CLARION
HOUSING

Circular Economy Strategy

mertonregen.org.uk

Explaining Circular Economy

What does circular economy involve?

Keeping materials and resources in use for longer

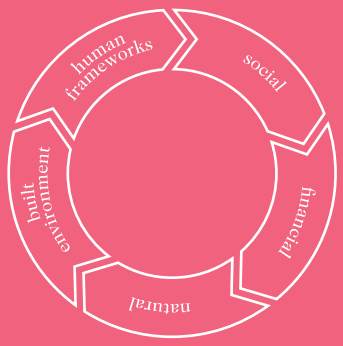
Through process improvements

New business models

Redesign of products and services

Requires a systems thinking partnership approach

Considers the social, financial, natural, built environment and human frameworks



Three fundamental principles

These principles are delivered through 12 key interventions that aim to:

- reduce waste generation
- maximise social value creation
- generate economic return on investment

The interventions span across all building life-cycle stages: product manufacture, construction, in-use and end-of-life.

...how it works and the potential business benefits

Strategy emerged through:

Extensive literature review

Engagement with Regeneration Team

Research into industry best practice

Successful implementation requires input from all project parties

Benefits:

£5,000,000 cost savings in waste disposal and materials purchase

16,500 fewer HGV movements

7,760 tonnes of CO_2 e savings

Avoid use of 122,000 tonnes of new materials

Contents

1 Executive Summary

1. Executive Summary

The circular economy aims to keep materials and resources in use for longer through the establishment of process improvements, new business models and redesign of products and services. The successful implementation of the circular economy requires a systems-thinking approach which considers the social, financial, natural, built environment and human frameworks in which business operates.

Our Circular Economy Strategy for regeneration established three fundamental principles: building in layers, social value and the waste hierarchy, which emerged following extensive literature review, research into industry best practice and engagement with Clarion and the Merton Regeneration Project teams.

1. Building in layers is the concept of designing adaptable and flexible buildings by considering the intended lifespan of each independent building layer, optimising building longevity and maximising material reclamation at end-of-life.

2. Social value is a critical element for client and local stakeholder-led initiatives which intend to reduce waste, strengthen community networks, create a sense of ownership for residents and promote a sharing economy.

3. The waste hierarchy is a set of philosophies for managing waste, ordered by environmental preference. It supports activities which eliminate and reduce waste prior to considering conventional waste management opportunities such as recycling. Energy recovery and disposal to landfill fall at the bottom of the hierarchy and should be avoided.

The building life cycle stages: product manufacture, construction, in-use including maintenance and refurbishment, and end-of-life, have been evaluated through the lens of the three fundamental principles. This has led to the determination of 12 key interventions which aim to reduce waste generation and materials consumption at all stages of the building life-cycle, while maximising social value creation and economic return on investment (Table 1).

The interventions have been mapped across the building life-cycle stages. The interdependencies between the interventions identified allow project teams to select a range of interventions to suit the scale of the project, while ensuring positive contributions are realised through the project life-cycle.

One or more interventions can be selected depending on the project team's knowledge of the Circular Economy. The implementation of selected interventions early in a project program and sharing of lessons learned across programmes will help to build capacity and confidence in the Circular Economy.

Table 1 Three fundamental circular economy principles and associated key interventions

Building in layers	Social value	Waste hierarchy
Designing out waste	Community led design	Demolition for maximum recovery value
Develop standardisation strategy including off-site/ modular components	Connect with existing community re-use networks	Specify high recycled content in products
Ensure buildings are easy to maintain and adapt	Develop a Meanwhile Strategy for under-utilised space	Supply chain integration
	Promote the sharing economy	Excellence in construction waste management
	Supporting household and community recycling	

Successful implementation of the Circular Economy Strategy will occur over time, through continuous learning and improvement. It requires input from all project parties including: Clarion Housing, Project Manager, Design Team, Procurement Team, Principle Contractor, Demolition Contractor and relevant External Stakeholders. Each of the parties are clearly assigned roles and responsibilities within the established 12 interventions.

The implementation of many of the interventions identified will be supported through a comprehensive approach to BIM. This Circular Economy Strategy operates as a stand-alone strategy but reference should be made to Clarion Housing BIM protocols.

Based on initial assessment of the 202,000m^2 gross internal floor area (GIFA) Merton Regeneration Project the scale of benefits that may be realised through comprehensive implementation of the Circular Economy Strategy are significant. For the demolition and construction phase benefits could include:

- £5,000,000 cost savings in waste disposal and materials purchase;
- 16,500 fewer HGV movements;
- 7,760 tonnes CO_2 e saving, equivalent to the annual operation of approximately 2,000 homes; and
- 122,000 tonnes of virgin material use avoided.

2 What is Circular Economy?

2. What is Circular Economy?

The circular economy intends to maximise the value of material resources at the end of their first useful life. Waste can be reduced at each step of the value chain by the establishment of process improvements, new business models and redesign of products and services.

The successful implementation of the circular economy requires a systems-thinking approach which considers the social, financial, natural, built environment and human frameworks in which businesses operate. This approach allows businesses to make informed choices and maximise the benefits of any investment or intervention.

Implementation of the Circular Economy Strategy will need to start early within the project programme. It can however be tackled in gradual phases to support practical learning and a continuous improvement cycle. Beginning with modest implementation measures and supporting inter-project analysis will enable a systematic approach to the Circular Economy and encourage the development of a Circular Economy culture across Clarion Housing and their project partners.

Clarion Housing has embarked on a journey to develop a practical interpretation of the circular economy in its vision for the Merton Regeneration Project (MRP). The approach is captured within this strategy.

The Circular Economy Strategy establishes three fundamental principles and then goes on to interpret these principles through the building life-cycle to define 12 key interventions with clearly assigned roles and responsibilities.

2.1. Fundamental Principles

Three fundamental principles; building in layers, social value and the waste hierarchy, are established as the vital components. The principles emerged following an extensive literature review, research in to industry best practice, and engagement with the MRP project team and the wider Clarion Housing including Clarion Futures.

2.1.1. Building in layers

Building in layers is the core concept of creating adaptable and flexible buildings. This principle considers the intended lifespan of each building "Layer" – site, structure, skin, services, space plan, stuff (Figure 1). By designing each layer to be as independent as possible, different layers can be refurbished, upgraded or replaced as required without damaging the adjacent layers. This helps create buildings that are simpler to maintain, flex or adapt, and it allows the components to be more readily reclaimed at end-of-life.

By respecting the inherent long-life of the structure and understanding the short, high maintenance/replacement cycles of the services, space plan and stuff, a building can be designed to optimise building, component and material longevity and flexibility.

This approach offers significant benefits to Clarion Housing as the developer and long-term asset owner of multiple new buildings, the retained value of materials and elements within the buildings is maximised and ease of maintenance improved. It also offers significant benefits to homeowners and tenants as it enables maintenance to be undertaken with minimal disruption, allows future upgrade of building services to ensure buildings are as efficient as possible and supports adaptation of the internal layout to meet changing homeowner needs.

Figure 1 Building in layers

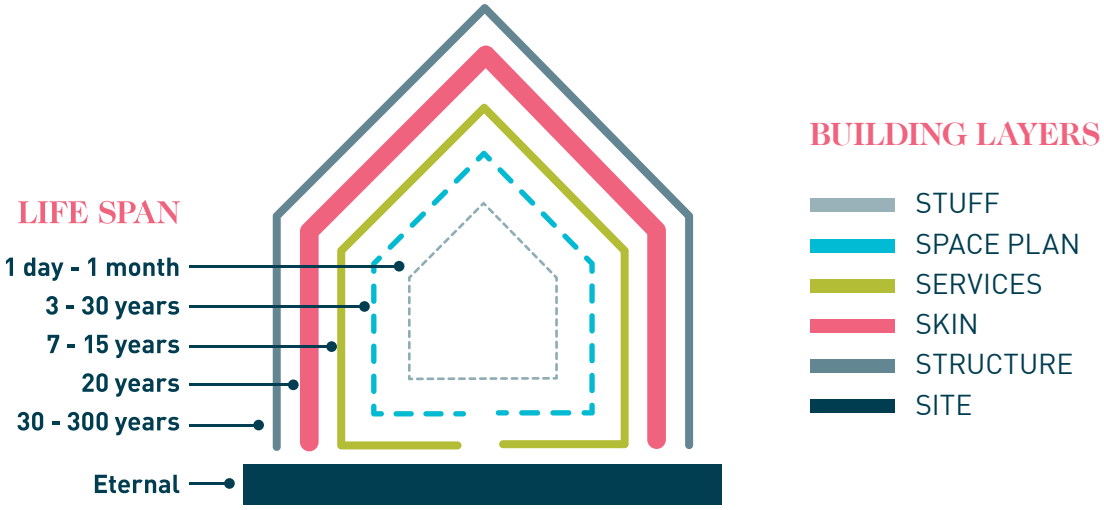
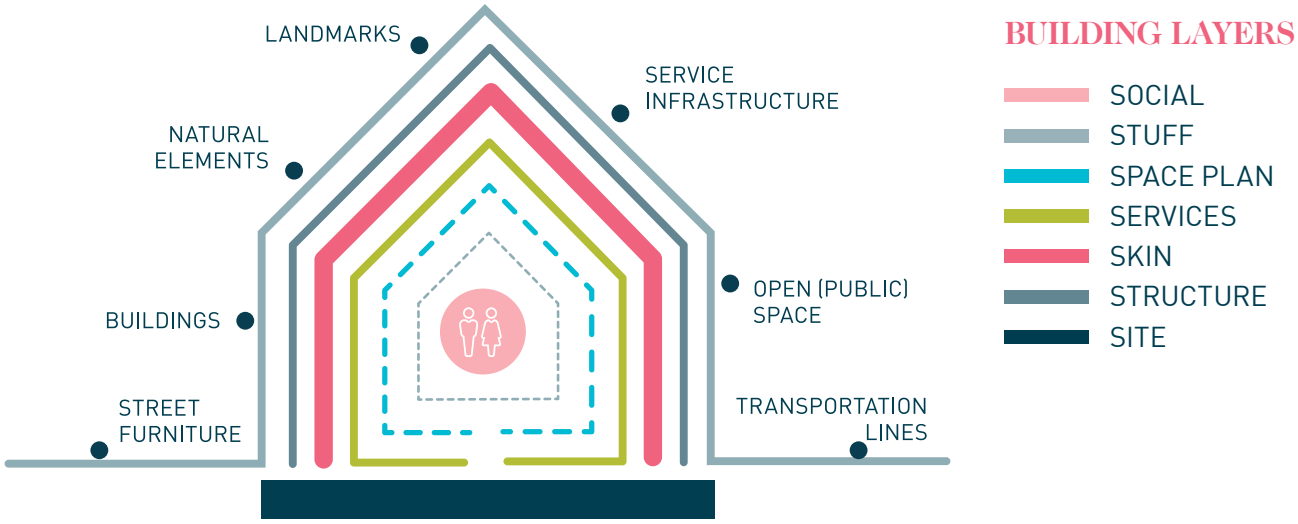


Figure 2 Adapted building in layers



2.1.2. Social value

As the country's largest housing association, Clarion Housing is in a unique position to create the opportunity to change people's lives. The work of Clarion Futures and local stakeholder liaisons is a critical element to maximise the social value.

Pro-active engagement with existing and new residents, businesses and community groups helps to ensure that new homes and spaces respond to community needs and creates a sense of ownership. In turn, this will minimise short term remodelling of homes and the associated waste, reduce the risk of anti-social behaviour (and potential damage of built assets), and maximise the sale value of private homes.

In addition, repurposing salvaged building materials can strengthen community networks. This is achieved by donating the salvaged material to local groups such as drama groups requiring materials for sets, micro-enterprises in the form of repair shops and up-cycling artisans, and supply of materials to local construction training colleges.

The integration of salvaged materials into new designs can also provide a historic connection for the existing community, a critical element of place-making.

People and community are at the heart of this Circular Economy Strategy, resulting in a modified approach to 'building in layers' (Figure 2).

This concept also adds a 'Surroundings' layer to the building which highlights the importance of the surroundings in reducing waste and promoting the sharing economy. For example, public transportation and pedestrian connectivity is a key factor in reducing car ownership (a private car, on average is only in use for 5% of the time, the other 95% of the time the value of this asset is 'wasted'). In addition, Wi-Fi-connected service infrastructure can help people reduce energy consumption in their homes.

2.1.3. The waste hierarchy

The construction industry is responsible for some 120 million tonnes of construction, demolition and excavation waste every year – around one third of all waste arising in the UK. An estimated 25 million tonnes of this waste ends up in landfill without any form of recovery or reuse.

The waste hierarchy is a set of actions for managing waste, ordered in preference of what is best for the environment. The most preferable option is 'prevention', at the top of the hierarchy and the least preferable 'disposal' at the bottom.

Figure 3 represents an interpretation of the conventional waste hierarchy, with recycling split in to three main tiers, and sub-tiers promoting on-site preparation and use of materials as opposed to off-site.

