



Transport for NSW

Beaches Link and Gore Hill Freeway Connection

Chapter 22

Urban design and visual amenity

22 Urban design and visual amenity

This chapter provides an assessment of the urban design, landscape character and visual amenity impacts of the project and identifies measures to address these impacts. A detailed urban design, landscape character and visual impact assessment has been prepared for the project and is provided in Appendix V (Technical working paper: Urban design, landscape character and visual impact).

The Secretary's environmental assessment requirements as they relate to urban design, visual amenity and landscape, and where in the environmental impact statement these have been addressed, are detailed in Table 22-1.

Avoiding or minimising impacts has been a key consideration throughout the design and development process for the Beaches Link and Gore Hill Freeway Connection project. A conservative approach has generally been used in the assessments, with potential impacts presented before implementation of environmental management measures. The environmental management measures proposed to minimise the potential impacts in relation to urban design, visual amenity and landscape are included in Section 22.8.

Table 22-1 Secretary's environmental assessment requirements – Urban design, visual amenity and landscape

Secretary's requirement	Where addressed in the EIS
Placemaking and urban design (visual amenity requirements)	
<p>1. The Proponent must identify how functional 'place' outcomes of public benefit will be achieved, including design principles and strategies that:</p> <ul style="list-style-type: none"> a. consider areas identified for future urban renewal; b. capitalise on reduced traffic volumes and the reduction of traffic permeation, particularly in and around commercial and community centres; c. avoid locating infrastructure, including ancillary facilities adjoining residential areas and other sensitive receivers, and justify where this cannot be achieved; d. achieve high quality landscaping, streetscapes, architecture and design; e. identify urban design strategies and opportunities that would enhance healthy, cohesive and inclusive communities, including in relation to accessibility and connectivity; f. consider resulting residual land treatments, and demonstrate how the elements of the proposal would be consistent with the 	<p>Chapter 22 (Urban design and visual amenity) provides the principles that identify how functional 'place' outcomes of public benefit would be achieved (in respect to points a – h) and are outlined in Section 22.2 and Section 22.8 and Table 1.2 of Appendix V (Technical working paper: Urban design, landscape character and visual impact).</p> <p>Justification for the location of ancillary facilities is provided in Chapter 4 (Project development and alternatives) and Chapter 5 (Project description).</p>

Secretary's requirement	Where addressed in the EIS
<p>existing and desired future character of the area traversed or affected by the proposal;</p> <p>g. identify opportunities to utilise surplus or residual land, particularly for the provision of community space (passive and recreational) and utilise key structures (such as ventilation outlets) for multiple uses (i.e. integration with other structures; and</p> <p>h. explore the use of Crime Prevention Through Environmental Design (CPTED) principles during the design development process, including natural surveillance, lighting, walkways, signage and landscape</p>	
<p>2. The Proponent must describe the accessibility elements of the proposal including relevant accessibility legislation and guidelines, including:</p> <p>a. impacts on public transport infrastructure and services;</p> <p>b. impacts on pedestrian and cyclist access and safety across and adjoining the proposal; and</p> <p>c. opportunities to integrate and enhance accessibility including the provisions public and active transport infrastructure as a result of the proposal.</p>	<p>A high-level outline of the legislation and guidelines relevant to the project and its possible visual amenity and landscape impacts is presented in Section 22.1.</p> <p>Accessibility and transport related issues are outlined in Chapter 8 (Construction traffic and transport) and Chapter 9 (Operational traffic and transport).</p>
<p>3. The Proponent must assess the visual and landscape impacts of the proposal, including ancillary infrastructure on:</p> <p>a. views and vistas;</p> <p>b. streetscapes, key sites and buildings;</p> <p>c. landscaping, green spaces and existing tree canopy including an assessment of likely magnitude of impacts to trees and need for removal to be undertaken by an arborist including the provision of measures to minimise and offset impacts;</p> <p>d. heritage items Aboriginal places, environmental heritage and areas of heritage sensitivity; and</p> <p>e. the local community.</p>	<p>The visual and landscape impacts of the proposal including ancillary infrastructure (in respect to points a, b, d, and e), associated with construction and operation are outlined in Section 22.6 and Section 22.7 respectively and Table 1.1 of Appendix V (Technical working paper: Urban design, landscape character and visual impact).</p> <p>The potential removal and likely magnitude of impacts to trees is assessed in Appendix W (Technical working paper: Arboricultural impact assessment) and is subject to further design development and construction planning.</p>
<p>4. The Proponent must provide artist impressions and perspective drawings of the proposal from</p>	<p>Appropriate impressions and perspective drawings of the proposal from key receiver locations are provided in Section 22.7.</p>

