Carbon Management Plan

Stage 1 – Business Case

[Worked Example]

Inner Sydney Mixed-use Social Housing Precinct

1 May 2025

NOTE

- This is a worked example about a fictitious project. It is not intended to represent any existing project in NSW.
- Content identified with blue text has been prepopulated from the Carbon Management Plan (CMP) template. Agencies can amend or add to this text (e.g. provide agency-specific policies or guidance that informs carbon decision making), if required.

NSW GOVERNMENT

Document control

Author/s	Project Manager Sustainability
Reviewed by	Development Manager
Approved by	Development Director
Branch / Team	Precincts
Division	Projects NSW
NSW Government Agency	Infrastructure NSW
Review date	May 2025

Version control

Version	Date	Amendment notes
1.0	1 April 2025	First version

Contents

0 Glossary

Term	Definition
Baseline (or reference case)	A business-as-usual scenario for the level of carbon emissions in the absence of additional measures to reduce emissions levels. It should be based upon consistent as-built data sets from prior project or comparable projects that reflect the time, scale, and scope.[1]
Carbon	Carbon dioxide equivalent for all greenhouse gas emissions.[2]
Carbon emissions	Emissions of greenhouse gases, measured in kilograms or tonnes of carbon dioxide equivalent emissions (CO_2-e).
Carbon management	Assessment, reduction and removal of carbon emissions during the planning, optioneering, design, delivery, operation, use, end of life (and beyond) of new, or the management of existing assets, networks and/or systems.[3]
Carbon reduction hierarchy	A decision-making process to minimise carbon emissions in the development of new, or the refurbishment of existing, assets or networks.[4]
Contribution analysis	Analysis undertaken to determine the importance of different elements of an asset in contributing to overall carbon emissions to identify hotspots and target mitigation efforts to inform decision-making.
Cost-benefit analysis	Cost-benefit analysis offers a structure for assessing capacity to improve net welfare, compared to the required investment. It includes qualitative and quantitative analysis, considers social, cultural and environmental costs and benefits, and uses market and non-market valuation methods. Outcomes that can be attributed to the proposal are compared with a base case – the business-as-usual scenario – and realistic alternative options. The benefits and costs of options are measured, valued and assessed to determine the preferred approach.[5] The preferred approach is called a "preferred option" or "proposed option" in this document.
Declared unit	A reference quantity used to report carbon results of a product, project or process when the full lifecycle is not being assessed e.g. m^2 Gross Floor Area (GFA) for a building. Unlike a functional unit (see definition below), a declared unit typically does not have a time dimension and so is not suitable when comparing the full lifecycle of an asset.

[1] British Standards Institution, PAS 2080: 2023 Carbon management in infrastructure, BSI Standards Limited, 2023.
[2] British Standards Institution, PAS 2080: 2023 Carbon management in infrastructure, BSI Standards Limited, 2023.
[3] British Standards Institution, PAS 2080: 2023 Carbon management in infrastructure, BSI Standards Limited, 2023.
[4] Adapted from British Standards Institution, PAS 2080: 2023 Carbon management in infrastructure, BSI Standards Limited, 2023.

Term	Definition
Embodied carbon	The greenhouse gas emissions and removals associated with the creation, maintenance and end-of-life disposal of an asset. This includes the emissions associated with the production and transportation of materials, construction related emissions and end-of-life emissions. In-use stage material-related emissions associated with maintenance, repair, replacement and refurbishment over the asset life are also considered part of embodied carbon. Note: this aligns with definitions in PAS 2080:2023 and RICS Whole life carbon assessment for the built environment,[6] excluding in-use stage emissions relating to operational expenditure, which is part of operational carbon.
Emissions life cycle module	The different periods of an asset's life are known as its lifecycle stages. Lifecycle modules provide standardised designations for each lifecycle stage, from A1 to D. They are referred to as product (A1-A3), construction (A4-A5), in-use (B1-B5), end-of-life (C1-C4), operational carbon (B6-B7), user carbon (B8), and benefits beyond the asset life cycle (D).
Enabled emissions (user carbon)	Emissions associated with activities enabled by an asset (e.g. emissions from third-party vehicles driving on a road).
End-of-life carbon	Carbon associated with the deconstruction, transport, waste processing, and disposal of capital assets at the end of their useful life. This forms part of embodied carbon.[7]
Operational carbon	The emissions associated with the operation (i.e. the in-use stage) of assets, particularly operational energy (module B6) and operational water (module B7). It can also include any module from B1 to B5 linked to operational expenditure. Examples include fugitive emissions of refrigerants (B1) and treatment chemicals for (waste)water infrastructure (B2).
Supply chain	A network of organisations that convert raw materials into finished products and deliver them to the consumer.
Upfront carbon	The carbon emissions and removals associated with the creation of an asset, network or system up to practical completion. This includes the emissions associated with the production and transportation of materials and construction related emissions. It excludes emissions generated during the use and end-of-life stage of an asset.
Value chain	The organisations, agencies, and industry stakeholders involved in creating, operating, and managing assets and may include government and policy makers, asset owners and managers, designers, constructors and builders, product and material suppliers and lenders.[8]

[6] British Standards Institution, PAS 2080: 2023 Carbon management in infrastructure, BSI Standards Limited, 2023.
[7] British Standards Institution, PAS 2080: 2023 Carbon management in infrastructure, BSI Standards Limited, 2023.
[8] British Standards Institution, PAS 2080: 2023 Carbon management in infrastructure, BSI Standards Limited, 2023.

Term	Definition
Whole life carbon (or whole of life carbon)	The total greenhouse gas emissions and removals associated with the creation, operation, maintenance and end-of-life disposal of an asset. This includes upfront carbon as well as in-use emissions (from maintenance, repair, refurbishment and operation of the asset), end-of-life disposal, and benefits and loads beyond the system boundary (e.g. avoided material production from utilisation of recycled or reused products).

1 Introduction

1.1 Purpose of the Carbon Management Plan

This Carbon Management Plan (CMP or 'the Plan') documents the governance, accountability, and reporting activities related to managing carbon on projects. It is also used to demonstrate compliance with the NSW Government *Decarbonising Infrastructure Delivery Policy* (Policy).

