sustainable future.

1. We need to recognise 'urban green' as more than an aesthetic consideration – it's a fundamental part of an urban 'ecosystem' which improves social interaction and physical and mental health

2. We must make landscapes work harder, for multiple end-users and to improve climate change resilience, through a multi-functional design approach

3. Design creativity is needed to deliver a green city ecosystem – from both city-wide strategic projects down to more imaginative uses of space within the layers of a city

4. By capitalising on advances in technology to measure the value that nature delivers through ecosystems services, we can optimise the planning and design of urban space to meet future demands

5. We need an integrated approach to delivery that better links and connects policy to transgress 'silo-driven' cultures and achieve long term benefits.

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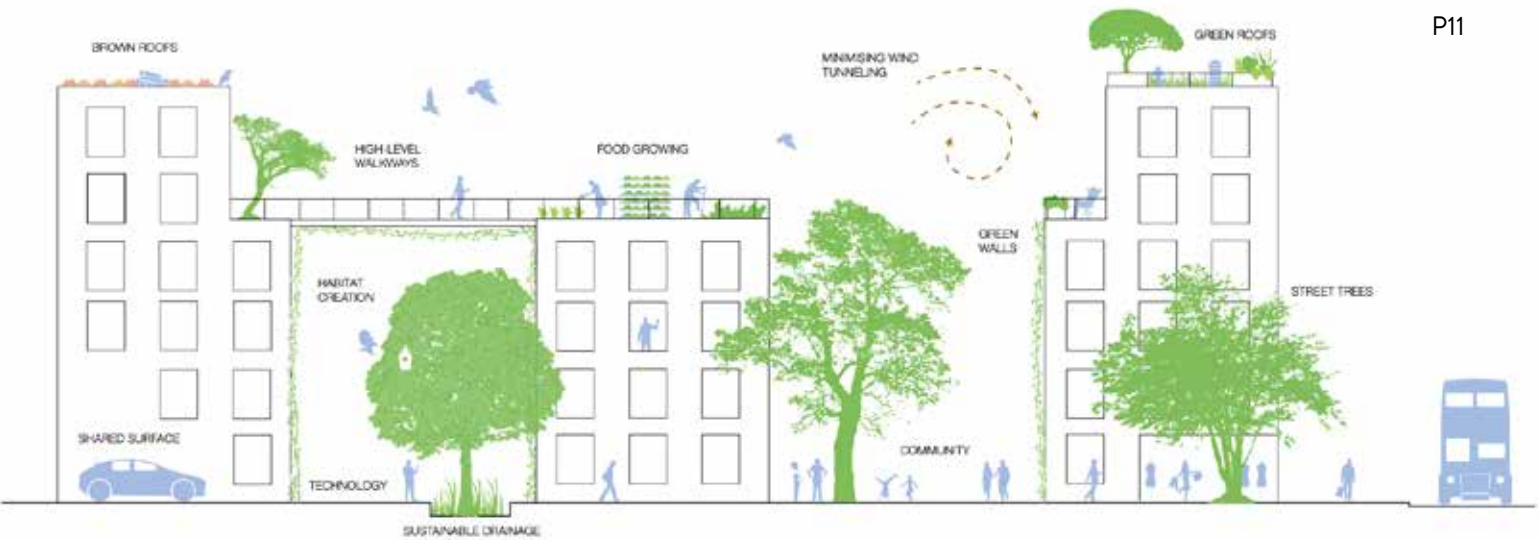
INTRODUCTION TO

Procuring Food for the Future Report 2020

The Procuring Food for the Future report 2020 examines the potential for various institutions to create better food systems that underpins local food economies & ecosystems. Their executive summary notes that 'A change to shorter supply chains, a more plant-based health-focused diet, and support for local food production can create social value and improved economic consequences for the immediate locale.' The report aims to promote good practice whilst exploring challenges faced by urban food growers today, and provides a range of recommendations for policy makers, organisations and communities to follow to create successful urban food production sites.

"Simultaneously businesses, individuals and communities need improved access to resources that could be used to grow local food enterprises or projects so as to be able to meet increased demand for local sustainably produced food. This is why it is so necessary to approach the problems of our current food system through the creation of a cross-sector food vision for the future in which we all have a part to play."

What do we mean by a sustainable food system?

Our working definition for sustainable food is that it should be produced, processed, distributed and disposed of in ways that:
• Contribute to thriving local economies and sustainable livelihoods - both in the UK and, in the case of imported products, in producer countries.
• Protect the diversity of both plants and animals and the welfare of farmed and wild species.
• Avoid damaging or wasting natural resources or contributing to climate change.
• Provide social benefits, such as good quality food, safe and healthy products, and educational opportunities.
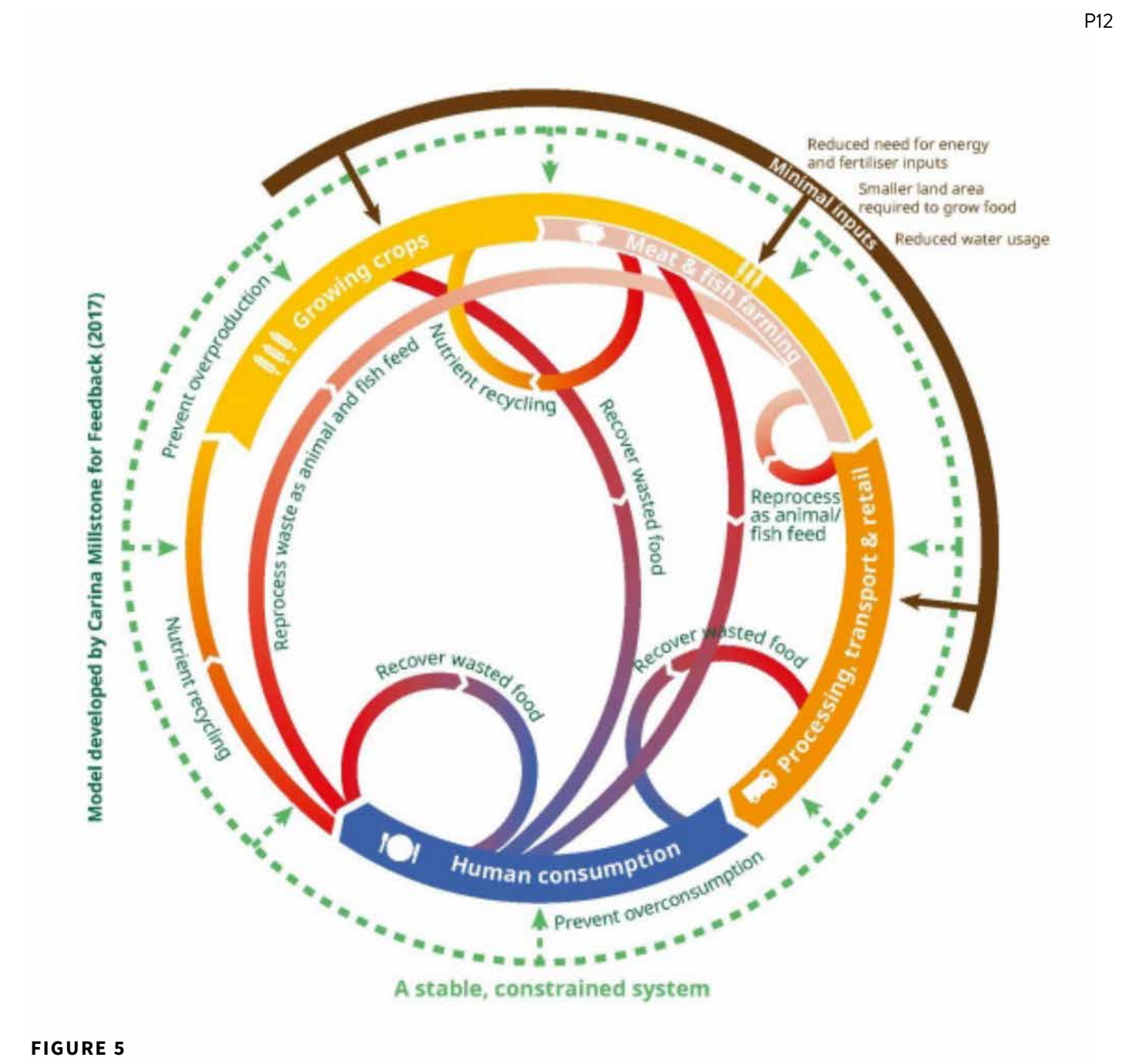• Follow a circular food system model to ensure maximum usage and minimum waste.

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Model developed by Carina Millstone for Feedback (2017)

FIGURE 5

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INTRODUCTION TO

Aire Valley Leeds Area Action Plan

The Aire Valley Leeds Action Plan is a development plan document which is in conjunction with the Leeds Local Development Framework (Leeds Local Plan), which focuses on the Aire Valley Leeds (AVL). Currently it's one of the largest regeneration and growth opportunities in the Leeds City Region. The AVLAP sets out a spacial planning framework which include plan wide policies, area and site specific plans to deliver an innovative and integrated approach to the sustainable regeneration of the Aire Valley Leeds.

The Skelton Gate area is part of the AVLAP, with to improve the quality of the area and it's surroundings. There are currently numerous developments taking place to the north of the site, Phases 1 & 2 for housing and an area of Green Belt to the south where part of the housing sites proposed in the AV111 Skelton Gate plan lies. The current policy proposals for Skelton Gate set out to deliver 1,800 new homes within a vibrant new community, a new local centre to support the new homes proposed, a local centre, including potential for a new food store, new primary and secondary schools, provision of space for health services, developed cycle and pedestrian routes, areas of green space and to connect Skelton Gate to the wider area.

Part of the Green Infrastructure Network plan notes:
"Skelton Gate lies at the confluence of the Wyke Beck and River Aire, linking two strategically important corridors, as well as Temple Newsam and Rothwell Country Park. Specific opportunities to improve the network in the area, in addition to provision of walking and cycling routes set out in Policy SG2 include:
• *Creation of a visitor destination at Skelton Lake based on a nature reserve and recreational area to include a visitor centre;*
• *Integration of the restored site at Skelton Grange landfill site into the network;*
• *Enhancing the tourism potential of the River Aire corridor*
• *The landfill area on site stopped operation in 2016, aims to restore the site within 5 years (2021) into an area of parkland and natural habitat" (AVLAAP, 2017)*
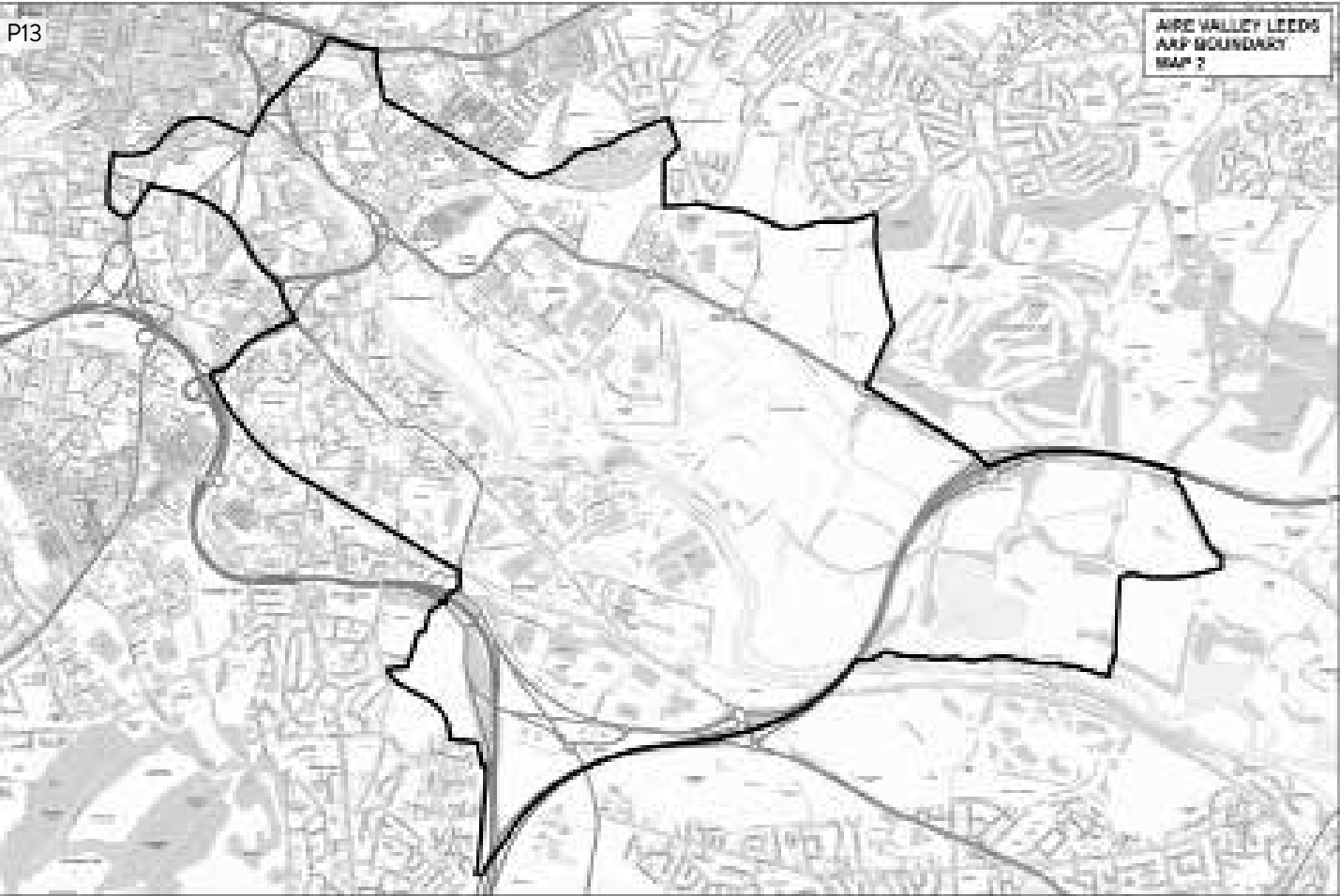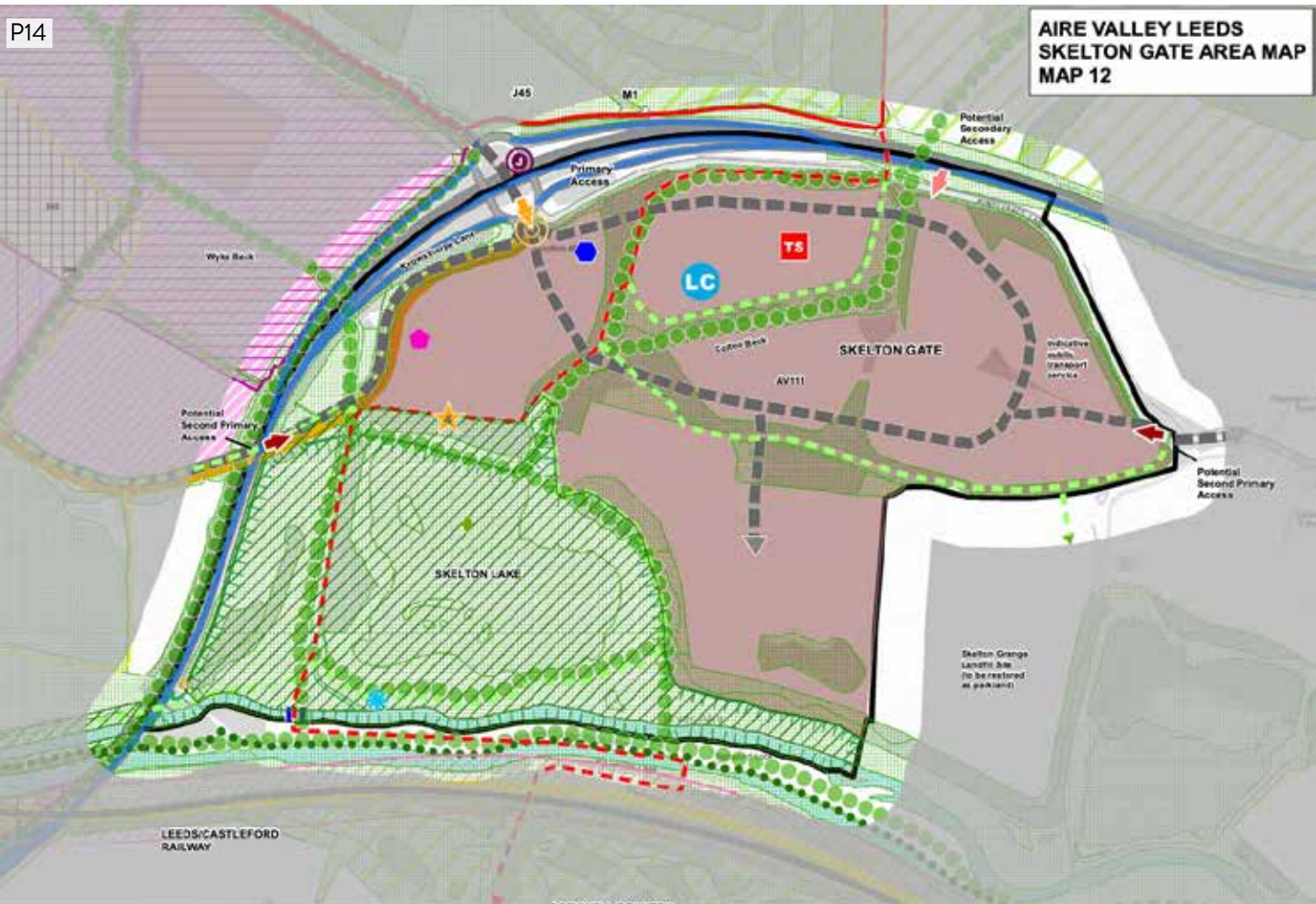
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FIGURE 6 - AIRE VALLEY BOUNDARY

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FIGURE 7- AIRE VALLEY SKELTON GATE AREA MAP

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2.0

SITE ANALYSIS

INTRODUCTION TO

Skelton Gate Proposals

Skelton Gate sits on the outskirts of Leeds within the Aire Valley, east of Junction 45 and the M1. The site currently comprises of mainly brown-field and agricultural land, and Is now home to the new Leeds Skelton Gate Services. The site itself measures approximately 30 hectares of former shrub and agriculture land, with indicative proposals for 700 dwellings and associated infrastructure/landscaping, shown in figure 2. Outline planning permission was granted by Leeds City Council in November 2017, comprising of:

- Up to 1,100 homes
- A local center including retail and community facilities
- A food store
- Education facilities including primary and secondary
- Extensive public open space and nature reserve around the Skelton Lake

Site completion would offer:

Social benefits

- Development of c.700 houses
- Meeting the Council's housing requirement
- Improvements to surrounding road network
- Pedestrian and cycle networks

Environmental benefits

- Creation of SuDS
- Green Travel Plan
- Strategic connections to existing networks
- Enhanced landscaping
- Biodiversity enhancements

Economic benefits

- £3.8m New Homes Bonus
- £1m additional Council Tax PA
- 194 direct operational jobs
- 116 indirect operational jobs
- 850 person years of employment

FIGURE 8 - SKELTON GATE INDICATIVE MASTERPLAN

**FIGURE 9 - SKELTON GATE INDICATIVE**

MASTERPLAN SKETCH

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SITE ANALYSIS

NCA Character Area 38

Skelton Gate sits within **NCA Character Area 38, the Nottinghamshire, Derbyshire & Yorkshire Coalfield**. The area has seen huge changes on its landscape due to industrialisation and development, with over 64% of the NCA being designated as Greenbelt land. The area is nationally important for its history, the geological deposits of coal and iron & its vast water network brought mass industrialisation, resulting in many historical features in the landscape which should be maintained for remembrance and education. The NCA profile says that the areas characteristics are:

- A low-lying landscape of rolling ridges with rounded sandstone escarpments and large rivers running through broad valleys, underlain by Pennine Coal Measures.
- Local variations in landscape character reflecting variations in underlying geology.
- Several major rivers flow through the rural and urban areas of the NCA, generally from west to east in broad valleys.
- A mixed pattern of built-up areas, industrial land, pockets of dereliction and farmed open country.
- Small, fragmented remnants of pre-industrial landscapes and more recent creation of semi-natural vegetation, including woodlands, river valley habitats and subsidence flashes, with field boundaries of clipped hedges or fences.
- Many areas affected by urban fringe pressures creating fragmented landscapes, some with a dilapidated character, separated by substantial stretches of intact agricultural land in both arable and pastoral use.
- A strong cultural identity arising from a history of coal mining, steel making and other heavy industry which resulted from the close relationship between underlying geology and resource availability, notably water power, iron ore and coal
- Features of industrial heritage such as mills, goits, tips, old railway lines, canals and bridges are evident, along with former mining villages.
- Many large country houses and estates established by wealthy industrialists in the 18th and 19th centuries and ancient monuments create focal points and important recreational opportunities within the landscape, such as Bretton Hall, Wentworth, Woodhouse, Temple Newsam, Nostell Priory, Bolsover Castle and the ruins of Codnor Castle
- Extensive urbanisation, such as in the major cities of Leeds and Sheffield, with terraced and back-to-back housing and grand 19th-century municipal buildings and churches at their centres, now surrounded by extensive housing and industrial development.
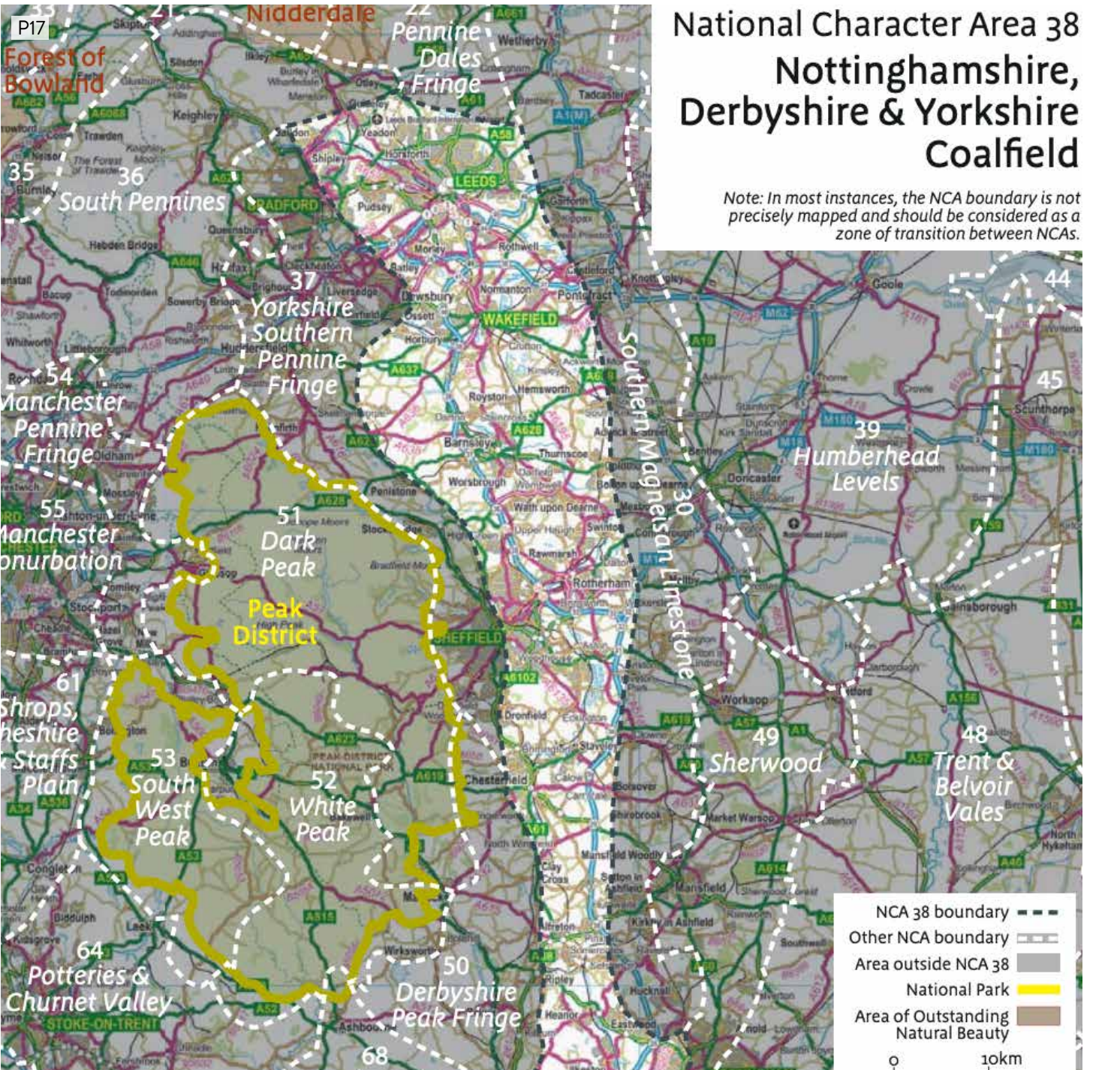
FIGURE 10
- Widespread influence of transport routes, including canals, roads and railways, with ribbon developments emphasising the urban influence in the landscape.
- An extensive network of multi-user trails on former railway lines and canal tow-paths, such as the Trans Pennine Trail and the Ebor Way.
- Continuing development pressure including land renewal and regeneration projects, especially along river corridors and around towns.

SEO 1: Restore and enhance existing areas and create new landscapes through the inclusion of woodland and networks of green infrastructure to raise the overall quality of design and location of new developments. Regeneration and restoration of industrial sites should seek to create green infrastructure that links fragments of the natural environment, leading to a functioning network for wildlife and access and recreational amenities for people.

NCA Character Area 38

BY-

- Reclaiming and restoring areas of contaminated and degraded land to create new post-industrial landscapes through the creation of habitats
- Creating green spaces close to where people live which are easily accessible, especially in regeneration zones within old mining areas and in inner-city developments.
- Creating new landscapes that are sympathetic to the local landscape character and incorporating habitats that will contribute to biodiversity and climate change mitigation, through careful planning of green infrastructure
- Ensuring that new development is located and designed with particular consideration for keeping important open views, and using tree and shrub planting of native species to assist in assimilating built structures
- Incorporating biodiversity and geodiversity in old quarries and on previously developed land into area plans and master plans for future developments,
- Realising the potential for canals and rivers to provide sustainable travel and access corridors alongside other green infrastructure benefits
- Incorporating past industrial land, such as disused railways, and recognising their important role for geodiversity and in providing linking corridors for biodiversity and recreation.
- Creating new permissive access routes, for example around reservoirs, and links to long-distance routes such as the Ebor Way and Trans Pennine Trail, and ensuring that some surfaced paths are provided for use by people of all levels of ability.
- Creating new recreational opportunities within developing landscapes in response to the Yorkshire and Humber Green Infrastructure Framework and the 6Cs Green Infrastructure Strategy, improving the quality of the environment for local residents and providing 'places to escape from it all' and easy access routes close to centres of population.
- Ensuring that country parks and accessible parkland and woodlands are maintained and managed so that they contribute both to the quality of the environment and to biodiversity networks.
- Ensuring that parkland are under management that maintains their historical value while enhancing the biodiversity and recreational benefits that they offer, and their settings.

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- Integrating the co-ordinated provision of green infrastructure in developments to offer the local community opportunities to enjoy their local green spaces and take action to improve them.

SEO 2: Protect and manage the archaeological and historical environment to safeguard a strong sense of cultural identity and heritage, particularly mining heritage, and use the area's distinctive sense of place to inspire interpretation and new development. Engage local communities with their past by enhancing the early, industrial and mining landscapes through restoration of key features of sites and improving access and interpretation.

For example, by:

- Conserving industrial buildings and associated features
- Using an understanding of the area's traditional and historic architecture, and its distinct patterns of settlement, to inform appropriate conservation of historic buildings, and to plan for and inspire any environmentally beneficial new development which makes a positive contribution to local character.

NCA Character Area 38

- Managing and restoring traditional field boundaries,
- Conserving, maintaining and restoring the area's distinctive farmsteads including those with nationally significant evidence of industrial use.
- Managing and interpreting disused quarries and other mineral workings to provide opportunities for geodiversity, recreation and education for schools, universities and people who are interested in the influence of the underlying geology on the history of the area, and for scientific research.
- Encouraging traditional production such as rhubarb in the 'rhubarb triangle' between Morley, Rothwell and Wakefield and products such as Yorkshire forced rhubarb, protected by the European Commission's Protected Food Names scheme, which give areas a sense of identity.
- Providing heritage interpretation for the many sites of historical, industrial, geological and cultural heritage interest
- Using local materials (sandstone and millstone for building, with stone flag or pantile roofs as appropriate) for restoration of traditional buildings to preserve visual unity and the connection with the underlying geology

SEO 3: Conserve, enhance and expand areas and corridors of semi-natural habitat such as grasslands and woodlands to create a functioning ecological network that links the fragmented patches of habitats through urban and sustainably farmed environments, thus assisting species and habitat adaptation to climate change, reducing soil erosion and diffuse pollution.

For example, by:

- Ensuring that existing areas of heathland are protected and managed,
- Widening the range of habitats in arable areas,
- Managing and enhancing the fragments of rough grazing, grassland habitats, lowland pastures and hay meadows in lowland areas, as valuable habitats for strengthening landscape character and enhancing biodiversity, including managing livestock levels to reduce poaching, and seeking ways of connecting them.
- Managing and restoring traditional field boundaries,
- Encouraging uptake of land management practices to support farmland bird populations, especially near to valley wetland habitats.

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- Encouraging land management practices such as creating grassland buffer strips and grass verges, reducing fertiliser inputs and managing rush pastures to provide a buffer to soil erosion and nutrient run-off in areas of arable production, particularly adjacent to watercourses.
- Increasing the planting of native trees and shrubs, and extending biodiversity networks, responding to the Yorkshire and Humber Green Infrastructure Framework and the 6Cs Green Infrastructure Strategy.
- Avoiding further fragmentation of agricultural land and semi-natural habitats.
- Increasing areas of native woodland within the landscape for recreational use, providing local sources of wood fuel and incorporating new development, while strengthening the ecological habitat network.
- Managing the area's diverse range of woodlands, veteran trees, wood pasture and parkland to enhance landscape character and safeguard their biodiversity value while seeking opportunities to enhance access.
- Planning for new opportunities to plant woods and new areas of wood pasture to expand existing sites, and to create

INTRODUCTION TO

NCA Character Area 38

short rotation coppice to enhance timber and biomass provision, increase carbon storage, regulate water flow and quality, and reduce habitat fragmentation.

SEO 4: Manage, enhance and extend wetland habitats associated with the rivers Aire, Calder, Dearne, Don, Rother and Erewash and their tributaries to increase the landscape's ability to naturally and sustainably manage flooding, improve water quality and increase the resilience of these habitats, the riverine landscape and associated species to climate change.