Secretary's requirement	Where addressed in the EIS
key receiver locations to illustrate the proposal and its visual impacts.	

22.1 Legislative and policy framework

An urban design framework (refer to Appendix V (Technical working paper: Urban design, landscape character and visual impact)) has been prepared with reference to the urban design principles in *Beyond the Pavement* (Transport for NSW, 2020g). A design review panel has been established for the project to provide independent review and advice throughout the design development. *Better Placed* (NSW Government Architect, 2017), other Transport for NSW design and biodiversity guidelines and local government planning documents, such as local environmental plans and development control plans, have also been considered in the preparation of the urban design framework.

The landscape character and visual impact assessment has also considered relevant local environment plans, development control plans, and regional planning documents. A complete list of the local environment plans, development control plans, regional planning documents, as well as guidelines relating to landscape character and visual impact assessment, is provided in Appendix V (Technical working paper: Urban design, landscape character and visual impact).

22.2 Urban design framework

Transport for NSW has developed a strategic urban design framework for the Beaches Link and Gore Hill Freeway Connection project to inform the urban design and establish benchmarks for achieving a well-planned and integrated road alignment through a high-quality urban design response. The urban design framework has been informed by the urban design policy, *Beyond the Pavement* (Transport for NSW, 2020g) and is provided in Appendix V (Technical working paper: Urban design, landscape character and visual impact).

22.2.1 Urban design vision and objectives

The urban design vision for the project is to provide “a distinctive motorway experience that, through a series of undulating subterranean journeys, provides a connection across Sydney Harbour from the urban centre of North Sydney, through residential suburbs towards the landscape of the Northern Beaches. It also provides east/west connectivity, improving access to employment centres like Macquarie Park and Chatswood and improved traffic levels on Warringah Road through Roseville Bridge. It is a transition between tunnel and surface environments, a connection across the Harbour and a link from city to bushland. It will provide enhanced green connections, improved pedestrian and cyclist amenity and facilitate local places to return to local communities”. This vision is further outlined in Appendix V (Technical working paper: Urban design, landscape character and visual impact).

To help achieve this urban design vision, urban design objectives and the desired outcome for each objective have been established to guide the urban design process. These are discussed in Table 22-2.

Table 22-2 Urban design objectives

Objective	Desired outcome
Identity and user experience	Develop a theme that references Sydney's unique geography and place to provide a user experience that enhances the journey, encourages awareness of the living environment, enables orientation and enhances safety.

Objective	Desired outcome
Integrated design	Provide an integrated urban design approach that thoughtfully seams the Beaches Link and Gore Hill Freeway Connection to its surrounding urban and landscape interfaces.
Connectivity and legibility	Provide connectivity between areas beyond the boundaries of the motorway corridor and promote increased legibility of places, buildings, streets and landmarks.
Urban renewal and liveability	Unlock potential for urban regeneration, landscape improvements as well as active transport and public transport upgrades along the project corridor. These urban renewal opportunities would provide high levels of urban amenity and liveability.
Living environments	Ensure the design, planning, construction and management of the project responds to the living environment. Infrastructure interventions would reflect a natural system approach which is responsive to the environment and promotes the highest levels of sustainability.
Sustainability	Embed sustainability considerations into the design and delivery of the project in order to minimise environmental and social impacts whilst delivering positive economic outcomes for the people of NSW.