The CMP is a live document that will be updated as the project progresses.

1.2 Project / program overview

1.2.1 Project overview and objectives

Infrastructure NSW is exploring the development of a Mixed-use Housing Precinct (MHP) at a site in Inner Sydney owned by NSW Government to address growing population demands and associated housing needs.[9]

This project aligns with the broader NSW Government strategic objectives around increasing housing supply, including affordable housing. This includes development on NSW Government-owned land and state rezoning of sites that are subject to redevelopment in priority growth areas.

One of the key goals of Infrastructure NSW is to maximise development in existing well-connected areas to better use existing infrastructure capacity and deliver homes in areas close to employment opportunities and other amenities.

The site consists of 3 light industrial warehouses. Two are in fair condition and currently being utilised as storage for NSW Government whilst one is in poor condition and not in use. The site selected for the MHP Project is well connected to existing public transport networks, employment opportunities and recreational areas, including a nearby public park. It is currently being underutilised due to the state of disrepair.

Additionally, the growing population in the area has resulted in congestion around the warehouses reducing access for commercial and heavy vehicles, further disincentivising its current use.

The surrounding growth of residential, commercial, and retail developments has increased demand for housing and mixed-use facilities within the suburb and is consistent with the priorities for NSW Government affordable housing development.

As such, the objectives of the MHP project include:

- Improve the supply of housing
- Achieve a minimum affordable housing share of 15%
- Demonstrate value for money of the site for NSW Government
- Facilitate broader community outcomes (e.g. affordable housing, employment, local heritage).

[9] Note that the MHP is a fictional project. It is not intended to be a realistic representation of any project in NSW. Any results or findings expressed in relation to Infrastructure NSW and MHP are for demonstration purposes only and should not be referred to or relied upon for actual projects.

1.2.2 Project delivery model

This is a development project, and the delivery model will be through a Project Development Agreement (PDA), with procurement through an Expression of Interest (EOI) and select tender to development partner.[10]

Table 1-1 sets out the project delivery stages.

Table 1-1: Project delivery phases

Phase	Lead party
Master plan, business case, and EOI (current stage)	Infrastructure NSW (landowner and delivery agency)
Reference design	Infrastructure NSW leading, supported by a consultant
Tender, detailed design, planning approval	Developer (engaged through PDA)
Construction	Builder (engaged by developer under the PDA)

At the time of writing, the Full Business Case for the project (i.e. MHP Business Case 2025) is being finalised, with the CMP included as an appendix. The project has also completed the master plan and conducted an EOI process.

1.2.3 Project options

Options explored as part of the *MHP Business Case 2025* include:

- **The base case – do minimum:** no change to zoning, refurbishment of the 2 warehouses in fair condition and continued operation of the sites for storage, with the warehouse in poor condition remaining unused.
- **Option A – Build new:** rezoning of the site to mixed-use precinct, build 3 new mid-rise towers suitable for mixed use.
- **Option B – Refurbish 1 site:** rezoning of the site to mixed-use precinct, build 2 new mid-rise towers suitable for mixed use and refurbish 1 warehouse for residential use.
- **Option C – Refurbish 2 sites:** rezoning of the site to mixed-use precinct, build 1 new mid-rise tower suitable for mixed use, and refurbish 2 warehouses for residential use.

The options are summarised in Figure 1-1.

[10] Note that for a design and construction project, the reference design would have greater design details, specifications and targets relating to sustainability and decarbonisation prior to going to tender for contractor to deliver against.

Figure 1-1: Mixed-use Housing Precinct - Project options

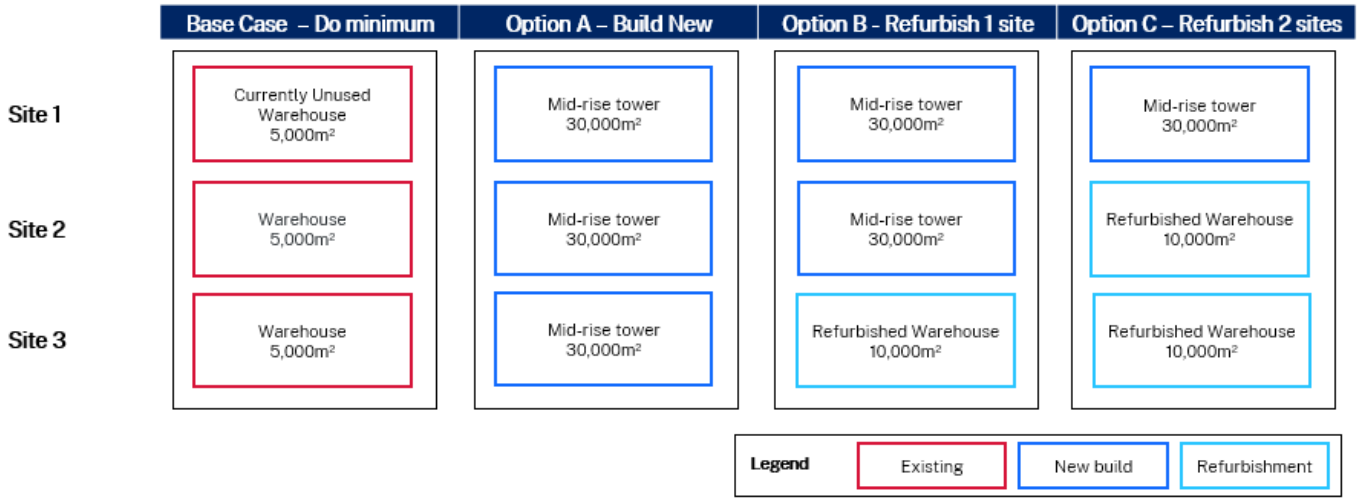


Table 1-2 summarises the total productive floor area of all 4 options.