For example, by:

- Restoring and extending fens and flushes to enhance biodiversity. This will help to improve water quality by filtration.
- Increasing semi-natural habitats to help to slow down the volume of water entering the river system during and after storms and periods of heavy rain. This has been trialled upstream of Leeds in the Upper Aire Valley.
- Restoring natural river dynamic and profiles, re-connecting rivers to their flood plains and restoring relic water features, and creating and expanding marginal habitats such as wet woodland, scrub and permanent grassland,
- Encouraging buffers of permanent grassland around wetlands, streams and rivers to enhance ecological quality and reduce diffuse pollution from agriculture
- Promoting land management practices to reduce erosion and pollution.
- Maintaining undeveloped flood plains to store water, and seeking opportunities to expand wash lands and water storage in flood plains.
- Protecting and increasing trees on urban streets, and promoting sustainable urban drainage systems and green spaces to aid interception and infiltration of rain water and slow run-off.
- Ensuring that the restoration of previous mining sites aids water flow regulation and, through their management, contributes towards flood management.

(NCA Profile 38. Nottinghamshire, Derbyshire and Yorkshire Coalfield, 2014)

All relevant and potential opportunities from the NCA character report have been highlighted in pink.

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SITE ANALYSIS

LCA - Leeds Landscape Assessment 1994

Local Landscape Character Assessments aim to describe and analyse the local character of various Districts, providing information on soil types, vegetation, geology, historical context and provide guidance for any development or alteration of the landscape. Leeds consists of five **regional** character areas which include Leeds Coal Measure (which the site sits in), Millstone Grit Plateau, Wharfedale, Eastern Limestone Belt, and Vale of York. Leeds Coal Measures area is a said to be "A large area of undulating country occupied by part of the Yorkshire coalfield and lying between the limestone belt to the east and the Millstone Grit moors to the west and north. The underlying geology of the coalfield has resulted in a mix of light, well-drained soils derived from the Coal Measure sands and clays. Horticulture is common, particularly in the south of the region, where the strips of intensive cultivation of potatoes, broccoli and rhubarb contrast with pockets of small-scale often degraded arable and pasture including large areas of horse pasture adjacent to settled areas. from the sands tones and much heavier soils derived from the Coal Measure sands and clays."(Leeds Landscape Assessment, 1994).

Skelton Gate sits just within the LCM4 Local Character Boundary, which can be defined by its association with the Lower Aire Valley. The area consists of undulating arable fringe farmland which extends from the parkland of Temple Newsam to Kippax, as well as the settlements of Swillington and Great Preston. The character of the area includes low cut hedgerows and smaller pockets of horse pasture on higher ground.

The following characteristics describe the LCM4 Character Area:

- *"Gently undulating fringe farmland*
- *Large open arable fields on high ground*
- *Smaller fields of horse pasture*
- *Strip woodland along becks*
- *Small wooded copses*
- *Low gappy hedgerows*
- *Landfill and quarrying activities*
- *Views over the Lower Aire Valley"* (Leeds Landscape Assessment, 1994).
- •

This particular character area has many connections to coal mining, quarrying and landfill which is seen on the site today (Biffa Landfill Site) which have had a huge impact on the landscape.

The management strategies advised from the LCA are:

- *"Restoration of the characteristic features within the landscape where these are falling into decline.*
- *Enhancement through new woodland planting, in areas where the character has been lost completely.*
- *Seek control of horse grazing and further degradation of pasture around the fringes of Swillington and Kippax.*
- *Instigate a programme of tree planting and encourage natural regeneration, designed to screen any intrusive landfill site or quarries.*
- *New planting should be carried out as part of any wider planting programme for the area and should be designed so as to maintain views over the lower aire valley."* (Leeds Landscape Assessment, 1994).

P25

FIGURE 11   26

SITE ANALYSIS

Site Context

Skelton Gate is a 170 acre site which is situated in Leeds, West Yorkshire. Sitting just off Pontefract Lane, the area has great transport links connecting to Junction 45 of the M1 motorway, 5 miles south east of Leeds City Centre which can be accessed easily via the park and ride or the A63. The site has great access to various cycle & pedestrian routes that link the area to surrounding Leeds, for example the Trans Pennine Cycle Trail which lies to the south of the site along the River Aire, connects Central Leeds to Chesterfield.

To the south of the site sits an area of Greenbelt land, which separates Leeds City Centre from surrounding areas such as Woodlesford and Rothwell. The site has been identified as a key area for growth in Leeds within the Adopted Core Strategy 2019, with proposals set out and development underway to the north of the site. Vast areas of park and agricultural land surround Skelton Gate, with great access to areas of green such as Temple Newsam, Newsam Green, RSPB St. Aidan's and Rothwell Country Park.

The site is in a great location for access to the city centre, as well as surrounding villages and cities via the M1 motorway. With already integrated cycle and pedestrian networks, the proposal has a pre-existing framework that merely needs enhancing to create successful GI links to surrounding areas. However, with the sensitive surrounding context of Greenbelt land & major M1 motorway dominating the site, this will significantly influence the end design proposal.

WEST YORKSHIRE

LEEDS

FIGURE 12

Attractive open green space & wetlands

Recreation space & development
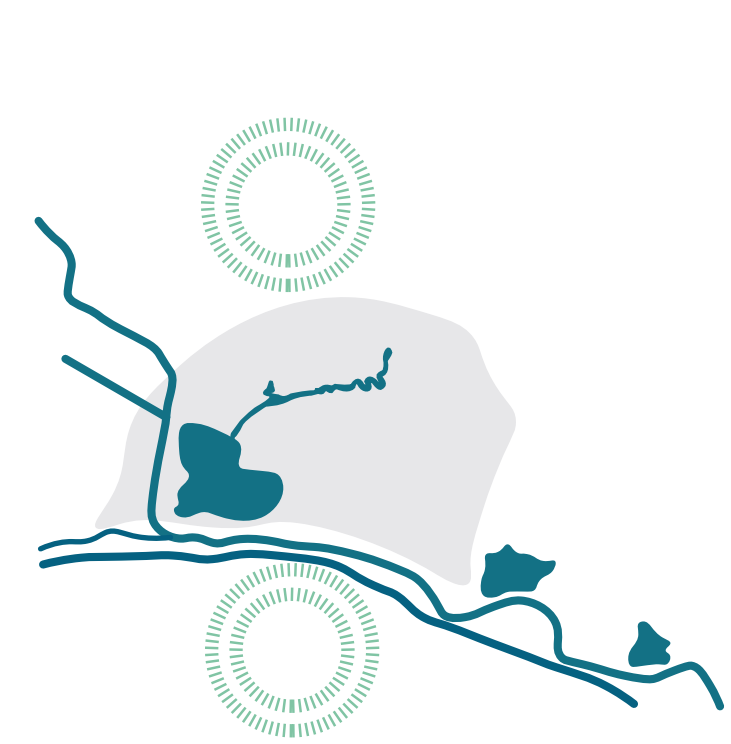

Finished development, phase 1 & 2 brownfield

■ Mixed Use Commercial

■ Mixed Use Residential

In terms of built form, surrounding the site there are generally mixed use residential areas to the east & south, where as to the west it becomes much more urbanised, sits various commercial buildings and warehouses. As shown in figure 13, there isn't much built form within the Skelton Gate site, apart from the Skelton Lake Services developments, Newsam Green Farm, Laventhorpe Hall, and other residential areas.

Identifying surrounding built form and uses is important for making sure the following design proposals make full use of Skelton Gate and it's surroundings. Connecting the site to surrounding established communities, recreational and commercial facilities is key to kick starting the regeneration of Skelton Gate through the implementation of green infrastructure. With the site already having well-established connections to many of these areas, it's key that the design proposal seeks to develop and enhance existing features and create connections to surrounding communities, to create a hub/destination for others to enjoy.

FIGURE 13   P28

Local Parks
Local parks include Rothwell Country Park and Temple Newsam, both in walking distance.

Communities
The site sits at the heart of various surrounding communities including Rothwell, Woodlesford, and Garforth.

Major Road Connections
Currently, Skelton Gate is dominated by the M1 which creates a barrier to the north and west.

Focal Points
Local parks include Rothwell Country Park and Temple Newsam, both in walking distance.
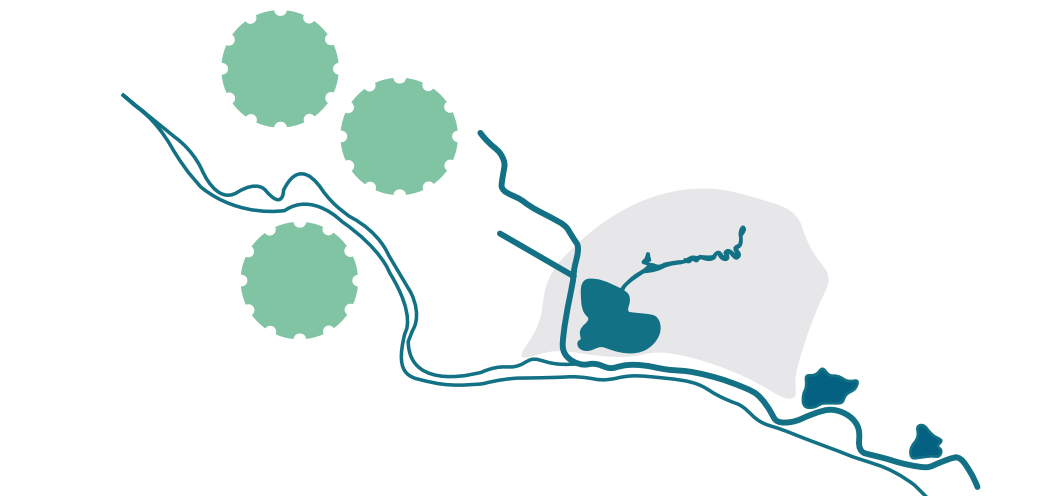
Workplace
Skelton Gate is located on the outskirts of Leeds City Centre, which means it is currently lacking the critical mass for becoming an area for employment.

Transport Connections
Skelton Gate is reasonably well-connected, with Newsam Green Park and Ride located a 5 minute drive away and access to the M1 makes the site easily accessible.

SITE ANALYSIS

Built Form

SITE ANALYSIS

Land Use Context

Skelton Gate is surrounded by agricultural land, villages, and parks on the outskirts of Leeds City Centre. It's vital that when developing the Skelton Gate proposal, local communities and green spaces are considered and GI connections are in place to link the site to areas such as Rothwell Country Park, St Aidan's Nature Reserve and Temple Newsam. Creating connections to surrounding communities is also vital, areas such as Woodlesford, Rothwell and Swillington are within walking distance due to the already established cycle and pedestrian network.

1. Temple Newsam
Tudor-Jacobean house and landscaped gardens designed by Capability Brown.

2. Newsam Green
Small village mainly comprising of agricultural land.

3. Swillington
A former coal mining village with a population of over 3,500. Close proximity to St Aidan's Nature Reserve and Newsam Green.

P30

P31

P32

4. Woodlesford
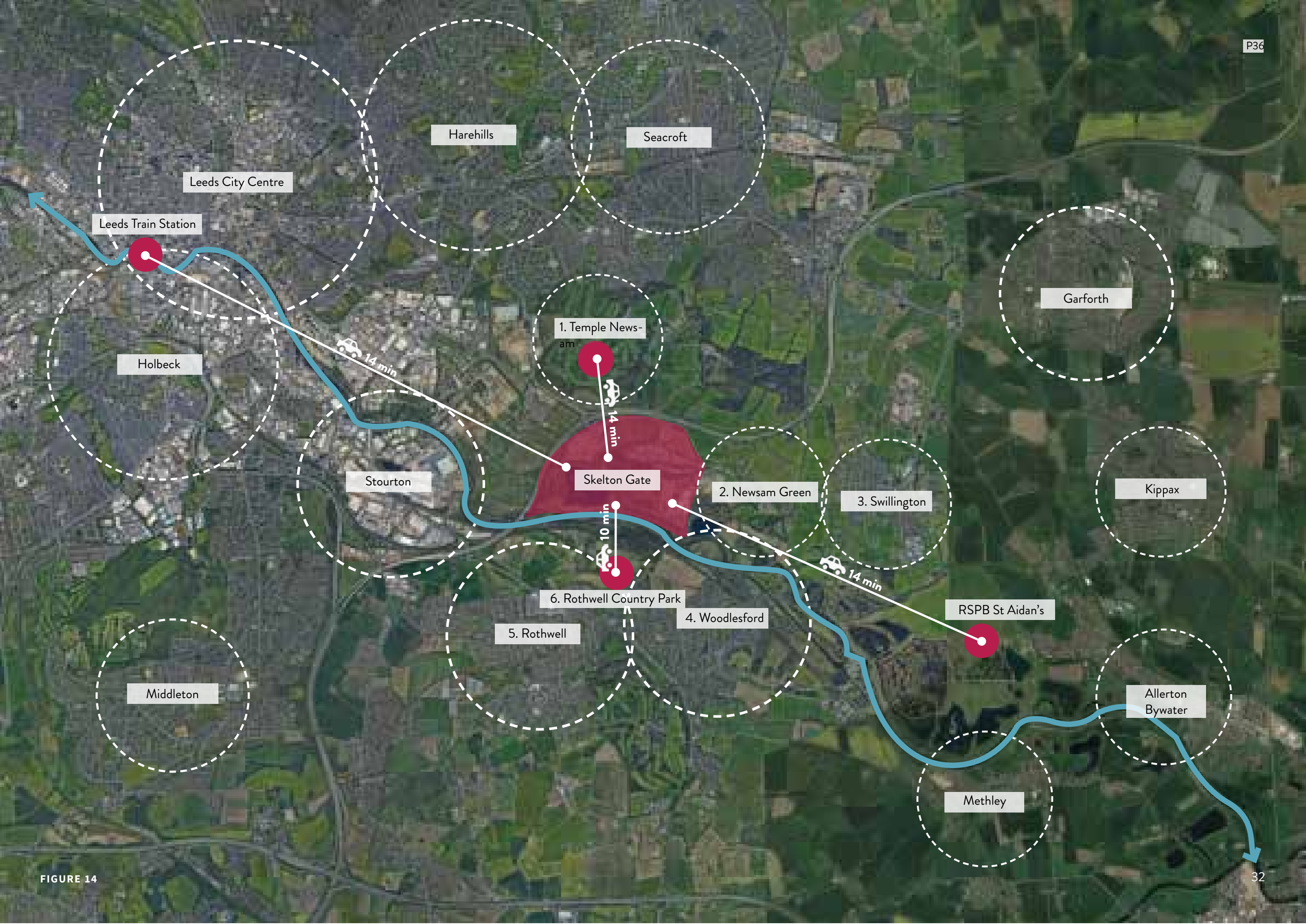A suburban village which sits on the banks of the River Aire & Aire and Calder Navigation.

5. Rothwell
A market town with a population of over 21,000.

6. Rothwell Country Park
A country park located in Rothwell, comprising of wetland, woodland, meadow and grassland areas.

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P34

P35

FIGURE 14

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SITE ANALYSIS

Surrounding Productive Landscapes & Initiatives

FIGURE 15

P37

1. Kirkstall Valley Farm
Previously privately farmed pre 2017, now a community supported area of urban agriculture in Kirkstall.

2. Meanwood Valley Urban Farm
A 24 acre city farm which was established in 1980. Both crops and animals are farmed, with many other services.

3. Hollybush Conservation Centre
Volunteering centre in Kirkstall, comprising of a community cafe/shop, garden and classroom.

4. Incredible Edible Kirkstall
Part of the Incredible Edible network - supporting communities to learn, share and grow.

P38

P39

P40

P41

5. Bedford Fields Community Forest Garden
An open access forest garden, serving the local communities of Woodhouse and Hyde Park.

6. City Veg Beds - Feed Leeds
3 City veg beds containing veg, herbs and fruit planting and maintained by Feed Leeds.

7. Swillington Garden Growers
Community supported agriculture scheme, providing annual veg box subscriptions & volunteering.

8. St. Lukes Community Garden and Orchard
A community garden and orchard at St. Luke's Community Centre.

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P43

P44

P45

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3. Hollybush Conservation Centre

2. Meanwood Valley Urban Farm

4. Incredible Edible Kirkstall

8. St Lukes Community Garden and Orchard

1. Kirkstall Valley Farm

5. Bedford Fields Community Forest Garden

Osmondthorpe Allotments

6. City Veg Beds - Feed Leeds

Holbeck Community Orchard

Lady Pit Allotments

Dewsbury Road Orchard

Cross Flatts Park Orchard

Skelton Gate

7. Swillington Garden Growers

P46

FIGURE 16

34

KEY

Restored soils mostly from quarry and opencast spoil'

Freely draining slightly acid loamy soils

Slowly permeable seasonally wet acid loamy and clayey soils

Loamy and clayey floodplain soils with naturally high groundwater

– – – Development Boundary

Restored soils - 'appropriate to grass but cereal production on restored sand and gravel workings.'

Freely draining slightly acid loamy soils - 'suitable for a range of spring and autumn sown crops' under grass the soils have a long grazing season. Free drainage reduces the risk of soil damage from grazing animals or farm machinery. Shortage of soil moisture most likely limiting factor on yields, particularly where stony or shallow'

Slowly permeable seasonally wet acid loamy and clayey soils - 'Mostly suited to grass production for dairying or beef; some cereal production often for feed. Timeliness of stocking and fieldwork is important, and wet ground conditions should be avoided at the beginning and end of the growing season to prevent damage to soil structure. Land is tile drained and periodic moling or sub-soiling will assist drainage.'

Loamy and clayey floodplain soils with natural high ground water - which is appropriate 'for productive grassland provided drainage is maintained. Risk of poaching and soil damage early and late in the grazing season. Cereal production where flood risk is low.'

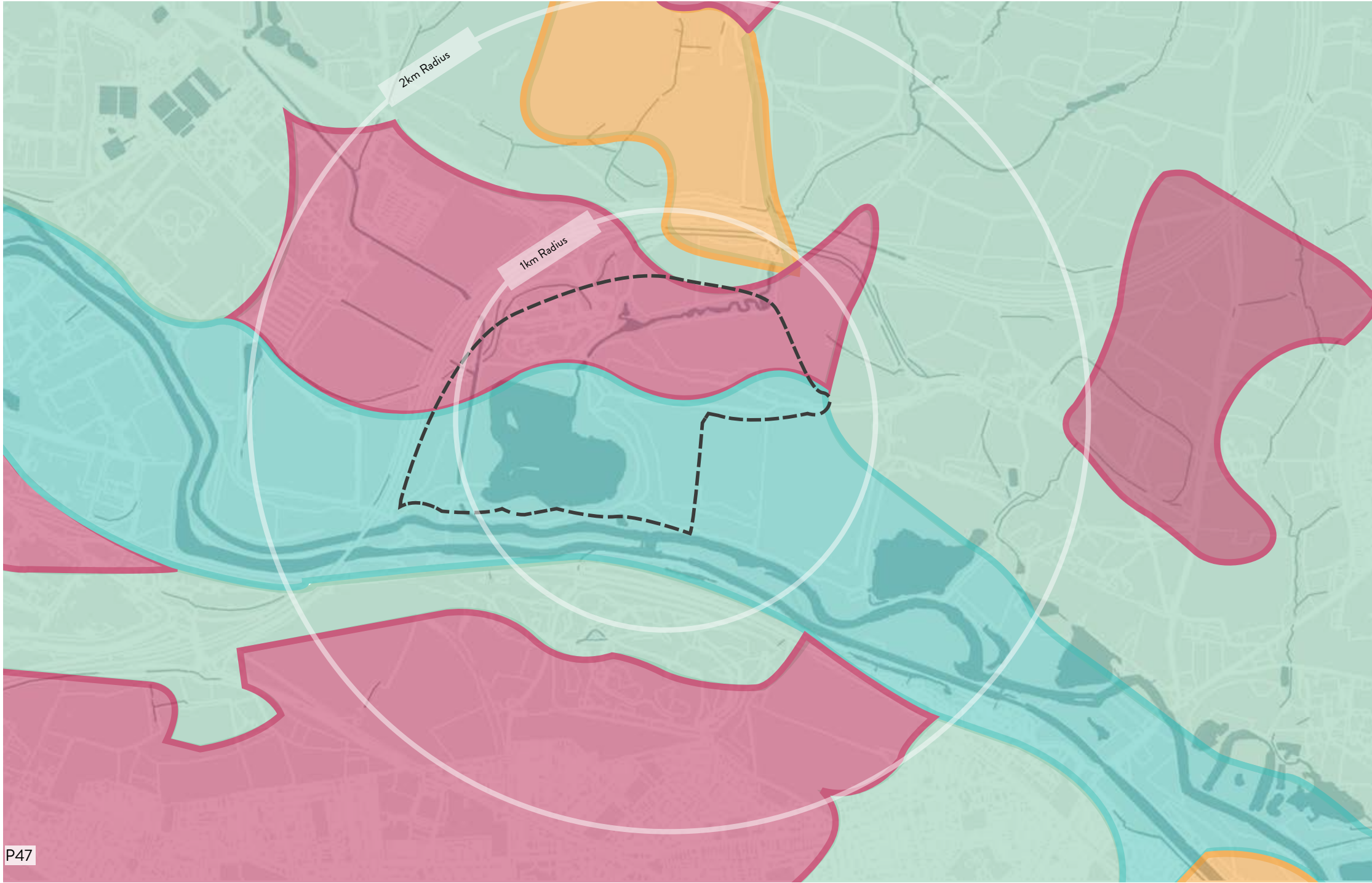Source: http://www.landis.org.uk/soilscapes/

FIGURE 17

Skelton Gate was a formerly a colliery site in the 1940's which was ceased around 1981, the site had areas of worked ground where underground cavities had been left from underground mining, these have now been restored. The site is now use for recreation, and in previous years as agricultural land enclosed by hedges. There are 4 types of soils found on site shown in figure 17, **Generally the quality of soil in the area is sufficient for development, however ground preparations will need to be made for each area.**

S I T E   A N A L Y S I S

Soil Types

KEY

Green Belt

Local Wildlife Site Policy G8 - Protection of important species and habitat area

Leeds Habitat Network

Bat Alert Area

– – – Development Boundary

https://leedscc.maps.arcgis.com/apps/webappviewer/index.html?id=8de441b78a-354b99aa31f565ef27586d

Skelton Gate is home to abundance of nature and wildlife, with much of the area already being part of the Leeds Habitat Network shown in figure 18. The Species Survey found Great crested newts, badgers, bats, brown hare, invertebrates, otter, reptiles, all of which are protected under the Wildlife Countryside Act 1981. There are no statutory protected site zones within 2km of the site, and the nearest SEGI is Avenue Wood Wetland to the North-east which is outside of the development area & is isolated from the site by the M1. To the south and east is Greenbelt land, which means these areas won't be available for development for the foreseeable future while agriculture, forestry and outdoor leisure is expected to prevail. In slightly more detail, figure 18 shows the local wildlife protection areas which consist of Skelton Lake.

FIGURE 18

S I T E   A N A L Y S I S

Natural Environment

STAGE 1 - GROUP WORK

Bodies of Water

The first stage of the project we were put into groups to collect background information and case studies in relation to various topics, then we applied a SWOC analysis to the current Skelton Gate proposals. Group B consisted of myself and Nicola Berry, we gathered information on relevant case studies and their relation to Skelton Gate, exploring the environmental, economic and social aspects through a SWOC analysis. Some of the researched subject areas included, Aquaculture, Drainage Swale, Urban Wetlands, Hydro-power, Natural Swimming Pools, and Bird Watching. Researching these areas helped delve deeper into what aspects the Skelton Gate site has to offer, with various bodies of water on site and brownfield land, many of our research areas proved to be appropriate.

Skelton Gate 170 acre area was a former colliery site, where Wyke beck and the River Aire join. The proximity of the River Aire to Leeds has proved to be a major driver for the development of Leeds as a major city, providing vast links to surrounding towns and villages from as far back 1699 when the Aire and Calder Navigation made the river navigable. The Aire and Calder Navigation lies adjacent to the River Aire, it was constructed back in 1704 to improve the Aire's navigability by boat, today still sees the waterways being used for transportation, and information from the Aire Valley Leeds Area Action Plan identifies further plans to carry freight to ease pressure of major city roads. The River Aire and Wyke Beck corridors are locally important GI connections, linking regional nature reserves at Fairburn Ings and St Aidans.

Overall from the research, we found that there is great potential for the water bodies on site to be put to use, with opportunities for all research areas to be implemented in the Skelton Gate design proposal.

P49

FIGURE 19 - BODIES OF WATER ON SITE
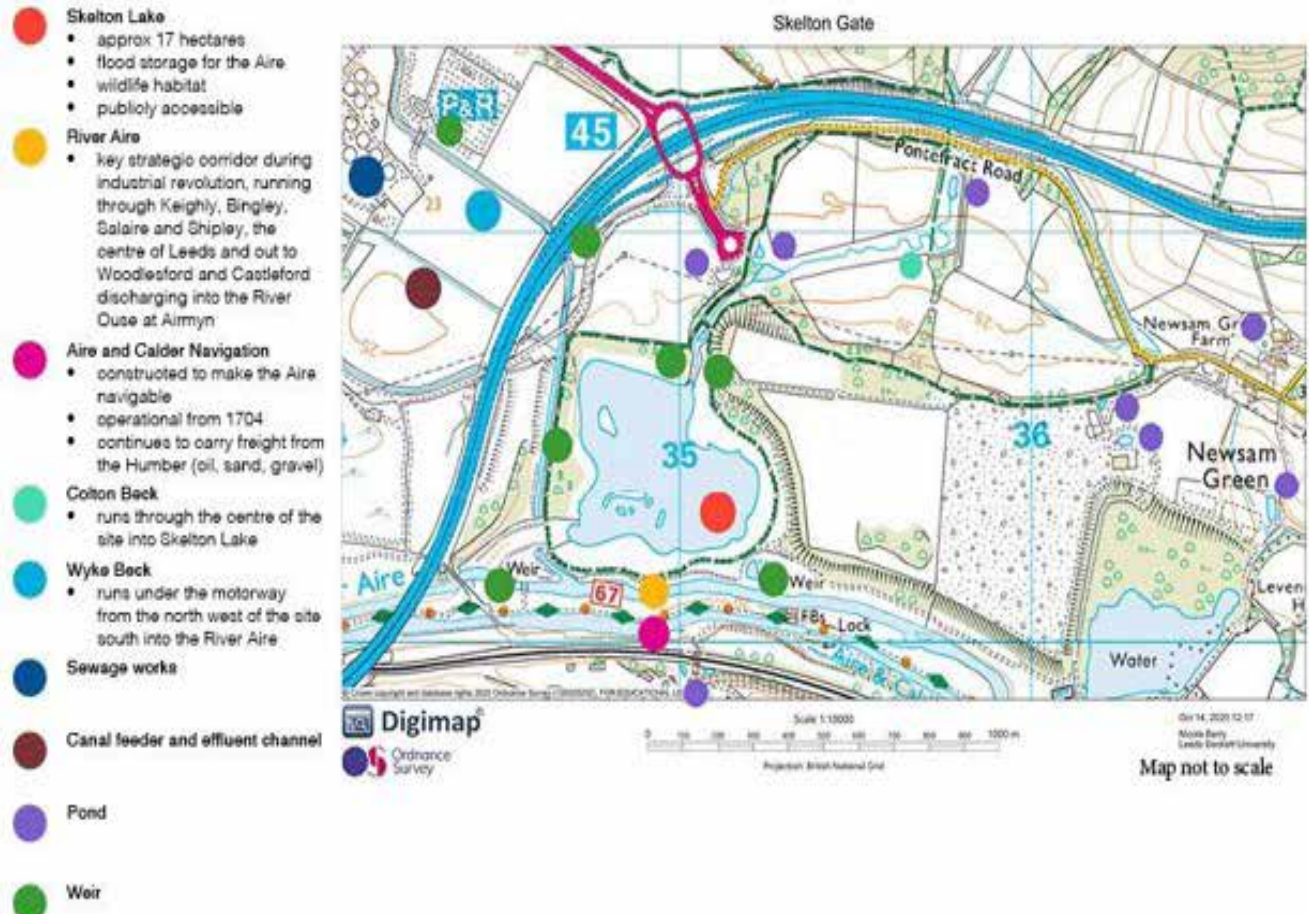
P50
FIGURE 20 - BODIES OF WATER ON SITE

STRENGTHS

- Freight carriage
- Leisure - boat travel
- Green infrastructure connection through the valley for migrating birds
- Increasing biodiversity on site,
- Link/create wildlife corridors through the valley for migrating birds,
- Good existing bird population
- Storm water storage
- Varied habitats
- Productive ecosystem
- Carbon storage
- Hydro-power can provide a Clean energy source, zero carbon, it's one of the cheapest renewable and has low running costs
- Aquaculture can provide employment for the local community, & provide local food production
- Forestry benefits include carbon sequestration, flood regulation, climate moderation and habitat
- Natural swimming pools - eco-friendly, less maintenance than the average pool, make it easier for
- Locals to freely use and less cost, provide new areas for natural habitats within Skelton Gate & encourage people from around Leeds/tourists to visit and use.
- Bird watching - Encourage people to visit the site, encourage tourism, create/encourage community cohesion

WEAKNESSES

- Pollution with urban and agricultural run-off
- Lack of river/canal moorings
- No commercial boat services at present
- Swales are vulnerable to large storms, with the surroundings of Skelton Lake/ponds being in a floodplain, high-velocity flows may ruin vegetation and cause overflow to the Skelton Gate site.
- Drainage Swales can have a negative effect if not placed correctly.
- Hydro-power potential disruption of habitat during construction Limited to no opportunity to increase power capacity in response to demand
- Fish farming may pollute water bodes (e.g. Skelton Lake), and may affect existing fish populations
- Forestry - Reduction of water yield, exacerbated by climate change
- Natural swimming pools - Aesthetics of a natural pool may put some new residents/visitors off, high initial investment, may be difficult to convince planners it's right for the Skelton Gate area. Natural pools require more land than the average pool.
- Bird watching - may disturb the local wildlife

OPPORTUNITIES

- Flood Alleviation
- Hydro-power, zero carbon energy production
- Additional freight capacity - ease pressure on road network
- Recreation
- Improve biodiversity
- Commercial boat services
- Potential boat stop
- Drainage swales can provide a green and environmental drainage solution, and possible habitat creation within the proposed housing development and surroundings.
- Restoration of degraded land
- Education and enrichment
- Culture, leisure & human well-being
- Hydro-power can be generated/controlled locally, and be an area for education.
- Aquaculture - Skelton Lake, various ponds etc. Could provide areas for aquaculture. Brownfield land is still available on site for potential aquaculture ponds to be built.
- Forestry - timber production, increase biodiversity, education, human well-being, recreation and leisure
- Natural Swimming Pools - they work in all climates, so can be used all year round by the new Skelton Gate community and visitors, could become a community exercise - getting help from the locals creates a natural swimming pool that has more meaning to the community.
- Bird watching - Potential to create a well known bird-watching area, opportunities to provide habitats for new nesting birds

CHALLENGES

- Risk of drowning, particularly around weirs
- To reduce pollution
- Engineered banks of Wyke Beck
- Position drainage swales to avoid overflow in floodplain.
- Drainage/infill for development
- Habitat degradation during development
- Preventing loss of biodiversity due to human activity when the site is occupied
- Invasive species - Himalayan balsam and Japanese knotweed observed on site
- Hydro-power can cause noise from turbines, in combination with weir and road noise. Potential power loss during drought conditions
- Aquaculture - Avoiding reducing water quality of Skelton Lake & surrounding ponds.
- Forestry - Potential to increase river sedimentation, leading to increased risk of flooding, potential to degrade aquatic habitat if badly designed or managed
- Natural swimming pools- Convincing locals and clients to accept a natural swimming pool instead of a standard pool may be tricky.
- Bird watching - making sure the design of Skelton Gate doesn't effect the current nesting birds on site.