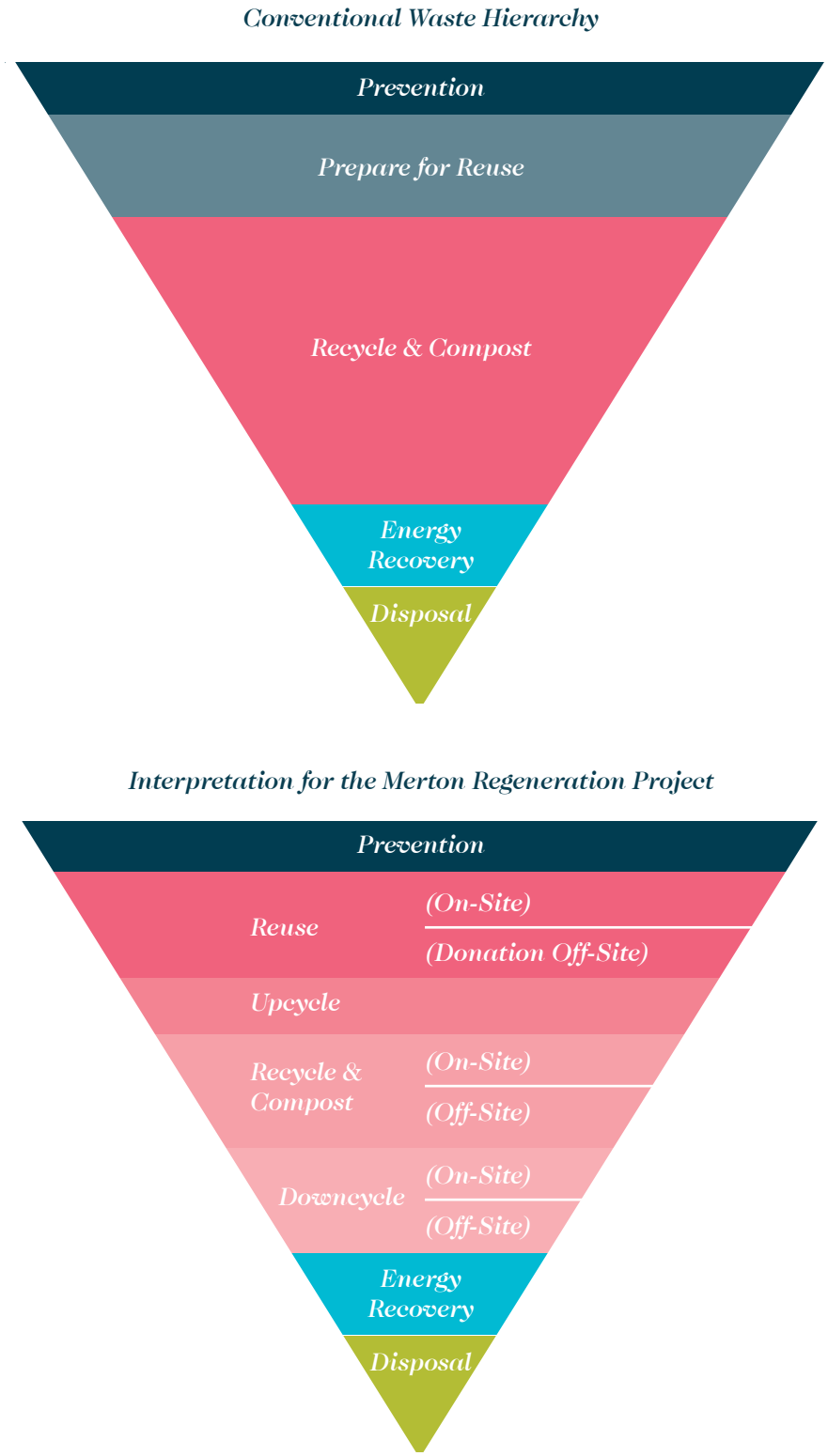
Upcycling represents the process of taking salvaged material and repurposing it to make something of greater value. Recycling retains the value of a material by reprocessing it to be used in the same function. Downcycling represents the process where the material's value is degraded through the recycling process.

There are many examples of downcycling in the current waste management industry: concrete crushed to create engineered fills, plasterboard shredded for use as animal bedding and glass crushed to create bedding sand for paving, while there are few examples of genuine recycling.

A distinction is made between off-site and on-site waste management. On-site reuse/recycling has several benefits over off-site which may include; reduced HGV movements on local community roads, reduction in construction cost (although demolition costs may increase to deliver good quality salvaged and recycled materials), and creation of a sense of place and community ownership.

Incorporating the waste hierarchy in a Site Waste Management Plan (SWMP) is mandatory as per the Estate Local Plan Policy EP E6 (item J). However, SWMPs are generally created by the contractor, when the most significant opportunities to prevent waste have already passed and tends to focus on the bottom tiers of the waste hierarchy. The intention to start the process of waste prevention with the design teams and incorporate information from Estate Management teams to maximise the benefits associated with materially-efficient design.

Figure 3: Waste hierarchy interpretation for the Merton Regeneration Project



3 Overview of Circular Economy Approach

3. Overview of Circular Economy Approach

In the conventional building life-cycle waste is generated, processed and disposed of at each stage of the building life-cycle[1] (Figure 4). This waste represents significant loss of economic and social value, while significantly increasing environmental degradation.

The building life-cycle stages have been evaluated through the lens of the three fundamental Clarion circular economy principles discussed in section 2.1. This evaluation has led to the determination of 12 key interventions that aim to reduce waste generation and materials consumption at all stages of the building life-cycle, while maximising social value creation and economic return on investment (section 5).

The 12 key interventions are:

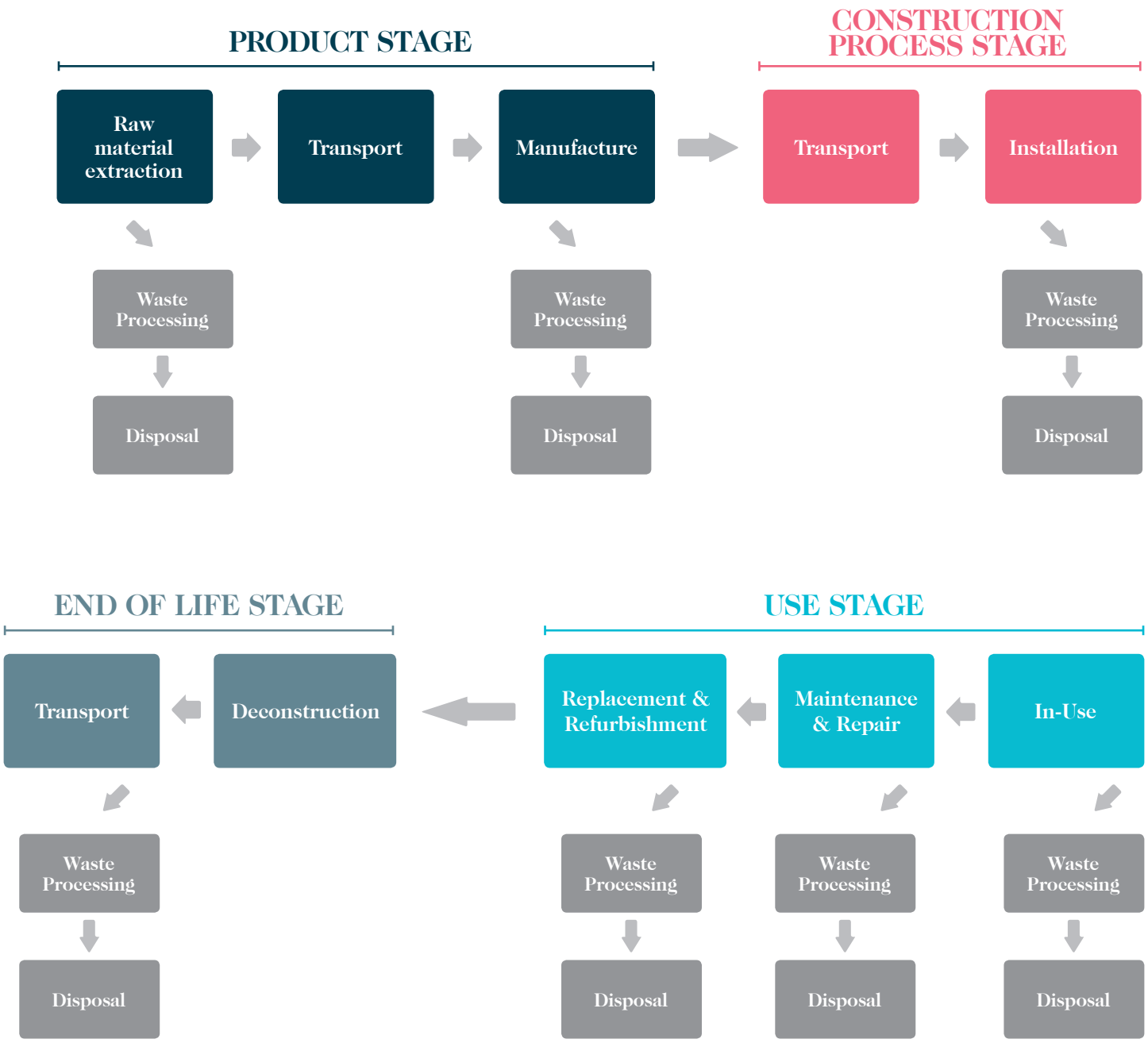
1. Demolition for maximum recovery value
2. Develop Meanwhile Strategy for under-utilised space
3. Design out waste
4. Specify high recycled content in products
5. Develop standardisation strategy including off-site/modular components
6. Supply chain integration
7. Excellence in construction waste management
8. Connect with existing community reuse network
9. Promote a sharing economy
10. Supporting community and household recycling
11. Community led design
12. Ensure buildings are easy to maintain and adapt

Figure 5 overlays the 12 interventions on to the building life-cycle to indicate at which life-cycle stage the specific intervention will have the most impact. It should be noted that it is not an indication of when the intervention should be considered by the project team. All the interventions need to be considered at the earliest stage of project planning to ensure successful implementation.

Figure 5 also indicates how the interventions interact with the three overarching principles of building in layers, social value and the waste hierarchy. This has necessarily been simplified as many of the interventions positively contribute to more than one of the overarching principles.

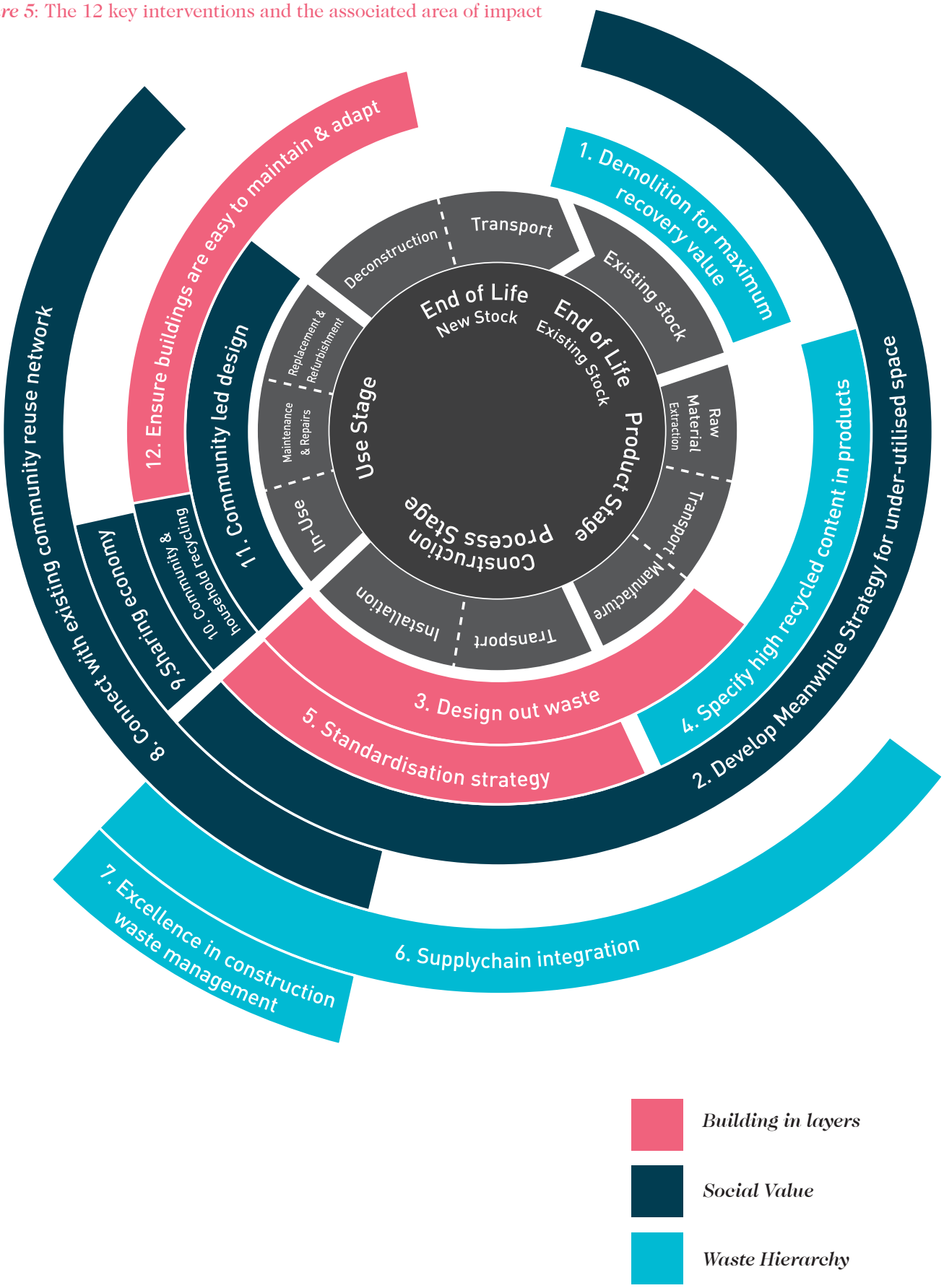
1 Building life-cycle stages as defined in BS EN 15978:2011, Sustainability of Construction Works, British Standards Institution

Figure 4: Conventional building life-cycle



The following sections offer an overview of the critical aspects of applying the Circular Economy Strategy at each life-cycle stage. Details of the proposed key interventions, including responsible parties, are discussed in detail in section 4.

Figure 5: The 12 key interventions and the associated area of impact



3.1. End of Life - Existing Stock

Early identification of materials for potential reuse, refurbishment or recycling through pre-demolition audits helps to maximise the value of materials recovered from the demolition process and minimise the transportation of waste for offsite processing or disposal. Although the demolition process may require more time and planning, financial benefits in the form of reduced waste disposal costs and generation of materials for future construction works should be realised. In addition, minimising the number of HGV movements associated with off-site waste disposal and subsequent material import delivers quantifiable, socio-economic benefits.

Space for storage of salvaged materials and for on-site recycling is a common issue on inner city sites and needs to be considered from the outset of the project planning process. Clarion Housing is currently engaging with London Waste and Recycling Board (LWARB) to discuss potential solutions to this issue for the Merton Regeneration Project.

3.2. Product Stage

The construction industry is the UK's largest consumer of natural resources. Waste and Resources Action Programme (WRAP) estimate the industry uses over 400 million tonnes of materials per year. The processing and transportation of raw materials to supply these useful building materials represents 8% of the total greenhouse gas emissions in the UK.