Table 1-2: Project options description

	Base Case – Do minimum	Option A – Build New	Option B - Refurbish 1 site	Option C – Refurbish 2 sites
Total productive floor area (m²)	10,000	90,000	70,000	50,000

To support the new precinct's changed use under Option A, B and C, the project will require supporting infrastructure totalling approximately $60 million. This includes water and sewer network station upgrades, electrical substation upgrades, telecommunication upgrades, road augmentation, active transport connections and a bus interchange.

These options were developed to test a range of scenarios, including balancing objectives of optimising housing supply, preserving heritage, and reducing cost and carbon. Refer to section 3.1 for further detail on options assessment results.

1.3 Policy context and guidance

This Plan has been developed with consideration to the policies outlined below.

NSW Government Decarbonising Infrastructure Delivery Policy

The Policy provides guidance to NSW Government infrastructure delivery agencies on expectations for managing upfront carbon in public infrastructure projects, ensuring upfront carbon is a key consideration throughout all project stages.

The Policy outlines requirements across the following 3 project stages:

- Stage 1 – Business Case
- Stage 2 – Planning approval, design, and procurement
- Stage 3 – Construction and practical completion.

The Policy focuses on applying the carbon reduction hierarchy in decision making, assessing the upfront carbon impact, engaging with market, and developing a Carbon Management Plan.

Agencies are required to demonstrate compliance with the Policy at Stage 1 – Business Case through submitting a completed Carbon Management Plan, policy compliance checklist (Appendix

A), and carbon reporting (Appendix B) to Infrastructure NSW at the end of the following quarter upon receiving an investment decision.

NSW Government Embodied Carbon Measurement for Infrastructure: Technical Guidance

The NSW Government *Embodied Carbon Measurement for Infrastructure: Technical Guidance* (Measurement Guidance) is designed to support consistent measurement of embodied carbon by NSW Government agencies, their advisors, delivery partners, and emissions tool vendors. The guide aims to improve carbon measurement consistency by providing common methodology, assumptions, approach to data use and reporting.

TPG24-34 Carbon emissions in the Investment Framework

The TPG24-34 sets out requirements for carbon considerations in NSW Government business cases and cost-benefit analyses. Specifically:

- NSW Government agencies must consider the impact on emissions that occur in NSW, or occur elsewhere to manufacture or transport materials or products consumed in NSW.
- All capital projects with a total cost of $100 million (or other projects when likely to materially impact the results or decision making) must include carbon emissions in cost-benefit analyses.

TPG24-34 provides the carbon values to apply in cost-benefit analyses.

State Environmental Planning Policy (Sustainable Buildings) 2022

The *State Environmental Planning Policy (Sustainable Buildings) 2022* (SB SEPP) requires residential and some non-residential developments to quantify and report on embodied emissions attributable to development. The SB SEPP uses the NABERS (National Australian Built Environment Rating System) Embodied Carbon methodology for measurement of embodied carbon.

Agency specific policies and commitments

Infrastructure NSW has the following relevant policies and commitments with sustainability related objectives:

- Infrastructure NSW Procurement Policy:
    - Infrastructure NSW requires all its team members to foster a viable market for sustainable goods and services by supporting businesses that demonstrate innovation in sustainability and comply with socially responsible and ethical practices.
- Infrastructure NSW Project Management Framework:
    - Consistent with obligations under the *Environmental Planning and Assessment Act 1979*. In the planning and delivery of infrastructure projects, Infrastructure NSW facilitates ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making.
- Infrastructure NSW Risk Management Guidelines:
    - Infrastructure NSW considers environmental impacts as a key category of consideration within its risk assessment process.

2 Objectives and targets

2.1 Carbon related project objectives

The MHP Project aims to achieve the relevant project objectives detailed in Section 1.2, whilst minimising social and environmental impacts during both construction and the life of development.

Through the *Climate Change (Net Zero Future) Act 2023*, the NSW Government has committed to reduce emissions in NSW, working towards net zero by 2050. To contribute to efforts to achieve net zero, Infrastructure NSW will set a carbon reduction objective for the MHP Project. The objective is for upfront carbon related to the project to be reduced compared to a business-as-usual (BAU) scenario[11]. Specific objectives include:

1. Reduce embodied carbon associated with construction, use and deconstruction of the precinct
2. Maximise on-site renewable energy generation
3. All electric buildings with operation supplied with 100% renewable energy (or otherwise offset through purchase of Large-scale Generation Certificates (LGCs)
4. Reduce need for active heating and cooling by incorporating passive design measures
5. Encourage active transport and walkability in the precinct.

2.2 [OPTIONAL] Carbon reduction targets

The following table details the upfront or embodied carbon reduction target for the project, and any other relevant carbon reduction targets.

Table 2-1: Carbon reduction targets

Objective	Description	Reduction target (%)
1	Achieve a 15% reduction in carbon emissions associated with construction (upfront) when compared to BAU*	15%
1	Achieve a 20% reduction in carbon emissions associated with operations, when compared to BAU	20%
1	Use concrete that has an average Portland cement replacement of more than 25%	>25%
2 & 3	Supply 100% of the energy needs for the operations phase of the project from renewable electricity (or otherwise offset through purchase of LGCs), from the first year of operation	100%

The development of carbon reduction targets was initially based on lessons learnt from recent Infrastructure NSW projects and the mid-level scenario for carbon abatement from Infrastructure

[11] BAU is defined by the carbon baseline in Section 2.3.

Australia's report *Embodied Carbon Projections for Australian Infrastructure and Buildings*.[12] Early market engagement was used to test the ability of the market to meet these targets which resulted in some refinement (see Section 4.1).

2.3 [OPTIONAL] Project carbon approach

To serve as the BAU reference point for the upfront and operational carbon targets, a carbon baseline will need to be developed during detailed design.

Given the limited available information during the business case stage, generic asset-level carbon intensity benchmarks from the NSW Embodied Carbon Databook were utilised to develop the upfront carbon estimates. At this point in time, these benchmarks are not considered appropriate to utilise as a target baseline for carbon performance.