S I T E   A N A L Y S I S

History

Skelton Gate was a former colliery site back in the early 1900s, which has since been used for agricultural land and areas of landscaping. From analysing historic maps over 2 centuries, it's clear that the formality of the site hasn't changed significantly. The river Aire was a predominant feature during the 19th and 20th century, until the change in water course direction after 1950. Much of the sites industrial past isn't present today, Skelton Lake & the previous extracted hole for the landfill site however is the result of a flooded open-cast mine which dominates the area. This may mean there is a chance of soil contamination within the area, the following design proposal will need to take into account this possibility & advise the appropriate conditions and obligations to build on contaminated sites.

General view of Skelton opencast site
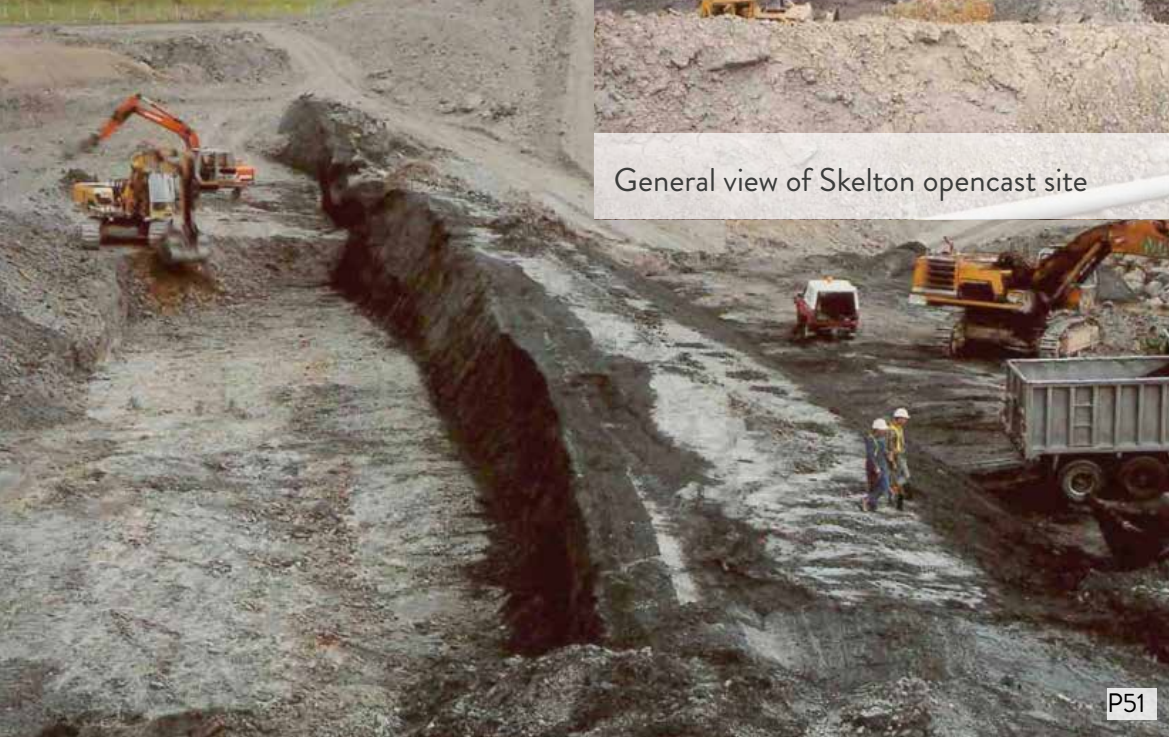
Extraction of folded Third Brown Metal Coal near a fault at Skelton opencast site

Opencast coal working at Skelton showing faulted strata above the Middleton Main Coal

Extract from Leeds City Council Contaminated Land Team

WHAT DO WE KNOW ABOUT THE SITE?	
Previous contaminative use	On Site: railway, works, sewage works, farm, opencast mining
	Off Site: opencast, agricultural, landfill
Environmental Setting	Geology: Solid – PLCM. Drift – river terrace present in NW of site. Fault present E to W in the centre of the site.
	Hydrogeology: Sec A
	Hydrology: Colton Beck on site. R.Aire and Aire and Calder navigation 600m to S of site. Skelton Lake present 300m to SW of site.
	Mining: Opencast + potential deep mining of seams to a depth of 190m
	Landfill: Oxbow Ash disposal scheme (industrial waste)
	Radon: No protection required.

P52
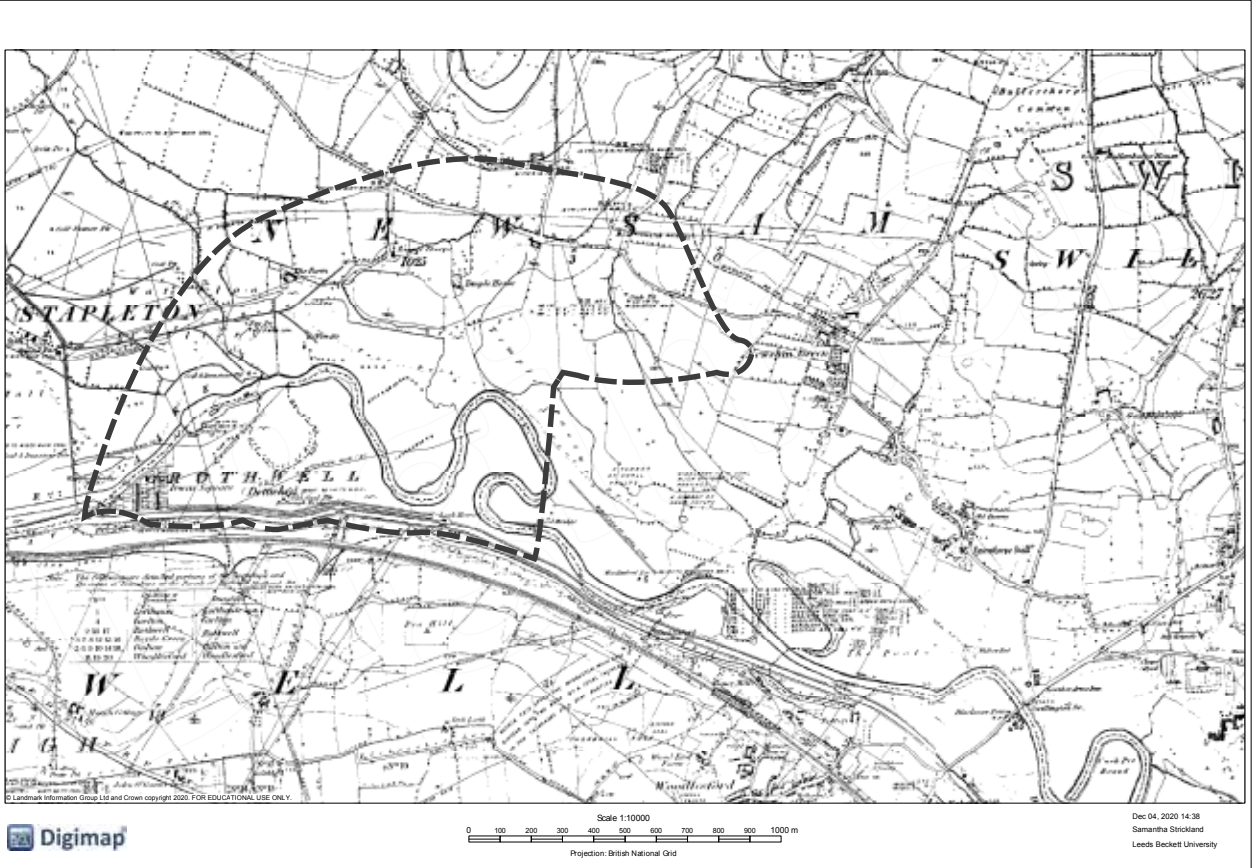
1850
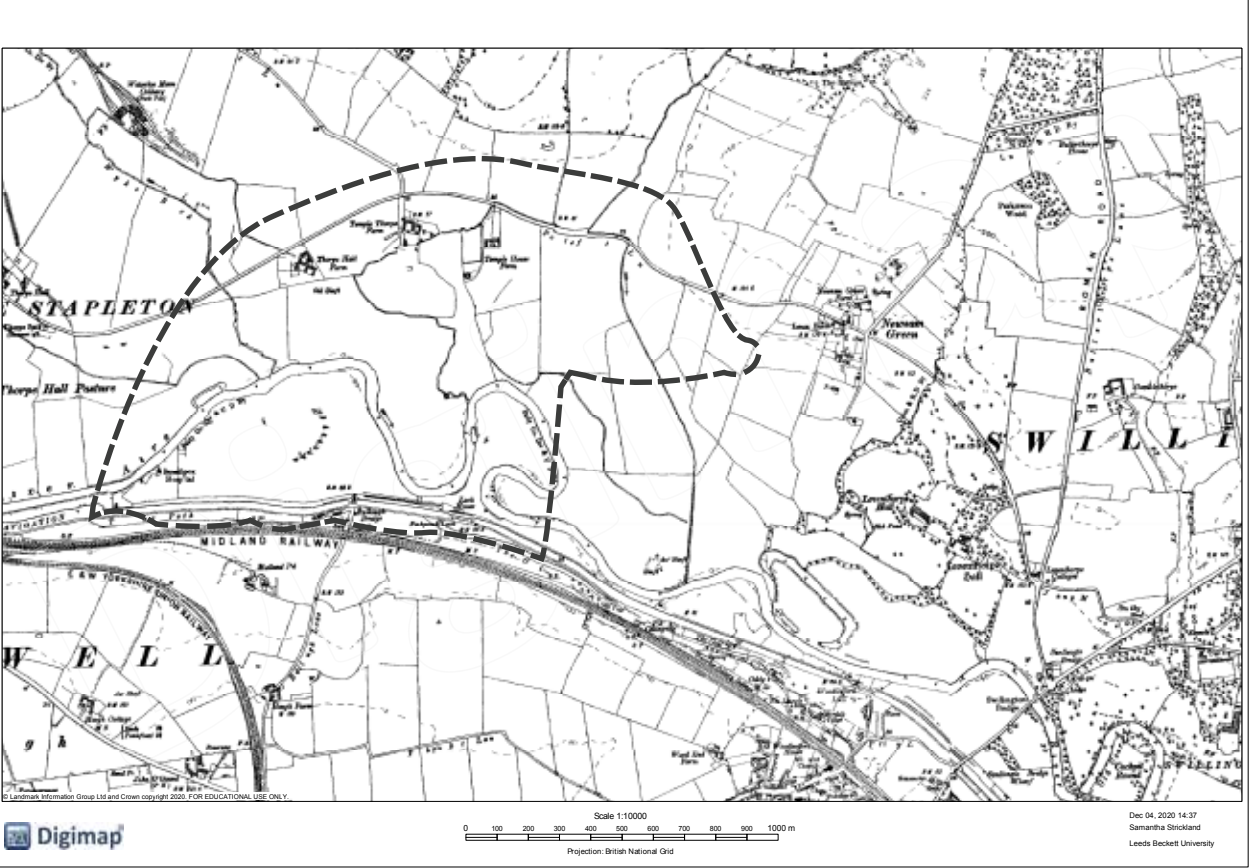
1900
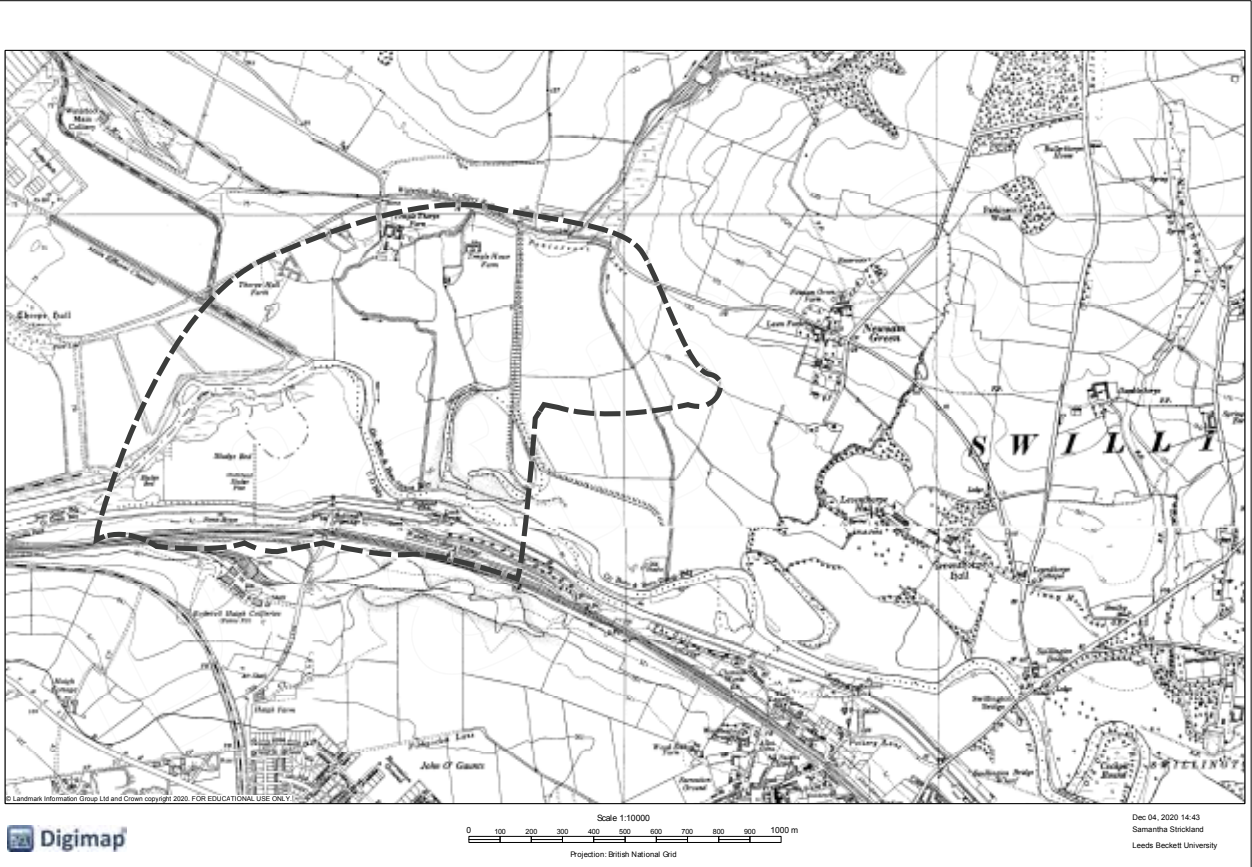
1950
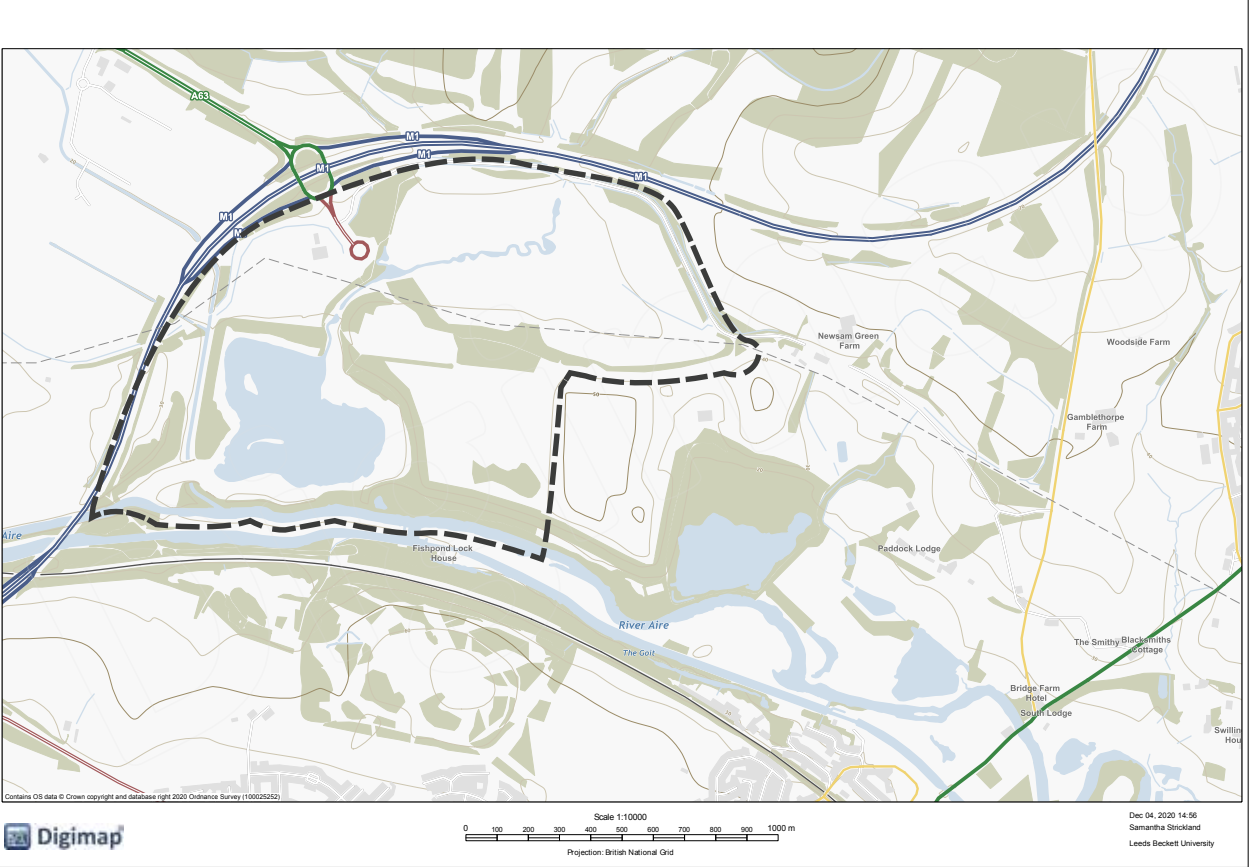
Contemporary
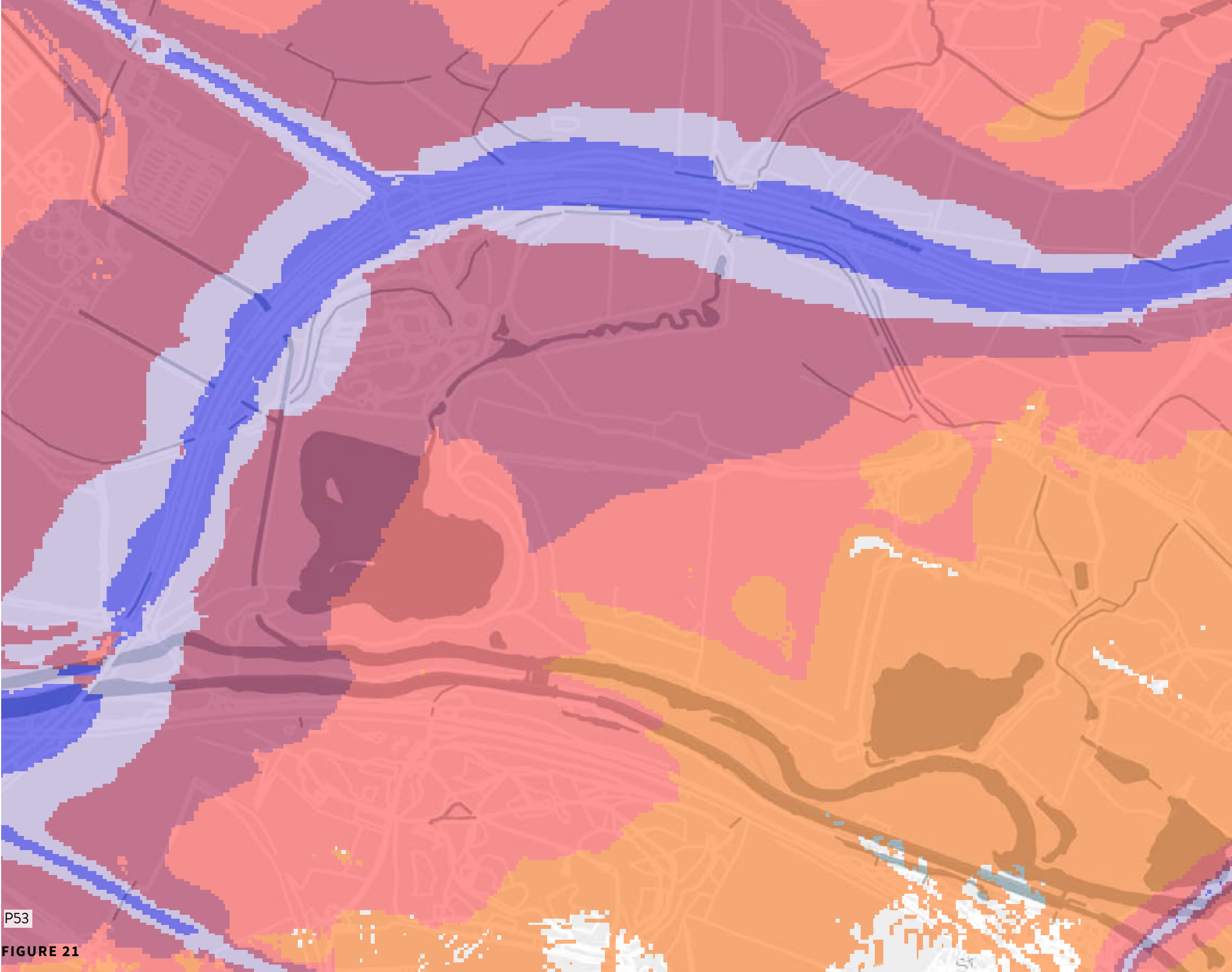
AVERAGE NOISE LEVEL KEY

- 75.0 and over
- 70.0 - 74.9
- 65.0 - 69.9
- 60.0 - 64.9
- 55.0 - 59.9

The Skelton Gate site is dominated by the M1 motorway that sits to the north-west of the site. One of the main features of Skelton Gate is it's transport connections to Leeds City Centre and surrounding areas, however there are issues that come with this benefit. Air and noise pollution is a big issue within the immediate proximity to the major roads surrounding Skelton Gate, these being Pontefract Lane, The M1, the A639 and the A642. As shown in figure 21, this effect the entire site ranging from 55db-75+ which is detectable from any part of Skelton Gate.

Mitigation measure may need to be implemented in the following design proposal. The M1 and surrounding major road connections aren't changeable, therefore mitigation measure should be put in place to block noise pollution and improve air quality, by increasing tree density and implementing GI connections that will also attract visitors to the site.

P53
FIGURE 21

S I T E A N A L Y S I S

Air & Noise Pollution

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Skelton Gate is home to various bodies of water that pose a flooding threat to the wider site. Figure 22 shows the flood risk to the site, ranging from high (dark purple) to very low (light blue). This shows that areas around the water bodies are at a high risk of flooding, which causes some issues with potential proposals around the Skelton Lake site. However, in areas of higher ground towards the middle of the area shows little to no threats of flooding.

"Properties were flooded by the Wyke Beck in August 2004, May 2005 and June 2007, and there was also a 'near miss' event in January 2008. However there is not an extensive history of property flooding from the beck. The majority of the properties which flooded in these recent events are located in the Dunhill Estate. The frequency and extent of these flood events has led the Environment Agency to look into developing a flood scheme for the Wyke Beck."

Source : https://www.whatdotheyknow.com/request/301627/response/762058/attach/4/Extracts%20from%20 Flood%20Investigation%20Study%20Final%20Report.pdf?cookie_passthrough=1

Flooding is becoming a major issue due to climate change, it's becoming more and more apparent and designers are needing to think carefully about whether certain interventions are going to withstand against the future effects of climate change. The high risk flooding areas need to be taken into consideration in the following proposal, placing heavily planted production areas/housing could be fatal in the coming years.

P54
FIGURE 22

S I T E A N A L Y S I S

Flooding

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SITE ANALYSIS

Surrounding Character

Skelton Gate Services
Entrance to Skelton Gate Services coming off the M1, newly done with planting and hard landscaping. Undulating green roof of the new Skelton Gate Services dominates the area, softening the grey hard landscaped/brownfield areas. The services itself offers a range of catering areas, shops, main amenities, a hotel, charging points and forecourts. Parking is free for 3 hours, charges apply there after.

Surrounding Skelton Gate Area - East
To the East of the Skelton Gate area sits mainly agricultural land, Newsam Green is the closest village to the east of the site. This area has a much more rural feel, avoiding the M1 motorways noise and view.

M1 Motorway
The M1 Motorway creates a boundary for the Skelton Gate site, as it sits dominating the North & West of the site. The M1 is 193 miles long and connects London to Leeds, making it one of Leeds key transport connections to surrounding areas.

Pontefract Lane
Pontefract Lane is one of the sites main connections to Leeds City Centre, connecting to the A63 & A61. Temple Green Park and Ride is connected to Pontefract Lane, which could provide parking/transport to the Skelton Gate Site.

Swillington
Swillington is a village to the east of Skelton Gate, which was formerly a colliery site. Swillington is a much busier village in comparison to Newsam Green with a population of just over 3000.

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Skelton Gate Services Viewpoints

View Point 1 - View of Skelton Lake from the footpath coming from the canal path. Surrounding grassland and wild scant vegetation, species include Trifolium sp,. Ranunculus sp., Poterium sanguisorba. Lots of birds found surrounding the lake, inc. Cormorant, Egret, Swans, Ducks and Little Gulls.

View Point 2- Following the footpath north towards Skelton Lake Services, passing Wyke Beck. Large metal fence separating the footpath from the beck, with mainly overgrown scrub and tree planting. Some species found include Rosa canina, Corylus avellana, Dipsacus fullonum, Aster x salignus, Crataegus monogyna. Noise from the M1not noticeable due to the white noise from the beck.

View Point 3 - View from footpath of Skelton Lake Services, extensive view of green roof and modern architecture. Adjacent to the service station, to the west, Betula pendula & Pinus sp. can be found. Reed bed has been constructed near the services , planted mainly with Typha latifolia and Aster x salignus (also found across the site), Daucus carota, Trifolium sp., Ranunculus sp., Plantago lanceolata. Plastic ground stabilisation mesh installed under grass areas.

View Point 4 - View from road looking over the site from the north, looking at the brownfield development area of Phase 1.

View Point 5 - View of Biffa Tip area from footpath, the tip is currently hidden by the topography and scant vegetation. The tip wasn't viewable from the footpath.

View Point 6 - View of brownfield/scant planting. Dominant species in the area include Betula pendula, Rosa canina, Crataegus monogyna, Quercus sp. Ulex sp., Rubus sp., Urtica dioica, Deschampsia angustifolium and Impatiens glandulifera (invasive).

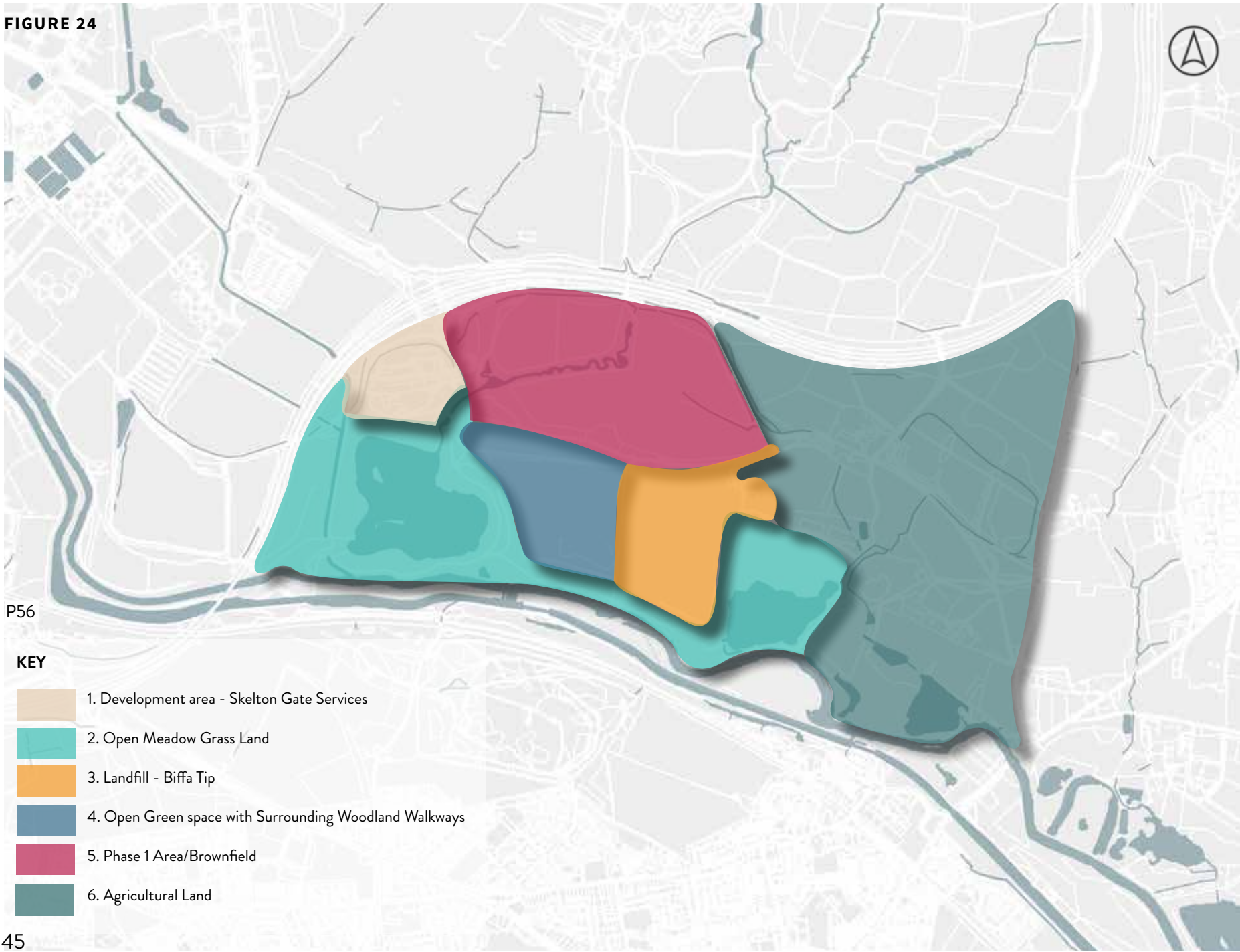**View Point 7** - View from higher ground to the north east side of the lake. Good views of the services/Skelton Lake/ surrounding Leeds.