Sustainable design initiatives that reduce the total quantity of materials required, maximise recycled content and promote the use of sustainably sourced renewable materials such as timber, can significantly reduce the primary resource consumption associated with the product stage.

Design parameters can often be established to reduce material off-cuts and waste while many suppliers have already invested in incorporating recycled materials in to their products as it makes business sense. It is therefore often only a matter of ensuring sustainability credentials form part of the design parameters and product selection process.

3.3. Construction Process Stage

WRAP indicate that a standard 6-yard waste skip costs a construction project over £1,500 in terms of materials purchased and not used, labour to fill the skip and waste disposal costs. WRAP also state that packaging accounts for approximately 34% of construction site waste by volume and 60% of pallets on construction sites are disposed of as waste.

Waste reduction on site starts with efficient design but is also heavily influenced by contractor purchasing and behaviour, off-site pre-fabrication, standardisation initiatives and reusable packaging solutions. The impact of the waste produced can be reduced by targeting salvage and community reuse for items such as good quality timber as well as investing in good site segregation to produce clean waste streams for recycling.

The construction process also offers great opportunities for local residents to secure training and employment, ensuring that this valuable human resource is not 'wasted'. Donation of excess construction materials to local training colleges can be a very successful way of engaging with potential future employees, while collaboration on school projects can help to introduce STEM (Science, Technology, Engineering and Maths) subjects to younger children. The implementation of circular economy at the construction stage is therefore closely linked to the work undertaken by Clarion Futures and social value creation.

3.4. Use Stage (In-use)

The New London Plan aims to increase municipal waste recycling rates to 65% by 2030 and have zero biodegradable waste to landfill by 2026. Many local authorities have similarly ambitious waste targets due to increasing constraints on landfill space.

Adequate space for storage of segregated materials that responds to the waste collection strategy agreed with the local council, both within homes and at community collection points, is a critical aspect to ensuring high community recycling rates.

Another key element of waste reduction in use is the promotion of the sharing economy with successful initiatives such as car-sharing and The Library of Things delivering social value and reducing consumerism. The provision of low-cost workshop space for up-cycling initiatives and running basic repair workshops with residents can also be positive ways of adding value to the community while reducing waste.

Regeneration Managers, Estate Services and Clarion Futures will play an important role in the promotion of low waste living through basic education and advice for residents. The short-term benefits of reduction in waste disposal costs may be amplified by the investment in small community-led businesses and programmes that work within the circular economy principles.

3.5. Use Stage (maintenance, repair, replacement, refurbishment)

Community-led design can help reduce short term refurbishment waste as new tenants and home owners are engaged in the layout and specification of their new home and community space. On the Merton Regeneration Project purchasing agreements are explored with major suppliers of fit-out products, such as kitchens and paints, to determine how many options can economically be offered to future tenants and homeowners.

In addition, by following the building in layers principle and involving maintenance staff in early design discussions, in use waste is significantly reduced as elements requiring regular maintenance or replacement before the end of the building life can be designed to be accessible without incurring damage to surrounding materials. This in turn should reduce maintenance costs and minimise disruption to residents.

3.6. End-Of-Life – New Stock

The building in layers principle, combined with design tools such as Building Information Modelling (BIM), allow design and contractor teams to prepare a detailed deconstruction statement which highlights how a building can be deconstructed to maximise the end-of-life value of the building components and materials.

Many building elements have a useful life beyond that of the building itself including structural steel, stone and bricks. Approaching the design of new buildings with an eye on what happens at the end of the building's useful life enables thinking of their new buildings as ‘material banks’; a place where components are ‘stored’ prior to being used on a future project.

4 Key Interventions for Circular Economy Implementation

4. Key Interventions for Circular Economy Implementation

Table 2 summarises the 12 key circular economy interventions that have been identified and classifies the party with principal responsibility for implementing the interventions. Successful implementation will require secondary support from other parties as identified.

Table 2: The 12 key circular economy interventions and responsible parties

	Clarion Corporate	Project Managers	Design Team	Clarion Procurement	Principal Contractor	Demolition Contractor	Clarion Operation & Maintenance	External Parties
Demolition for maximum recovery value	Support		Support	Support		Principal		Support
Develop Meanwhile Strategy for under-utilised space	Principal	Support	Support					Support
Design out waste		Support	Principal					
Specify high recycled content in products			Support		Principal			
Develop standardisation strategy including off-site/ modular components	Principal	Support	Principal		Support		Support	
Supply chain integration	Support	Support	Support		Principal		Support	
Excellence in construction waste management		Support		Support	Principal			
Connect with existing community reuse network	Principal	Support			Support	Support		Support
Promote a sharing economy	Principal							Support
Supporting community and household recycling	Principal		Support				Support	Support
Community led design	Principal		Principal					Support
Ensure buildings are easy to maintain and adapt			Principal		Support		Support	

The tables in sections 4.1 to 4.12 expand on each intervention, highlighting the opportunities and challenges and detailing the process for implementation.

Applying all interventions to a project will maximise the social return on investment and environmental benefits for the project. However, it is recognised that this may not be feasible for every project. Some of the interventions can be undertaken relatively independently while others have a level of co-dependency and will be difficult to implement as stand-alone opportunities. Figure 6 illustrates the co-dependencies and should be referred to when selecting the interventions which will be pursued on any given project. Figure 5 should be used to inform the selection of interventions to ensure that the project is able to respond to the three key principles of the Circular Economy Strategy and demonstrate impact across the full building life-cycle.

Figure 6: Co-dependencies of the 12 key interventions

4.1. Demolition for maximum recovery value

Responsible Parties	**Principle:** Merton Regeneration Project team, Demolition Contractor **Support:** Clarion Housing Group, Design Team, Procurement Team, External Parties
Purpose	To maximise the value and quantity of materials recovered for potential reuse and recycling during demolition.
Opportunities	• Targeted segregation improves the quality of demolition materials and maximises potential for material reuse and on-site recycling, offering following on project savings and reducing waste disposal costs. • Well-segregated materials are more likely to be recycled by off-site Materials Recovery Facilities rather than incinerated or sent to landfill. • Reuse of site components in the new build helps to create a historic connection and a sense of place for rehoused and new Clarion Housing residents. Material segregation, storage and use can be incorporated as part of a Meanwhile use which activates under-utilised space during the construction programme. • Salvaged materials can be donated to local businesses, construction colleges and community groups; this creates social value and a network of construction works within the local community.
Challenges	• Engaging architects in the identification, specification and reuse of salvaged materials. • Deconstructing buildings rather than demolishing requires more time, space (for an increased number of segregated skips) and commitment from the demolition contractor, possibly increasing the cost of demolition (although subsequent savings may be realised in construction phases). • Safe storage space for salvaged materials, particularly where materials are intended for use in future construction phases. • Additional resources required to brief contractors and monitor demolition works. • Quantity of materials recovered may differ significantly from pre-demolition estimates. • On-site reprocessing of concrete and other inert materials requires a crushing license and technical expertise. On-site reprocessing may create a dust nuisance if not carefully managed.
Implementation	• Undertake a site survey at Stage 1 with the design team to identify potential materials for salvage or on-site recycling and use. • Identify potential sites for safe storage and on-site reprocessing of salvaged demolition materials. • Instruct the demolition contractor to undertake a pre-demolition audit to accurately quantify waste streams and prepare a deconstruction statement which details how the buildings will be deconstructed to maximise the value of waste material resources. The deconstruction statement should detail the onward reuse, recycling or disposal routes for all waste streams, with the associated tonnage. Preference should be given to local recycling and recovery facilities that have been audited for legal compliance. • As a minimum, demolition contractors should endeavour to salvage natural stone, bricks, good quality items of furniture, timber and top soil. Plasterboard, carpets, vinyl flooring, concrete, asphalt and mixed masonry should all be carefully segregated to maximise recycling potential. • Example wording for demolition contracts was developed for the Merton Regeneration Project and is included in Appendix A for reference. • Request monthly reports from demolition contractors stating progress against the suggested KPIs below. • Refer also to Intervention 8: Connect with existing reuse networks, Section 4.8.
Suggested KPIs	• Divert a minimum of 90% of waste, by mass, from landfill (excluding hazardous materials). • Establish a target for the salvage and local reuse of materials. • No biodegradable or recyclable waste sent to landfill.
Benefits	• Reduction of negative environmental effects associated with disposal in landfill such as emissions of methane and other gases, pollution of groundwater, surface water and soil. • Reduction in the number of HGV movements on local roads. • Reduction in the cost of waste disposal (although this may be off-set by increased fees associated with the additional time required for deconstruction of buildings). • Reduction in the required quantity and associated cost of construction materials. • Opportunity to connect to the local community and create a positive relationship with the demolition / construction works. • Supports the GLA's New London Plan targets of ensuring that zero biodegradable or recyclable waste goes to landfill by 2020. Other planning authorities are likely to adopt similar standards.

4.2. Develop Meanwhile Strategy to include storage and use of salvaged materials

Responsible Parties	**Principle:** Merton Regeneration Project team **Support:** Project Managers, Design Team, External Parties
Purpose	To activate under-utilised space during the construction programme to deter anti-social behaviour and provide community facilities and business opportunities. Site-salvaged demolition and construction materials should be included in the construction of the Meanwhile site as well as potential programmes such as upcycling workshops.
Opportunities	• Beneficial reuse of demolition and construction waste materials. • Early provision of community facilities to maintain and develop community spirit through the duration of the works. • Test-bed for circular economy enterprises such as upcycling workshops and a Library of Things (refer to Intervention 9: Promote a sharing economy, Section 4.9) with the potential to allocate successful enterprises permanent space. • Potential to engage local schools in horticulture programmes that provide trees, plants and skills for construction and operational phases of the project. Programme collaborators may include Sustainable Merton, school groups or Friends of Ravensbury.
Challenges	• Identification of potential sites for Meanwhile uses - ideally sites should be available for a minimum of two years to allow enterprises and community networks to establish. • Certification for use of salvaged material (dependant on proposed use of salvaged materials). • Coordination and funding for community enterprises and management of the Meanwhile space.
Implementation	• Identify potential locations for a Meanwhile site, ensure there is sufficient space within the Meanwhile site to accommodate storage of site-salvaged demolition materials ear-marked for installation in the new construction works, as well as other community-led activities. • Engage with local community members to determine level of interest and any specific need that could be fulfilled by a Meanwhile site. • Identify existing local social enterprises to partner with, or develop an independent social enterprise, or engage Clarion Futures to manage the Meanwhile site. • Engage design teams, contractors and supply chain partners in supporting the Meanwhile site through volunteer skills or labour, or donation of waste materials. • Refer also to Intervention 8: Connect to existing reuse networks, Section 4.8.
Suggested KPIs	• Number of regular users of the Meanwhile site. • Number of viable circular economy enterprises created through the Meanwhile site.
Benefits	• Community engagement including resident participation in programmes and activities related to the project. • Increasing the value of land and assets by supporting Meanwhile businesses and activities. • Reduced security costs due to the activation of under-utilised space.

4.3. Designing out waste

Responsible Parties	**Principle:** Design Team **Support:** Project Managers
Purpose	To encourage efficient use of materials by applying lean design principles, using reclaimed materials and components, and substituting high replacement cycle materials with more robust materials.
Opportunities	• Reduced risk of construction programme delays and cost due to rework associated with clashes. • Efficient materials procurement and reduced waste management costs by designing for standard product dimensions. • Reduced maintenance cost by improving robustness of elements that historically required regular replacement. • Increased long-term economic value of the built asset by considering how apartments and homes can be adapted to meet changing family needs. • Extended productive life of high embodied carbon and expensive built elements such as the structure and foundation.
Challenges	• Additional design fees may be requested to support effective communication and engagement across the project team from the earliest design stages. • Designers rarely consider cutting patterns for elements such as plasterboard when locating windows and doors.

Implementation	• At Stage 1/2 the Designers should hold a designing-out waste workshop to:
	  • Develop design proposals responding to the existing site topography to minimise cut and fill.
	  • Review the existing site to identify potential materials that may be salvaged and incorporated into the design including materials from earlier demolition phases.
	  • Evaluate structural frame solutions for efficiency and future flexibility, including configuration of apartments and houses and the potential placement of non-structural walls to allow home- owners to adapt their spaces as their needs change.
	  • Avoid dictating the use of external space as far as reasonably practical and demonstrate how open public space can be configured to support a range of different community uses.
	  • Evaluate the potential for modularisation and product standardisation (refer to Intervention 5: Develop standardisation strategy including off-site/modular components, Section 4.5).
	  • Work with the Clarion Operation and Maintenance teams to determine items with high replacement cycles and evaluate more robust alternatives.
	  • Record actions taken to design out waste.
	• At Stage 3/4 the Designers should hold a second workshop to:
	  • Develop the ideas of future flexibility further, demonstrating how apartments could be reconfigured to support a growing family, or an aging couple.
	  • Consider how floor to ceiling heights and door locations work within standard dimension for key building products such as plasterboard, timber stud, wall and floor tiles to minimise offcuts and waste.
	  • Evaluate the use of self-finished materials such as timber, architectural concrete and brick to minimise the extent of finishing and wet trades required on site.
	  • Consider how the building could be deconstructed in future to allow beneficial in-situ reuse of long life-span items such as the foundation and frame of a building and maximise salvage and recyclability of other building components.
	  • Provide a designing out waste statement including a refurbishment and deconstruction statement within the Stage 3 design report to demonstrate how principles have been incorporated.
	• Communicate design initiatives to reduce waste to the contractor and supply chain to promote more efficient procurement.
	• Example wording for design team contracts was developed for the Merton Regeneration Project and is included in Appendix A for reference.
	• BIM may be a useful tool in designing out waste and quantifying the benefits of design initiatives.

Suggested KPIs	• Provide a designing out waste statement that quantifies waste reduction initiatives and sets a target of tonnes of waste generated per 100m2 of Gross Internal Floor Area (GIFA).
Benefits	• Reduced demand for materials, which can translate in to lower procurement costs if the contractor and supply chain pro-actively engage with initiatives. • Less wastage on site reducing waste handling and disposal costs.