Infrastructure NSW is in the process of gathering upfront carbon information from a wider set of projects to establish more appropriate asset-level benchmarks ($kgCO_2e/m^2GFA$) for use in future baseline setting. However, this dataset does not currently have an appropriate sample size for this purpose. As-built information collected from the MHP Project will contribute to improving this benchmarking.

To achieve an appropriate level of accuracy, a bespoke baseline value will need to be defined in Stage 2, consistent with the principles in the Measurement Guidance. This is expected to use estimated quantities and generic emission factors.

An initial carbon estimate will be developed during the reference design phase to inform tender and planning approvals.

During detailed design, more detailed carbon analysis will be undertaken to inform design development and track performance against carbon targets.

In the construction phase, carbon analysis will need to be updated and provided by the developer at practical completion to meet agreed obligations, with any changes to approvals subject to the landowner's consent.

As there are 2 separate targets established, one for upfront carbon (A1-A5) and one for carbon emissions in operations (B1-B7), a baseline will be established for each using consistent lifecycle stage system boundaries throughout the project. Minimum inclusions are expected to cover the items shown in Table 2-2.

Table 2-2: Baseline and forecast minimum inclusions

Upfront carbon baseline	Operational carbon baseline
• Structure • Foundation • Envelope (e.g. façade, cladding, glazing, roof, insulation) • Temporary civil and structural works (not including reuse) • Associated infrastructure (where relevant): (e.g. roads and pavements, car parks, drainage and retaining structures).	• Synthetic gas leakage (e.g. refrigerants, SF6) • Maintenance, repair, refurbishment and replacement of any materials accounted for in the upfront carbon boundary • Operational energy • Water and wastewater.

[12] https://www.infrastructureaustralia.gov.au/reports/embodied-carbon-projections-australian-infrastructure-and-buildings

Any stored carbon in products (e.g. sequestered biogenic carbon), carbon neutral products, or carbon offsets will not be included within the baseline and will not count towards the achievement of the target, but rather disclosed separately.

Emissions from the demolition of existing building and infrastructure assets are to be included within the upfront carbon target for this project to incentivise low emissions and circular demolition practices. However, these must be clearly separated out in final reporting to establish consistent future benchmarks.

3 Project carbon analysis

3.1 Options assessment

The *MHP Business Case 2025* considered a range of criteria as a part of a multi-criteria analysis to determine the optimal option to meet the project objectives. These included carbon emissions, but also trade-offs between housing and retail floor space. Some key factors can be seen below:

- **Build nothing:** The base case involved refurbishing 2 warehouses in fair condition (noting the build nothing option does not meet the required need). The rationale for proceeding with new infrastructure can be found within *Chapter 2 - Strategic Case* of *MHP Business Case 2025.*
- **Upgrades or repurposing of existing infrastructure:** Options B and C involved refurbishing existing infrastructure.
- **Using assets for multiple purposes:** Options A, B and C proposed building at least 1 asset for mixed use.

The MHP Business Case 2025 also explored opportunities for low carbon design and construction methods. The identified opportunities did not factor into the options assessment as these can be applied equally to Option A, B and C, and the extent to which these opportunities are able to be implemented was marginal. These opportunities have been summarised in Table 3-6 of Section 3.4.

The preferred option identified through the CBA undertaken at the end of Full Business Case is Option B, with a capital expenditure (CAPEX) of $300 million.

Option B has been selected as it is best able to meet multiple project objectives, including housing supply, local employment, maintaining heritage and reducing carbon, with the highest benefit to cost ratio. Options were compared within the Multi-Criteria Analysis (MCA) and combined with carbon values within Cost-Benefit Analysis (CBA) consistent with TPG24-34. Further detail is captured within the respective MCA and CBA documents, but the key considerations are:

- The base case has the lowest emissions and intensity but does not provide new housing, which is the main objective of the project.
- Option B has an absolute upfront carbon impact (tCO_2e) and carbon intensity (tCO_2e/m^2 GFA) between that of Option A and C. The absolute emissions of Option C are slightly lower than that of Option A and B, however it results in substantially fewer dwellings. Option A provides for more dwellings but with higher absolute emissions and carbon intensity. The preferred Option B presents a balance between these competing objectives.
- Differences between operational carbon between options is marginal given 100% of the electricity needs for the project will be offset for the operations phase.
- Differences between carbon emissions associated with end-of-life phase will be marginal between options and small relative to upfront carbon emissions.

3.2 Carbon assessment results (base case and preferred option)

An estimate of the emissions associated with each option was developed consistent with the Measurement Guidance for use within the MCA and CBA process.

Under the SB SEPP, the MHP Project is required to quantify and report on embodied emissions attributable to buildings within the development. To obtain development consent, embodied

emissions associated with the building scope will be required to be reported which will be completed through the *NABERS Embodied Carbon Calculator*.

Given the significant proportion of the capital spend is infrastructure that is excluded by the SB SEPP, embodied carbon associated with infrastructure required within the precinct (e.g. water, power, telecommunication and transport infrastructure) will be reported via the *Decarbonising Infrastructure Delivery Policy reporting template* (Appendix B).

The NSW Embodied Carbon Databook was utilised to develop the upfront carbon estimates. This required the use of floor area estimates (m^2GFA) provided within the Reference Design as outlined in Table 3-1.

Table 3-1: Data inputs for carbon assessment

Design stage	Master plan
Date of design stage	1 August 2024
Key data inputs	Master plan drawing set and report

Table 3-2 provides an overview of the carbon assessment for the base case and the preferred Option B. Full reporting of carbon results of the entire project (buildings and infrastructure) in line with the Measurement Guidance is detailed in the Appendix B.

Table 3-2: Carbon assessment results

Lifecycle Module	Base case		Preferred option	
	Absolute (tCO_2-e)	Per declared unit (tCO_2-e/unit)	Absolute (tCO_2-e)	Per declared unit (tCO_2-e/unit)
Upfront carbon (A1-A5) - excl biogenic carbon	3,162 [2,375 – 3,956]	0.32 [0.24 - 0.40]	54,950 [42,313 – 68,642]	0.78 [0.60 - 0.98]
Maintenance, repair, refurbishment and replacement (B2-B5)	790	0.08	8,643	0.12
End-of-life (C1–C4)	158	0.02	2,747	0.04
Operational energy (B6)	430	0.04	0	0
Operational water (B7)	1,205	0.12	10,101	0.11

3.2.1 [OPTIONAL] Trade-offs across lifecycle stages

Trade-offs across the project lifecycle have been considered as part of the options evaluation. These have been laid out in Table 3-3.