View Point 8 -View from walk route south of Skelton Lake. Open views and easy walking routes, mainly grassland with some scant planting. Lots of Lamium album, Galium verum, Cirsium Ranunculus sp. found in the grass adjacent to the River Aire.

FIGURE 23

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ANALYSIS

Character Areas

FIGURE 24

P56

KEY

1. Development area - Skelton Gate Services

2. Open Meadow Grass Land

3. Landfill - Biffa Tip

4. Open Green space with Surrounding Woodland Walkways

5. Phase 1 Area/Brownfield

6. Agricultural Land

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P56

P56

P56

P56

P56

P56

P56

SITE ANALYSIS

Wildlife Habitats

The majority of Skelton Gate consists of mainly woodland, grassland and wetland habitats which all support a vast array of wildlife and plants. Skelton Gate is also known for being a key site for bird watching in West Yorkshire, being home to a variety of birds that attractors visitor attention. Adjacent to the Skelton Gate site (within a 3km radius) sits a variety of parks, nature reserves and other bird watching areas, including:

- BW 225: Skelton Lake
- BW 224: Skellington Ash Ponds
- BW 148: Laventhorpe Water Meadow
- BW 208: Rothwell CP
- BW 13: Avenue Wood, Temple Newsam
- BW 147: Laventhorpe Flash
- BW 238: Swillington
- BW 145: Lemonroyd STW
- Nature Reserve - RSBP St Aidan's Nature Park
- Temple Newsam Park
- Rothwell Country Park

All providing key habitats/pass through areas for wildlife. The effect of development on our local wildlife needs to be put at the forefront of design, this may need modern thinking to enable us to create spaces that meet the needs of humans and wildlife. For example, during the development of The Olympic Park in London, one of the key objectives was to 'leave a valuable legacy of open space and biodiversity to act as a catalyst for the regeneration of the area' (Cities Alive, 2014). The Skelton Gate site seems to need a similar way of thinking, with such a rich array of wildlife and plants, the proposed design needs to create a space that benefits both humans and wildlife.

Types of birds found 225: Skelton Gate

Spotted Sandpiper Great Egret White-winged Tern Little Gull Red-necked Grebe

Rough-legged Buzzard Great Grey Shrike Western Cattle Egret Franklin's Gull

P57

Character Area 1

Development Area - Potential for habitat areas to be created, but non currently stated on this part of the site. Possible habitat areas for birds, hedgehogs etc. - open to the public for education/experience?

Character Area 2

Wetland, Woodland & Grassland habitats - home to a variety of plants and wildlife. Potential for these areas to be enhanced through new flora and fauna that attract different species.

Character Area 3

No specific habitats - landfill sites damage and destroy natural habitats. Potential to transform landfill site into a fertile wildlife habitat/woodland.

Character Area 4

Open Grassland habitats - the overgrown planting is home to a variety of plants and wildlife, to make use of this space - habitats and planting will need to be worked with/enhanced to avoid disturbing any wildlife on site.

Character Area 5

Brownfield Development area - much of the planting/habitats have now been destroyed due to phase's 1 & 2, area has potential to propose planting and habitat regeneration.

Character Area 6

Agricultural land - Seasonally wet pastures and woodland habitats.

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SITE ANALYSIS

Vegetation

"Details of the plant species found on site are included in the target notes. Species recorded are all commonly occurring and undoubtedly occur elsewhere in similar habitats in the local area. The habitats on site comprise a complex matrix of newly established habitats following restoration of the land. The neutral semi-improved grassland has a moderate species diversity and ecological value. The grassland is now becoming established but succession to scrub habitat appears rapid, in the absence of grazing, with numerous saplings in the age range 1-3 years not evident on site. Whilst the assemblage of species within it is higher than improved pasture, the species are all indicative of past disturbance, this habitat does not constitute a BAP habitat. The intact hedges on and bounding the site are of variable quality; they are mostly species poor but several contain a good diversity of woody plant species where they have recently been planted. All hedgerows are a UK BAP habitat and should be retained in any proposed scheme. Where lengths need to be lost, they should be replaced. Scrub woodland to the site boundary is recently established from planting/ restoration of the site. Young hawthorn, oak, ash, willow and silver birch trees with a simple scrub ground flora of bramble, nettle and thistles. Part of which will been cleared to the road side. There is no Japanese knotweed, giant hogweed or Himalayan balsam on the site." - Ecological Appraisal, Skelton Gate (envirotech).

P58 — Trifolium sp.

P58 — Daucus carota

P58 — Ranunculus sp.

P58 — Aster x salignus
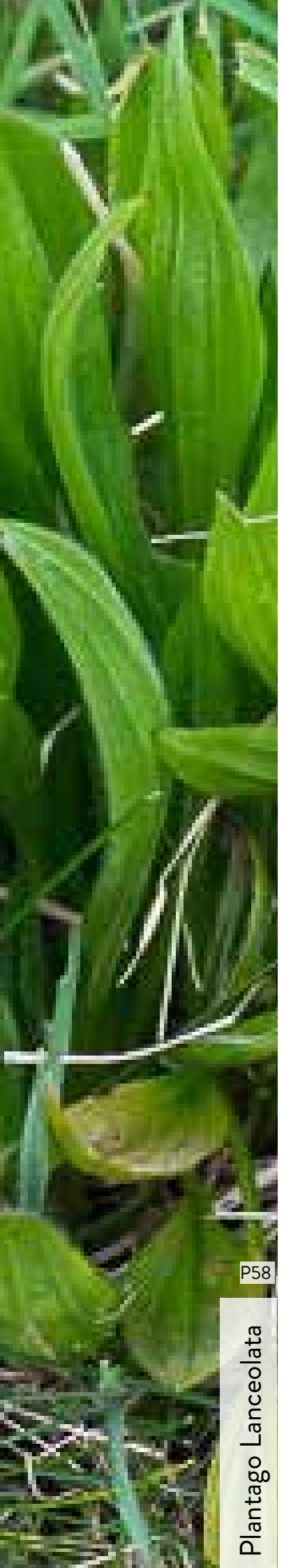
P58 — Plantago Lanceolata

P58 — Typha latifolia

P58 — Poterium sanguisorba
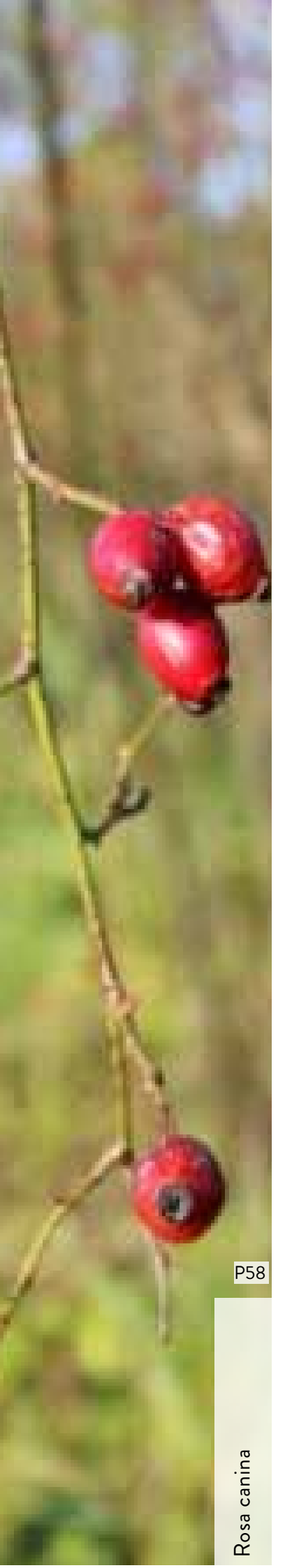
P58 — Rosa canina

P58 — Rosa canina

P58 — Dipsacus fullonum

KEY

- Primarily Birch Woodland
- Willow, Oak, Birch and Hawthorn
- Willow, Birch, Aspen, Alder, and Plum
- White Willow
- Alder, Oak, Aspen and Birch
- Pear, Plum, and Apple
- Hawthorn
- Oak, Hawthorn and Maple
- Row of Ash
- Willow
- Leaning Cottonwood
- Case of Black Knot - Prunus trees at risk across site
- Development Boundary

The site is home to an array of characterful woodland planting, however there was a common repetition across the site with the mix of wetland trees, fast growing trees and historical specimens. Figure 25 shows the woodland areas on site and which trees have been identified.

Wetland trees include:
- Willow
- Alder

Fast growing:
- Populus,
- Birch,
- Maple
- Fruiting Trees

Historical Specimens:
- Oak
- Hawthorn
- Fruiting Trees

The character of the tree and woodland planting on site must remain/be enhanced to benefit future development interventions. Opportunities arise for habitat enhancement and creation, along with urban food production opportunities e.g. orchards.

P58
FIGURE 25

SITE ANALYSIS

Trees & Woodland

49

Quercus palustrus

Acer campestre

Crataegus monogyna

Aster x salignus

Populus termula

Genus alnus

Salix alba

50

KEY

- Definitive - Bridleway
- Definitive - Footpath
- Definitive - Byway
- Permissive - Bridleway
- Permissive - Footpath
- Non-Definitive Bridleway
- Non-Definitive Byway
- Desire Routes
- Recreational - Footpath
- Trans Pennine Trail
- Development Boundary
- Tunnels under M1

P58

P58 Walking & Cycling along the Bridleway

Skelton Gate has an already well-established cycle and pedestrian network that creates connections to surrounding Leeds via routes along the Trans Pennine Trail. However, the M1 motorway acts as a barrier for expansions of these connections to the north & west. Tunnels that already exists under the m1 are shown in figure 26, these provide vital access to the site from the canal path and bridleway from & to Temple Newsam. From visiting the site, these underpasses feel intimidating due to the evidence of anti-social behaviour, making access unenjoyable and slightly unnerving.

Pedestrian and cycling is a key park of Skelton Gate, with most of the site being only accessible on foot or by bike. This is a great characteristic for the site and should be worked with & enhanced to access surrounding areas through GI in the following design proposals.

P58

FIGURE 26

SITE ANALYSIS

Public Rights of Way

51

P58

FIGURE 32

KEY

Viewpoints

Inaccessible Viewpoints
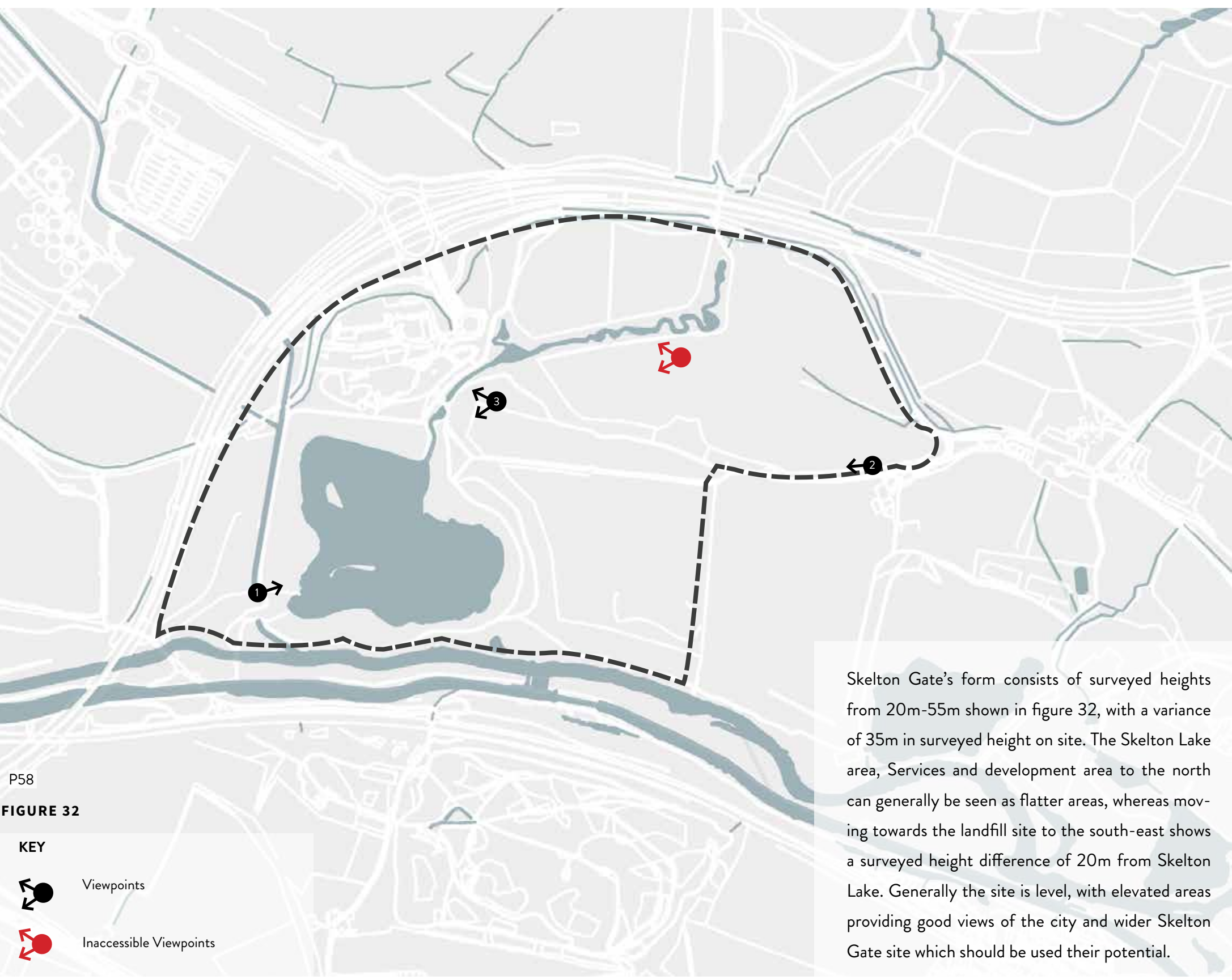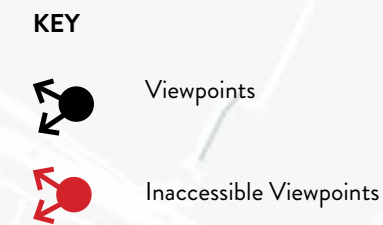
Skelton Gate's form consists of surveyed heights from 20m-55m shown in figure 32, with a variance of 35m in surveyed height on site. The Skelton Lake area, Services and development area to the north can generally be seen as flatter areas, whereas moving towards the landfill site to the south-east shows a surveyed height difference of 20m from Skelton Lake. Generally the site is level, with elevated areas providing good views of the city and wider Skelton Gate site which should be used their potential.

SITE ANALYSIS

Key Views

P58
Viewpoint 1
1 The footpath coming into the site from the canal footpath takes you to a scenic view of Skelton Lake.

P58
Viewpoint 2
2 View from Pontefract Lane (on site) looking south west.

P58
Viewpoint 3
3 View from the highest point on site. Looking south west towards Skelton Lake.

P58
Viewpoint 3
3 View from the highest point on site, looking north west towards Skelton Gate Services.

52

FIGURE 27

P59

FIGURE 28 - 3D VIEW OF SKELTON GATE

Skelton Gate's form consists of surveyed heights from 20m-55m shown in figure 27, with a variance of 35m in surveyed height on site. The Skelton Lake area, Services and development area to the north can generally be seen as flatter areas, whereas moving towards the landfill site to the south-east shows a surveyed height difference of 20m from Skelton Lake. Generally the site is level, with elevated areas providing good views of the city and wider Skelton Gate site which aren't currently being used to their full potential.

With much of the site being levelled for new development, elevated areas should be taken into consideration and utilised in the following design proposals.

SITE ANALYSIS

Land form
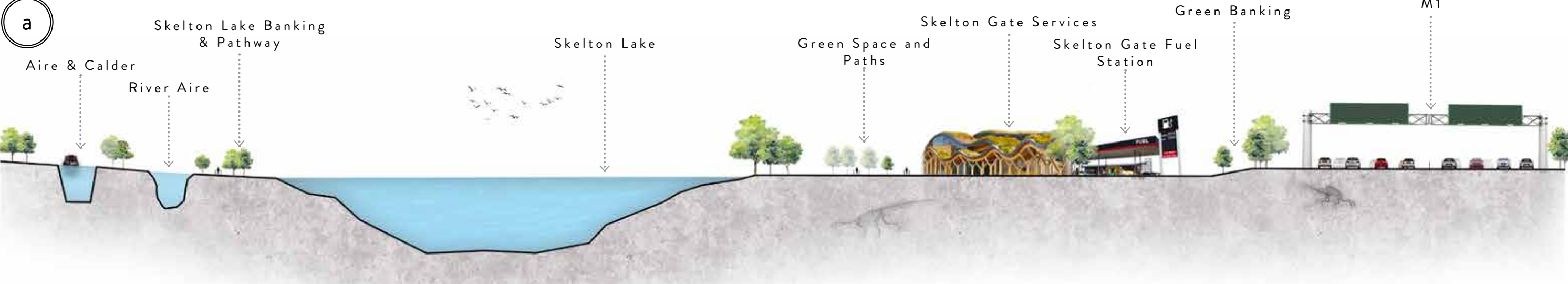
P60
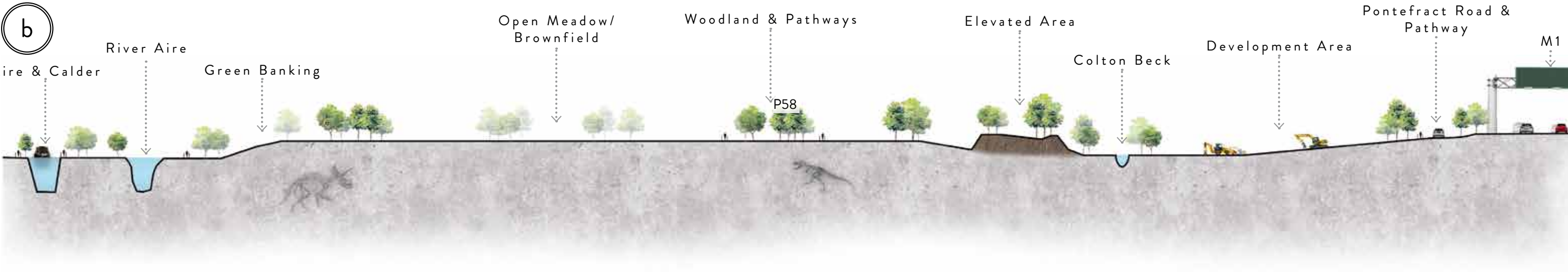
FIGURE 29

P60

FIGURE 30
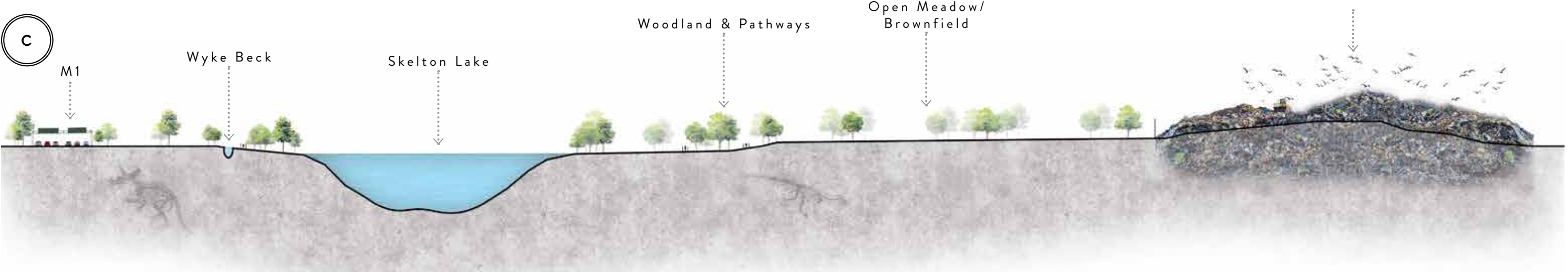
P60

FIGURE 31

P60

URBAN

AGRICULTURE

Skelton Gate is a 30ha site which has a vast amount of land with potential for various types of urban food growing. With food scarcity being one of the major issues we will come to face in the near future, planning ahead for Leeds will provide the security the city needs.

CONSERVATION

COMMUNITY

The current Skelton Gate development proposes 700+ new dwellings on site, there is more potential for creating a sustainable community with further careful planning which will create a sustainable, low-impact and affordable community for Leeds.

ECOLOGICAL

ENHANCEMENT

The site already has a well established habitat network and substantial woodland planting that would benefit from enhancement rather than re-design. Skelton Gate is a key area for wildlife, with proposals for enhancement it gives the area opportunities to thrive. With the M1 being a dominant barrier to the site, there are opportunities to utilise the current under/overpasses as wildlife corridors to surrounding green spaces - Temple Newsam and Rothwell Country Park through the careful implementation of GI networks.

HIGHWAY

MITIGATION

The M1 is a dominant barrier to Skelton Gate, causing mass noise and air pollution and is visual blemish on the site. Mitigation measures offer the opportunity to 'blank out' and reduce the effects of the M1 on the Skelton Gate site, making it better for users and residents.

SITE ANALYSIS

Key Focus Topics

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Surrounding Productive Landscapes

Hollybush Conservation Centre

Incredible Edible Kirkstall

Kirkstall Valley Farm

Meanwood Valley Urban Farm

St Lukes Community Garden and Orchard

5.Bedford Fields Community Forest Garden

Osmondthorpe Allotments

6. City Veg Beds - Feed Leeds

Holbeck Community Orchard

Lady Pit Allotments

Dewsbury Road Orchard

Cross Flatts Park Orchard

Skelton Gate

Swillington Garden Growers

P61

FIGURE 33

56
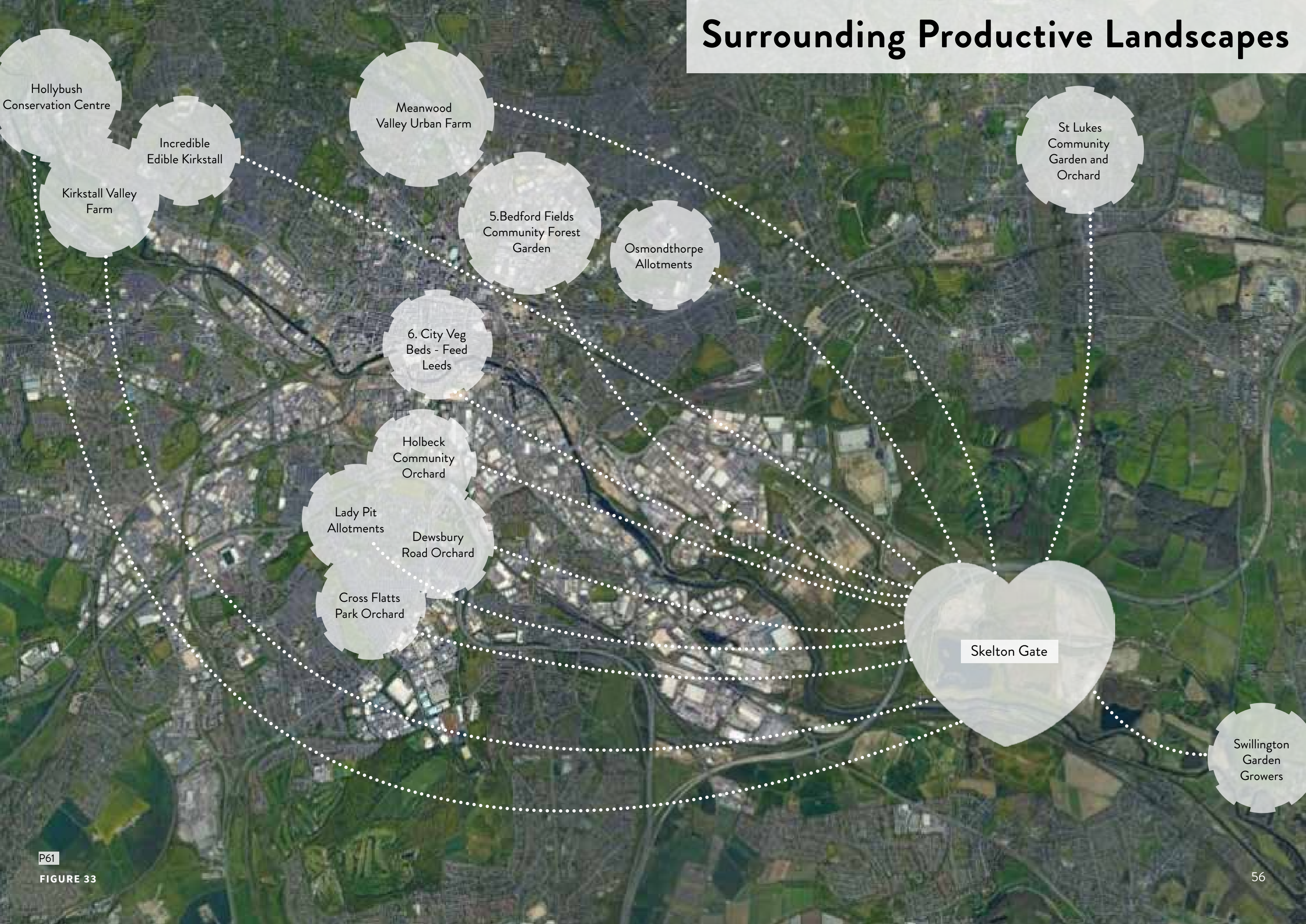
The following site and analysis concludes opportunities for urban agriculture, new communities, ecological enhancements & highway mitigation measures that to create a new urban farm & conservation community on the outskirts of Leeds. The site has an array of positive characteristics that can be worked with and enhanced, including open green space, proposed plans, well-established pedestrian and cycle networks, rich flora and fauna,already well established connections to surrounding communities and the city centre. The following plan has been created to show the potential connections, nodes, green infrastructure networks, and character areas the following design proposal aims to achieve.

KEY

- - - Development Area
- · · · Surrounding Connections
- ▬ Potential Green Infrastructure Connections
- ● Nodes

Development Character Areas -
Urban Agriculture & Conservation Community

Development Character Areas -
Urban Agriculture, Conservation Community & Highway Mitigation

Development Character Area - Ecological Enhancement & Experimental Food Growing

Development Character Area - Urban Agriculture & Parkland

～ Water Noise

· · · Traffic Noise

SITE ANALYSIS

Conclusion Plan

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FIGURE 34

STRENGTHS

- The site currently has well established cycle & pedestrian networks, with links to central Leeds and other surrounding cities.
- Good location - situated between 2 popular green spaces, Temple Newsam and Rothwell Country Park, and poses potential GI connections to wider green areas.
- Forms part of Leeds' industrial heritage
- Rich in characterful woodland planting and open green space.
- Views over Leeds and the Skelton Gate site from elevated areas.
- Planning permission granted for current developments - potential to enhance these proposals. The current developments meets the vision
- Home to Skelton Lake, Wyke Beck, and various other water bodies that can be utilised within the following design proposal.

WEAKNESSES

- Close to Biffa landfill site
- M1 motorway creates an obvious barrier for the area
- New development lacks character and doesn't use the site to it's full potential
- Contaminated landfill land
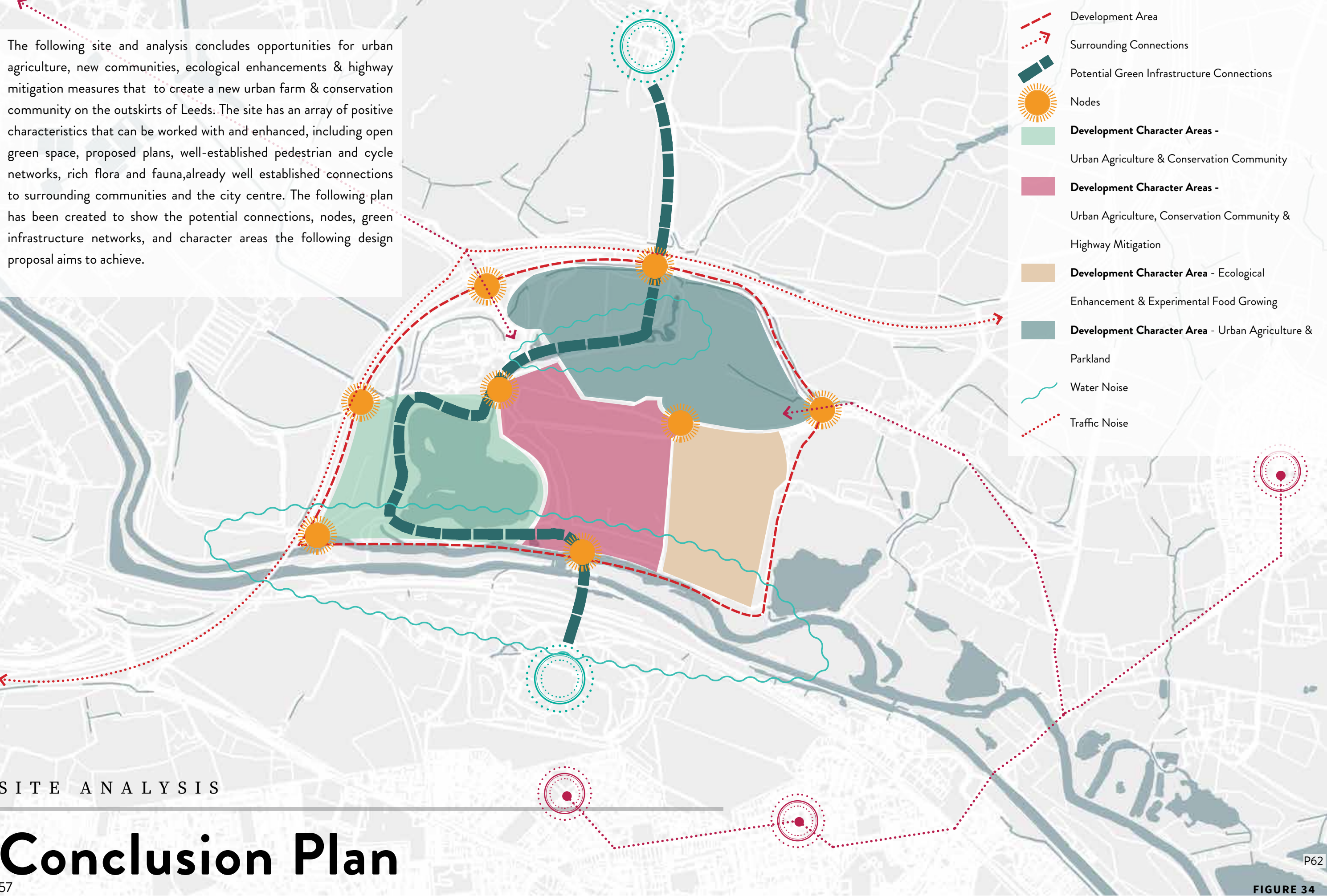- Invasive species along Wyke Beck - Black Knot
- Anti-social behaviour due to lack of development

OPPORTUNITIES

- Wider GI connections to surrounding communities and green spaces - Temple Newsam, Rothwell Country Park, Woodlesford, Rothwell & Swillington.
- Connect the site to wider urban agriculture projects, by joining the local food networks such as Feed Leeds and Incredible Edible.
- Education - Wildlife, nature and urban food growing.
- Mitigation measures to reduce air and noise pollution within the site.
- Enhance cycle and pedestrian networks
- Large amount of space with potential for large scale urban farming.