4.4. Specify high recycled content in products

Responsible Parties	**Principle:** Principle Contractor **Support:** Design team
Purpose	To create a demand side driver for the increased recycling of materials and the investment in new recycling procedures by product manufacturers.
Opportunities	• Numerous mainstream products are available with high recycled content at no additional cost. • Engagement with supply chain initiatives such as Interface's ReEntry programme demonstrates a clear market demand for recycled products. • Products made from rapidly renewable materials such as bamboo, straw and cork can provide a viable alternative to mainstream products and can contribute to biophilic design initiatives. • Creation of a network of preferred suppliers and key product manufacturers who may be interested in creating future take-back schemes for products that are removed during refurbishment.
Challenges	• There may be a perception that materials with high recycled content are of inferior quality. However, all building materials must meet the same technical standards and testing regimes and therefore perform equally. • The design team may not be aware of products with increased recycled content, nor be familiar with including requirements in specifications, therefore additional sustainability workshops may be needed to engage the design team. • Even when requirements are included in specification, or products are selected with increased recycled content, requirements can sometimes get lost in the contractor procurement procedures, for example when requirements are not explicitly communicated to sub-contractors. Additional quality control procedures that include sustainability requirements may have to be introduced to engage the contractor and their supply chain.

Implementation	• The desire to increase the recycled content of materials and products used on projects must be communicated in an initial project kick-off sustainability workshop.
	• Detail recycled materials within design proposals and reports. As a minimum, designers should review the following opportunities:
	  • Engineered fill (up to 100% recycled content)
	  • Concrete (at least 7% recycled content, and/or 40% cement replacement)
	  • Blockwork and concrete paving (at least 50% recycled content)
	  • Insulation (at least 50% recycled content)
	  • Plasterboard (at least 95% recycled content)
	  • Carpet tiles (at least 50% recycled content)
	  • Asphalt roads (at least 40% recycled content)
	• Design teams may wish to use WRAPs on-line Net Waste Tool to baseline project performance and identify opportunities for increasing recycled content.
	• Include specific reference to minimum recycled content in key specifications.
	• Include requirements in contractor and design team contracts (refer to Appendix A for example contract clauses).
	• Implement monitoring and reporting procedures to ensure opportunities are realised by contractors and their supply chain partners.

Suggested KPIs	• Minimum 15% recycled content by total material mass. • Minimum recycled content achieved for 5 key products (refer to Implementation section for examples).
Benefits	• Increased recycled content is often available in mainstream products by large suppliers and does not incur a cost premium, but it does require project team awareness to ensure the correct products are selected. • Natural and recycled material use fewer raw resources and the production process often produces less pollution and waste.

4.5. Develop standardisation strategy including off-site/modular components

Responsible Parties	**Principle:** Merton Regeneration Project team, Design team, **Support:** Project Managers, Principle Contractors
Purpose	To promote standardisation of key elements across projects, which supports efficient product procurement, installation and maintenance. To realise the benefits from off-site modular construction such as shorter construction programmes, less waste and reduced community disturbance.
Opportunities	• Standardisation of key components such as windows and MEP equipment and lighting will simplify maintenance, part repair and replacement for the Clarion operations, asset management and maintenance team. • Modularisation covers a range of building elements. Elements such as pre-fabricated risers are becoming relatively commonplace whilst elements such as bathroom pods and complete housing solutions are slowly gaining traction within the housing industry. • Development of sites with access limitations and/or unclear long-term plans (such as those adjacent to infrastructure hubs that may be subject to future expansion) could benefit from modularisation to allow easy installation and potential deconstruction and relocation.
Challenges	• Standardisation and modularisation requirements must be issued early to the design teams. Designers must fully embrace this approach to eliminate the incidence of non-standard components ('specials'), which can significantly impact the cost effectiveness of the intervention. • Modularisation of homes and apartments suffer from the perception that it delivers homes with little architectural merit or future flexibility. This can be overcome through good layout and design detailing that considers the end user from the outset. • Modular construction suffers from higher embodied carbon than regular construction. This is due to transportation and lifting dictating the limiting structural state of the unit. This can worsen if non-UK fabrication facilities are used. Solutions to reduce the embodied carbon, such as localised reinforcement for lifting, can be realised through early engagement with the supplier. • Production capacity for modular components within the UK supply chain can fluctuate, early commitment to a fabricator is encouraged to secure the fabrication slot and maintain programme.
Implementation	• Merton Regeneration Project is developing a list of standardised components. This can be obtained from the Technical Design Manager. Project teams should review this list prior to starting RIBA Stage 2 and agree which standard components will be incorporated into the design. Requirements must be instructed to the design team. Where designers wish to deviate from standardised components, timely approval must be sought from Clarion. • At the start of RIBA Stage 2, the design team and project managers should undertake a modularisation review to identify elements of the design that could benefit from off-site fabrication. These elements may include bathroom pods, risers and mansard roofs. • Where extensive pre-fabrication is desired, a modular fabricator should be pre-selected to enable the designers to respond to any constraints such as standard dimensions. Project teams should consider booking a fabrication slot as early as possible to maintain programme. • Designers must consider modularity in design and identify 'specials' on design drawings. • Any agreements made with a modular fabricator must be communicated to the competing contractors at the earliest stages of contract award. • Procurement models for standardised components should be reviewed with the preferred contractors and take the form of a centralised material purchase and issued to the sub-contractor. • Transportation and construction details of modular components should be reviewed by the contractor and supply chain as early as possible to determine if low carbon solutions are available.
Suggested KPIs	• <5% 'special' components across standardised and/or modular designs • Establish a site waste generation target as part of a wider designing out waste programme. Refer to Intervention 3: Designing out waste, Section 4.3.
Benefits	• Centralised procurement of standard components across Clarion projects should reduce build costs, complexity and site waste. • Standardised components allow for easier maintenance. As the range of products are reduced, spare parts may be stocked centrally, allowing for more efficient maintenance and limiting cost overheads for storage. UK-wide MEP equipment servicing may be negotiated with the supplier. • A well-implemented modularisation strategy can deliver significant programme savings and reduce on site construction waste and vehicle activity by as much as 60%. • Modular buildings may be able to be dis-assembled, relocated and refurbished thereby extending the lifespan of these building elements and reducing the demand for new raw materials.

4.6. Supply chain integration

Responsible Parties	**Principle:** Principle Contractor **Support:** Clarion Housing Group, Project Managers, Design team
Purpose	To reduce packaging waste on site and promote closed-loop recycling of key construction products, through pro-active engagement with the supply chain.
Opportunities	• Collaboration with key supply chain partners already operating end-of-life product take back and recycle schemes such as Interface's ReEntry programme for carpet tiles; or British Gypsum's plasterboard programme for construction waste, provides a strong demand profile for these types of services, encouraging further investment and research. • As packaging waste accounts for over 30% of construction waste (by volume), development of re- usable packaging solutions with key supply chain partners can lead to a significant reduction of site waste management and disposal costs. Products supplied in large quantities across a relatively short programme duration, such as bricks, light fittings and plumbing fixtures and fittings could quickly deliver cost benefits for both the supply chain and Clarion. • Direct agreements with innovative waste reprocessing companies, rather than disposing of waste via a waste contractor, can support the establishment of new recycling business models. • Opportunities for innovative re-processing of plastic film exist through Yes Recycling and pallets through CM Pallet Services Ltd or Associated Pallets.
Challenges	• The supply chain is only likely to invest in reusable packaging solutions for large product orders, scale may be helped through the implementation of Intervention 5: Develop standardisation strategy including off-site/modular components, Section 4.5. Suppliers need time to respond to requests for re-usable packaging and develop suitable solutions, therefore discussions should start during the earliest phase of the project to deliver reusable packaging in the latter project phases. • Supplier take-back and recycle schemes often require a high quality, segregated waste stream to enable recycling, therefore site operatives need to be engaged and briefed on the waste management intentions. Space needs to be provided for segregated waste streams and re-usable packaging (refer to Intervention 7: Excellence in construction waste management, Section 4.7). • Transport logistics are often out-sourced by suppliers; a site delivery may not be returning to the original supplier and therefore unable to offer a take-back scheme for reusable packaging.

Implementation	• Clarion will discuss feasibility to integrate products with known closed-loop recycling facilities into the standardisation strategy and discuss potential logistics with 3 or 4 key supply chain partners.
	• Designers will specify products identified by Clarion, example wording for design team contracts was developed for the Merton Regeneration Project and is included in Appendix A for reference.
	• Contractors are required to explore reusable packaging solutions with key product manufacturers at the earliest opportunity. Solutions may include:
	  • Flat pallets: wood pallets have the greatest potential for cutting costs and emissions and reusable plastic pallets are better for waste reduction
	  • Box pallets: High quality plastic folding box pallets (reduces the need for disposable packaging)
	  • Bulk bags: can replace palletised disposable paper/plastic stacks (for repeat deliveries)
	  • Steel stillages: specialist steel A-frame stillages (carrying plate glass) can replace single trip pallet of non-standard sizes and associated protective disposable packaging. Could be extended to be used for other products such as dense cladding, heavy panels and frames
	  • Cable drums: returnable drums can replace smaller disposable cardboard and plastic reels.
	  • Plastic crates: Small folding creates used in the retail sector are good for smaller distribution systems such as fixtures, fittings materials, tools etc.
	• Where returnable packaging solutions are not available, the contractor will identify opportunities to maximise the salvage and local recycling of packaging waste, with a focus on timber and plastic films.

Suggested KPIs	• Selection of 5 key supplies who currently operate take-back schemes • 20% reduction in packaging waste (through supplier take-back or reuse schemes) • Segregation of all plastic film and timber packaging for high value recycling or reuse.
Benefits	• Demonstration of leadership by Clarion and supply chain partners in plastic packaging waste, with full transparency of recycling. • An estimated 34% of construction site waste by volume is packaging and 60% of pallets on construction sites are disposed of as waste, therefore by focusing on reducing key packaging waste streams, waste disposal costs should be reduced. • Potential to enter into long-term return and supply agreements with key product partners to reduce the cost and waste associated with maintenance and refurbishment.

4.7. Excellence in construction waste management

Responsible Parties	**Principle:** Principle Contractor **Support:** Project Managers, Procurement team
Purpose	To minimise the total amount of construction waste produced on-site through best practice material handling procedures. To maximise site segregation of construction waste to enable local reuse of waste materials and increase the quality of recyclable materials. To improve the transparency of the waste management supply chain.
Opportunities	• Proper materials storage and handling can reduce the amount of waste produced at source. Initiatives such as plasterboard cutting rooms can support waste reduction during installation. • Segregation and donation of reusable materials such as timber and bricks can create a positive relationship with local programmes in need of materials (refer to Intervention 8: Connect with existing community reuse network, Section 4.8). • Careful segregation of waste materials enables higher quality recycled materials and encourages local reprocessing. This improves the transparency of waste processing and confidence in the end use of waste materials.
Challenges	• Training staff in waste reduction techniques and proper segregation will take time and requires a cultural shift in attitudes towards waste. • Multiple skips for segregated streams and a dedicated area for reusable material may have a greater initial outlay and will require more space on site. A dedicated waste manager may be needed to manage the waste compound and ensure appropriate segregation of waste. • Many contractors do not evaluate waste disposal further than the first-tier waste handler, the subsequent journey and final disposal or recycling site of waste is often unknown. A majority of plastic waste is shipped to Asia, where it may not be recycled, even though it was segregated for recycling at the material handling facility and would have been recorded as diverted from landfill. • Contractors often engage with a single waste and/or logistics contractor that utilise a limited, known network of material handling and waste management facilities.

Implementation	• Clarion will undertake initial research into local waste handling facilities and their onward disposal routes to understand opportunities for legal, transparent waste disposal.
	• The project managers will identify potential space for storage of reusable materials and allocate appropriate space to allow extensive segregation of waste materials.
	• The principle contractor will develop a comprehensive Site Waste Management Plan (SWMP), one month prior to starting on site. The SWMP must detail actions and initiatives to reduce construction waste and ensure the legal disposal of waste. The SWMP should include:
	  • How BIM and associated quality management procedures will be used to accurately order materials and minimise rework;
	  • Identification of key supply chain partners that could be approached to develop re-usable packaging solutions and supplier take-back and recycle schemes (refer to Intervention 6: Supply chain integration, Section 4.6);
	  • How key sub-contracts will be managed to incentivise waste reduction and segregation;
	  • Detail how site waste will be managed to maximise segregation at site;
	  • Identify how reusable materials will be stored and distributed (refer to Intervention 8: Connect with existing community reuse network, Section 4.8);
	  • Detail off-site waste recycling, disposal routes and how legal waste disposal will be verified;
	  • Detail frequency of waste-related site team meetings, toolbox talks and progress reviews;
	  • Set project waste targets and KPIs and
	  • State the method of reporting and monitoring, including responsibilities and frequency of reporting.
	• Include requirements in principle contractor contracts (refer to Appendix A for example contract clauses).

Suggested KPIs	• Waste generation target in tonnes waste per 100m² of GIFA to be set by the principle contractor. • 80% site segregation of waste. • 95% diversion from landfill (excluding hazardous waste).
Benefits	• Financial investment in better waste management and segregation on site should be offset by reduced waste handling fees (handling fees for segregated skips is generally cheaper then mixed waste skips). • Proper storage of waste reduces the risk of accidents and environmental incidents. • Responds to increasing global awareness around the transparency of waste disposal. • Maximises the value of recyclable materials and increases the downstream recycling potential.