Table 3-3: Identified trade-offs

No.	Trade-off	Detail	Further reference
1	The potential for greater maintenance, repair, and replacement demand for options that refurbish the existing warehouses compared to new build options. This needs to be balanced with reduced upfront carbon.	This has been considered using reduced upfront carbon benchmarks for the refurbishment from the NSW Embodied Carbon Databook and increased use phase benchmarks derived from past Infrastructure NSW projects. On balance, refurbishment is still considered to be a lower carbon choice, and these quantitative findings have been integrated into the carbon values used in options comparison.	Balancing trade-offs has been identified as a risk with mitigation measures for Stage 2 and further outlined in Section 3.4.
2	Refurbishment of the existing warehouse, whilst lower in upfront carbon, could lead to difficulties in achieving sufficient airtightness or insulation thicknesses. This could hinder energy efficiency by increasing energy demand for heating and cooling.	Consideration should be made to balancing energy efficiency requirements with upfront carbon requirements. This is considering the potential for significant alterations to negate operational carbon benefits through an increase in upfront carbon. This is particularly relevant given the commitment for operational energy to be provided from renewable sources. **Note:** As Options A, B and C will all be powered through renewable energy, this has not been considered quantitatively in the assessment at this stage but will be investigated through design development.	

3.3 Main sources of carbon

The relative contribution to whole life carbon from lifecycle stages for the preferred option is estimated to be:

- 57% from Products (A1-A3)
- 13% from Operational water (B7)
- 12% from Construction (A5)
- 11% from Maintenance, repair, refurbishment and replacement (B2-B5)
- 4% from Transport (A4).

This breakdown is based on the project meeting its target for 100% of the electricity needs for the project offset during operations (e.g. through an embedded network arrangement or similar, or purchase of LGCs). However, if this commitment is not fulfilled in delivery, then the whole of life emissions would increase by approximately 7% due to the emissions from operational energy (B6).

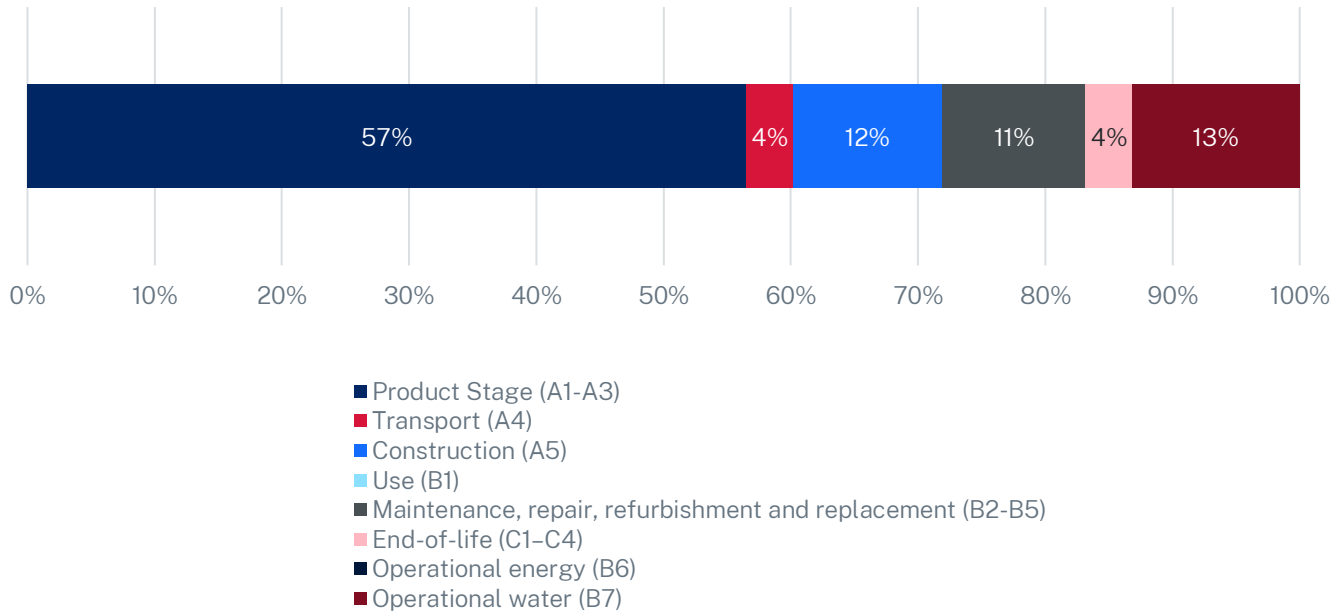
The following table (Table 3-4) includes a summary of the main sources of carbon within each of these key lifecycle stages. Due to limited data availability for the carbon estimate at this stage, the analysis has used key project characteristics (e.g. m^2 GFA) and carbon intensity benchmarks for the assessment. Key sources in Table 3-4 are informed by expected/typical built form and construction methods.

Table 3-4: Carbon hotspots relevant to the project

Lifecycle Module	Key sources of emissions (or "hotspots")
Product (A1-A3)	The primary contributions to the carbon footprint are likely to be the use of concrete and steel for the foundations and superstructure of the new buildings. For the refurbishment retrofit of the building envelope, internal structural upgrades and new finishes are likely to be the largest contributors.
Operational water (B7)	Emissions associated with water supply and wastewater treatment for the buildings such as energy use in the distribution network, fugitive emissions from wastewater treatment and chemicals used at treatment plants.
Construction (A5)	Energy use from plant & equipment on site (e.g. diesel and electricity).
Maintenance, repair, refurbishment and replacement (B2-B5)	Replacement of shorter-lived building components over the life of the project (e.g. building services and finishes as well as periodic fit outs of the commercial and retail spaces).
Transport (A4)	Transport of bulk materials to site (e.g. concrete, steel and aggregates) and transport of waste from both demolition materials from the existing buildings and spoil from basement excavations.