CHALLENGES

- The M1, dominating and creating a barrier to the site. Mitigation measure may help to reduce the impact on residents & users of Skelton Gate.
- Working with the current development proposals
- Anti-social behaviour/lack of use makes the site uninviting
- Working with/enhancing the wildlife and flora - good selection already on site.

2.0

What is a Productive Landscape?

Productive landscape is based on the mixture of uses, where they all support each other to create a harmonious space. We want to move away from the separation of the landscape and envision a combination of all uses not only in the city, but also on the outskirts, where zoning is very present at the moment. That reduces distances and makes a stronger character of the space. The cut of transport costs between research, production, processing and retail helps to build a better local economy.

Productive dynamic landscape is resilient. Easy adaptable to change, it replies to the dangers of the future. Possible future scenarios do not degrade the landscape, but change it in a way it is possible. For example, in the time of economic crisis, productive landscape starts working more with nature and focus on local agriculture production.

(PIA KANTE, 2016)

PRODUCTIVE LANDSCAPE OF THE FUTURE

PUBLIC OPEN SPACES	SOCIAL INFRASTRUCTURE	PRODUCTIVE LANDSCAPE	WORK + RESEARCH INFRASTRUCTURE	ECOLOGICAL LANDSCAPE
PLAYGROUNDS	FARMERS MARKETS	TREE NURSERY	LEARNING INCUBATORS	NATURE PARKS
RECREATIONAL AREAS	OUTDOOR KITCHEN	ORCHARDS	PRODUCTION AREAS	GEOTHERMAL ENERGY
SMALL PARKS	KINDERGARTEN	GROWING FIELDS	TECHNOLOGICAL CENTER	REVITALIZED RIVER
PLAZAS	NURSING HOME	GREENHOUSE		CLEANING PLANTS
		PASTURES		

FIGURE 35
(Kante, 2016)
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PRINCIPLES FOR A SYSTEMS THINKING APPROACH FOR URBAN AGRICULTURE

1. PROMOTE BIODIVERSITY

2. INCREASE FOOD SECURITY AND FOOD SAFETY

3. INCORPORATE EDUCATION AND OUTREACH FOR AWARENESS

4. BE CLIMATE ADAPTIVE FOR ENVIRONMENTAL RESILIENCE

5. MAXIMIZE WATER ACCESSIBILITY, AVAILABILITY, AND QUALITY, AND ADDRESS THE VALUE OF ONE DROP

6. MAXIMIZE WASTE AND ENERGY EFFECTIVENESS

7. PROVIDE FOR SOIL RESILIENCY AND SOIL HEALTH

8. DEVELOP A SYSTEM NETWORK THAT IS BOTH REGIONALLY AND LOCALLY APPROPRIATE

9. PROMOTE SOCIAL RESPONSIBILITY

10. PROTECT AND INCREASE HUMAN HEALTH BENEFITS

11. PROVIDE FOR THE CONNECTION OF PEOPLE WITH NATURE TO THE ENRICHMENT OF BOTH

12. FOSTER COMMUNITY, PLACE MAKING, AND SOCIAL RESILIENCE

13. DEVELOP DYNAMIC CONNECTIVITY BETWEEN THE HUMAN AND ECOLOGICAL SYSTEMS

14. PROMOTE SUSTAINABLE ECONOMIC BENEFITS AND OPPORTUNITIES

15. INCREASE THE TREATMENT OF WASTE AS A RESOURCE FOR ZERO-WASTE OUTCOMES §

RESEARCH - URBAN AGRICULTURE

Supporting Growth of Vegetation on Restored Landfill Sites

Skelton Gate is home to the Biffa Landfill site that stopped operation in 2016, the aim is to restore the area within 5 years (2021) into a park for local residents and visitors. The landfill area covers approximately 55 acres, there is potential for other uses to be implemented along side a park, such as experimental growing.

The Forestry Commission & Urban Forest have been looking into the growth of vegetation on restored landfill sites, the work began in 1998 and was completed in 2008 which analysed the potential for growth of trees and vegetation within these areas. The research concluded that:

• *"Tree survival rates: for most species, around 50-85% of originally planted trees remain from early restoration work*

• *Exceptional survival: some species, including white poplar, white beam and ash, have survived exceptionally well considering the hostile landfill site condition*

• *Growth: trees have grown steadily over 10 years, although growth rates differ between species and site*

• *Limits: some of the tallest trees (exceeding 6m in height) show slight signs of limitation to their growth*

• *Fastest growers: fastest growing species remain poplar, alder, cherry, white beam and ash*

• *Nutrients: all sites show signs of nitrogen deficiency, but few have low phosphorus or potassium*

• *Fertilisation: applications of nitrogen fertiliser may be required to achieve full canopy closure*

• *Soil cover: sustainable growth for trees over at least a decade require at least 1m of soil cover; in droughty areas or in soils with low moisture-holding capacity, deeper soil cover is necessary*

The research concluded that **1.5m of soil or soil-forming material over a mineral cap will ensure that trees can be established on**

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landfills without posing a significant threat to cap integrity for at least 16 years. *It is still a little early to assess the full impact of tree rooting on cap integrity or the interaction between conditions within the landfill cap and tree rooting over the life time of a tree."* (Doick, 2008)

CASE STUDY - URBAN AGRICULTURE

Growing on Landfill Sites

An economic student from the University of Texas has been trialling the succession of growing produce on the top of a landfill site in her local town. The idea grew from issues of food scarcity in areas which are classified as 'food deserts', these are areas where supermarkets aren't easily accessible. Example of a 'food desert' is Del Valle, where no near by market or shops, locals find it difficult to find sufficient food access.

Joy Youwakim chose the Auric Landfill site in her local town and "thought it would look like a pile of trash, but it looked like a dirt hill. So I said - why don't we grow food on top of it?". After years of trying to finalise the paperwork that would allow her to launch the farming project, Youwakim now manages to grow produce from a landfill site. The landfill site is full on toxic chemicals from the rubbish left, but it has been covered with a liner (a heavy sheet of clay or fibreglass) that protects the earth, and the soil put on top needed to be deep enough to grow roots without touching the liner. Youwakim managed to produce a range of crops such as melons, radishes, cucumbers, and green onions which were all tested and were safe to eat.

As well as food production, landfill sites have great potential for growing and supporting tree growth. Research has shown:

Tree survival rates: for most species, around 50-85% of originally planted trees remain from early restoration work

Exceptional survival: some species, including white poplar, white beam and ash, have survived exceptionally well considering the hostile landfill site conditions

> **Growth:** trees have grown steadily over 10 years, although growth rates differ between species and sites

> **Limits:** some of the tallest trees (exceeding 6m in height) show slight signs of limitation to their growth

> **Fastest growers:** fastest growing species remain poplar, alder, cherry, white beam and ash

> **Nutrients:** all sites show signs of nitrogen deficiency, but few have low phosphorus or potassium

> **Fertilisation:** applications of nitrogen fertiliser may be required to achieve full canopy closure

> **Soil cover:** sustainable growth for trees over at least a decade require at least 1m of soil cover; in drought areas or in soils with low moisture-holding capacity, deeper soil cover is necessary

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The research concluded that 1.5m of soil or soil-forming material over a mineral cap will ensure that trees can be established on landfills without posing a significant threat to cap integrity for at least 16 years. It is still a little early to assess the full impact of tree rooting on cap integrity or the interaction between conditions within the landfill cap and tree rooting over the life time of a tree."

This innovative idea shows huge potential within the Skelton Gate site. The Biffa landfill site takes up a large area that could be re-used for food production for the wider Leeds area in a similar way to the above. The Biffa landfill is a large site measuring approximately 58.0 acres -this gives the potential for producing up to 15,784kg of food.

Planting on Post-Industrial Sites & Soil Re-mediation

Skelton Gate was a former post-industrial colliery site, although this may give the site a rich industrial history, there are causes for concerns as to whether the site is safe for it's users and the environment. This also applies to the ex-landfill site that sits on site, the involvement of hazardous materials and contaminants may mean the following design proposal may need to consider soil re-mediation measure prior to development.

Soil re-mediation technologies have developed a lot over the past decade, in the 1970's, when Seattle Gas Works Park was being designed, the primary clean up technology was capping the oil-saturated ground and planting turf on topsoil - all contaminated areas were off limits. Meanwhile, during the design of Duisburg Nord Park, Latz decided on minimal natural interventions - where over time plants helped reduce the contamination of the land. The aim of remediating soils is to make a site suitable for use, without environmental risk.

There are options to have the soil treated or non-treated, these include:

Treatment

- Bioremediation (enhancing/controlling biological processes to reduce the contaminants of concern to target levels)

- Chemical Oxidation (chemical application to reduce the contaminants, and enhance natural attenuation where appropriately selected materials are injected to achieve remedial targets.

- Stabilisation (tieing up contamination so that the risk from contamination is removed)

- Soil Washing (sorting soils into different constituent parts, gravels, sands, and other fines to find the contaminants and remove them)

- Thermal Desorption (process where heat is used to remove contaminants from soil)

Non-treatment

- Soil Disposal (removal of contaminated soil)

- Engineered solutions (engineer out the issue, using the process source - pathway - receptor.

P68
Soil Washing

P68
Bio-Remediation

P68
Thermal Desorption

CPUL Theory

The concept of Continuous Productive Urban Landscapes (CPUL's) defines the integration of urban agriculture into planning of urban spaces as a essential element of sustainable development.

"A Continuous Productive Urban Landscape (CPUL) is an urban (green) infrastructure linking food-producing sites of varying scales and operating types with other (green) open spaces right across a town or city thereby connecting all those parcels of land to the citizens as well as to other food system activities and ultimately to the rural landscape." (Bohn & Viljoen, 2005)

P69
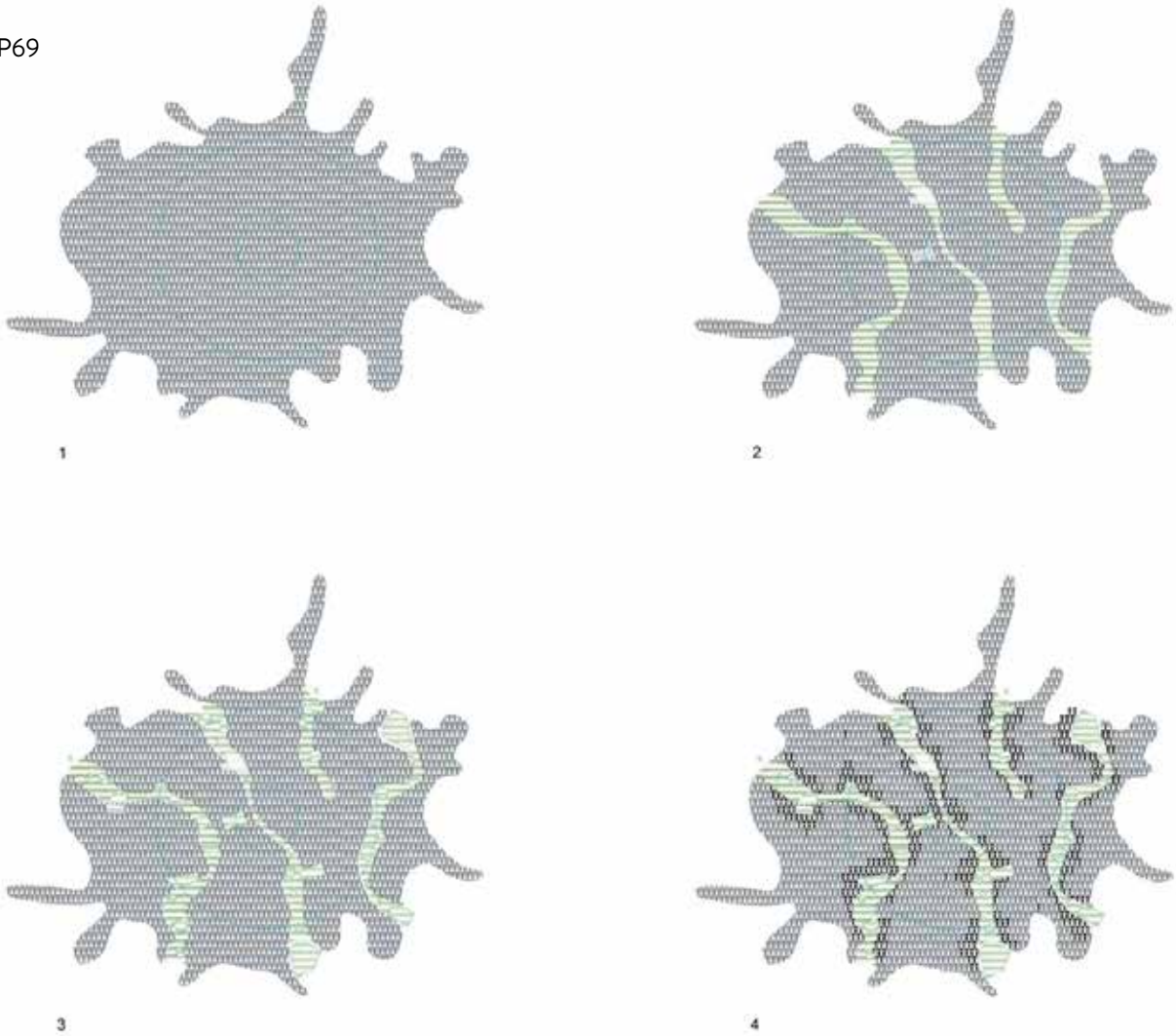
1. Bring your own city.

2. Map all your existing open spaces and connect them through green infrastructure.

3. Insert agriculturally productive land. (Note: you may wish to alternate between 2 and 3.)

4. Feed your city! (Image: Bohn&Viljoen 2004)

Concept grew out of design research and was first designed for and then defined by Bohn&Viljoen Architects respectively in 1998

Went on to undertake various design studies on actual sites in the UK

Research indicated a strong environmental and design case

With these findings the CPUL Designing Urban Agriculture for Sustainable Cities book was created in 2004/SNUA 2014

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Old Slenningford Farm, Ripon

Old Slenningford Farm is an informal smallholding (17 acre plot)/community group north of Ripon in north Yorkshire, their aim is to demonstrate how easy it is to live a low impact life, by offering courses, events, WWOOF (World Wide Opportunities on Organic Farms) events and allow volunteers to come along and help. The farm was set up in 2004, with a rented field to keep livestock including pigs, chickens, bees, sheep as well as food growing areas such as raised beds, poly-tunnels, an orchard and a Forest Garden.

Kirkstall Valley Farm

Kirkstall Valley Farm is located just off Kirkstall Road, it was privately farmed up until 2017, it is now owned by the Kirkstall Valley Development Trust. The trust is a 'community benefit society set up in 2016 to develop a learning and leisure park over 200 acres of inner Leeds' (KVDT, 2021). The areas business plan aims to support a local community agriculture scheme that employs workers and sells veg boxes to local residents and shops for profit. There are plans to develop the site further for social and educational projects, currently the farm supports the local Community Payback probation service.

Meanwood Valley Urban Farm

Meanwood Valley Urban Farm is a working farm based in Leeds, established in 1980 the city farm aims to reconnect people with their food. The farm works in partnership with Leeds City Council providing a community, environmental education services for schools, holiday play schemes, development programmes for adults with learning disabilities, allotments, leisure resources for visitors, and conference facilities.

RESEARCH - URBAN AGRICULTURE

The Northern Forest

The Northern Forest is an initiative that aims to tackle the lack of tree planting in the north - with only 7.6% tree cover in an area of 13 million people. Their plan is to plant an additional 50 million trees that will transform the landscape for local communities and visitors, by planting more trees the Northern Forest aims to:

- Reduce the risk of flooding

- Store thousands of tonnes of carbon

- Make people across the north happier and healthier

- Create thousands of new jobs

The White Rose forest is a local authority based joint based venture that covers much of West Yorkshire, including Leeds. Working along side landowners, local businesses and community groups to create resilient natural environments to adapt to climate change.

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The White Rose Forest is the community forest for North and West Yorkshire.

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CASE STUDY - URBAN AGRICULTURE

Water Management Techniques That Affect Design Choices

Aquaponics - a recirculating environment with fish and plants in a nature-mimicking process. The waste product of the fish provides nutrients for the plants which in turn filter the water that the fish are living in.

Hydroponics - In this recirculating water system, because the nutrient water supplies the food to the plants in place of soil, it requires the specific knowledge on how to create a mix of nutrients to deliver the right combination of nutrients required by the specific plants. One issue is that the nutrient solution eventually becomes toxic to the plants and will require disposing of, **potentially toxic waste issue. Potential for a job/educational programme.**

Rainwater Harvesting - In urban areas, water rates are typically higher that the reduced rate of rural areas, and since agriculture requires a lot of water, catchment of rainwater is an affective way to promote water conservation and reduce the amount of water required for mitigation. There are a variety of ways to harvest rainwater from small-scale rain barrels to catchment systems such as cisterns.

Reclaimed Water - Harvesting water from household wastewater, also known as graywater, can be restricted in many cities. However, there are technologies such as constructed wetlands and other means to clean collected kitchen, and laundry wastewater. These treatments need to be considered when developing needs of the project, as they do require land areas and swales for treatment zones and some more sophisticated systems require pumps and filters. **Never apply raw graywater directly to plants you can plan on eating raw or plants whose leaves or fruits are within reach of it. Graywater is good for watering orchards, shrubs, and composts piles.**

Irrigation Technologies - Drip irrigation is more efficient than a hand-watering system. Drip irrigation can be through emitter lines, a soaker hose, spot emitters, micro spray emitters, and T-tape. Drip systems can conserve about 50% or water used by other methods. Installing an on/off valve at each planter bed is an effective way to control for the variable watering needs of crops selected.

Living Machines/Black water - The technologies for living systems are extremely expensive and will likely not be used for most urban agriculture landscapes in the near future. Should the project be extensive enough to be considering the use of living machines for the project, it would be a way to design systems that are more regenerative and balanced for all the open space and building systems. Some machines can provide a great educational resource to promote innovative technologies into sustainable landscapes.

(Philips, 2013) p 172-173

"ANOTHER CONSIDERATION IS THAT SOCIAL AND HEALTH AND WELL-BEING METRICS ARE NEEDED THAT ACKNOWLEDGE THE MANY ASPECTS OF FOOD AND AGRICULTURE THAT ARE CENTRAL TO FOSTERING HEALTH AND HAPPINESS IN OUR LIVES. FOOD IS CENTRAL TO HUMAN BIOLOGY, SOCIOLOGY, AND PSYCHOLOGY. EVERYONE NEEDS FOOD TO SURVIVE, ENJOYS FOOD AS NOURISHMENT AND CELEBRATION, AND ARE CONNECTED TO OTHERS BY FOOD AS WE CELEBRATE OR GATHER FOR A MEAL. FOOD CAN BECOME A PLATFORM OR LAYER FROM WHICH WE ADDRESS OTHER IMPORTANT ELEMENTS OF COMMUNITY, ECOLOGY, AND LIVEABILITY INCLUDING THE PHYSICAL, SOCIAL, ECONOMIC, CULTURAL, AND ENVIRONMENTAL HEALTH OF THE CITY. FOOD IS THE GATEWAY TO THE STAKEHOLDER CONVERSATIONS BETWEEN CITY, COMMUNITY AND PROJECT DEVELOPER OR FUNDER." (PHILIPS, 2013)

RESEARCH - URBAN AGRICULTURE

Feed Leeds & Growing a Resilient Food System in Leeds

Feed Leeds was created in 2011, it's a constituted network of organisations and individuals involved with sustainable local food, which aim to offer advice and recommendations to those who seek it. Feed Leeds has helped with many developments and has gained a huge amount of connections in the time it has been running. This year, Feed Leeds has produced a policy for Leeds called 'Growing a Resilient Food System in Leeds' which aims to promote health, sustainability and food security through a range of recommendations to achieve a resilient food system in Leeds. The policy analyses the current barrier, strengths & opportunities and other local food systems through various food system workshops to deliver recommendations for working groups to look to achieve. These include:

- Create a local brand
- Improve access to land
- Grow business ecosystems
- Engage, educate and up skill

"The UK is a net importer of food, as is Leeds, so trade plays an important role in food and nutrition security, with current uncertainties having major resilience implications. Meanwhile, climate change is impacting both local and global food systems. Heat stress affected UK crops last year, and rain reduced the wheat harvest by 40% this year, while globally; droughts, fires, floods, changing humidity leading to diseases, soil degradation and more are affecting production, which impacts on food availability and prices. Biodiversity is being lost at alarming rates, while unhealthy consumption habits increase diet-related chronic diseases, putting pressure on health services. Leeds needs to be strategic and bold, to increase the climate resilience of its food system while promoting health, sustainability and food security." (Sakai, 2020)

The policy sets of recommendations which can be utilised in the following design proposals for Skelton Gate.

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Overview

- "A resilient, healthy and sustainable food supply should be viewed as a matter of public good, as it underpins public health, social equality and environmental quality

- Leeds has plenty of farmland, expertise, innovation, and excellent practice. Minimal interventions could deliver major changes and benefits.

- We recommend that Leeds City Council sets up a high-profile task force to work with local stakeholders to create a local sustainable food brand, improve access to land for growers, strengthen economic measures to support a vibrant local food ecosystem, and promote education and skills development." (Sakai, 2020)

RESEARCH - URBAN AGRICULTURE

Incredible Edible Network

The Incredible Edible Network is a non-profit community interest organisation founded by executive director Paul Long and run by a team of volunteers. Within the Yorkshire and the Humber region, there are 18 groups ranging in size. Closest to the Skelton Gate site is the Incredible Edible Garforth & Kirkstall groups, their aims are to :

1. Closer communities - Create a better sense of neighbourhood & belonging by Setting up & supporting the creation of Edible Growing facilities / space the whole community can access & enjoy (Urban Agriculture) Learn new skills, grow your own food & share with your Neighbours. (Food is something we all have in common)

2. Plot to plate / seed to compost education & healthy sustainable living - Provide & support Educational workshops, facilities, events & clubs to tackle food poverty & other health related illnesses such as Obesity, Malnutrition & Depression.

3. Social Enterprise & Support - Provide Eco therapy, work experience & volunteering opportunities, facilities & work groups to support communities.

4. Support the food insecure & vulnerable members of the community.

5. Working with nature - Promote sustainability & healthy living.

6. Supporting members of the community - Provide educational / healthy activities, facilities, events & clubs

7. Promote seasonality & support local Producers & organisations

The Incredible Edible Network presents a bold solution to help tacking food scarcity in cities by helping to closer communities and encourage others to grow their own produce. Integrating the network into the Skelton Gate proposals will put the area on the 'food map' for Leeds, If implemented correctly, will closer surrounding communities, provide education, social enterprise & food support for vulnerable members of the community, work with nature, and promote local produce.
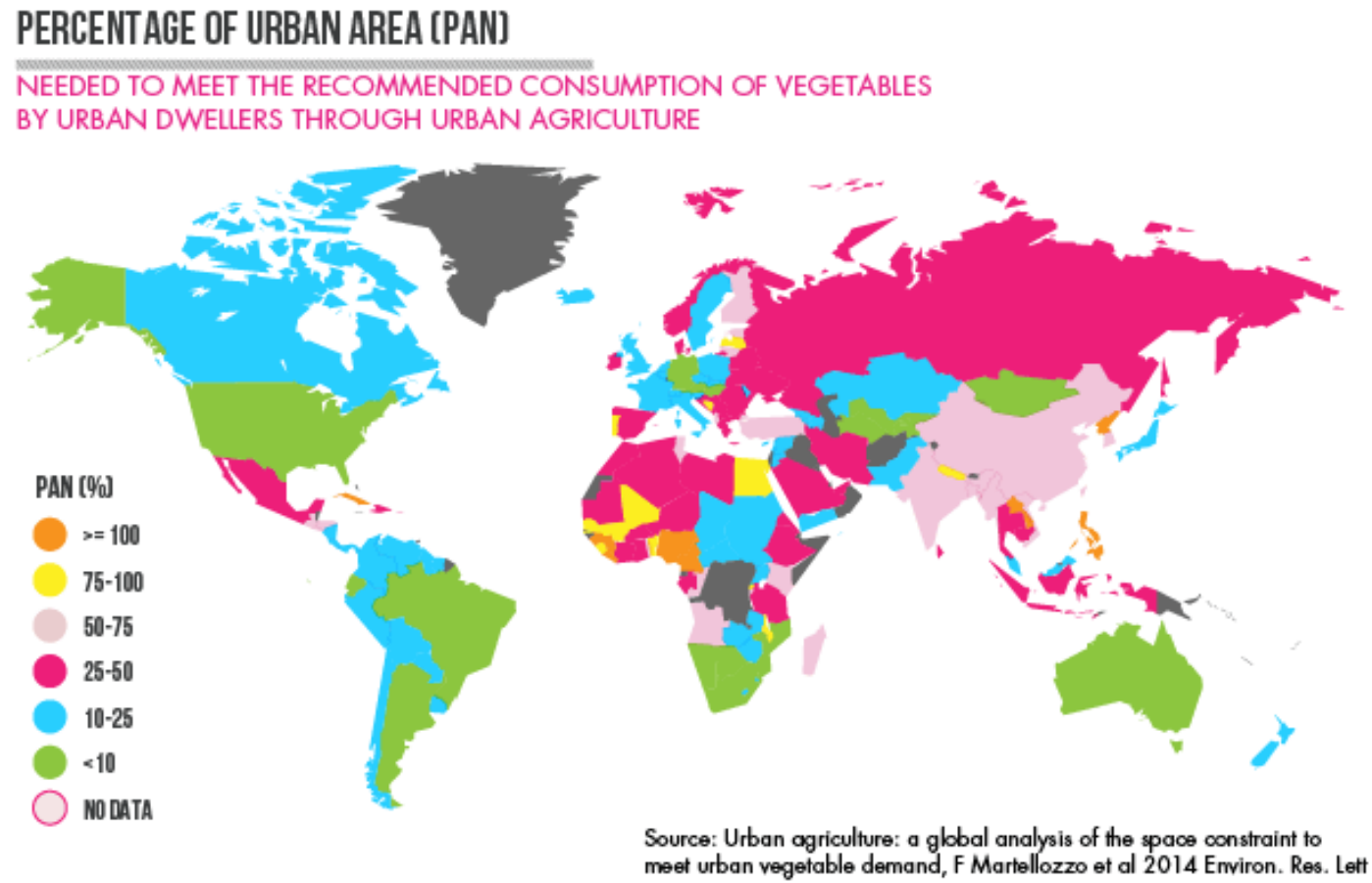

INCREDIBLE EDIBLE NETWORK

POLLINATION STREET

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DESIGN INTERVENTIONS

Rooftop Farming

With land becoming more and more sought after in our cities, we need to think more about the space we currently have and ways we can utilise spaces effectively. Rooftop farming considers what is seen as unusable spaces, as areas for urban agriculture either on our homes or businesses. There are many benefits to rooftop farming, which include:

• Rainwater retention - depending on the type of growing medium, agricultural units on urban roofs can retain up to 90% of rainwater

• Ample Expansion Space

• Decreased likelihood of some pests and human interference

• Air flow benefits

• Effect of urban noise on urban rooftop plant growth

PERCENTAGE OF URBAN AREA (PAN)
NEEDED TO MEET THE RECOMMENDED CONSUMPTION OF VEGETABLES BY URBAN DWELLERS THROUGH URBAN AGRICULTURE

PAN (%)
- >= 100
- 75-100
- 50-75
- 25-50
- 10-25
- <10
- NO DATA

Source: Urban agriculture: a global analysis of the space constraint to meet urban vegetable demand, F Martellozzo et al 2014 Environ. Res. Lett

CASE STUDY - URBAN AGRICULTURE

River park Farm, Manhattan USA

Manhattan's largest and fully mobile urban farm is the River park Farm, the site sits on top of River park restaurant. The farm was created to grow produce that can be used in the kitchen of the restaurant below, which is not readily available in the city. The site itself is a construction site put on hold, the developer Alexandria Real Estate (owner of the site) and restaurant owners Tom Collichio and Sisha Ortuzar came up with the idea of having a mobile urban farm on a construction site that had been put on hold due to 2010's New York Real Estate Recession.

They decided to convert milk crates into planters to allow the production areas to be easily moved when they needed to - the true test of the milk crates came when Hurricane Irene hit New York a week before the opening, where 10 volunteers moved the entire farm of 3,000 full-grown plants into the office lobby.

Fully-mobile urban farms offer a quicker and simpler method to urban agriculture, they are easily set up in areas that may not be suitable for permanent developments such as rooftops, shop installations, and construction areas that have been put on hold. For Skelton Gate, this type of urban agriculture may work well for temporary installations for education, for residents and experiments. The temporary solutions of up-cycling household products is something that will become more and more popular in the near future, proposals which can use recycled products should do so to reduce the effects of climate change.

Bee Keeping

Bee colonies and other pollinators are in decline due to many issues, including intensive farming, chemical use, higher temperatures due to climate change, and lack of nutrition. It's vital that we act now and play our part in helping to save bee's from becoming extinct, as they play a huge part in pollinating our crops.

Bee keeping is relatively simple, requiring only a hive, protective clothing, related tools and of course, bees. with such a simple way of producing food and helping reduce the risk of extinction, bee keeping is an initiative that many people can do at home, and on a larger scale.

Aquaponics

Aquaponics is a mixture of growing aquatic animals and growing plants without soil - essentially a combination in which plants are fed the animals waste.