4.8. Connect with existing community reuse network

Responsible Parties	**Principle:** Merton Regeneration Project team **Support:** Project Managers, Principle Contractor, Demolition Contractor, External Parties
Purpose	To demonstrate clear implementation of the waste hierarchy for positive community benefit through the donation of good quality waste materials and products.
Opportunities	• Connecting with construction training colleges and other programmes through material donation can be integrated with apprenticeship programmes and employment opportunities on Clarion projects. • Connection with local artisans and businesses or potentially supporting the creation of new businesses and community facilities as part of a development Meanwhile Strategy (refer to Intervention 2: Develop Meanwhile Strategy for under-utilised space, Section 4.2) through material donations provides clear social value while reducing waste. • Selecting materials for salvage that respond to community demand reduces the need for long- term on-site storage of materials as materials may be delivered directly to off-site partners. • Where trees are removed as part the site clearance programme, the local fabrication of the timber in to street furniture, or integration in to the public realm for habitat creation provides a positive reuse story for the local community that will often be attached to mature trees in development areas.
Challenges	• Co-ordination between community demand for materials and demolition/construction waste arisings is necessary. There will likely need to be a designated individual to co-ordinate an extensive waste reuse programme. • Logistics of transporting and off-loading salvaged materials is often challenging as community groups do not have access to large vehicles or forklifts, therefore it is likely the contractor will have do supply an HGV with hi-ab for distribution of materials. • The classification of demolition and construction arisings as waste can make reuse difficult, however the Environment Agency have recently made considerable efforts in the classification of construction arisings to support reuse. • The additional time required for segregation and salvage, combined with programme constraints can cause frustrations within the workforce, however clear communication of the social value implications and sharing case studies of end uses can increase motivation.
Implementation	• Clarion will map local community groups and construction colleges requiring material donations. Timelines, storage capacity and collection options will need to be established with interested parties. • A dedicated material storage facility will need to be identified with project managers. • Clarion will communicate material requirements to demolition and construction contractors and ensure requirements are reflected in pre-demolition audits and Site Waste Management Plans. The distribution of salvaged materials should be discussed with principle contractors at the earliest opportunity. • Distribution of products should be clearly recorded, and case studies generated to increaseoperative motivation for implementing best-practice site waste management.
Suggested KPIs	• Identify potential reuse partners within 3km of the project site and establish projects with at least 10% of those identified. • Provide apprenticeship opportunities onsite from local colleges – total number to be determine in collaboration with Clarion Futures.
Benefits	• Create a positive connection with the existing community through donation of re-usable waste materials. • Demonstrate a clear commitment to, and implementation of the Waste Hierarchy. • Potential to positively contribute to a local Meanwhile Strategy (refer to Intervention 2: Develop Meanwhile Strategy for under-utilised space, Section 4.2). • Early engagement with training programmes may increase the quality and motivation of local apprentices.

4.9. Promote a sharing economy

Responsible Parties	**Principle:** Merton Regeneration Project team **Support:** External Parties
Purpose	To establish local, social enterprises and provide community programming which encourages residents to reduce waste through the sharing of resources whilst also strengthening community networks.
Opportunities	• Establish a Library of Things where residents can borrow tools and equipment at low cost, as well as potentially join practical events like DIY classes. This could be initiated as part of the Meanwhile Strategy (refer to Intervention 2: Develop Meanwhile Strategy for under-utilised space, Section 4.2). • Introduce car and cycle sharing companies into the development to encourage residents to move away from car ownership. • Implement a 'move buddy' scheme to help tenants relocate, particularly the vulnerable (e.g. the elderly and those moving for the first time). In preparing for the move unwanted or broken items could be donated for repair and reuse through the community network.
Challenges	• The Library of Things requires a strong volunteer network. • There are upfront costs to establishing sharing schemes, including provision of space, purchase of shared products, etc. Once a scheme is successfully established it should be cost neutral, being funded through membership fees.

Implementation	• Library of Things UK can help establish a Library of Things. Clarion should book a visit with the site at Crystal Palace to gain a full understanding of how the system works. Estate Managers should identify potential volunteers in the local area to undertake a tour with the Clarion team. The next steps are likely to include:
	  • Identify location(s) for the Library of Things – this could be part of the Meanwhile Strategy or have a permanent location within the development;
	  • Identify list of desired products and contact potential suppliers for donations or discounts;
	  • Determine membership structure – annual membership, pay-per-use, first time free or other;
	  • Set up borrowing structure – online reservation platform, in-person or other; and
	  • Hire volunteers and paid persons to manage business, report on success and feedback to Clarion.
	• Clarion to initiate a meeting with Zipcar, or other car share scheme to discuss partnership opportunities.
	• Clarion to initiate a meeting with Brompton Bike Hire, or other bike share scheme to discuss partnership opportunities.

Suggested KPIs	• 80% of residents, over the age of 18, do not own a private car. • 40% of residents, over the age of 18, hold membership to the Library of Things.
Benefits	• Social enterprises such as the Library of Things provide employment and volunteering opportunities for residents whilst creating a strong community network. • Upskill residents and encourage behavioural change to favour a circular economy approach to purchasing, using and disposing. • Reduces waste resources and consumerism by reducing the consumer demand for new, underutilised materials. • Car share and bike share schemes can help to reduce the number of cars on the road and reduce private parking requirements. Land no longer required for parking can be used for green public space, while residents' health is improved due to the increased use of active transport methods. • A move buddy service will help residents fix, sell, donate or recycle unwanted items before they move. The Merton Regeneration Project team can lend reusable packing materials and help advise on economic and environmentally friendly purchasing decisions for the resident's new home.

4.10. Supporting community and household recycling

Responsible Parties	**Principle:** Merton Regeneration Project team **Support:** Design Team, Clarion Operations & Maintenance, External Parties
Purpose	To provide high-quality waste segregation and management facilities at household and community level to promote household waste segregation and maximise local recycling rates. To introduce community composting and growing schemes to eliminate organic waste from landfill and provide residents access to seasonal, home-grown food.
Opportunities	• Refuse collection and recycling points can be incorporated into the public realm. If there is a sense of community observation, residents are less likely to 'dump' waste and sort waste from recycling. In addition, informal resident interaction at disposal facilities can improve recycling rates as residents support one another in depositing waste in the correct receptacle. • Colour coded bags for different waste streams can be provided to residents. Bags can be marked with apartment details to help determine those residents that require further support and engagement in waste segregation. • Collaboration with estate management and maintenance teams to develop community-led composting activities. • Reverse vending machines may be installed in key public areas where residents can insert recycling to earn public transport or other credits (refer to case study). • Bulky items may be donated through a community reuse or upcycling programme.
Challenges	• Allocation of management rates to cover waste collection and local composting schemes. • Establishing community buy-in for waste segregation and composting.
Implementation	• Establish the waste streams collected by the local authority and undertake accurate waste forecasts to size containers and establish collection regime. • At Stage 2 design, identify appropriate space within buildings and/or the public realm for centralised waste collection facilities and community vegetable gardens (where applicable). Example wording for design team contracts was developed for the Merton Regeneration Project and is included in Appendix A for reference. • Ensure kitchens are sized to accommodate separate waste bins for segregated waste streams identified. • Identify residents that may volunteer to support a community 'grow your own' programme. • Determine how waste management services will be paid for within community charges. • Prepare Home Information Packs to include details on how the recycling and waste management scheme operates. • Run community education and awareness programmes to enhance recycling and recovery rates.
Suggested KPIs	• 20% reduction in household waste production. • 50% of residential waste segregated, by mass. • Zero organic waste to landfill.
Benefits	• An active community recycling programme reduces the risk of fly-tipping and therefore may reduce estate maintenance costs. • Community composting helps to meet the UK waste and recycling targets - which can only be achieved by tackling the biodegradable fraction. As an estimated 30% municipal waste is organic, local composting can significantly reduce the number of waste vehicle movements within the community. • Community gardens can contribute to a healthy lifestyle by providing fresh, affordable herbs, fruits and vegetables, and offer a focus point for community cohesion. • Community gardens reduce "food miles" that are required to transport nutritious food.

4.11. Community led design

Responsible Parties	**Principle:** Merton Regeneration Project team, Design team **Support:** External Parties
Purpose	To put the end-user at the heart of the design process to ensure that the public realm, buildings and facilities provided meet the requirements and expectations of the residents to eliminate potential unnecessary refurbishment and reduce the likelihood of vandalism.
Opportunities	• Engagement with local schools to establish what children want in the public realm to promote play and discuss proposals with older residents to ensure their needs can also be met within the same space to promote cross-generational interaction. • Provide future tenants and residents with a selection of finishes and fixtures to select from to reduce unnecessary refurbishment. • Provide public space which is flexible, adaptable and has the potential to meet multiple purposes simultaneously.
Challenges	• Requires time and financial commitment from Clarion to facilitate workshops and enable design team to integrate feedback into the design. • Offering a selection of finishes to tenants requires the early establishment of supply chain partners for items such as kitchens, bathroom fixtures, paints and flooring.
Implementation	• Design contracts should detail the expectations of community-led design to allow design team to integrate the design costs into proposals. Example wording for design team contracts was developed for the Merton Regeneration Project and is included in Appendix A for reference. • Workshops co-ordinated and promoted by Clarion local Estate Managers to ensure all existing community members are well-represented, including those that are hard to reach. • The workshops should include, as a minimum, common internal areas, access/egress, community facilities and public open space. • Clarion, in collaboration with project managers to prepare a list of options for fixtures and finishes including, as a minimum, paints, flooring, kitchens and bathroom fixtures. Preferred options to be established for each resident and communicated at the contract tender stage to enable contractors to price for the selected fixtures and finishes.
Suggested KPIs	• Facilitate two workshops with the local community per project. • Demonstrate to contributors the outcomes of the workshops have influenced the design by applying a minimum of 5 recommendations.
Benefits	• Engagement of existing residents in the design of their new homes and spaces creates a strong sense of community and strengthens the resident's attachment to their home and community. • Selection of fixtures and finishes by residents prior to moving in, eliminates waste from early, unnecessary redecoration and refurbishment. • Improved civic participation brings people together with a shared sense of purpose and mutual benefit, positively impacting on the sense of community.

4.12. Ensure buildings to maintain and adapt

Responsible Parties	**Principle:** Design team **Support:** Principle Contractor, Operations & Maintenance
Purpose	To design buildings that are flexible, adaptable and simpler to maintain, allowing components to be more readily replaced at the end of their useable life without damaging surrounding components. To identify building elements that are generally replaced before the end of their design life and establish more robust alternatives to reduce maintenance costs and waste.
Opportunities	• Various elements of a building have different lifespans and should, therefore, be largely independent of surrounding elements to enable easy access and replacement or maintenance. The design should allow different layers to be "peeled off" and replaced or salvaged without damaging the adjacent layers, to optimise building, component and material longevity. • The needs of a family change over time, homes and apartments should be designed to minimise the number of structural walls within the space to allow residents to restructure space as their family needs change. Consideration should be given to how an extra bathroom or downstairs bedroom could be accommodated. • Avoid permanent fixing of products such as glue and cement mortar to enable end-of-life deconstruction and salvage of building elements. • Ensure items that require regular maintenance can be serviced from communal areas to reduce the need to gain access to people's homes to undertake critical maintenance.
Challenges	• Maintenance teams or subcontractors may disregard the design approach to preserve surrounding materials while repairing and replacing components. • Specification of more robust products for elements that are commonly replaced before the end of their design life may incur greater capital expenditure, with savings not realised until many years later. • The avoidance of permanent fixings such as glues and cement mortar may require specialist skills or changes to conventional construction methodologies which may incur additional cost.

Implementation	• Designers to consider how internal room layouts can be adapted to the changing needs of a family and how public spaces can accommodate change in capacity, function of performance.
	• Design specifications to specifically exclude permanent fixing of building elements with glues and cement mortar as far as reasonably practical.
	• For elements that have relatively short replacement cycles such as interior finishes, the design team should specify products that are recyclable at their end of life and confirm the recycling route with the product supplier.
	• Clarion Housing operation and maintenance team should identify the ten areas of highest maintenance and repair spend as earliest as possible within the project programme. Designers can then determine if more robust alternatives exist and propose these alternatives in design specifications.
	• Design teams to engage with Clarion Housing operations and maintenance team early in the design process to identify building components that require regular maintenance or replacement and ensure these items are easily accessible without the need to enter private homes as far as reasonably practical and without damage to adjacent materials. Building components that should be easily accessible may include:
	  • Air filters for heating, ventilation and cooling equipment
	  • Water pumps and valves
	  • Water and waste piping
	  • Light fixtures
	• Contractors should be required to demonstrate alternative methods to eliminate permanent fixing of salvageable building products such as brickwork e.g. use of lime mortar.
	• Example wording for design team and principle contractor contracts was developed for the Merton Regeneration Project and is included in Appendix A for reference.

Suggested KPIs	• Stage 3 design reports to include a section detailing how the design responds to this intervention • Demonstrate 10% saving in maintenance costs through the selection of more robust products
Benefits	• Creation of adaptable, flexible buildings reduces the likelihood of premature demolition thereby offering significant long-term cost savings to Clarion. • Consideration of maintenance needs during design reduces the associated on-going costs of maintaining the buildings.

5 Potential Benefits for Merton Regeneration Project

5. Potential Benefits for Merton Regeneration Project

The scale of benefits that could be achieved through the application of a comprehensive circular economy strategy have been estimated. It has not been possible to estimate the associated benefits for all interventions, but a broad estimate has been provided, drawing on previous project experience.

The scale of benefits detailed has drawn on the pre-demolition survey for High Path phase 1 and the masterplan documents for all three schemes. In addition, the estimates have been informed by project analysis undertaken by KLH on other projects including:

- The demolition works at the Olympic Park where 220 buildings were demolished including a number of high-rise tower blocks, compared to 153 buildings due for demolition across the Merton Regeneration Project.
- The construction of 33,000m² Gross Internal Floor Area (GIFA) for Phase 1 of the East Wick and Sweetwater development on the Queen Elizabeth Olympic Park. While the development is smaller than the Merton Regeneration Project (MRP), which aims to provide over 200,000m² GIFA, it provides a good reference point for Merton as the development offers a variety of housing types including townhouses, mews and low-rise apartment blocks, the majority of which are designed with brick facades.

5.1. Benefits available through demolition phase

This benefits assessment considers the implementation of intervention 1: Demolition for maximum recovery value, using the Olympic Park demolition as a reference study, which achieved 98.5% diversion from landfill, but only 0.5% of which was reused on or off-site.

A significant quantity of demolition material will be generated by the demolition works. The estimated quantities are detailed in Table 3.