Figure 3-1 shows the major sources of emissions across the project lifecycle. At this stage, further detail regarding the specific contribution breakdown within each module is not available due to the use of carbon intensity benchmarks. However, it is expected a more detailed breakdown will be completed in Stage 2.

Figure 3-1: Upfront carbon contribution by lifecycle stage



3.4 Key risks, opportunities and actions for carbon reduction

Table 3-5: Key risks and actions

No.	Risk description	Proposed or implemented mitigations	Status	Owner
1	Discovery of contaminated land or materials could increase emissions associated with construction and waste treatment.	Additional geotechnical and contamination assessments to be undertaken at the concept design stage. Design options to minimise foundation depth and ground disturbance to be explored as part of concept design development. The carbon impact of treatment options for any contaminated material (e.g. rehabilitation methods vs disposal) to be considered as part of design development and value engineering.	Planned	Engineering Manager
2	An unexpected level of deterioration in the existing building identified for refurbishment could lead to higher demand for new materials and/or reduced design life or increased maintenance requirements.	Additional structural investigations and testing to be undertaken during the concept design stage to maximise the reuse of existing elements. Opportunities for repair rather than replacement to be explored and implemented where reasonably practical. This will include consideration of maximising design life and minimising maintenance.	Planned	Engineering Manager
3	Refurbishment of the existing warehouse could lead to difficulties in achieving sufficient airtightness or insulation thickness that could hinder energy efficiency and lead to higher energy demand in operations for heating and cooling.	Design investigations to consider trade-offs between retention of existing building elements and impacts on energy efficiency. Renewable energy to be required for the operations stage for all residual energy consumption.	Planned	Lead Architect

Table 3-6: Key opportunities and actions

No.	Opportunity description	Actions (implemented or potential)	Status	Owner
1	Explore alternative structural design solutions such as mass timber to both reduce the building mass and foundation extents, as well as reduce embodied emissions compared to traditional concrete and steel construction methods.	Value engineering workshops to consider alternative structural design options and cost and carbon saving potential. Integrate carbon valuation into cost-benefit analysis of value engineering opportunities.	Planned	Lead Architect
2	Maximise the reuse of the existing materials onsite including: • building elements within the refurbished warehouse • repair and use of elements from the warehouses to be demolished • retaining paths, pavements, stormwater systems and similar elements within the precincts urban design.	Inventory of existing materials to be prepared as part of concept design with a condition assessment. Design development to consider all reasonably practical opportunities for retention and reuse.	Planned	Lead Architect
3	Integrate water efficiency within the design to minimise emissions associated with operational water and wastewater impacts.	Set out minimum WELS ratings within the design specifications for all water using appliances. Specification of drought resistant planting with low to no irrigation requirements within precinct landscape design. Minimum of 5 Star NABERS rating to be specified within contracts.	Planned	Lead Architect

4 Implementation of carbon management

4.1 [OPTIONAL] Procurement and market engagement

4.1.1 [Optional] Procurement strategy and early market engagement

The MHP development will be through a divestment from NSW Government under a 2-stage procurement process. Stage 1 was an EOI process that will be followed by a Request for Tender (RFT) prior to appointing the developer for the delivery of the project.

The procurement strategy details how early market engagement supports the delivery on the project objectives and carbon targets during the subsequent stages.

During the master plan and business case stage, market research and sounding have been used to set the targets outlined within Section 2.2. During the following stages, project partners will be encouraged to add additional improvements in line with the project objectives and with consideration of cost and value-for-money outcomes.

To promote innovation, the RFT will allow for tenderers to propose alternative solutions which may have cost and carbon benefits. This will include the integration of a key performance indicator which encourages exceedance of the minimum upfront carbon target. The delivery procurement strategy has determined the evaluation criteria and weightings that will be used to assess tenderers, considering compliance with carbon targets.

The returnable schedules for the RFT will include a mandatory section on Environmentally Sustainable Design. This will provide the opportunity for the tenderer to outline their approach to the targets and enable the opportunity to bid-back more ambitious options and targets.

Table 4-1 below outlines the early market engagement activities used to support the management of carbon during procurement.

Table 4-1: Supply chain participants, opportunities to influence and early engagement on carbon reduction

Stage	Who to engage?	Early engagement approach
Masterplan and business case	Potential developers, designers, and tenants	Market research / horizon scanning Market sounding
Reference Design	Potential developers, contractors, and material/product suppliers	EOI Industry briefing
Tender for delivery/development	Shortlisted developers	RFT briefings Tender interactives
Detailed design and construction planning	Sub-contractors and material/product suppliers	To be conducted by successful developer

4.1.2 [Optional] Tender brief requirements for concept design

As the project progresses into the Reference Design stage, Infrastructure NSW will engage relevant advisors to develop options and decide upon a preferred design to use as a basis to procure a

developer under the PDA.

The scope for the Reference Design advisors will include the following requirements, for which relevant contract clauses will be included as part of the procurement strategy:

- A *Design Sustainability Workshop* must be held including key members of the project team during the tender period. The workshop must include discussion of carbon reduction risks and opportunities including the identification of potential additional innovations.
- Significant design decisions within the *Reference Design Options Report* must consider the impact on the project's carbon footprint through a method appropriate to the size of the opportunity.[13] Initiatives must at a minimum include:
    - Further investigations into the condition of the buildings and infrastructure on the current site must be undertaken. The goal is to establish a materials library documenting the condition of primary materials and building elements, outlining the intended repair and reuse or disposal pathway.
    - Opportunities for pursuing alternative structural design systems such as mass timber framing must be evaluated.
    - Design options to minimise foundation depth and ground disturbance to be explored as part of concept design development. The carbon impact of treatment options for any contaminated material (e.g. rehabilitation methods vs disposal) are to be considered.
    - Potential materials substitution initiatives such as high levels of cement replacement in concrete and similar will also be investigated and where confirmed, included within specifications in later stages.