Primarily there are 3 different systems, which include media beds, nutri-ent film techniques, and deep water culture. Aquaponics is a great way to grow your own food, both on a small and large scale without the need for fertilizers with a better result of healthier organic produce.

Hydroponics

Hydroponics is a system where plants are grown without soil, instead using nutrient solutions. There are many different types of plants that can be grown, for example lettuce, spinach and peppers. The benefit of using hydroponics is that they'll use 10x less water than the standard soil-grown crops.

CASE STUDY - URBAN AGRICULTURE

Estimating Harvest

With the rising challenges of feeding a growing population, estimating the food output for areas of urban food production is key to meeting the needs of the surrounding population. When proposing and establishing a food production site, it is key that you can estimate your growing output - analysing costs & profits.

"For a quarter-acre of land, while it is difficult to say exactly how much food you can grow since it depends on choices selected, the climate, how long the growing season is, and how intensively you choose to grow the crops, here is a ballpark number that is possible to achieve:
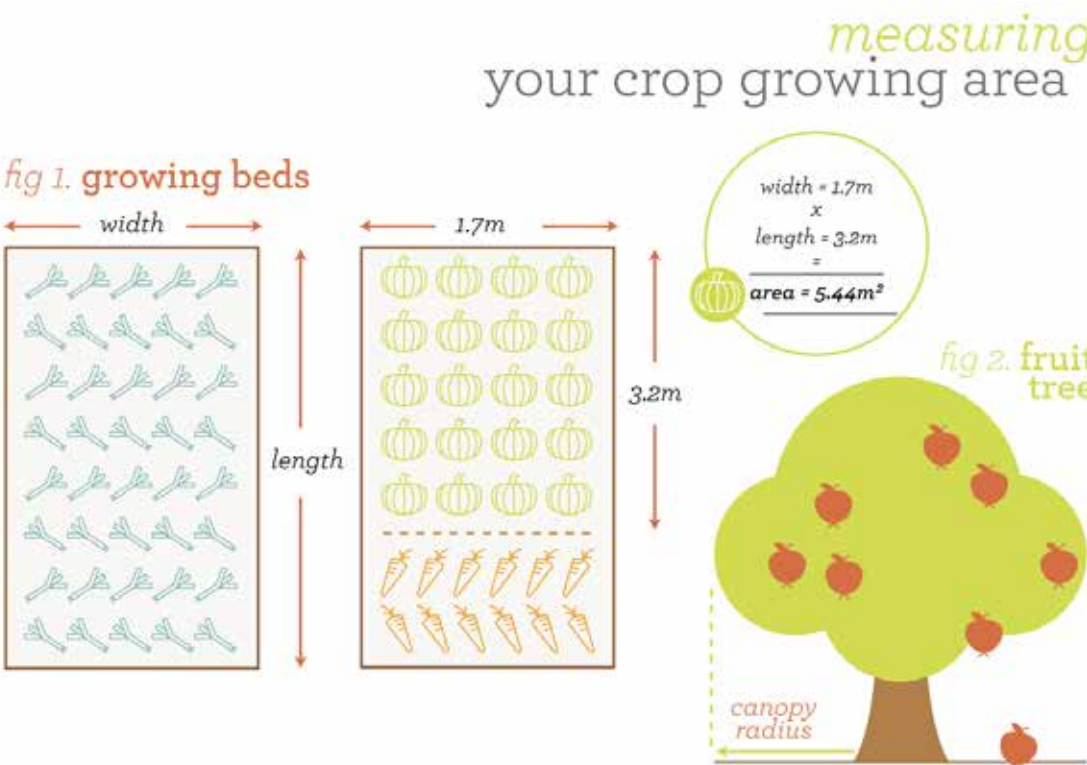
- 50 pounds of wheat

-280 pounds of pork

-120 cartons of eggs

-100 pounds of honey

- 25 -75 pounds of nuts

- 600 pounds of fruits
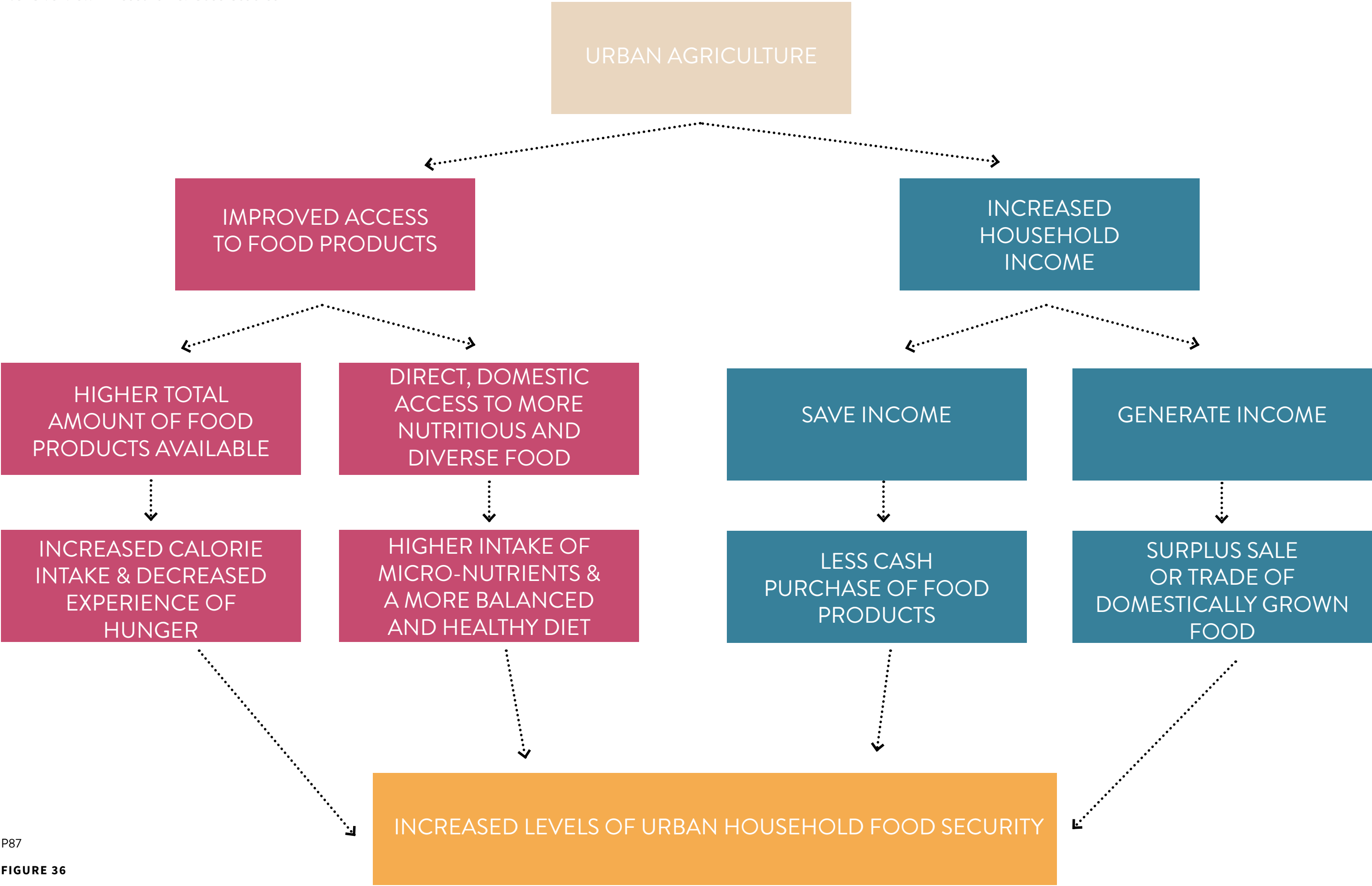
- 2000+ pounds of vegetables"

Source: Madigan, 2009

measuring your crop growing area

fig 1. growing beds

fig 2. fruit tree

width = 1.7m
x
length = 3.2m
=
area = 5.44m²

canopy radius

preparing to weigh your crop

Crop	Preparation for weighing
Apples & pears	Leaves and twigs removed, stalks retained
Plums	Leaves and twigs removed
Berries & currants	Leaves and stems removed
Tomatoes	Unwashed with calyx (green top) still attached, if possible
Onions & garlic	Roots removed, air-dried and free of soil (ready for storage)
Leeks	Roots removed, cleaned and trimmed to approx. 20cm green leaf
Broccoli & cauliflower	Heads trimmed to a 10 cm stalk and leaves trimmed
Brussel sprouts	Stems removed – just weigh the heads
Cabbage	Excess leaves removed and base trimmed to where edible leaves start
Kale, Chard & Spinach	Individual leaves cut from stem/base, weigh before washing
Lettuce / salad leaves	Individual leaves cut or excess/inedible leaves removed from head, weigh before washing
Courgettes, Cucumbers & Squash / pumpkins	Stem removed, soil brushed off
Peas, Broad Beans, Runner Beans & French / Climbing Beans	Fresh, in pods, untrimmed.
Asparagus	Stalks trimmed, weigh unwashed.
Rhubarb	Leaves removed, stalks trimmed to base.
Sweetcorn	Leaves and stems removed
Beetroot, Carrots, Parsnips & Turnips / swedes	Washed and air-dried, with tops trimmed to <5 cm
Potatoes and Jerusalem Artichokes	Air-dried and unwashed
Radish	Leaves and excess / non-bulbous root trimmed

URBAN AGRICULTURE

IMPROVED ACCESS
TO FOOD PRODUCTS

INCREASED
HOUSEHOLD
INCOME

HIGHER TOTAL
AMOUNT OF FOOD
PRODUCTS AVAILABLE

DIRECT, DOMESTIC
ACCESS TO MORE
NUTRITIOUS AND
DIVERSE FOOD

SAVE INCOME

GENERATE INCOME

INCREASED CALORIE
INTAKE & DECREASED
EXPERIENCE OF
HUNGER

HIGHER INTAKE OF
MICRO-NUTRIENTS &
A MORE BALANCED
AND HEALTHY DIET

LESS CASH
PURCHASE OF FOOD
PRODUCTS

SURPLUS SALE
OR TRADE OF
DOMESTICALLY GROWN
FOOD

INCREASED LEVELS OF URBAN HOUSEHOLD FOOD SECURITY

URBAN FOOD PRODUCTION

Analysis

SOCIAL BENEFITS

- Volunteering, job and educational opportunities
- Increase physical health - encourage people to get outside
- Increased security - it's said that communities with urban gardens have seen a reduction in crime.
- Aesthetic values - Skelton Gate has the potential to become an attractive outdoor space for visitors and residents.
- A unique place - visiting an urban farm may not be something many people do very often.

ECONOMIC BENEFITS

- Food production
- Promote tourism to the site
- Local employment
- Community selling
- Commercial value
- Recyclable products - food waste can be recycled, containers can be used for food production etc.
- Opportunity for local markets, shops, selling to surrounding shops, which in turn will help boost the local economy.

ENVIRONMENTAL BENEFITS

- Restoration/enhancement of biodiversity
- Mass planting - edible landscapes
- Provides a pleasant space for residents and visitors
- Helps improve climate, planting trees and plants help improve air pollution and air quality.
- Tree planting may help mitigate the impact of the M1 to the site.
- Green roofs, roof gardens and vertical farms may improve noise pollution from the M1 and surrounding roads.


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RESEARCH - URBAN AGRICULTURE

Conservation Communities

"A conservation community is a group of individuals and families living in a community who are committed to saving large parcels of land from ecological degradation. This land can be forested land, agricultural land, ranch land, or any other type of land that needs protecting from high-impact development."

https://artsandculture.google.com/entity/conservation-community/m05f6bq9?hl=en

COMMUNITY

QUALITY OF LIFE

CONSERVATION
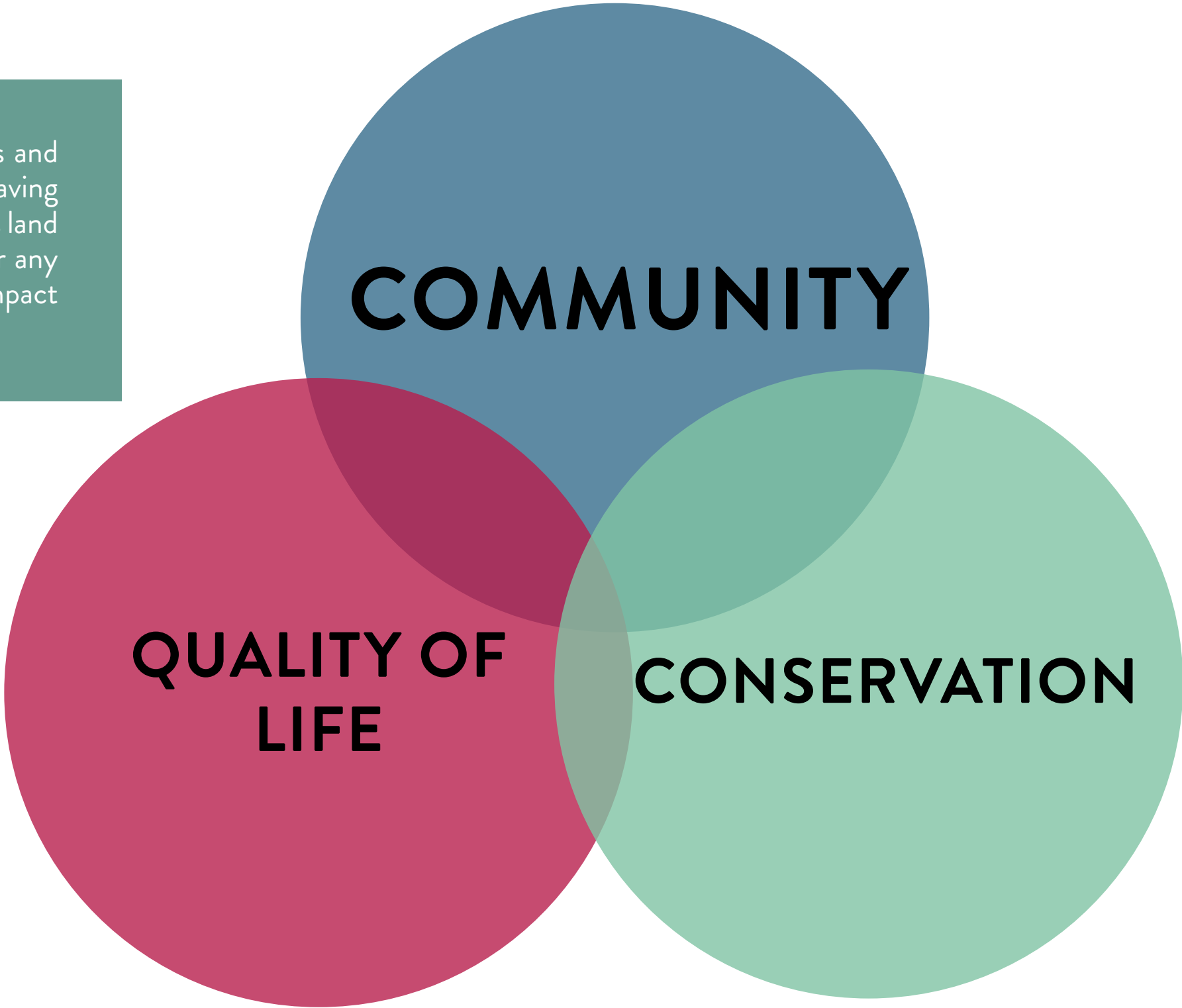
CASE STUDY - LOW IMPACT COMMUNITIES

Lilac, Leeds

LILAC (Low impact Living Affordable Community) was set up in 2012, comprising of 20 eco-built households in West Leeds. The residents take care of the homes and land within the area, through a Mutual Home Ownership Society which is a financial model that ensure the areas permanent affordability.

"All residents feel they are part of a strong, flourishing neighbourhood where they can directly participate" through environmentally "low impact living."

LILAC was created in 2006 by a group of five Leeds residents that were interested in the idea of building their own homes and bring their children up in an alternative way. The original design was based on the 'Danish co-housing model: mixing people's needs for their own space in private homes with shared facilities and encouraging social interaction.

How LILAC achieves its low impact status:

Straw Bales

We built the houses with ModCell, a company which has developed a low-carbon modern method of construction using panel timber walls insulated with strawbale. This significantly reduced the CO2 emitted during construction. In total, the LILAC development captured and stores over 1,080 tonnes of atmospheric equivalent CO2 through photosynthesis during the growth of the timber and straw.

Passive Solar /MVHR

The insulating materials and design of the buildings combine to store solar heat in the winter and reject solar heat in the summer, thus reducing the need to input heating energy.

Solar Energy

Each home has a 1.25kw solar PV array, with an extra 4kw on the common house. The houses also have solar thermal for space and hot water heating.

Sharing

We consider the environmental impact of our daily activities, for instance through car sharing; pooling equipment and tools; sharing meals twice a week; and looking to the local area to provide as many needs as possible. Growing food on our allotments means we eat as locally as physically possible!" (LILAC, 2020) .

The community led design shows how building an affordable, eco-friendly community can benefit not only the residents living in it, but the areas surroundings too, benefiting wildlife and contributing to the prevention of climate change. However, there are some elements that may not appeal to everyone - for example, Sharing. With the site already working well in Leeds, this sets out a framework that could possibly be mirrored within the Skelton Gate site - there is potential for creating more low impact affordable homes and communities.

CASE STUDY - CONSERVATION COMMUNITIES

Prairie Crossing, Illinois USA

"Prairie Crossing, a planned 'village' neighbourhood in Grayslake, Illinois, is a self-described conservation community. Conservation has been central to the community's design, vision, goals and activities since its inception. A central component to their conservation strategy is the 100-acre, certified organic, peri-urban farm on the neighbourhood's western border. The farm enables Prairie Crossing's residents to support hyper-local agriculture through a variety of initiatives and businesses.

One of the main undertakings at the farm is Prairie Crossing's own Farm Business Development Center. The administration and residents at Prairie Crossing recognised a need for more environmentally conscious farmers and farms to feed the region's growing population. Toward this end, the center serves as an incubator, providing training, land, material resources, and financing to help educate and enable a new generation of farmers. Another important component is the Prairie Crossing Learning Farm, with its mission 'to educate and inspire people to value healthy food, land and community through experiences on the farm.' (Prairie, 2012. The farm contains greenhouses, free-range hen house and poultry pasture, a fruit orchard, all of which are used as learning environments for their summer farm camp and after school farm camp. " (Philips, 2013)

Prairie Crossing is a good example of a successful community integrated within an open habitat system, one of the lessons learnt from the Environmental Team Leader (Mike Sands) was that the site should be located nearer to the town's centre rather than at the edge of the community. Having the farm at the centre of the community creates a sense of belonging, connecting the community to nature, education, and improving resident's health. In relation to Skelton Gate, this design process would fit well within the sites location just outside Leeds City Centre. With plans for community development in place, there lies opportunities to promote further connections to surrounding habitats, nature and education through this way of thinking.

DESIGN INTERVENTIONS

Green Roofs

Green roofs bring many economic, environmental & social benefits to a design, as well as being aesthetically pleasing. With potential for buildings within the design proposal, roofs offer a new floor to which aren't usually utilised - these spaces are being used not only as green roofs, but for urban farming, bee keeping, and other green initiatives that work towards reducing the effects of climate change. The benefits of green roofs are:

- Provides rainwater buffer
- Purifies Air
- Reduced the ambient temperature
- Increases solar panel efficiency
- Reduces ambient noise outside and inside
- Extends life span of roof
- Adds value to the building
- Increases biodiversity
- Creates dire-resistant layer
- Increases the feeling of well-being
- Offers healing environment
- More social interaction, less vandalism
- Direct-green, low maintenance
- Saves time and money
- Erosion protection

1 Végétation et couche de substrat

2 Membrane filtrante

3 Couche de drainage

4 Revêtement d'étanchéité antiracines

5 Couche d'étanchéité du toit

6 Isolation

7 Pare-vapeur

8 Structure du toit

LOW IMPACT CONSERVATION COMMUNITIES

Analysis

SOCIAL BENEFITS

- Provide an inviting and attractive place to visit and live.
- Creates a sense of community
- Opportunities to meet new people and be part of a low impact and sustainable way of life.
- Create a low impact movement and act as a prime example of how future housing proposals should be developed.

ECONOMIC BENEFITS

- The sense of community and attractive way of life can add value to property and land.
- Opportunities for food production, farming opportunities, shops, schools etc.

ENVIRONMENTAL BENEFITS

- Conservation
- Protecting and enhancing wildlife and planting on site
- Low impact and sustainable housing
- Residents having a low carbon footprint

CASE STUDY - ECOLOGICAL ENHANCEMENT

Wildlife Overpasses & Underpasses

Skelton Gate is home to an abundance of wildlife, including amphibians, badgers, bats, birds, brown hare, invertebrates, otter and reptiles. Currently, there is an existing green/habitat corridor which is connected to the agricultural land to the east and Rothwell Country Park to the south. To the north-west of the site sits the M1 motorway, a dominant barrier which blocks off many connections from Skelton gate to other surrounding green spaces.

Currently there are 2 existing tunnels under the M1, which sit in the areas noted on figure 37, The northern tunnel which connect Temple Newsam to Skelton gate provides a key connection for humans, but is currently uninviting and disused. Some examples below show overpasses and underpasses around the world in small and large scales which have been successful in creating connections for wildlife while meeting the needs of humans. Larger scale examples include the wildlife overpasses in Banff National Park and in Montana, USA - these were places over busy highways which had shown large amounts of road kill near heavily populated wildlife areas. The smaller interventions include Toad Tunnels and Amphibian
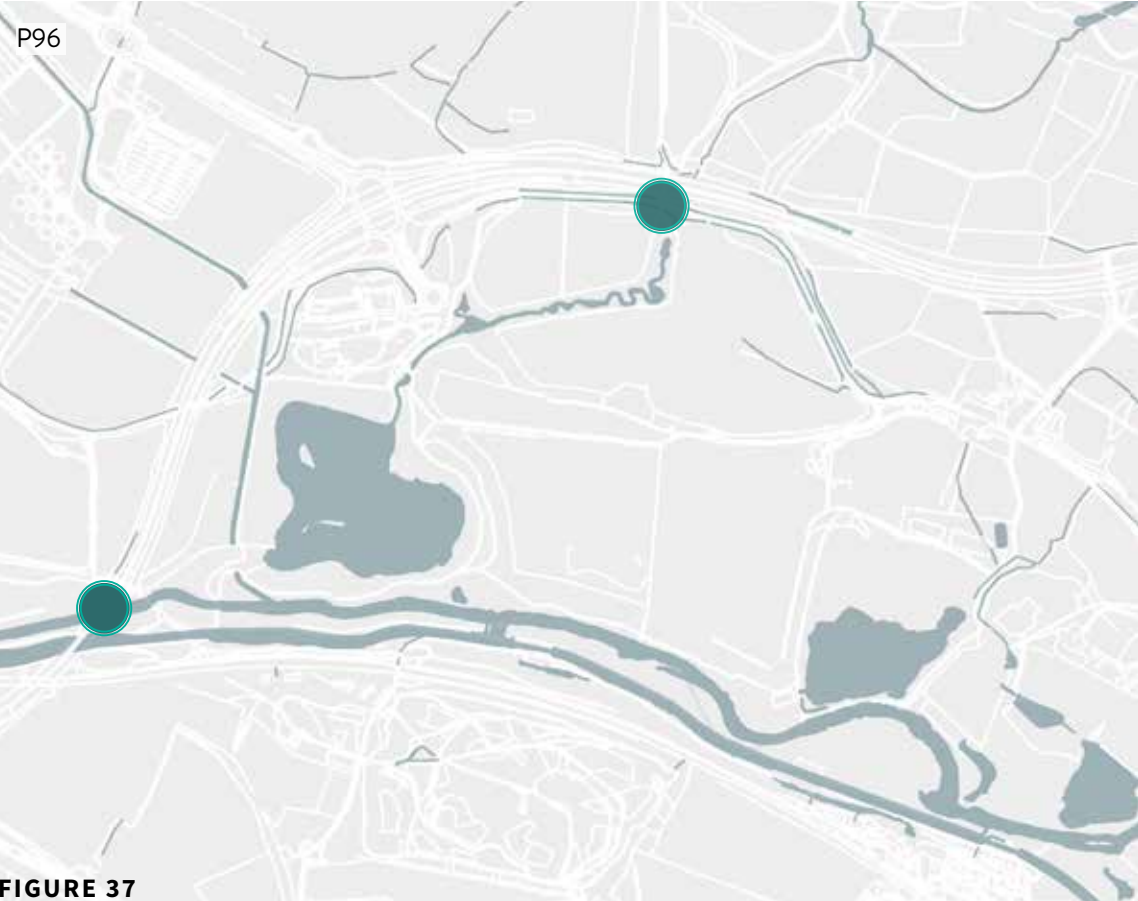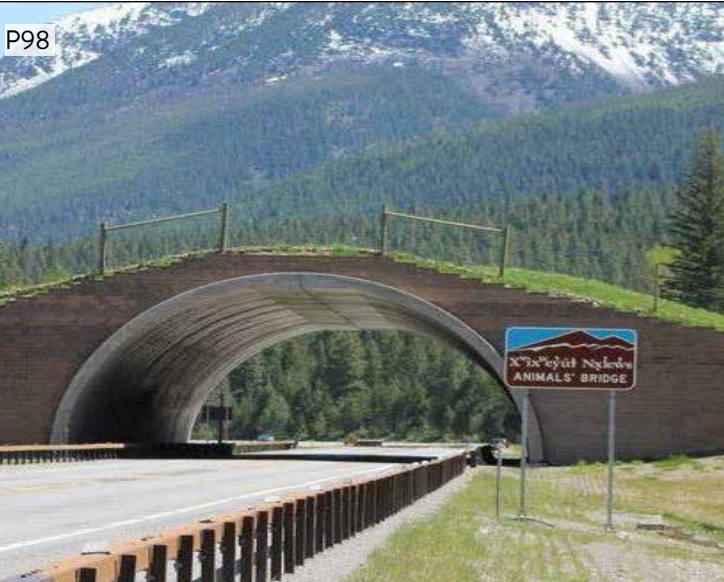
wildlife crossings, each of which provide safe routes for smaller animals - which could be easily integrated into the Skelton Gate design proposal.

The interventions showed "that in just one two-mile stretch, wildlife-vehicle crashes reduced from an average of 12 a year to 2.5, reducing costs of crashes by 90 percent—over $100,000 (£77,000). It's statistics like these that have led to the addition of crossings there over the last two decades." (Clevenger, 2019).

FIGURE 37

Overpasses

Underpasses

Banff National Park, Canada

Wildlife Crossing, Montana, USA

Toad Tunnels, Wales

Amphibian wildlife crossings, California

Queen Elizabeth Olympic Park

The site within East London - a modern urban destination with a historic industrial past. Similar to Skelton Gate, the sites post-industrial past hasn't stopped it from being one of the most successful legacy programmes in the UK, creating communities, jobs, investment, opportunities, homes, a park and venues which are used by millions every year. Biodiversity enhancement was a major factor within the design of the Olympic Park, with provisions for creating 45ha of new habitat, including 20ha of rich grassland to replace loss.

Biodiversity was a key part driver within the design and landscaping measures to date include:

4,000 trees planted

300,000 wetland plants

525 bird boxes, many set in the bridges

150 bat boxes, some located in the Olympic Stadium structure

8 toadflax habitat patches

4 grass snake egg laying sites

2 kingfisher nesting banks

2 sand martin banks

2 otter holts

(https://www.ciria.org/News/blog/biodiversity_site_visit.aspx)

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Wildlife Interventions to be utilised at Skelton Gate

OTTER SHELVES
An intervention produced by Durham City council - to provide otter shelves in a new culvert, as otters are said to prefer scurrying along a riverbank than swim.

BADGER TUNNELS
Tunnels for Badgers were built under the A11 in Norfolk, providing a safe and easy crossing to either side of the A11.

WATERVOLE PIPE
The Highway Agency is legally required to protect certain species when carrying out construction - Under the M6 in Cumbria, 8 Water Vole pipes were designed to enable wildlife to safely move.

DOORMOUSE BRIDGE
Dormice live in trees and usually prefer overpasses to using underpasses because of this - so an intervention was created to provide a safe access route suspended from 20ft wooden poles.

BAT & BIRD BOXES
These boxes encourage local bats and birds into areas to provide a place for roosting. Can be built for walls, trees and other surfaces.

TOAD TUNNELS
Toad tunnels are essentially small scale underpasses, these can be used by other animals too.

AMPHIBIAN WILDLIFE CROSSING
Specifically designed crossings for amphibians under roads - potential for some on busier roads within the Skelton Gate design proposal.

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DESIGN INITIATIVES

Protecting Crops from Wildlife

When proposing urban agriculture interventions on a site where there is a dominant presence of wildlife, will mean mitigation measures will need to be considered to avoid animals eating crops. Rooftop farming is an answer to this, but there are some strategies for protecting crops from wildlife:

Agricultural fences - wire,plastic, electric.

Natural repellents - smoke, fish or garlic, chilli peppers, lavender, castor oil

Chemical repellents

Biophysical barriers

Electronic repellents

Ultrasonic electronic repellents which are silent to humans, but give off a high frequency sound for wild animals.

Sonic electronic repellent - audible noise that scars animals.

CASE STUDY - HIGHWAY MITIGATION

Highway Mitigation Measures

The M1 is a dominant barrier that seperates Skelton Gate with the north & west, incluidng Leeds City Centre. The services are a popular stop off for users of the motorway, which means at certain times the area can become very busy with vehicles. Previous site analysis showed the effect the M1 has on the noise & air pollution within the area, with 75+ DB being recorded on the motorway, and 55+ DB being reorderded across the whole site.

In the UK, roadside mitigation measure may include earth bunds, visual screens (barriers/walls/planting/earth bunds), and noise barriers which vary in size depending on the location and impact. Natural barriers are also an option, research has indicated that tree and shrub planting can help reduce noise pollution. Leonard and Parr (1970) & Reethof (1973) discovered that a planted section of dense tree and shrub planting between 15-30m wide could reduce sound pollution by as much as 10 DB.