Table 3: Estimated quantities of demolition materials at Merton Regeneration Project and associated impacts

Material	Quantity (tonnes)	Estimated cost of recycling/disposal off-site (£)	Total number of HGV movements	Carbon footprint of transportation and recycling (tonnes CO_2e)
Concrete	221,500	£3,211,000	22,100	235
Bricks/ Hardcore	77,000	£1,117,000	7,700	82
Metal	11,500	£44,000	1,150	12
Bitumen	6,500	£93,000	650	9
Timber	2,500	£39,000	250	53
Other	3,000	£242,000	650	69
TOTAL	**322,000**	**£4,747,000**	**32,500**	**460**

There are a range of opportunities for reuse and recycling on-site. Two key opportunities are considered:

- Careful segregation of concrete materials for on-site crushing and production of engineered fills for subsequent construction use (an estimated 65,000 tones of engineered fills is required for the construction works); and
- Salvage of a minimum of 10% of bricks on site and reuse in feature elements of the new construction.

The potential benefits of these two salvage strategies alone are estimated to be:

- £3,500,000 financial saving (excluding on-site processing and additional demolition costs but including the avoided cost of purchasing virgin materials);
- 2,160 tonnes CO_2e saving (including benefit associated with not using virgin materials); and
- 14,500 individual HGV movements eliminated from local roads (this does not account for the fact that there may be some movement of materials between the three sites in order to implement the strategy).

5.2. Benefits available through design and construction phase

This benefits assessment considers the implementation of intervention 7: Excellence in construction waste management and intervention 3: Designing out waste, which are assumed to include elements of intervention 6: Supply chain integration, intervention 5: modularisation and standardisation, and intervention 4: High recycled content. The benefit analysis draws on extensive materials modelling work undertaken for East Wick and Sweetwater Phase 1.

Table 4 provides estimates of the total quantities of materials required for the project.

Table 4: Estimated quantities of materials required for MRP

Materials	Mass installed (tonnes)
Concrete	217,500
Screed & mortar	28,000
Blockwork	8,500
Metal	14,500
Aggregates	65,500
Bricks	17,000
Timber	4,500
Plastics	50
Glass	550
Stone	150
Plasterboard	17,500
Insulation	3,000
Flooring	1,000
Paint	500
Misc	1,000
TOTAL	**379,000**

Table 5 applies standard practice wastage rates and recycled content in new materials to the associated products and compares the impacts against good design, procurement and construction practices as supported by the circular economy interventions.

Table 5: Comparison of standard and good practice design and construction principles

	Standard practice	Good practice
Total quantity of materials required (tonnes)	408,200	393,000
Total quantity of waste generated (tonnes)	29,500	15,000
Total number of associated HGV movements for material and waste transport	48,000	46,000
Cost of waste material included in waste disposal (£)	3,183,000	1,634,000
Embodied carbon associated with material use (tonnes CO_2e)	93,600	88,000
Total mass of recycled materials included incorporated in construction (tonnes)	29,000	135,500

The potential benefits associated with the application of key circular economy principles in design and construction include:

- £1,549,000 saving in material and waste disposal costs;
- 2,000 HGV movements eliminated;
- 5,600 tonnes CO_2e avoided; and
- 122,000 tonnes less virgin material used.

5.3. Benefits available through operational phase

This benefits assessment considers the implementation of intervention 10: Support community and household recycling and draws on the waste data contained within the South London Waste Partnership Joint Municipal Waste Strategy 2010. It is estimated that each resident produces 417kg of waste annually and approximately 38% is currently recycled. It is assumed that at least 75% of households engage in recycling.

Through the implementation of an innovative and extensive community and household recycling programme, including on-site composting it is assumed that capture rates of individual waste streams for recycling can be increased by 50%, and that resident participation can be increased to 90%.

It is assumed that there are approximately 7,000 residents across the regeneration sites. The associated impacts are detailed in Table 6.

Table 6: Estimated quantities of municipal waste for Merton Regeneration Project and associated impacts

Municipal waste stream	% composition of municipal waste	Applying current waste management practice in Merton across MRP			Potential best practice waste management across MRP	
		Annual waste generation (tonnes)	Estimated capture rate (%)	Annual waste recycled (tonnes)	Capture rate (%)	Annual waste recycled (tonnes)
Paper & card	36.0	1052	60	473	90	852
Plastics	10.7	312	40	94	60	168
Textiles & Shoes	1.8	53	50	20	75	36
Misc.	8.7	253		0		0
Glass	10.2	299	55	123	83	222
Metal	2.1	61	60	27	90	49
Garden	6.5	189	75	106	100	170
Compost	24.0	701	50	263	75	473
TOTAL	**100**	**2919**		**1107**		**1971**
% recycling rates		**38%**			**68%**	
Weekly waste vehicles movements		**7**			**5** (assuming on-site composting)	

The benefits associated with implementation of a comprehensive community and household recycling scheme include:

- A 75% increase in recycling rates, bringing MRP in line with municipal recycling rates achieved in leading EU countries such as Germany and Austria;
- 640 tonnes of compost generated annually for use on community parks and vegetable gardens; and
- Weekly waste vehicles movements reduced from 7 to 5 with potential savings in rates for residents.

6 Case Studies

6. Case studies

A range of case studies are included within this report to demonstrate the value of the intervention detailed and provide examples where circular economy interventions have been successfully implemented.

Case studies include:

- Demolition for maximum recovery value: London Olympic Park
- Meanwhile strategy for under-utilised space: Hackney Wick Frontside Gardens
- Design out waste: Brighouse and Sowerby Bridge leisure centres
- Supply chain integration: ISG and SAS collaboration to reduce packaging waste
- Promote a sharing economy: Crystal Palace Library of Things
- Supporting community and household recycling: City of Beijing subway and plastic bottle recycling partnership
- Community led design: Merton Regeneration Project, High Path

Case Study: Demolition for maximum recovery value

London Olympic Park

Over 220 buildings were demolished across the 2.5 square kilometer London Olympic Park, prior to the construction of venues for the Olympic Games. The Olympic Development Agency (ODA) set several waste targets during the demolition, design and construction phases of the London 2012 Olympic Park, including 90% diversion from landfill of demolition waste by weight.

Process

A Demolition and Site Clearance Materials Management Plan was produced for the whole Olympic Park site, prior to the start of demolition. The Plan set out guidelines for:

- Pre-demolition audits
- Recommended routes for each material category (prioritising onsite reuse strategies)
- Stockpiling materials onsite to maximise reuse and recycling opportunities.

All demolition contractors were asked to respond to the Plan as part of the tender process and targets were included in all contracts.

A dedicated Materials Manager within the delivery partner team then undertook additional site visits. The purpose of the site visits was to identify desirable materials for salvage with designers, engage with demolition contractors to discuss requirements and ensure safe storage of materials. The Materials Manager was also responsible for implementing re-use and high value recycling opportunities and tracking materials across the site as demolition progressed.

Outcomes

Due to proper deconstruction, segregation and onsite storage, this project was able to exceed project targets, diverting 98.5% of waste from landfill with the majority being reused and recycled on-site. Although disappointingly, less than 1% of material was re-used, including eight steel portal frame buildings which were sold for off-site reuse.

On-site salvage and reuse include:

- 38 tonnes granite setts, discovered underneath many of the old roads have been used on the Stadium island site to provide an attractive alternative to asphalt along part of the river bank and was also installed on the Greenway as a feature around utility access and drainage areas.
- 117 tonnes sandstone, salvaged from a wall and reimagined as paving and installed outside the site offices to provide an attractive staff and visitors entrance, as well as on The Greenway to provide a texture change, highlighting the access to the café on The Greenway.
- 485 tonnes of concrete block paving, salvaged from site and used to surface a temporary logistics compound (in use for approximately 5 years), providing a more attractive and cost-effective alternative to asphalt paving.

Careful demolition and segregation of demolition materials enabled high value recycling to be undertaken including 30,000m³ of concrete crushed to large dimensions for use in gabion baskets as an alternative to quarried stone.

Over 220 buildings were demolished across the 2.5 square kilometer London Olympic Park, prior to the construction of venues for the Olympic Games. The ODA set several waste targets during the demolition, design and construction phases of the London 2012 Olympic Park, including 90% diversion from landfill of demolition waste by weight.

Benefits

The extensive site segregation, storage and repro-cessing led to a range of benefits including:

- Over 20,000 HGV movements removed from local roads through reprocessing of materials on site,
- Over £5 million of construction product created
- Salvaged materials helped to create a connection to the historic environment in an area dominated by new buildings and infrastructure.

Case Study: Meanwhile strategy for the under-utilised space

Hackney Wick Frontside Gardens

Frontside Gardens was a skate-boarding civil engineer's idea in response to a competition launched by the London Legacy Development Corporation (LLDC) to identify meanwhile uses for some of the plots scheduled for development on the fringes of the London Queen Elizabeth Olympic Park. The competition was originally for a 3-month lease and included a small grant of a few thousand pounds.

The success of Frontside, combined with delays to re-development caused by a down-turn in the market, meant that the project ran from September 2012 to January 2017. Although relying heavily on volunteers, the project was relatively financially self-sufficient following the initial grant for construction.

Process

The LLDC ran an open competition to determine meanwhile uses for a number of under-used spaces on the fringe of the Olympic Pak. The competition ran alongside research work undertaken on behalf of the LLDC to investigate effective models for delivery of 'meanwhile use'.

Central to Frontside's proposal was a focus on using salvaged materials to construct the skate park, thereby creating a much-needed recreational provision with a social purpose and minimal environmental impact.

Andrew Willis, director of Frontside, made use of contacts locally and through the Olympic Park to secure a range of materials to construct the skate park and engaged with the local community to help construct and manage the space, as well as making it a popular destination.

Outcomes

Frontside Gardens made use of reclaimed flooring from a demolished warehouse, while old petrol tanks and tyres became planters for end of season shrubs from the local garden centre. Metal rails and buffalo boards were obtained from the temporary Horse Guards Parade beach volleyball facility and old tennis club seats were given a new lease of life.

About a third of the area was dedicated to a café and 'chill-out' space to encourage use by the wider community, not just those interested in skating. In addition, a range of events including screen printing workshops, t-shirt tie-dying sessions and film premieres have been held at the skate park, appealing to awider audience.

To encourage use by young people, under-16s could skate for free throughout the operational period of Frontside and a number of women-only events encouraged women to give skating a try.

Benefits

Frontside delivered a range of benefits over its 5-year life including:

- Use of a range of waste materials
- Creation of new and positive relationships within the existing community
- Provision of a safe and legal area for graffiti artists to paint
- Enabled local users to try a range of new activities

The small grant on which Frontside was created demonstrates that effort and creativity matter more than a massive budget. It also demonstrates that meanwhile facilities can often become financially self-sufficient and deserving of a permanent place in the local community.

Case Study: Designing out of waste

Brighouse and Sowerby Bridge Leisure Centres

Willmott Dixon built two new leisure centres, Brighouse and Sowerby Bridge Leisure Centre for Calderdale Council in Yorkshire from 2008-2010. They include swimming facilities and fitness suites and achieved a BREEAM 'good' rating. The combined budget for the schemes was £11 million.

While BREEAM 'good' is not considered particularly challenging, the team incorporated designing out waste principles early in the design process to prevent waste onsite and improve efficient material use. Significant waste and cost savings were identified due to the early consideration of waste generating activities at design stage.

Process

At the design stage, the project team and client worked together to identify opportunities to implement key designing out waste principles.

This was done by facilitating a Design out Waste Workshop to explore all possible design changes to reduce waste. The workshop included representatives from the architect, council, cost consultants, contractor and building services sub-contractor.

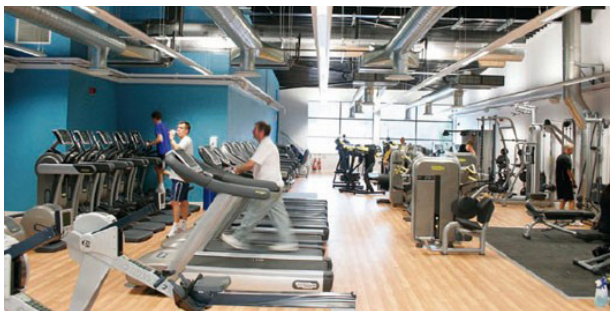
All ideas were rated based on ease of implementation and impact, leading to a shortlist of seven ideas. A detailed analysis was then undertaken for the shortlisted ideas, comparing construction cost, quantity of site waste, value of materials wasted and embodied carbon of the suggested design stages against the existing design.

Of the seven shortlisted design changes, five were taken through to the next stage:

- Accurate assessment of material quantities to reduce over ordering and implementation of good materials handling practices on site to reduce waste;
- use of pre-insulated ducting instead of ducting followed by lagging on-site;
- reduced packaging on bricks (i.e. delivered without pallets or polythene wrap, just metal strapping);
- use of precast stairs instead of cast in-situ; and
- selection of ceramic tile sizes to best match the size of the area being tiled

Outcomes

Four of the five changes demonstrated cost savings and were subsequently implemented. Selection of smaller ceramic tile sizes was omitted due to its considerably higher cost over the original design, largely due to the additional labour time required for installation.



Benefits

The scale of benefits calculated by the project team is significant:

- 0.5% reduction in total project costs, a saving of £56,175;
- elimination of 251 tonnes of waste, with an associated waste disposal cost of £13,582;
- embodied carbon saving of 479 tonnes; and
- 552 hours of on-site labour requirements saved

Case Study: Supply chain integration

ISG and SAS collaboration to reduce packaging waste

In 2017, contractor ISG produced over 100 tonnes of plastic packaging waste. Over the past year, ISG has been exploring innovative approaches to reducing onsite waste production through IGS's supply chains and projects.

Ceiling tiles, while available in standard sizes, are often manufactured in bespoke sizes to meet client and designer demands. This means that standardising containment for transport is costly and unrealistic. Until recently, in almost all cases, bespoke wooden pallets would be constructed in order to contain the tiles, and then disposed of after reaching sites. This is highly inefficient and wasteful.

Process

In collaboration with ISG, SAS developed an adjustable plastic crate solution that can be expanded or contracted to fit a range of ceiling tile shapes and sizes. This crate can then be returned to their manufacturing plant for reuse. However, SAS traditionally uses third-party haulage companies to deliver its goods, and these vehicles may move on to any number of delivery jobs, making it logistically impractical to return the crates.

To determine whether a business case for adoption of the reusable crates could be made, ISG trialled the reusable plastic crates on a central London project.