4.2 [Optional] Design

During the detailed design stage, any significant design decisions will consider the impact on the project's carbon footprint through a method appropriate to the size of the opportunity. Value engineering workshops will consider low carbon design opportunities, including but not limited to those in section 3.4. Those opportunities found feasible and demonstrating value for money will be considered for implementation.

Whole of life carbon emissions and progress against the targets outlined in Section 2.2 will be required to be submitted to Infrastructure NSW at the 80% design and Issued-for-Construction (IFC) design development stages to track progress.

A carbon baseline will be required to be established at the IFC stage consistent with the principles outlined in Section 2.3.

4.3 [Optional] Construction

Significant design and construction decisions should consider the impact on the project's carbon footprint through a method appropriate to the size of the opportunity.[14] Construction planning will consider low carbon construction opportunities, including but not limited to those in section 3.4, and implement those found feasible and demonstrating value for money.

As-Built quantities will need to be monitored by the contractor, with 6-monthly reporting on

[13] Projects should look to quantify the carbon impact where possible, but this may include qualitative or semi-quantitative evaluation for less significant changes through to an assessment of value-for-money and carbon valuation for the most significant opportunities.
[14] Projects should look to quantify the carbon impact where possible, but this may include qualitative or semi-quantitative evaluation for less significant changes through to an assessment of value-for-money and carbon valuation for the most significant opportunities.

emissions and progress against the targets outlined in Section 2.3 to be required, as well as final reporting at practical completion. This will include reporting on any materials with available EPDs.

At practical completion, a comparison to the carbon baseline established during design will need to be provided, with any variations to the baseline (as per Section 2.3) clearly justified.

Emissions associated with the building scope will be required to be reported through the *NABERS Embodied Carbon Calculator* whilst the emissions across the project including infrastructure components will be required to be reported through Appendix B.

5 Roles and responsibilities

5.1 Project governance for carbon management

Table 5-1: Roles and responsibilities for carbon management

Role	Responsibility
Infrastructure NSW MHP Project Director	• Set and communicate clear carbon objectives and targets for the project. • Promote a culture of working to reduce emissions. • Sign off on the completed CMP Stage 1 Template (CMP), including Appendices A and B.
Infrastructure NSW Project Team	• Ensure business case is developed in alignment with principles and actions of the Policy. • Ensure that carbon is considered in options analysis and decision-making, including in cost-benefit analysis consistent with TPG24-34.
Infrastructure NSW Sustainability Manager	• Develop CMP for alignment with Infrastructure NSW policies and processes. • Support tender evaluation for consideration of sustainability carbon outcomes. • Identify opportunities and risks for carbon reduction. • Inform the development of the stakeholder engagement plan and procurement strategy in relation to carbon reduction.
External Sustainability Advisor	• Support the development of the CMP, including Appendices A and B, with Infrastructure NSW Sustainability Manager (this document). • Undertake carbon assessment. • Advise on the development of carbon reduction strategies.
Technical Manager	• Ensure that low carbon options are incorporated into design, and that carbon is considered as part of options assessments and value engineering. • Manage relevant risks and opportunities and consider technical feasibility.
Infrastructure NSW Procurement Team	• Include carbon objectives in procurement strategy. • Ensure that carbon management objectives and requirements are captured in tender and contract documentation. • Communicate carbon objectives and requirements as part of any market engagement and interactive activities. • Undertake tender evaluation with consideration of carbon/sustainability outcomes.
Infrastructure NSW Communications and Engagement Team	• Develop stakeholder management plan. • Communicate carbon objectives and requirements as part of market engagement.

5.2 Identification of value chain members and their roles in carbon management

Table 5-2: Value chain members

Value chain member	Role and responsibilities in managing carbon
Delivery agency (Infrastructure NSW)	• Establish clear governance, objectives, and targets for carbon management. • Facilitate early market engagement to test delivery teams' ability to offer lower carbon outcomes and meet carbon objectives and targets. • Develop and update the CMP as required with support from the sustainability advisor.
Consultants/advisors (Business Case and Reference Design stages)	• Incorporate carbon emissions and valuation into CBA and the *MHP Business Case 2025.* • Identify and incorporate low carbon solutions in design. • Consider carbon as part of options assessments.
Developer (To be tendered)	• Participate in early market engagement activities and support in the identification or risks, opportunities and low carbon innovations. • Outline approach to meeting project targets within the tender response. • Ensure that objectives and requirements are incorporated into delivery contracts (e.g. design and constructors). • Encourage designers, constructors, and suppliers to challenge current practices and seek out decarbonisation opportunities.
Designers (To be tendered)	• Identify further low carbon design opportunities and raise within early market engagement. • Respond to tender brief requirements within design. • Embed carbon reduction requirements within the design and specifications.
Sustainability advisor (To be tendered if required[15])	• Support evaluation of carbon reduction opportunities and develop strategy for meeting targets. • Develop carbon baseline. • Assist with producing Stage 2 and 3 CMP.
Constructors (To be tendered)	• Identify further low carbon construction opportunities, including innovation in construction methodology, and raise within early market engagement. • Embed carbon reduction opportunities within the construction methodology. • Integrate objectives and requirements into supplier and subcontractor tenders and contracts. • Monitor data required for as-built carbon reporting.
Product/material suppliers (To be tendered)	• Identify and raise carbon reduction opportunities/innovations. • Provide Environmental Product Declarations.

[15] External sustainability advisor may not be required if the Developer and/or Designer have sufficient in-house sustainability expertise e.g. a dedicated Sustainability Manager

5.3 Carbon reporting

Table 5-3 sets out timing and the reporting responsibilities using Carbon Management Plan and the Decarbonising Infrastructure Delivery Policy reporting template.