Some points to consider when planting shrubs & trees to reduce noise pollution:
"Noise is more effectively attenuated by completely screening the source from view. Although gaps and partial views through a barrier may create an impression of greater noise reduction, they will allow noise to penetrate.
A noise barrier should be planted as close to the noise source as possible.
Widely spaced trees do not reduce noise effectively. Wide belts of high densities are required to achieve significant noise reduction.
Effectiveness is closely related to the density of stems, branches and leaves. Use trees with sense foliage and branches that reach close to the ground. Alternatively plant an under-story of dense shrubs or a surrounding hedge.
Where year-round noise screening is desired use broadleaved evergreens or a combination of conifer and broad-leaf evergreen species.
Soft ground is an efficient noise absorber. Avoid hard surfaces - asphalt and concrete reflect virtually all incident sound at any angle.
Cultivating ground before planting, and the addition of well-rotted organic matter to the soil surface may also help to reduce noise whilst vegetation becomes established." (https://www.trees.org.uk/Trees.org.uk/files/8c/8c69f212-a82e-424b-96d1-c8ff6dc02403.pdf)

As Skelton Gate is heavily effected by the noise produced from the M1, the natural alternative may not be a strong enough intervention if the site is going to be home to residents. In some areas, such as around the housing areas/buildings - dense tree planting may be a good option in mitigating this issue locally.
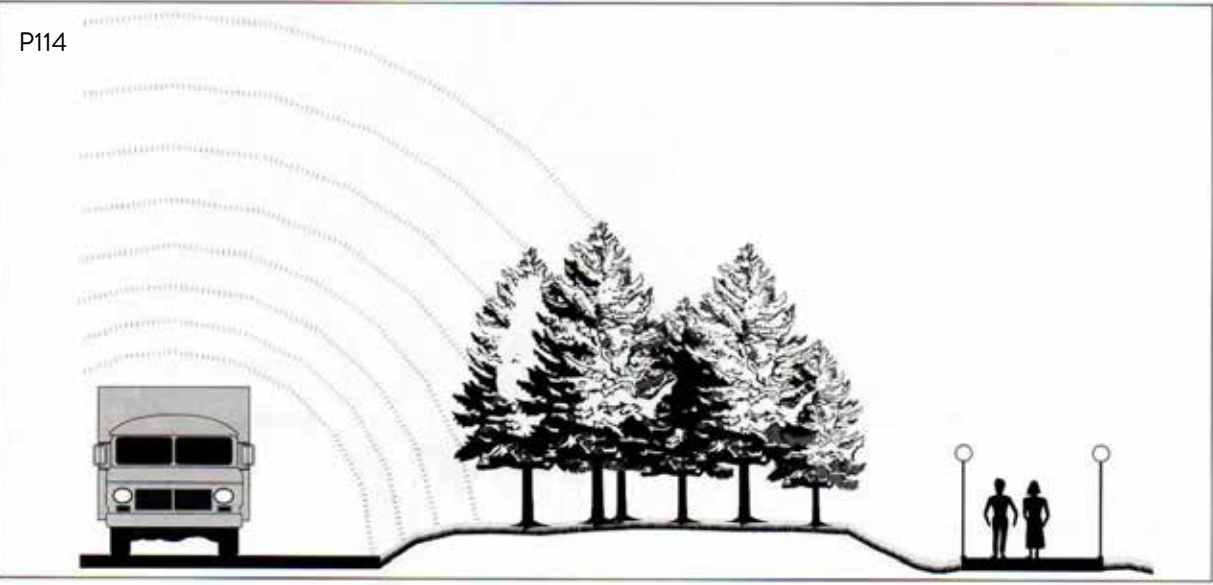
FIGURE 38

A visual barrier between the noise source and the hearer may help reduce the perception of noise. (Source: Grey & Deneke, 1986)

Haverbeke (1972) also found reductions in noise level of 5–10dB for belts of trees between 15-30m wide.

Noise Barrier Effectiveness

FIGURE 39

5 to 8 dBA reduction per 100 ft of buffer width

≥30 ft — Noise control buffer — Additional setback (see diagrams)

20 to 80 ft — Setback for safety issues May need to be more for drifting snow
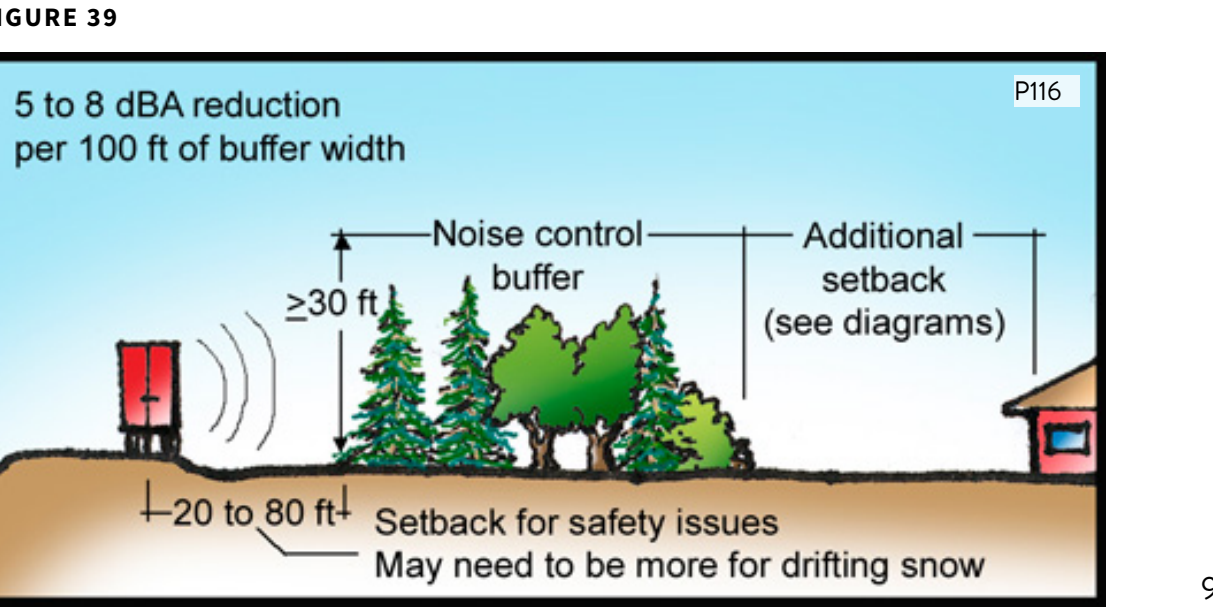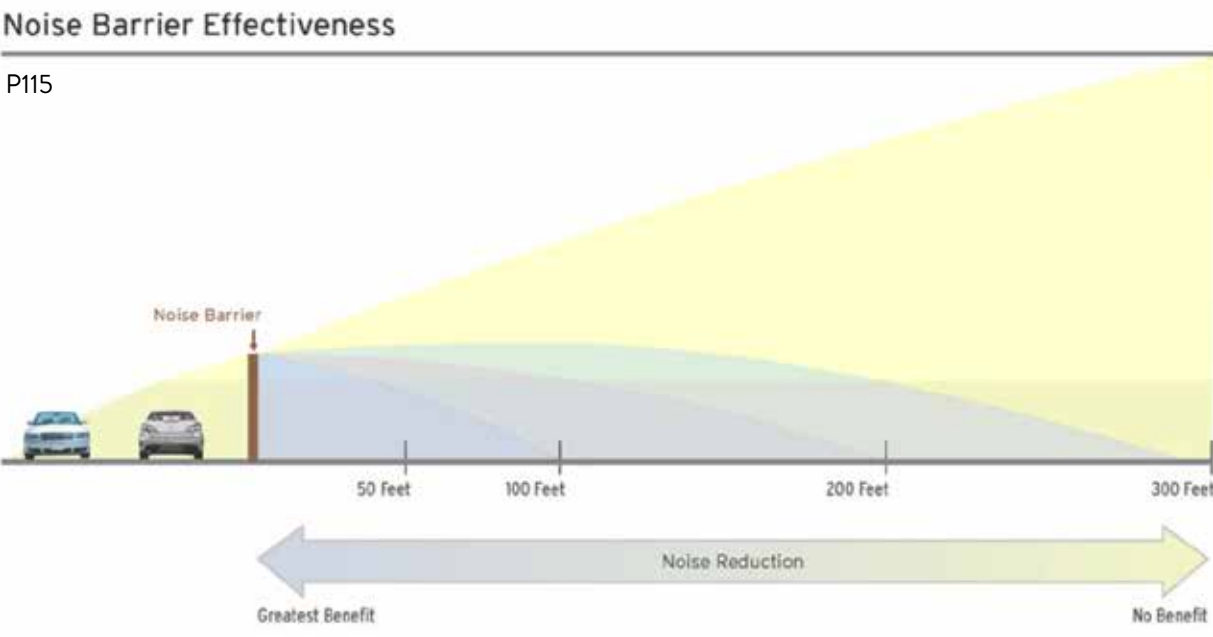
C A S E   S T U D Y   -   C O N S E R V A T I O N   C O M M U N I T I E S

Highway Mitigation Measures

A less natural alternative to reduce noise pollution is the use of sound barriers, these line the motorway with an exterior structure designed to protect sensitive land users from the noise pollution of roads. These are the most effective method of reducing noise pollution, and there are many different alternatives available that mitigate sounds for locals.

Some examples have been taken from Knauf Insulation - which are manufacturers for road sound barrier insulation. All of which are excellent for sound absorption, noise insulation, resistant to weathering and are custom made to fit.

For Skelton Gate, due to the intensity of noise pollution on site, these extreme measure may come as a benefit to future residents and users of the site. The arrangement of buildings on site can also reduce noise impacts on the site. Making sure residential buildings are orientated away from the M1, and placing non-residential buildings closer to cause will create noise barriers that will benefit residents living on site. Reducing the impact of the M1 through highway mitigation measure such as these - along with natural alternatives, will reduce the effect the motorway has on the site and make Skelton Gate a scenic and enjoyable area to be.

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KNAUF INSULATION RSB BOARD GVB (RSB B GVB)
Insulation boards for road sound barriers exposed to outside influences
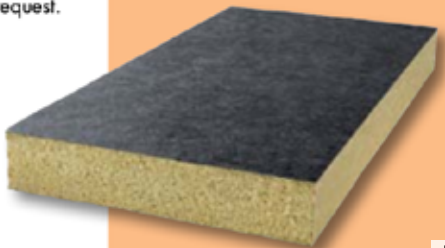
DESCRIPTION

KNAUF INSULATION RSB B GVB are boards made of rock mineral wool **faced with black glass fleece**. Black glass fleece facing protects the mineral wool boards from degradation caused by air flow and other outside influences.

Knauf Insulation RSB B GVB provides sound absorption and insulation against noise produced by traffic or industry. The dimensions of each board are customized according to the dimensions of each road sound barrier system.

Additional facing colours (besides black glass fleece) are also available on request.

BENEFITS

- Excellent sound absorption
- Excellent noise insulation
- Requested air flow streaming resistance
- Mechanical stability throughout the product's lifetime
- Hydrophobic properties help to resist weathering
- Dimensional stability
- Reaction to fire: Euroclass A1
- Our production technology enables custom-made dimensions

APPLICATION
Due to their acoustic properties boards are used as core elements in **road sound barriers** and other sound absorbing/insulation systems that are **exposed to air flow and other outside influences.**

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KNAUF INSULATION RSB BOARD GW (RSB B GW)
Insulation boards for road sound barriers exposed to extreme outside influences

DESCRIPTION

KNAUF INSULATION RSB B GW are boards made of rock mineral wool **faced with black glass tissue**. Black glass tissue facing protects the mineral wool boards from degradation caused by extreme outside influences such as air flow, stones, high-pressure water cleaning and snow removal.

Knauf Insulation RSB B GW provides sound absorption and insulation against noise produced by traffic or industry. The dimensions of each road sound barrier system.

BENEFITS

- Excellent sound absorption
- Excellent noise insulation
- Mechanical stability throughout the product's lifetime
- Requested air flow streaming resistance
- Hydrophobic properties help to resist weathering
- Dimensional stability
- Reaction to fire: Euroclass A2
- Our production technology enables custom-made dimensions
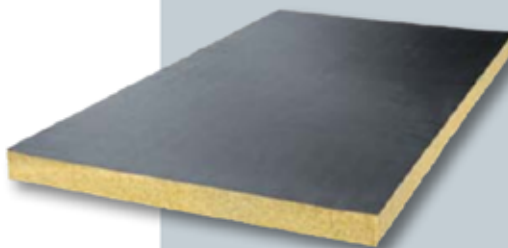
APPLICATION
Due to their acoustic properties boards are used as core elements in **road sound barriers** and other sound absorbing/insulation systems that are **exposed to extreme outside influences.**

P117

KNAUF INSULATION RSB BOARD (RSB B)
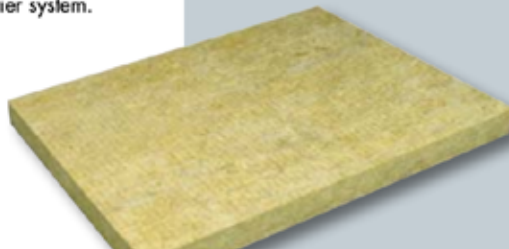**Unfaced boards for road sound barriers**

DESCRIPTION

KNAUF INSULATION RSB B are boards made of rock mineral wool. Due to their acoustic properties they are used as core elements in road sound barriers. Boards provide sound absorption and sound insulation against noise produced by traffic or industry.

Unfaced Knauf Insulation RSB Board is designed for road sound barrier systems where protection against air flow is added separately. The dimensions of each board are customized according to the dimensions of each road sound barrier system.

BENEFITS

- Excellent sound absorption
- Excellent noise insulation
- Mechanical stability throughout the product's lifetime
- Hydrophobic properties help to resist weathering
- Dimensional stability
- Reaction to fire: Euroclass A1
- Our production technology enables custom-made dimensions

APPLICATION
Due to their acoustic properties boards are used as core elements in **road sound barriers** and other sound absorbing/insulation systems **where protection against air flow is added separately.**

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E C O L O G I C A L   E N H A N C E M E N T S   &   H I G H W A Y   M I T I G A T I O N

Analysis

S O C I A L
B E N E F I T S

- Reduce the effect of the M1 for residents and visitors, as well as wildlife.
- Create a more attractive area to visit, live and work
- Retains the natural aesthetic of the site
- Well-being boost though living in close proximity to green space, and not being able to notice the M1 that originally dominated the site.

E C O N O M I C
B E N E F I T S

- Reduction in the effects of the M1 may increase house prices
- Retaining the natural aesthetic of the site will also add the the land value and house value
- Potential for job creation within ecological protection

E N V I R O N M E N T A L
B E N E F I T S

- Protecting and enhancing natural habitats
- Designing for both humans and wildlife, meeting the needs of both parties.
- Increased woodland planting
- Small but useful interventions will help protect wildlife from site users.

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FIGURE 41
P120

VISION

Aims

P119

FIGURE 40

- Mitigate the effects of the M1
- Low impact conservation communities
- Improve cycle and pedestrian access to the wider site
- Provide pedestrian wetland access and embrace the water-bodies on site.
- Introduce Urban Food Production Facilities
- Recreational Park
- Introduce and enhance new habitats

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VISION

Objectives

- Tree planting for both the landscape and for food production
- Introduce new means of urban food production
- Enhance the landscape for wildlife
- Low impact sustainable communities
- Urban Farming
- Education and Visitor Facilities
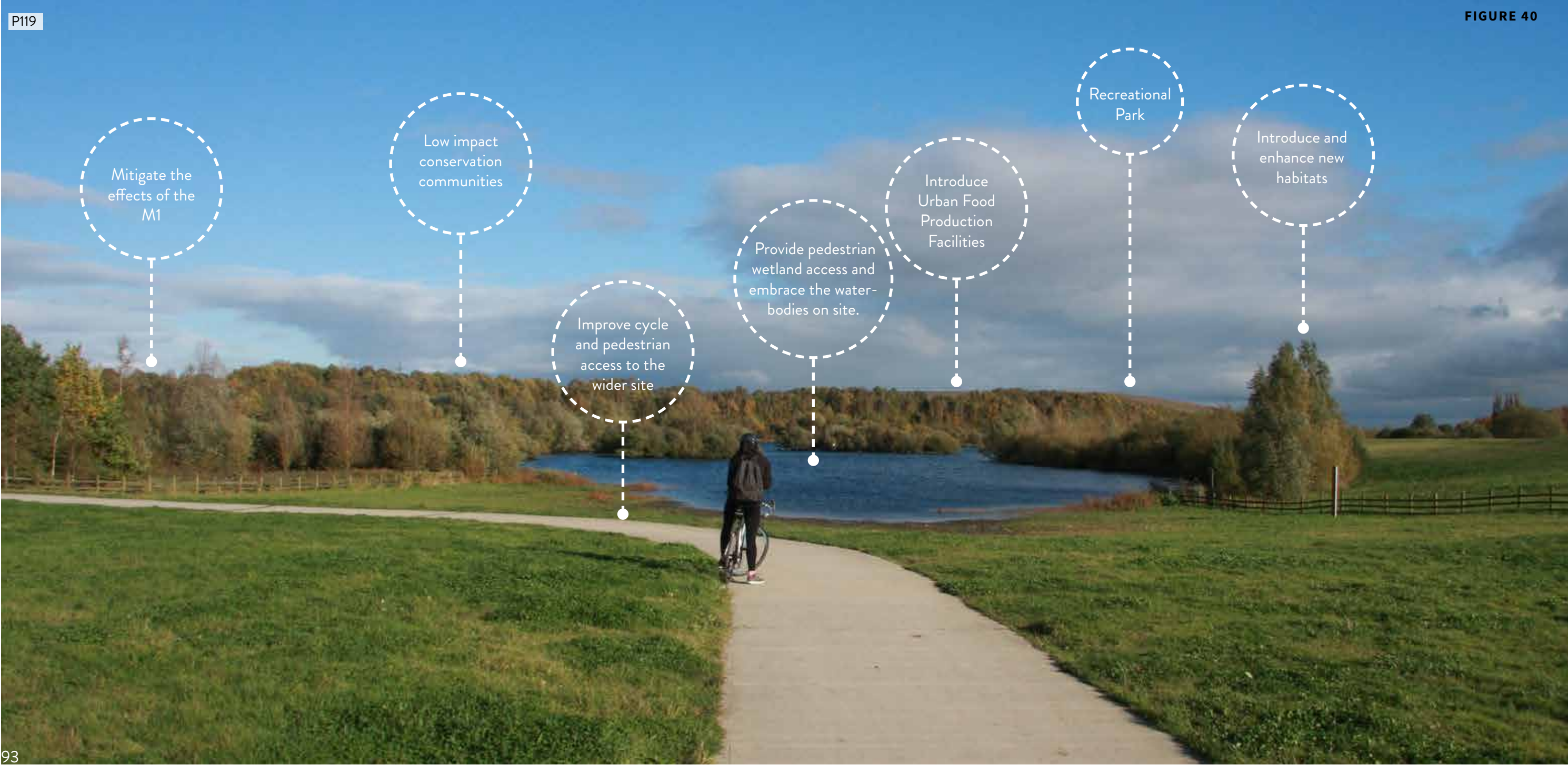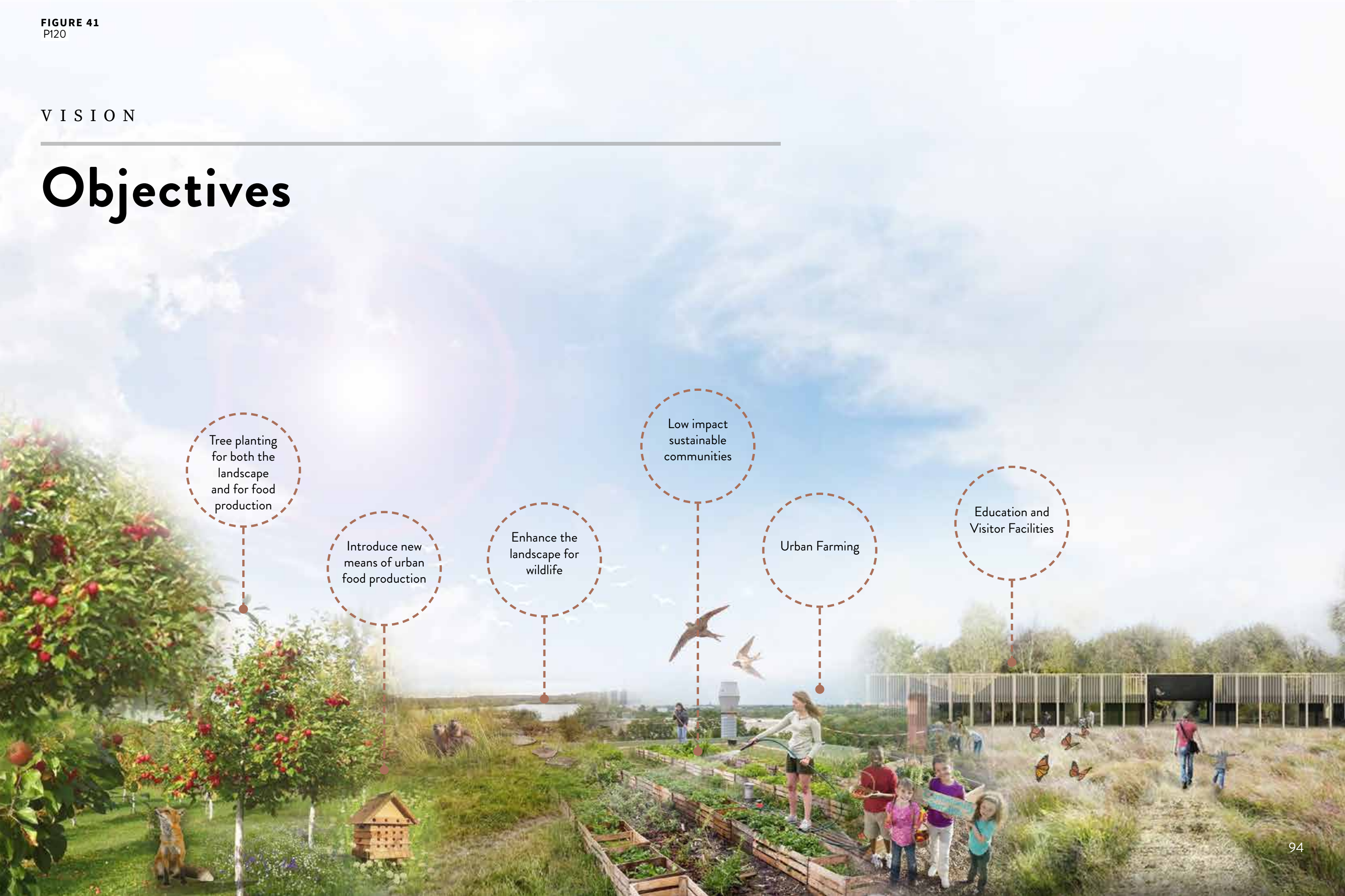
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3.0

DESIGN

CITIES ALIVE

Design Brief

Site Context
Skelton Gate sits on the outskirts of Leeds within the Aire Valley, east of Junction 45 and the M1. The site currently comprises of mainly brown-field and agricultural land, and Is now home to the new Leeds Skelton Gate Services.

Chosen Site Area
The chosen site area comprises of brown-field land and 5 on site water bodies:
1- Skelton Lake
2- Unnamed Lake
3- River Aire
4- Aire and Calder Navigation
5- Wyke Beck

Design Brief
The following proposal for Skelton Gate aims to provide an area that will work within the existing wetland settings to create new diverse conservation community while also providing areas for urban food production that will supply Leeds with fresh produce. The site will form an exciting and modern food production/habitat hub for Leeds, providing areas for recreation, education and habitat creation. The design brief aims to challenge the future plans for urban farming and analyse how productive landscapes can tackle food scarcity in cities in the future.

> "By 2050, food security may be one of the most critical factors of global geopolitics, with its intimate ties to oil prices, transport networks, climate change and population growth."
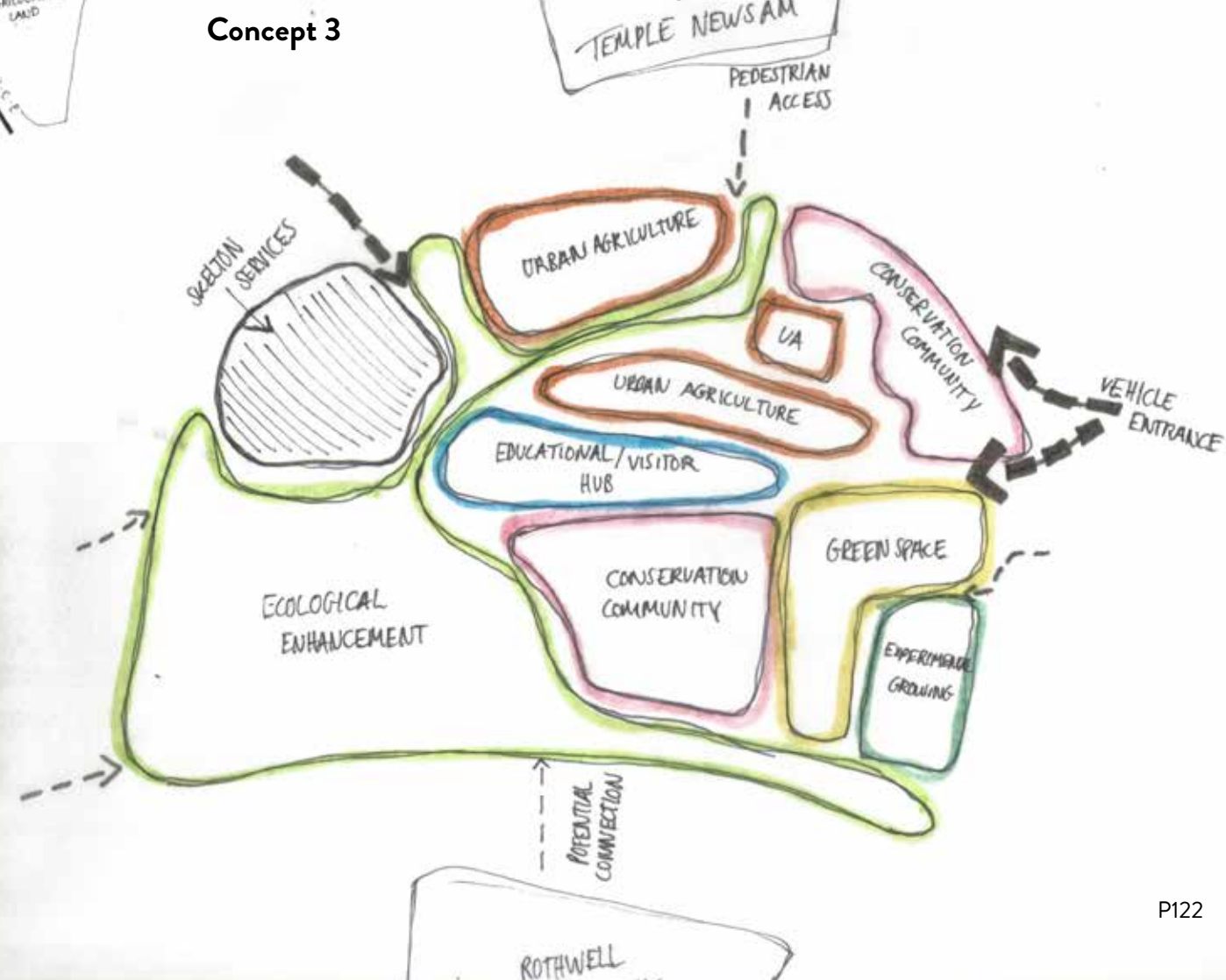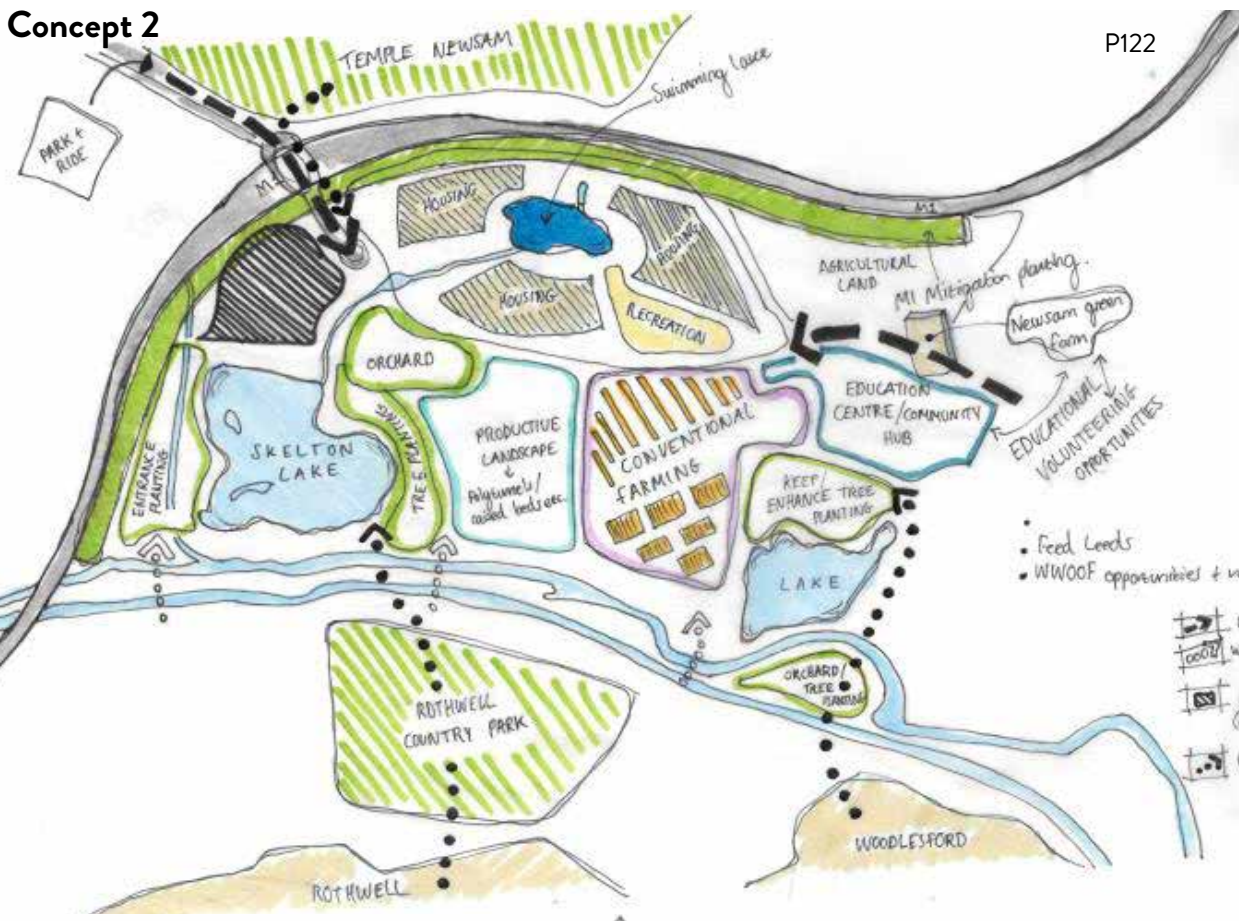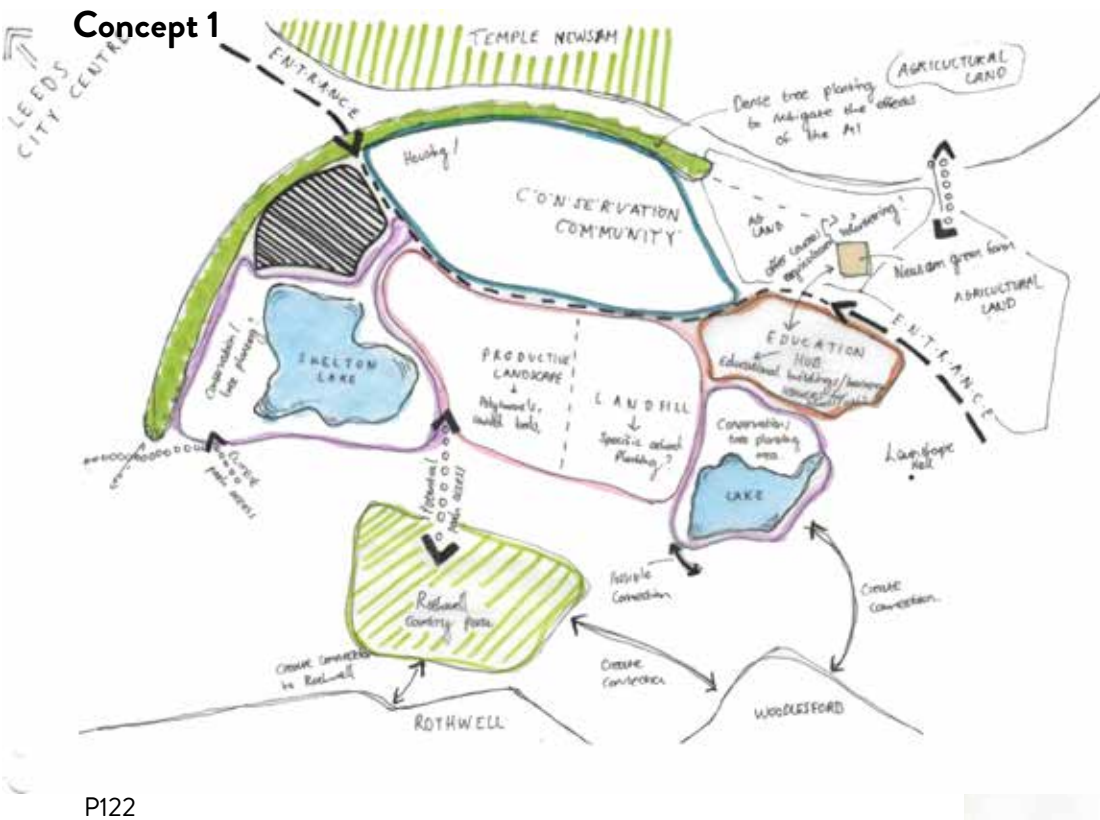> Cities Alive (Armour, 2014)

Aims:
• Provide areas for:
i) Urban food production e.g. allotments, orchards, vertical farming, hydroponics, floating farms, edible wetlands, fruit and vegetable growing.
ii) Community, educational and research facilities
iii) Social and Recreation – a park with cycling and walking routes.
iv) Habitat creation e.g. wetland and specific planting.
v) Improve cycle and footpath links to surrounding communities and GI.
• Create a community led design, providing jobs, education, and connections to surrounding communities.