The switch required extensive logistical planning with the supply chain to insure the crates were palletised and returned. This also took investment from SAS to develop the reusable crate system and upskill subcontractors installing the tiles to ensure they understood the importance of reusing crates and how to manage coordination.

Outcomes

Ceiling tiles were delivered in 47 reusable plastic crates, removing the need for 4,200 wooden crates with plastic sheet wrapping. Each wooden crate costs between £40 and £50, which is charged to ISG.

The trial proved successful and ISG is now looking to roll out the crate across the business in hopes to inspire others in the construction industry to do the same.

Benefits

The trial resulted in:

- A waste saving of 280 tonnes with the adjustable plastic crate offering a zero-waste solution;
- 1.6 tonnes carbon saving, the saving will increase with every subsequent reuse of the plastic crates; and
- Almost £300,000 cost savings, taking into account cost of the crates and subsequent disposal.

Case Study: Promote a sharing economy

Crystal Palace: Library of Things

The Library of Things is an organisation in which non-traditional collections such as kitchen appliances, tools, gardening equipment, electronics, toys, instruments and recreational equipment are loaned out to members in a process similar to traditional libraries.

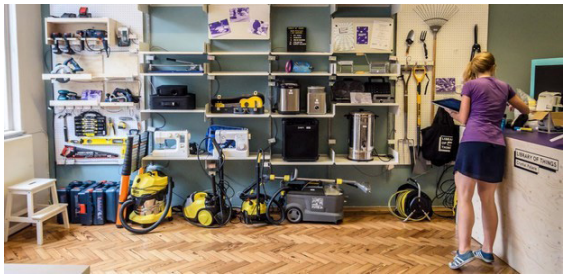
Following a pilot test site in South London, 300 local people crowdfunded over £9,000 in Crystal Palace to bring the Library of Things to their community library. Library of Things, Crystal Palace Transition Town and Upper Norwood Library Hub worked together to open this site in 2017.

Process

The Crystal Palace Library of Things received match funding against the crowd-funded £9,000. This enabled them to pay a Community Activator and purchase the 'Things' required for the library.

The purchase of stock was informed by the pilot with the stock base streamlined to 50 product lines, and 100 things overall. The Upper Norwood Library Hub provided guaranteed low-rent space for the Library.

They have developed an online catalogue of items available so that borrowers can reserve ahead of time. A 'smart lock' system allows borrowers to help themselves to things as you would a Santander bike or a Zipcar.



Outcomes

The purpose of The Library of Things is to connect people and encourage a sense of community through sharing. In addition to creating a centre to borrowing things, the Library of Things is a place to upskill residents through DIY classes and provides volunteer opportunities to hold events and meet neighbours.

Mender and upcycling workshops provide local people with new skills and potential business opportunities, while volunteers receive training and can borrow things at discounted rates!

"Library of Things has given me a reason to get up in the mornings. I've found something I'm good at and feel valued for that. I now bump into other volunteers and borrowers I know in the street. And I've had the confidence to find a job after three years of unemployment!"

Benefits

Apart from the obvious community and social benefits the Library of Things also contributes to waste reductions, as people are giving the skills and tools they need to mend and maintain basic household items.

Home maintenance such as garden work and carpet cleaning can be undertaken at much lower cost as the need to purchase expensive equipment is eliminated.

This in turn also eliminates waste as one neighbourhood may share underutilised tools such as drills, saws, garden rakes, step ladders, etc.

Expanding the initiative

The Library of Things offers support to local people who want to start a Library of Things in their neighbourhoods. They identify three core ingredients to creating a successful Library of Things:

- A group of well-networked local people;
- A community space to host the borrowing kiosk; and
- A mixed local community who want to use a Library of Things

The Library of Things takes responsibility for sourcing, maintaining and repairing 'things' in the library, as well as the development of online and digital services. They also take care of insurance, book-keeping and administration thereby leaving the host community to focus on local marketing and outreach, volunteer recruitment and coordination and maintaining a clean, staffed Library of Things.

Case Study: Supporting community and household recycling

City of Beijing: Subway and plastic bottle recycling partnership

The incentive theory of motivation suggests that human behavior is motivated by a desire for reinforcement or incentives. For example, generally, humans understand why they should recycle, but they will likely be motivated to recycle properly when it is incentivised with reward.

This philosophy has been applied to the plastic bottle waste epidemic in Beijing.

Process

In an effort to divert plastic bottle waste to landfill, beginning in 2012, the city of Beijing installed 34 "reverse" vending machines in high traffic subway station throughout the city. These vending machines manufactured by Incom Recycle Co. work by inserting a plastic bottle, sensors scan the bottle to evaluate the value of the plastic and then money, mobile phone minutes or public transportation credits are rewarded. It is estimated the value of each bottle is between 5-15 cents.

Outcomes

Today, over 2,200 such machines are located around China's capital and an estimated 18 million empty bottles have been recycled in Beijing in this manner. Due to the success, Incom Recycling Co. plans to expand the reverse recycling machine to other large cities across China.

Benefits

There are obvious environmental benefits to the reverse vending machines. Connecting deposit rewards to public transport credits further benefits by encouraging the use of public transport over private car use.

In addition, reverse vending machines can make recycling collection cleaner and streamlined and reduce the amount of physical space required for recycling stations and provide more storage capacity though integrated compaction.

Expanding the initiative

Reverse vending machines are an automated way to collect, sort and handle the return of used drink containers. The first fully automated reverse vending machine was created by TOMRA in 1972. Some machines can collect and sort glass, plastic and metal.

This year, Environment Secretary Michael Gove announced the proposed introduction of a deposit return scheme to drive up recycling rates and reduce litter, it is currently under consultation. Reverse vending machines are suggested as an innovative part of this scheme, with reports claiming that adoption of these vending machines could boost collection rates for plastic bottles from 60% to more than 85%. Co-op, Coca-Cola and other supplier corporations have been piloting these machines this year. Reverse Vending, Unisan and other reverse vending machine manufacturers have established facilities in the UK and are in the process of looking for partners across the UK.

At present just 43% of the 13bn plastic bottles sold each year in the UK are recycled, 700,000 are littered every day. In Germany, a deposit return scheme was introduced in 2003 and 99% of plastic bottles are now recycled.

Case Study: Community led design

High Path - part of the Merton Regeneration Project

Merton Priory Homes, now part of Clarion Housing, began engaging with local residents in 2013 to involve them in the development of their new community and homes. Two community engagement officers, were involved in the management of the estate prior to 2010 when it was under local council management, and who live locally, maintain regular contact with residents through informal home visits in between more formal community engagement events.

Process

A range of formal and more informal events have been undertaken by Clarion Housing since 2013.

The first community engagement events in 2013 endeavoured to capture what residents like and dislike about their current homes and community to inform the draft masterplans, which were launched at a consultation event in 2014.

The launch event on the draft master plans (including Ravensbury and Eastfields) saw over 400 people attend to discuss the plans and look at the quality and layout of the proposed homes and neighbourhoods. Between six and 12 home types were presented to the residents of each neighbourhood. They have been designed following consultation with residents to accommodate a wide variety of family sizes and configurations.

Further consultation events have been undertaken in 2015 and 2016, highlighting changes made in response to community feedback.

In addition to the community engagement undertaken on the masterplan, Clarion Housing have been engaging the residents in more innovative ways.

In September 2018, Clarion Housing engaged local charity, Sustainable Merton and Merton Abbey Primary School, to create a nursery of saplings at Morden Recreation Ground. The saplings will be grown on land provided by the council and managed by Sustainable Merton for the next 5 years, at which point the saplings will start to be relocated on to the new High Path Estate.

Outcomes

The community engagement exercises undertaken to date have garnered support for the regeneration project from a community that was largely unenthusiastic at the outset of the exercise. One High Path resident, following the 2014 draft masterplan launch, stated:

"When the idea of regeneration was first suggested I have to admit I was against it as we were expecting new kitchens and bathrooms from Circle Housing Merton Priory…. Since attending all meetings and workshops I feel more happy with the regeneration proposals and what this could mean for the estate as a whole. I know it's not going to be ideal living in a worksite, but the finished product and outcome will be well worth the wait."

Further Opportunities

There are a range of additional engagement exercises that could further contribute to a sense of place and delivery of a circular economy at High Path. These include:

- Development of options for kitchens, bathrooms, finishes and fixings for home owners, thereby reducing the likelihood of early refurbishment
- Determine the design of the public park to ensure it is flexible, adaptable and has the potential to meet multiple purposes simultaneously.

7 Procurement and Contract Wording

Merton Regeneration Project

Procurement and Contract Wording to Support the Circular Economy

1. Purpose of the Document

The Merton Regeneration Project is implementing a Circular Economy Strategy. This document has been prepared to help procurement teams engage designers, demolition contractors and construction contractors with the correct knowledge to support delivery of the Circular Economy.

The document provides inclusions for Pre-Qualification Questionnaire (PQQ) and Invitation to Tender (ITT) documents, as well as contractual clauses. The inclusions are considered mandatory, and any concerns over their inclusion should be raised with Paul Quinn, Director of Merton Regeneration.

Further support and training can be provided if required.

2. Suggested PQQ Questions

2.1. Demolition Contractor

1. Please advise if you have an environmental management system (EMS) and if your EMS is certified to a recognised third party standard. If so advise which standard and the date of your last audit.

2. Please advise of your experience in measuring and managing waste at source and using the waste hierarchy to deliver returns that are of benefit to the end client or to your own business.

2.2. Construction Contractor

1. Please advise if you have an environmental management system (EMS) and if your EMS is certified to a recognised third party standard. If so advise which standard and the date of your last audit.

2. Please advise of your experience in measuring and managing waste at source and using the waste hierarchy to deliver returns that are of benefit to the end client or to your own business.

3. Please outline your experience in considering resource efficiency and procuring secondary or recycled materials.

3. Suggested ITT Questions

3.1. Design Team

1. Please detail your experiencing in designing to Circular Economy principles and identify the 5 biggest opportunities for the Merton Regeneration Project.

3.2. Demolition Contractor

1. Provide a method statement to demonstrate how at least 90% of the quantity of the materials arising from the demolition and site clearance will be recovered for reclamation or recycling. In addition, show that the most significant opportunities (for example the top 5) to increase the proportion of materials recovered for use on-site have been considered, and implement good practice where technically and commercially viable.

3.3. Construction Contractor

1. Please detail your approach to design and supply chain management to minimise construction waste generation. Please include examples of where you have successfully engaged with your supply chain to deliver innovative solutions to reduce construction and packaging waste. Provide a target waste generation rate (in tonnes per 100m^2 of Gross Internal Floor Area) for the project.

2. Please provide details of how demolition waste streams (generated by others) and products with high recycled content will be incorporated in to the project. Highlight any programme or construction risks and provide a target recycled content for the project.

3. Please provide details of waste management practices and disposal routes that will be applied to achieve 80% site segregation of materials and 95% diversion from landfill. Please confirm that sufficient space and resources are assigned to site waste management to ensure the proposed strategy can be delivered.

4. Suggested Contract Clauses / Employers Requirements

4.1. Circular Economy Position Statement (for inclusion in all Contract Documents)

The Circular Economy Strategy that aims to minimise material waste and maximise benefits to local community members. Successful implementation of this approach requires input from all those involved in the project; the project management team, designers, contractors, supply chain partners, community members and local businesses. It is recognised that there are strong links between the Circular Economy, Social Value and return on investment, and therefore expected that all project partners contribute to the implementation of Circular Economy principles.

For the Merton Regeneration Project, the following Circular Economy approaches are being pursued:

- Salvage and storage of site clearance and demolition materials for incorporation in to the new public realm and community facilities
- Segregation of waste material streams to maximise recycling value
- Extensive use of recycled and natural materials that can in turn, be recycled at the end of their useful life
- Engagement with key supply chain partners to develop zero waste packaging solutions and alternative business models promoting take-back schemes and recycling
- Promotion of standard components that can be used across the whole Merton Regeneration Project
- Use of modular construction techniques to minimise waste, where applicable
- Development of a designing out waste strategy through engagement with the design team
- Building in layers approach to enable easy access to items requiring repair and replacement and promote end of life deconstruction
- Workshops with the existing community to empower them to influence their new public and private spaces
- Identification of a network of local businesses and community groups to maximise the reuse and recycling of construction and demolition waste
- Develop partnerships with local training colleges to enable the donation of construction training materials, and to source the future workforce
- Establish a Library of Things to support a sharing economy and develop basic DIY skills within the community
- Ensure appropriate storage is provided for waste segregation within buildings and homes and agree a waste collection and servicing strategy
- Develop a community composting and vegetable growing facility

4.2. Design Team Specific Contract Inclusions

4.2.1. Key Approaches

A number of key approaches can be applied in the implementation of the Circular Economy. Many of these approaches require design input and reporting. The key approaches and associated Designer responsibilities are listed below.

Community-Led Design

The Circular Economy puts the end-user at the heart of the design process to ensure that the building and facilities provided meet the requirements and expectations of the end-user. The designer should make an allowance for a minimum of two facilitated workshops with the local community. The focus of the workshops should include common internal areas, access/egress, community facilities and public open space, as well as individual housing units.

Designing Out Waste

The designer should hold a minimum of two Designing Out Waste workshops; one at Stage 1/2 and a second one at Stage 3/4. The Merton Regeneration Project team could can help facilitate these workshops if required but must be in attendance. The design team should refer to WRAP's Designing Out Waste Guidance for further information[1].

The first workshop at Stage 1/2 will include a review of the site with the intention to identify potential materials that may be salvaged and incorporated in to the design. Where existing buildings have already been demolished the designer will receive a list of salvaged materials, complete with estimated quantities, dimensions and photographs for consideration. Identified and/or available materials may include:

- Timber from site-felled trees
- Lime-mortared bricks
- Natural stone paving materials
- Street furniture
- Kitchen furniture and white goods
- Wall lights
- General furniture
- Urinal and ceramics
- Bannisters

There is also likely to be a quantity of site-won recycled materials available for use including:

- Crushed concrete (size requirements for crushing may be dictated by the designers)
- Mixed masonry rubble
- Crushed glass for pavement bedding
- Top soil

At Stage 1/2 the designer should:

- Incorporate salvaged and recycled materials from site demolition works and land clearance.
- Seek to design to the existing site topography. Where cut and/or fill is required these must be balanced within the phase boundary.
- Evaluate structural frame solutions for efficiency and future flexibility, including configuration of apartments and houses and the potential placement of non-structural walls to allow homeowners to adapt their spaces as their needs change.
- Avoid dictating the use of external space as far as reasonably practical and demonstrate how open public space can be configured to support a range of different community uses.
- Evaluate the potential for modularisation and product standardisation.