Table 5-3: Carbon reporting responsibilities

Stage	Responsibility	Timing
Business Case (Stage 1)	INSW Sustainability Manager, supported by external sustainability advisor	At the end of Full Business Case
Detailed Design (Stage 2)	Developer, supported by design consultants	100% detailed design
Construction (Stage 3)	Developer, supported by reporting from contractors	Practical completion

6 Appendices and supplementary templates

6.1 Appendix A – Policy compliance checklist

Decarbonising Infrastructure Delivery Stage 1 Policy compliance checklist

Principle	Policy requirement	Compliance status (e.g., Yes, No, Partial, N/A) / Refer to
Apply the Carbon Reduction Hierarchy	Mandatory actions (all agencies)	
	1. Provide sound reasons in project inception and registration documentation for why new infrastructure is required to address the problem or service need, including consideration of upfront carbon.	*Yes - see Section 3.1*
	2. On an "if-not-why-not" basis, the business case options analysis must consider: a. build nothing option(s) b. upgrades or repurposing of existing infrastructure c. using assets for multiple purposes d. low carbon design and construction methods (at the Full Business Case stage).	*Yes - see Section 3.1*
	3. Business cases must include clear rationale for proceeding with any new infrastructure options.	*Yes – see Section 3.1 & MHP Business Case Summary Section 7*
Assess the upfront carbon impact	Mandatory actions (all agencies)	
	4. Business cases must consider carbon as part of options analysis in line with the NSW Guide to Cost-Benefit Analysis (CBA Guide). The agency must: a. estimate the upfront carbon associated with each option using the Measurement Guidance, which has provisions for maturing and foundational capabilities b. include carbon emissions as a criterion when assessing preliminary options in the multi-criteria analysis. Where feasible, this should include whole life carbon c. for the preferred option in the Full Business Case, identify the main sources of upfront carbon, and use this to inform carbon reduction objectives for market engagement.	*Yes* *4a: See Section 3.2* *4b: See MHP Business Case Summary Section 7* *4c: See Section 3.3 & 3.4*
	Optional actions (agencies with maturing capabilities)	

Principle	Policy requirement	Compliance status (e.g., Yes, No, Partial, N/A) / Refer to
	5. Set an upfront carbon reduction objective as part of the broader SMART (Specific, Measurable, Achievable, Realistic, Timely) project objectives set for the Preliminary Business Case. This will be revised to a target in the Full Business Case.	*Yes – see Section 2.2*
	6. As part of target setting, the agency should first define a baseline for the preferred option in the Full Business Case. This means: a. identifying comparable projects or sector benchmarks that can inform the baseline, such as interjurisdictional examples or sub-asset level benchmarks b. adjusting or tailoring the baseline to suit the context of the project with supporting justification.	*Partial – see Section 2.3. Baseline to be defined at Stage 2.*
	7. The agency should set an upfront carbon reduction target. In setting the target, agencies should consider alignment with reduction ambitions set by government or comparable organisations, industry bodies, or projects, while having regard for trade-offs between carbon reduction and additional costs. The agency should: a. identify an ambitious upfront carbon reduction target for the project b. compare the target to those set for comparable projects in the same sector c. consider how value chain perspectives may be incorporated (e.g. via market sounding process) d. identify and consider any trade-offs that the upfront carbon reduction target may produce across the asset lifecycle. See Table 5 in the policy for examples of whole life carbon trade-offs.	*Yes* *7a: See Section 2.2* *7b: See Section 2.2* *7c: See Section 4.1.1* *7d: See Section 3.2.1*
	8. Both the baseline and the target should be revisited following procurement to reflect any further carbon reductions proposed by the successful bidder.	*Yes - see Section 4.1.1*
Engage with the market	Optional actions (agencies with maturing capabilities)	
	9. Include requirements to capture all reasonable decarbonisation opportunities (such as in materials, structure, and construction emissions) in the brief for concept design. This should draw on the major sources of carbon identified in action 4c.	*Yes - see Section 4.1.2*

Principle	Policy requirement	Compliance status (e.g., Yes, No, Partial, N/A) / Refer to
	10. Following concept design, the agency should test these opportunities with the market as part of early engagement processes. The agency should: a. consider a variety of market engagement methods b. allow adequate time in the project schedule for meaningful market engagement that is proportionate to the size of the project and its risks c. understand market appetite and ability in relation to decarbonisation d. encourage low carbon initiatives by contractors, such as in materials, structure and construction methods. Note, if the requirements under 9 and 10 are not carried out prior to Full Business Case, the stakeholder engagement plan should outline how these requirements will be met in Stage 2.	*Yes - see Section 4.1.1*
Develop a Carbon Management Plan	Mandatory actions (all agencies)	
	11. The agency must prepare a Carbon Management Plan as part of a Full Business Case. The level of detail should reflect the project's size and risks. Alternatively, a standard organisation-wide carbon management plan can be used where agency procedures do not vary across projects.	*Yes - this document*
	12. The Carbon Management Plan must document: a. the expected supply chain participants and opportunities for control and influence to reduce carbon b. the roles and responsibilities for upfront carbon management and measurement (both in the project team and across the value chain members) c. how the procurement strategy seeks to promote early engagement and innovative decarbonisation approaches d. how and when supply chain participants can be involved as part of early engagement, for example in relation to the application of low carbon methods, and reflect this in the stakeholder engagement plan e. results of carbon quantification for the preferred option in accordance with the Measurement Guidance f. key risks related to achieving upfront carbon reductions for input into the risk register.	*Yes* *12a: See Section 4.1.1 & 5.2* *12b: See Section 5* *12c: See Section 4.1.1* *12d: See Section 4.1.1* *12e: See Section 3.2* *12f: See Section 3.4*
	Optional action (agencies with maturing capability)	

Principle	Policy requirement	Compliance status (e.g., Yes, No, Partial, N/A) / Refer to
	13. Include carbon reduction targets and metrics in project objectives assigned to respective value chain members or roles, aligning with the overall reduction target.	*Yes - see Section 5*

6.2 Appendix B – Decarbonising Infrastructure Delivery Policy reporting template

Please refer to a separate Excel file 'Worked example – Reporting template – Decarbonising Infrastructure Delivery Policy'.

NSW GOVERNMENT