Attractive open space

Peaceful rural setting

Disused brown-field land

DESIGN

Initial Plan Ideas

Concept 1

Concept 2

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Concept 3

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From site and analysis to research, the main concept and interventions have been chosen for what will be included in the proposal. These include a conservation community, productive landscape, potential areas for ecological enhancement and highway mitigation. The following initial plans zone different areas within Skelton Gate.

Concept 1
Concept one zones the north of the site as a conservation community area, a productive landscape to the south/landfill area, and education area to the east. After evaluation, this didn't seem the most fitting layout - the new community would benefit from being located to the east/west of the site to avoid the M1.

Concept 2
Concept two aimed to develop concept one slightly further, working out housing layouts, possible urban agriculture area etc. Once again, the concept didn't seem a strong response to a successful urban farm and community.

Concept 3
The final concept consists of a mixture of concept one and two, the focus is to create an integrated network of areas which work together while also providing attractive spaces for both humans and animals. Ecological enhancements will take place around Skelton Lake which spills into the rest of the site, benefiting urban food production areas, conservation communities, educational and visitor hubs and open green space.

DESIGN

Strategy & Aims

The design aims to create a new urban farm & conservation community on the outskirts of Leeds, while connecting to surrounding production sites through established networks such as Feed Leeds. Low-impact communities, sustainable urban farm & food production initiatives. Ecological enhancements, highway mitigation and green infrastructure connections are at the forefront of the design proposal.

URBAN AGRICULTURE

Provide areas for urban food production on the outskirts of Leeds City Centre which provides food security for local and surrounding communities, as well as social, educational, economic and recreational opportunities.

Skelton Gate is a 30ha site which has a vast amount of land with potential for various types of urban food growing. With food scarcity being one of the major issues we will come to face in the near future, planning ahead for Leeds will provide the security the city needs.

CONSERVATION COMMUNITIES

Create a conservation community which is committed to preserving and enhancing Skelton Gate.

The current Skelton Gate development proposes 700+ new dwellings on site, there is more potential for creating a sustainable community with further careful planning which will create a sustainable, low-impact and affordable community for Leeds.

ECOLOGICAL ENHANCEMENT

Enhance existing and create new habitats for plants & animals

The site already has a well established habitat network and substantial woodland planting that would benefit from enhancement rather than re-design. Skelton Gate is a key area for wildlife, with proposals for enhancement it gives the area opportunities to thrive. With the M1 being a dominant barrier to the site, there are opportunities to utilise the current under/overpasses as wildlife corridors to surrounding green spaces - Temple Newsam and Rothwell Country Park through the careful implementation of GI networks.

HIGHWAY MITIGATION

Introduce highway mitigation measures to reduce the effects of the M1 on Skelton Gate

The M1 is a dominant barrier to Skelton Gate, causing mass noise and air pollution and is visual blemish on the site. Mitigation measures offer the opportunity to 'blank out' and reduce the effects of the M1 on the Skelton Gate site, making it better for users and residents.

DESIGN

Vision

Urban Agriculture

Urban Food Production Facilities

Ecological Enhancements

Sustainable Conservation Communities

Job Creation

Green Infrastructure

Enhanced Tree Planting
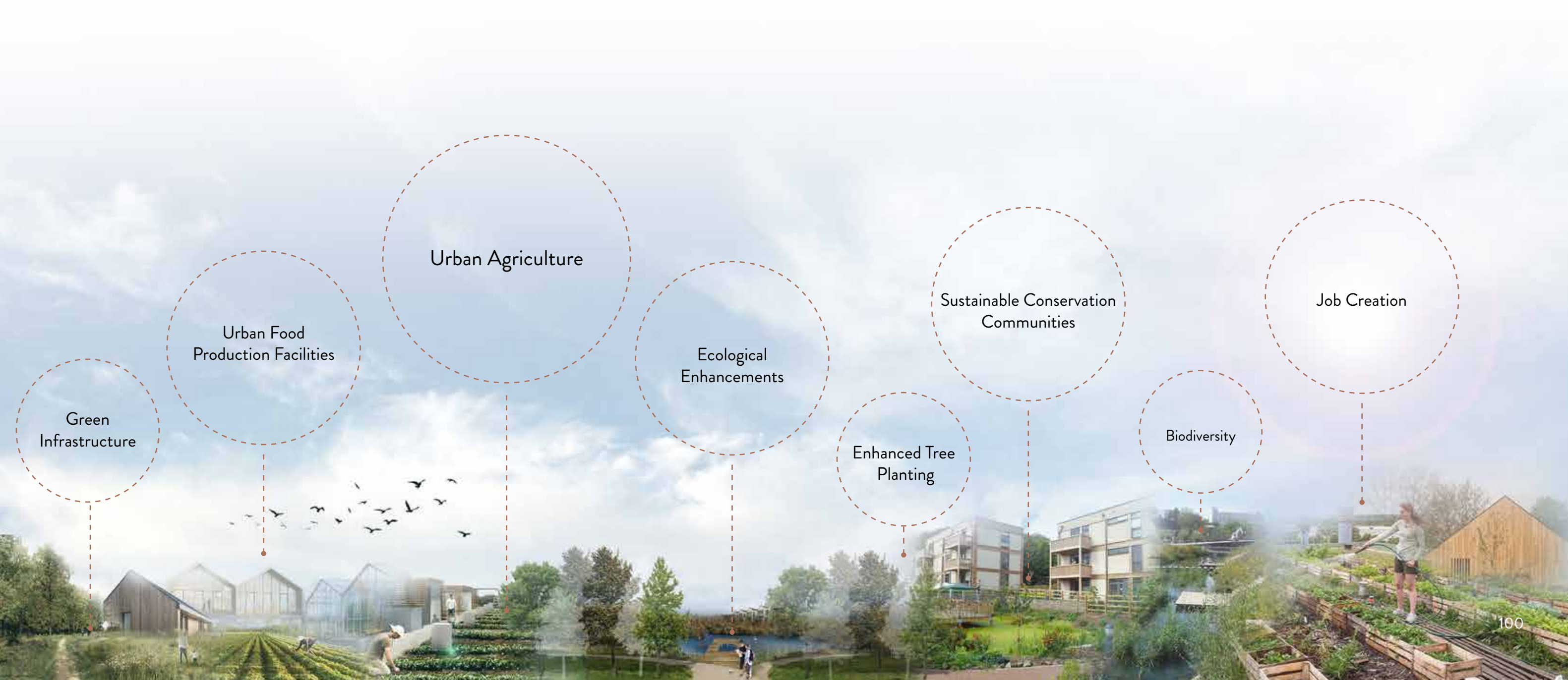
Biodiversity

DESIGN

Masterplan

1. **Skelton Lake**
   Introduction of new tree and shrub planting surrounding Skelton Lake aims to enhance and introduce new habitat areas for biodiversity while improving the overall visual aesthetic of the area. Improved pedestrian walkways and new elevated decking area allows visitors to get closer with nature, while respecting the local habitats.

2. **Visitor & Education**
   Facilities for both Skelton Lake & Skelton Urban farm. Offering outdoor growing areas for local schools & other groups to gain experience in urban food growing & learn about local biodiversity.

3. **Conservation Community**
   Sustainable residential areas with central allotment spaces, park area, central garden/growing areas, rooftop growing & green roofs.

4. **Open Green Space**
   Located on the former landfill site sits an open area of green space for local residents and visitors to enjoy.

5. **Experimental Growing**
   Area for experimental growing on top of an ex-landfill site, Tree & urban food growing will take place in the area. The ground will be covered with a liner of fibreglass with a layer of soil on top which is deep enough to grow roots without touching the liner.

6. **Urban Agriculture**
   Areas of urban food production, on site production facilities providing jobs for local residents and the surrounding communities of Leeds. Areas for vegetable growing, orchards, vertical farming, rooftop farming, mushroom growing below buildings, and urban bee keeping.

7. **Highway Mitigation**
   Dense tree planting & noise barriers will be implemented into the design proposal to reduce the impact of the M1 to residents and visitors of the site.

8. **Rothwell Country Park Connections**
   Creating easier connections from Skelton Gate to Rothwell Country Park via bridges over the River Aire & Aire and Calder Navigation. This in turn creates a GI network from Rothwell Country Park, through Skelton Community Urban Farm to Temple Newsam via pedestrian routes.


DESIGN

Design Concept and Framework

ENTRANCES AND NODES
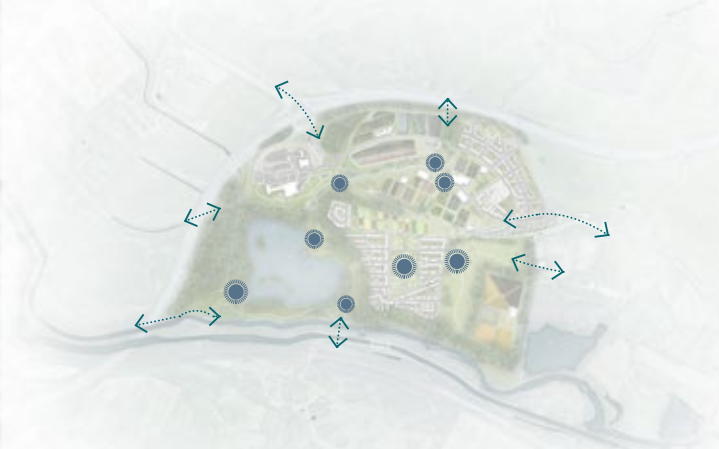
Existing entrances have been enhanced to create direct links in and out of Skelton Urban Community Farm, creating connections to surrounding communities & green spaces for both humans and wildlife. New direct links via bridges over the River Aire and Aire & Calder navigation over to Rothwell Country Park. Nodes have been designed to create links throughout the site.

GREEN INFRASTRUCTURE
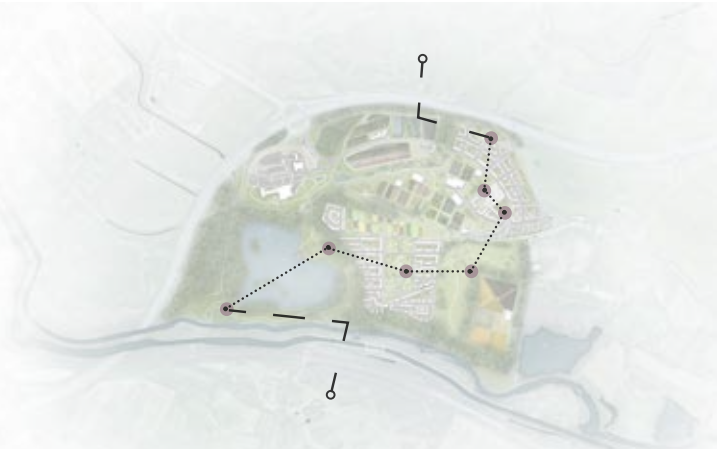
Skelton Gate is rich in natural green space, one of the key characteristics the proposal aims to work with and enhance. Creating a successful green infrastructure network provides areas for both wildlife and humans, while creating a direct link between Temple Newsam & Rothwell Country Park.

ECOLOGICAL ENHANCEMENT & HIGHWAY MITIGATION

Noise & air pollution is currently one of the main issues Skelton Gate faces, with the M1 creating a barrier to the north & west of the site. Highway mitigation measure have been proposed to reduce the effects of noise and air pollution, by introducing dense tree planting and noise barriers to the north of the site to reduce the effects for community residents. Skelton Gate is home to an array of flora and fauna, which the proposal aims to protect and enhance by increased planting & diverted pedestrian access away from habitat areas.

UBRAN FOOD PRODUCTION
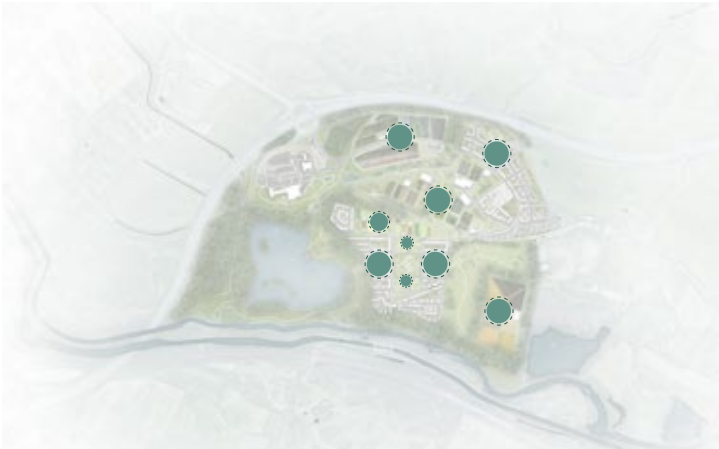
Across the site sits various different types of urban food production initiatives, some of these include allotment gardens, agricultural farming areas, bee keeping, green roofs, experimental farm land, educational food growing spaces and vertical farming initiatives. With the issue of food scarcity becoming more and more apparent, the proposal aims to relieve the effects this has on surrounding Skelton Gate communities & the rest of Leeds.

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Site Section

P127

Green Roofs & Rooftop Farming

Increase Biodiversity

Allotment Gardening & Open Green Space

Low-Impact Sustainable Housing

Increase Biodiversity

Sustainable Architecture

Urban Agriculture

Rooftop Bee Keeping

Educational Urban Agriculture

Improved Pedestrian Networks

Enhanced Tree Planting

P128

Conservation Community
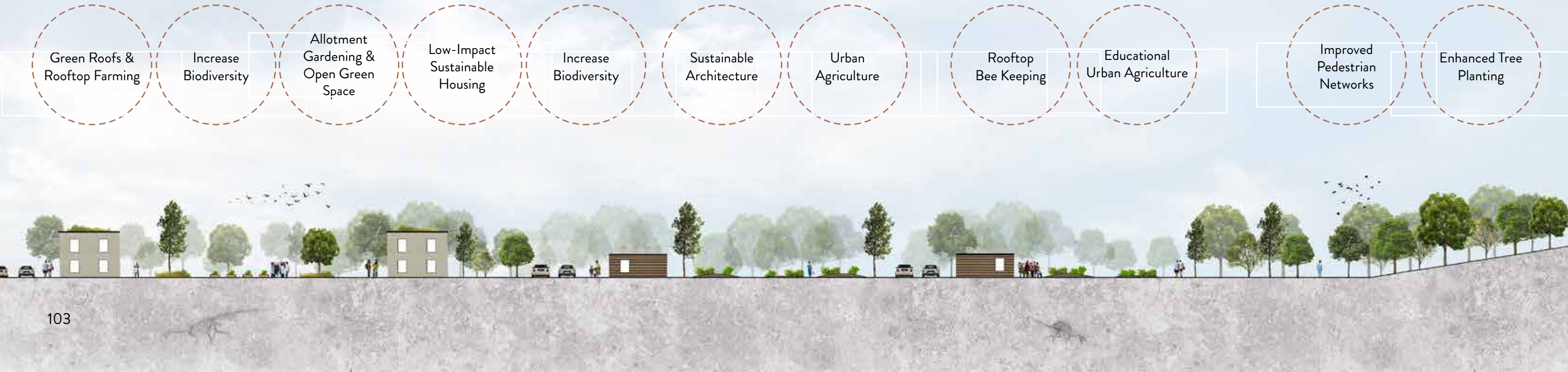
DESIGN

Conservation Community

DESIGN

Educational Growing Area

DESIGN

Educational Growing Area

DESIGN

Educational Growing Area

3.0 Overview - Design

DESIGN

Summary

The Cities Alive - Rethinking Green Infrastructure provides guidance on developing designs with strategies for green infrastructure, figure 37 graphically sets out the key elements Landscape Architects and other professions within the sector aspire to achieve from their designs. These include:

- Multiple Functions
- Multiple Users
- Future Users
- New Needs
- New Functions

Essentially the design must be adaptable for future changes, it must consider new techniques and tools for future-proofing to be beneficial for it's users, how the users may change or grow, what their future needs are, and be a space that has more meaningful qualities other than just being aesthetically pleasing.

The following pages aim to analyse the design process against the checklist for Landscape Architects & City Designers provided by Cities Alive, ARUP.
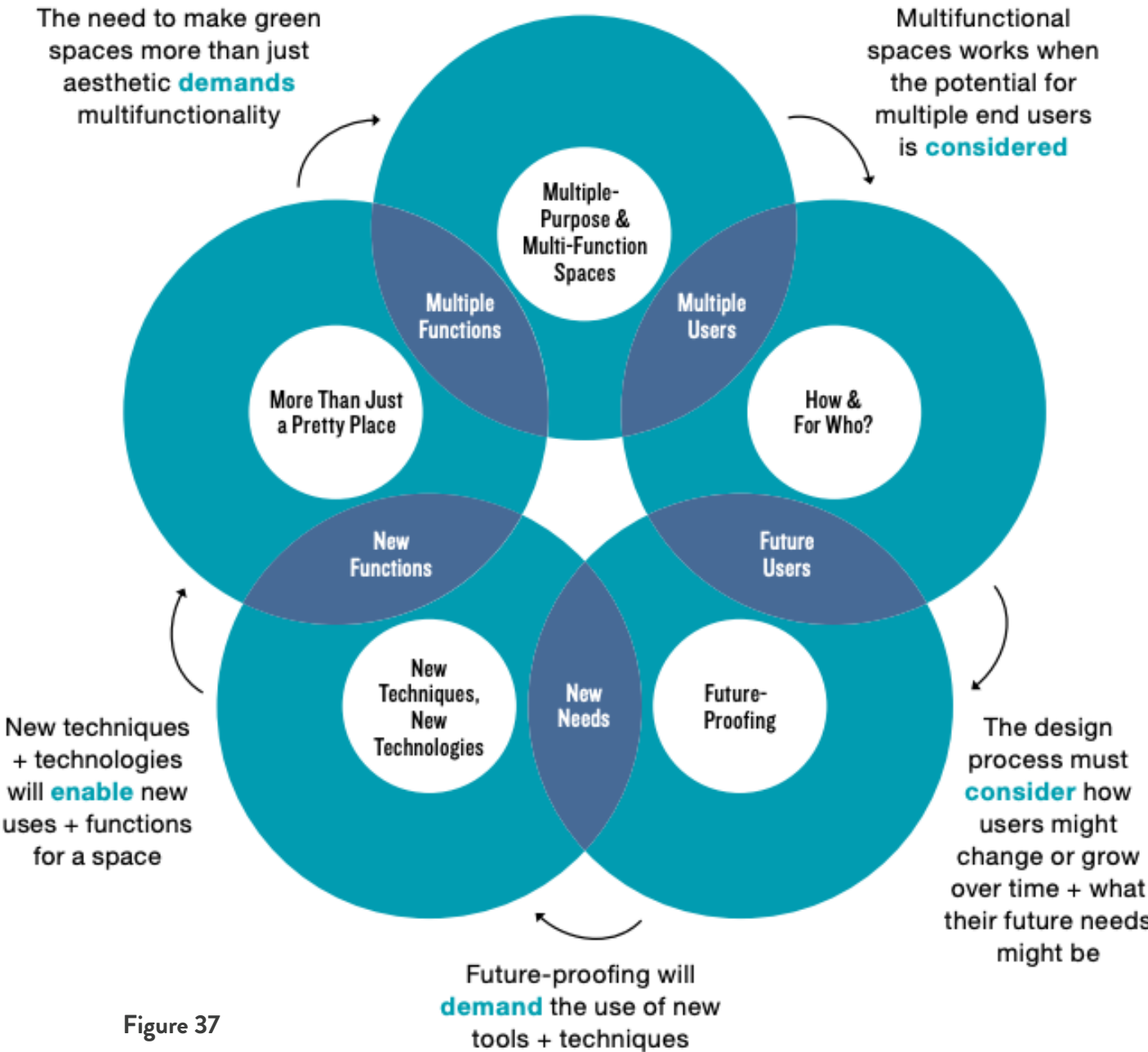

The need to make green spaces more than just aesthetic **demands** multifunctionality

Multifunctional spaces works when the potential for multiple end users is **considered**

More Than Just a Pretty Place

Multiple Functions

Multiple-Purpose & Multi-Function Spaces

Multiple Users

How & For Who?

New Functions

New Needs

Future Users

New Techniques, New Technologies

Future-Proofing

New techniques + technologies will **enable** new uses + functions for a space

The design process must **consider** how users might change or grow over time + what their future needs might be

Future-proofing will **demand** the use of new tools + techniques

Figure 37

LANDSCAPE CONTEXT AND ASSETS

- ☒ Acknowledge geographic setting and landscape characteristics
- ☒ Take account of water catchment/supply
- ☒ Note current land uses and design responses to locality
- ☒ Consider ecosystem services and implications for biodiversity
- ☒ Review history of area and any heritage implications
- ☒ Note social and economic factors influencing landscape
- ☒ Review implications of climate change, energy needs, population growth
- ☒ Consider plans and any design proposals to date
- ☒ Review similar projects/case studies and project approaches

LANDSCAPE CONTEXT AND ASSETS

The following design proposal has considered each element from the Landscape context and assets section in detail through site analysis and research, it was found that the site's location provided great links to surrounding communities and Leeds City Centre, along with well-established pedestrian and cycle networks which have been utilised to create a community urban farm on the outskirts of Leeds. Existing design proposals were considered and improved to create a more sustainable, economical, environmental and culturally beneficial design which will not only benefit surrounding communities, but the entire Leeds region. Projects such as Feed Leeds & the Growing a Resilient Food System in Leeds policy, Incredible Edible, Procuring Food for the Future Report 2020 and the Food Security Challenge have all been taken into account throughout this report, providing guidance and design considerations which have influenced the final design.

SUSTAINABLE MASTERPLANNING

The site's masterplan aims to achieve a successful community urban farm on the outskirts of Leeds - protecting biodiversity, heritage assets including Skelton Lake, adapt existing landscape into various new uses to benefit users and residents within the community, education & visitor hub and urban farm. Eco-friendly & productive built structures have been considered to optimise the development's efforts to mitigate the effects of climate change, encouraging use of low carbon building materials, green roofs and productive roofs to make use of all the space available. Urban food production on site will provide jobs to residents and surrounding communities, while also producing food that can be used in local shops and cafés - or wider scale.

SUSTAINABLE MASTERPLANNING

- ☒ Conserve historic landscape, built form and significant aesthetic features
- ☒ Prioritize development on disturbed land wherever possible
- ☒ Protect natural heritage and enhance biodiversity of site
- ☒ Reuse redundant structures and adapt existing landscapes for new uses
- ☒ Design for socially inclusive community and neighbourhood safety
- ☒ Plan compact development to optimize land development potential
- ☒ Cater for wide spectrum of users and communities
- ☒ Site buildings to minimize energy use
- ☒ Ensure site is part of green and blue infrastructure
- ☒ Develop design rooted in local context
- ☒ Encourage local use through ease of access
- ☐ Design networks for walking and cycling and permeable space
- ☒ Ensure connections to public transport
- ☒ Respond to the ecology of the place
- ☒ Design social gathering spaces and active frontages
- ☐ Integrate overall vision with detail design
- ☒ Engage local community/stakeholders
- ☒ Enhance biodiversity
- ☒ Incorporate productive landscapes
- ☒ Create unique, comprehensible and memorable places
- ☐ Plan for the inclusion of public art
- ☒ Encourage local business opportunities
- ☒ Design for multiuse and range of uses
- ☒ Sustain landscape from economic and social perspectives
- ☒ Design for health of all ages
- ☒ Connect people to places/destinations
- ☒ Include information and interpretative facilities
- ☒ Provide amenities for diverse range of users
- ☒ Provide for flexible space for future change of uses
- ☒ Provide shelter and shade with large trees

ECOLOGICAL SITE DESIGN

☒ Generate green energy on-site

☒ Use indigenous and/or non-invasive plant species

☒ Use ecosystem services and enhance site ecology

❑ Minimise night light pollution

☒ Incorporate homes for wildlife

☒ Extend local plant communities

☒ Balance cut and fill of soil on-site

☒ Minimise floodplain development

☒ Use water-sensitive urban design

☒ Maximize water retention on-site

☒ Restore and create wetlands

☒ Reduce impervious surfaces

☒ Take measures to reduce air pollution

GREEN TECHNOLOGIES

☒ Use recycled materials

☒ Green structures/buildings

☒ Use timber from sustainable sources

☒ Use durable products

❑ Minimize mowing/use of machinery

☒ Use organic compost, fertilizers and mulches

☒ Decompose waste on-site

☒ Use phytoremediation on contaminated sites

☒ Use porous paving

☒ Procure local construction products

LANDSCAPE MANAGEMENT

☒ Facilitate education for sustainability

☒ Establish a landscape management plan

☒ Incorporate site nursery and composting

☒ Ecological monitoring to inform change

☒ Ongoing design and conservation

☒ Minimize use of pest/herbicides

☒ Site-based maintenance/park manager

This guide/checklist was developed initially with particular reference to the Sustainable Sites Initiative developed by the Lady Bird Johnson Wildflower Center / American Society of Landscape Architects in 2007.

List provided courtesy of Chris Royffe, Leeds Metropolitan University

ECOLOGICAL SITE DESIGN

Creating an ecologically rich development was at the heart of the design proposal, Skelton Gate is already home to an abundance of wildlife and vegetation that needs to be retained and enhanced during any development. The development aims to create a productive landscape while providing ecological enhancement, conservation within communities and natural highway mitigation measures that will equally benefit humans and wildlife. Green energy is considered across the site, especially within the low-impact sustainable housing areas and production buildings to mitigate the effects of climate change. There is a significant increase of tree planting and production planting on site, which in turn will reduce noise and air pollution created by the M1 motorway which dominate the north of the site.

GREEN TECHNOLOGIES

Green technologies have been conisdered across the site - the low-impact sustainable housing using only eco-friendly recycled materials, green roofs & rooftop farming. Sustainable technologies within urban agriculture are at the forefront of the proposal, aiming to create a sustainable community urban farm on the outskirts of Leeds - specifically aiming for food production areas to use new green technologies to achieve a sustainable harvest output.

LANDSCAPE MANAGEMENT

Landscape management is essential to any successful design scheme, with food production being at the forefront of the design - it is key that specialists, workers, volunteers are all on hand to maintain the landscape. The conservation community area aims to encourage residents to 'look after' their surroundings, respecting the ecological and productive landscape. The masterplan is made up of zones , these include an ecological enhancement zone, education/visitor centre which provides information and allows schools to experiment with urban food growing, conservation communities which manage ongoing design and conservation, and minimal use of pesticides on the food production sites.

DESIGN

Analysis

SOCIAL BENEFITS

- A multifunction space provides different uses for different audiences, creating a dynamic and unique place to visit for all ages
- Volunteering & Job opportunities for residents and surrounding communities
- An aesthetically pleasing place to live and visit - providing a diverse number of zones to meet the needs of a wider audience.
- Conservation communities offer opportunities to meet new people and be part of a low impact and sustainable way of life
- Improved quality of life for residents
- Local food scarcity relief
-

ECONOMIC BENEFITS

- A productive landscape with a successful harvesting output can economically benefit the community and bring more money into the region.
- Various local employment opportunities within the education centre, visitor centre, food production sites, services, and ecological preservation.
- Increased popularity of the site will attract more visitors
- Low-impact & eco-friendly alternatives
- The sense of community with conservation communities can add value to property and land.

ENVIRONMENTAL BENEFITS

- Ecological enhancements will improve and introduce new biodiversity and vegetation
- Productive landscape create 'green islands in a sea of concrete masses'
- Reducing the impact of the heat island effect
- Urban farming helps to conserve water, and re-routing it to underground water channels
- Conservation
- Protecting and enhancing wildlife and planting on site
- Designing for both humans and wildlife, meeting the needs of both parties.

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