At Stage 3/4 during the second designing out waste workshop, the designers should:

- Develop the ideas of future flexibility further, demonstrating how apartments could be reconfigured to support a growing family, or an aging couple.
- Consider how floor to ceiling heights and door locations work within standard dimension for key building products such as plasterboard, timber stud, wall tiles and floor tiles to minimise offcuts and waste.
- Evaluate the use of self-finished materials such as timber, architectural concrete and brick to minimise the extent of finishing and wet trades required on site.
- Review opportunities to incorporate products with high recycled content.

The outcome of the Designing Out Waste workshops must be included in the relevant Design Stage reports submitted to the Client.

1 WRAP's Designing Out Waste Guidance for Buildings and for Civil Engineering can be accessed on-line here: https://www.modular.org/marketing/documents/DesigningoutWaste.pdf

http://www.wrap.org.uk/sites/files/wrap/Designing%20out%20Waste%20-%20a%20design%20team%20guide%20for%20civil%20engineering%20-%20Part%201%20%28interactive%291.pdf

Modular Construction and Standardisation

At Stage 2, the Designers will undertake a modularisation review with the project managers in order to identify elements of the design that could benefit from off-site fabrication. These elements may include bathroom pods, risers, mansard roofs, etc. Once the modular elements have been agreed with the project managers, the designers must design to the agreed module dimensions and ensure that 'specials' represent less than 5% of the modularised elements.

The designers must review the list of standardised components provided by the Merton Regeneration Project team and incorporate these in to the design. The standardised components have been carefully selected to support efficient maintenance and refurbishment across the Merton Regeneration Project and to deliver cost efficiency. Where the designer wishes to deviate from the standardised components, timely approval must be sought from the client.

Specifying Products with a High Recycled Content

To support a Circular Economy, the designers must specify products with high recycled content. As a minimum five key building products must incorporate increased recycled content, as identified by WRAP. These materials may include:

- Engineered fill (up to 100% recycled content)
- Concrete (at least 7% recycled content, and/or 40% cement replacement)
- Blockwork and concrete paving (at least 50% recycled content)
- Insulation (at least 50% recycled content)
- Plasterboard (at least 95% recycled content)
- Carpet tiles (at least 50% recycled content)
- Asphalt roads (at least 40% recycled content)

Products with increased recycled content are available from main stream suppliers, often at no additional cost premium.

Building in Layers (supporting future refurbishment)

The designer will consider 'building in layers' as a key design principle to support future maintenance, refurbishment and reuse.

For elements that generally have a relatively short replacement cycle, such as interior finishes, the designer should specify products that are recyclable at the end of life and confirm the recycling route with the product supplier.

The designer will identify building components that require regular maintenance or replacement and ensure these items are easily accessible without the need to enter private homes as far as reasonably practical and without damage to adjacent materials. Building components that should be easily accessible include:

- Plumbing fixtures, faucets, valves
- Water and waste piping
- Lighting fixtures
- Air filters for heating, ventilation and cooling equipment
- Wiring for electrical systems

Consideration should also be given to how key building elements such as major plant and equipment, windows, doors and roofs can be replaced without undue disruption.

The foundation and frame of a building generally has a much longer lifespan than other building elements and therefore the designer must consider how the building could be deconstructed in the future to allow inspection and reuse of the frame. The Stage 3 design report must include a statement on refurbishment and deconstruction, demonstrating how the 'building in layers' principle has been incorporated.

Supplier Take-Back and Recycle

The designer should seek to specify products from suppliers with takeback schemes and suppliers who use reusable product packaging solutions. Some known suppliers with takeback schemes include: IKEA, Desso, Interface, Saint Gobain, and British Gypsum.

Supporting Household and Community Recycling

The designer must provide sufficient space in all homes and apartments to allow home owners to segregate their waste. This should include as a minimum food waste, paper and card, other dry recyclables, and non-recyclable household waste. Sufficient space should be provided within apartment blocks and private households to enable segregated waste to be securely stored prior to collection. Communal bins should be sized for fortnightly collections with the exception of food waste, which should be sized for weekly collections.

4.2.2. Minimum Requirements

The designer must include an assessment of the cost, programme and wider sustainability impacts of proposed Circular Economy solutions in their Design Stage submissions. As a minimum Design Stage submissions must:

- Include a Designing Out Waste statement which quantifies the volume or mass of waste avoided through the implemented initiatives and set a robust construction waste target for the project, expressed as tonnes waste generated/100m² of Gross Internal Floor Area)
- include a refurbishment and deconstruction statement identifying how the building in layers approach has been considered in design and quantify long-term cost and waste savings
- identify where salvaged and recycled materials from the site have been incorporated and identify at least five key building materials that have been specified with an increased recycled content. The Designer should provide an estimate of the overall recycled content of the project, targeting a minimum of 15% by mass.
- Demonstrate how the waste servicing strategy allows residents to segregate at least 50% of their waste for recycling
- Ensure that 100% of timber products are FSC or PEFC certified, with an unbroken chain of custody

4.3. Demolition Contract Specific Inclusions

4.3.1. Pre-Demolition Audit and Deconstruction Statement

The Contractor (or associated subcontractor) will conduct a pre-demolition audit in collaboration with the architect to determine existing building components that will be removed and segregated for reuse, refurbishment or recycling.

The outcome of the audit, including estimates of the tonnage of material to be reused, recycled (on and off-site), sent to energy recovery and landfilled must be provided in the form of a deconstruction statement.

The deconstruction statement must also demonstrate how the building will be deconstructed to maximise the reuse and recycling value of materials and provide details on how materials will be segregated and stored. Legal disposal routes for all waste streams leaving site must be identified within the deconstruction statement. Local facilities which upcycle materials rather than downcycle materials should be favoured.

The deconstruction statement must be provided to the Merton Regeneration Project prior to starting on-site, such that progress can be monitored and the design teams can be notified of materials available for reuse in future phases and local programmes and artisans can be informed of material available for refurbishment and upcycling opportunities.

The demolition contractor will be responsible for the removal and/or reprocessing of all materials segregated for reuse and recycling. The intention is for a third party to remove salvageable materials from a safe location at an agreed time that does not impact on the agreed programme.

4.3.2. Site Clearance

The contractor will remove and legally dispose of all waste materials that must be sent to off-site recycling facilities or landfill. Materials removed shall become the property of contractor and shall be disposed of in compliance with applicable rules and/or regulations.

The contractor must:

- Identify any street furniture that can be salvaged for reuse and include it within the pre-demolition audit.
- Retain the timber from any felled mature trees in a form agreed with the Clarion Project Manager.
- Segregate asphalt waste from concrete and mixed masonry waste.
- Appropriately stockpile any topsoil away from drainage infrastructure and other sensitive receptors.

4.3.3. Soft Strip

During soft strip, the contractor will be responsible for salvaging and carefully segregating materials identified as salvageable in the pre-demolition audit. Such items may include (depending on condition):

- Kitchen furniture and white goods
- Wall lights
- Fire extinguishers
- General furniture
- Urinals and ceramics
- Bannisters

Other materials identified in pre-demolition audit must be removed and carefully segregated for recycling to maximise the value of these recycled materials. These items may include:

- Vinyl flooring
- Carpet tiles
- Plasterboard
- Wiring

4.3.4. Demolition

The contractor will deconstruct rather than demolish the buildings on site to maximise the value of waste materials to the client.

During demolition, the contractor will be responsible for salvaging and carefully segregating materials identified as salvageable in the pre-demolition audit. Such items may include:

- Lime-mortared bricks
- Natural stone paving materials
- Street furniture

Other items that must be removed and carefully segregated for recycling to maximise the value of these recycled materials include:

- Windows and glazing
- Concrete (not to be mixed with other inert materials such as brick, slate and roof tiles)
- Mixed masonry (excluding concrete and natural stone)
- Metals
- Solid timber products (should not be mixed with manufactured timber products such as chipboard and MDF)

4.3.5. Minimum Requirements

The contractor must demonstrate how over 90% of waste generated during the contract will be diverted from landfill. The contractor shall establish a target for the salvage and local reuse of materials, and prioritise reuse over segregation and recycling. The contractor will also ensure that there no biodegradable or recyclable waste is sent to landfill.

Where the contractor is involved in a number of phases of the project, the contractor will aim to increase levels of reuse over phases of the project, in addition to increasing overall diversion from landfill rates to 95%.

Any hazardous material, such as elements containing asbestos will be excluded from the targets.

The contractor shall measure and report quantities of material reused, recycled (on-site and off-site), recovered and/or sent to landfill to the project manager on a monthly basis.

4.4. Construction Contract Specific Inclusions

The contract wording provided below assumes a traditional build only contract. Where a design and build option is being procured, both the designer and the contractor text should be included in the Employer's Requirements. The combined text may be revised to avoid repetition.

4.4.1. Key Approaches

A number of key approaches are applied in the implementation of the Circular Economy. The design has already responded to a number of these key approaches and the contractor must familiarise themselves with the design details that are influenced by Circular Economy requirements.

The key approaches and associated contractor responsibilities are listed below.

Construction Waste Minimisation and Management

The contractor must develop a comprehensive Site Waste Management Plan (SWMP), one month prior to starting on site. The SWMP must detail actions and initiatives to reduce construction waste including, but not limited to:

- How BIM and associated quality management procedures will be used to accurately order materials and minimise rework
- Identification of key supplier chain partners that could will be approach to develop reusable packaging solutions
- Identify key supply chain partners that could benefit from a supplier take-back and recycle scheme
- How key sub-contracts will be managed to incentivise waste reduction and segregation
- Detail how site waste will be managed to maximise segregation at site
- Identify a storage location and potential distribution routes for donation of over-ordered and re-usable construction materials. Options may include local construction training colleges, community groups and charities.
- Detail off-site waste recycling and disposal routes and confirm how legal disposal of waste will be verified.

The SWMP must detail waste generation targets (in tonnes waste per 100m^2 of Gross Internal Floor Area) and demonstrate how 80% of construction waste, by mass, will be segregated on site to achieve 95% diversion from landfill (excluding hazardous waste). The SWMP must also provide for monthly reporting to the client against the targets specified.

Modular Construction and Standardisation

Aspects of the design support off-site fabrication and modular construction. The contractor must familiarise themselves with these elements of the design and ensure modularisation does not result in an increased embodied carbon of construction. Additional opportunities for modularisation must be discussed with the project manager at the earliest opportunity.

A number of standardised components have been identified. These standardised components have been carefully selected to support efficient maintenance and refurbishment across the Merton Regeneration Project and to deliver cost efficiency. The contractor must not deviate from the standardised components, without prior client approval.

Increasing Recycled Content

A range of site-won recycled materials may be made available during construction. Site-won materials may include crushed concrete, mixed masonry rubble, top soils and sub soils, and asphalt. The contractor must seek opportunities to incorporate as much site-won recycled materials as possible and should engage with the demolition contractor (via the project manager) to ensure demolition materials are provided to the required specification for use in construction.

In addition, a number of key building products will have been specified with high recycled content. Where an alternative is proposed by the contractor, the recycled content of the proposed products must be equal or greater than the one specified.

The contractor must target a minimum 15% recycled content by mass for the project, including a range of high value items such as floor finishes and concrete, and monitor performance against the target. Progress must be included in monthly client reporting.

Building in Layers
(supporting future refurbishment)

The contractor will familiarise themselves with the concept of 'building in layers' as principle to support future maintenance, refurbishment and reuse.

Any building components that are likely to require regular maintenance or replacement, in particular MEP, will be easily accessible and the contractor will provide details on how these items can be accessed and maintained without damage to adjacent materials.

Consideration should also be given to how key building elements such as major plant and equipment, windows, doors and roofs can be replaced without undue disruption.

The foundation and frame of a building generally has a much longer lifespan than other building elements and therefore the contractor must detail how the building can be deconstructed in the future to allow inspection and reuse of the frame, while maximising the recycling potential of other building elements.

The contractor must provide a detailed maintenance and deconstruction statement highlighting how the building has been constructed to promote future ease of maintenance, refurbishment and deconstruction.

Alignment with Social Value

Implementation of the Circular Economy has the opportunity to deliver Social Value in the form of:

- Supporting local business, charities and construction colleges either through material donations, upskilling or job opportunities
- Reducing community disruption due to a reduction in construction vehicle movements
- Using reclaimed materials from site to create a historic connection and a sense of place
- Protecting the local environment from fly-tipping and poor waste management practices
- Creating new business models and supporting supply chain innovation
- Engaging local people in the creation and management of their communities

The contractor must demonstrate how their approach to the Circular Economy has delivered social value. The Social Value creation should be calculated and reported on a monthly basis. The contractor should target social value creation equal to 1% of total contract value through the implementation of Circular Economy principles. This target is in addition to any social value created through staff volunteering, training and apprenticeships, managed under Clarion Futures.

4.4.2. Minimum Requirements

The contractor must:

- Develop a comprehensive SWMP, prior to starting on site. The SWMP must set a robust construction waste target for the project, expressed as tonnes waste generated/100m^2 of Gross Internal Floor Area), in addition to targeting 80% waste segregation on site and 95% diversion from landfill (excluding hazardous waste).
- Identify sufficient space and resources to allow site-segregation of waste, including storage of re-usable materials.
- Demonstrate how a minimum 15% recycled content by mass for the project will be achieved, including a range of high value items such as floor finishes and concrete.
- Provide a detailed maintenance and deconstruction statement highlighting how the building has been constructed to promote future ease of maintenance, refurbishment and deconstruction.
- Ensure that 100% of timber products are FSC or PEFC certified, with an unbroken chain of custody.
- Demonstrate that the approach to the circular economy will deliver a social value, equal or greater than 1% of the contract value.

The methodologies applied to measurement and monitoring of the identified targets must be agreed and approved with the Merton Regeneration Project team prior to starting on site. Monthly reports, detailing progress against all targets must be provided.

Contact us

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