22.2.2 Urban design requirements

The urban design requirements of the project have been informed by the urban design vision and objectives and encompass the requirements for the spatial and functional design of the urban and public domain, and the built elements of the project. The architectural treatments for the tunnels, surface connections and other operational infrastructure would be guided by the urban design requirements and finalised during further design development of the project.

Experience and function

Good urban design has the ability to connect communities and provide a positive experience for users. Design principles for spatial and functional design of the project, and the relevant urban design objective that these would address, are provided in the urban design framework in Appendix V (Technical working paper: Urban design, landscape character and visual impact).

Urban elements

The built elements of the project would contribute to creating desirable public spaces by providing a high-quality experience for users and a balanced, contextually responsive approach. Table 22-3 outlines the principles for designing the urban elements of the project. Further detail, including the proposed approach to achieving these principles, is provided in the urban design framework in Appendix V (Technical working paper: Urban design, landscape character and visual impact). These principles, including CPTED principles, would be further developed during the further design development stage of the project.

Table 22-3 Principles for designing urban elements of the project

Urban elements	Design principle	Relevant urban design objective
Earthworks	Visually integrate earthworks into their landscape setting as much as possible, keeping engineered structures to a minimum.	<ul style="list-style-type: none"> • Urban renewal and liveability • Integrated design • Living environments • Sustainability.

Urban elements	Design principle	Relevant urban design objective
Noise walls	Visually integrate noise walls into the road corridor and urban/landscape setting as part of a coordinated whole-of-corridor design.	<ul style="list-style-type: none"> • Identity and user experience • Integrated design • Sustainability.
Retaining walls and flood walls	Visually integrate retaining walls and flood walls into the road corridor and urban/landscape setting as part of a coordinated whole-of-corridor design.	<ul style="list-style-type: none"> • Identity and user experience • Integrated design • Connectivity and legibility • Living environments.
Mainline tunnels and ramp tunnels	Deliver a tunnel that makes a positive contribution to the journey experience through intuitive wayfinding and a varied and stimulating driver environment.	<ul style="list-style-type: none"> • Identity and user experience • Integrated design • Connectivity and legibility.
Tunnel portals and trough structures	Deliver portals and trough structures that are visually appealing, sensitive to their context, reflect the above ground environment and provide a legible, self-explaining journey which enables awareness of location.	<ul style="list-style-type: none"> • Identity and user experience • Integrated design • Connectivity and legibility • Living environments.
Motorway facilities, ventilation outlets and motorway control centre	Minimise the physical footprint and visual impact of these structures whilst ensuring they are designed as high quality pieces of well integrated architecture.	<ul style="list-style-type: none"> • Identity and user experience • Integrated design • Connectivity and legibility • Sustainability.
Road bridges	Deliver elegant road bridges that integrate all architectural and engineering systems requirements while minimising visual impacts.	<ul style="list-style-type: none"> • Identity and user experience • Urban renewal and liveability • Integrated design • Connectivity and legibility • Sustainability.
Shared user bridges	Deliver well designed and attractive shared user bridges that provide safe access for all pedestrians and cyclists.	<ul style="list-style-type: none"> • Identity and user experience • Urban renewal and liveability • Integrated design • Connectivity and legibility • Sustainability.
Landscape treatments	Provide new and reinstated landscapes that are appropriate to the local conditions, consistent with the existing varied character of the project, provide opportunities to increase canopy cover wherever possible and provides improved public realm amenity.	<ul style="list-style-type: none"> • Identity and user experience • Urban renewal and liveability • Integrated design • Living environments • Sustainability.
Materials and finishes	Deliver a road corridor and associated infrastructure/public domain that presents a consistent palette of high-	<ul style="list-style-type: none"> • Identity and user experience • Urban renewal and liveability

Urban elements	Design principle	Relevant urban design objective
	quality materials representative of the project image and local context.	<ul style="list-style-type: none"> • Integrated design • Sustainability.
Safety in design and crime prevention through environmental design (CPTED)	Provide a corridor that allows all users, including motorists, pedestrians, cyclists and maintenance and management people to manage a safe and responsive journey.	<ul style="list-style-type: none"> • Urban renewal and liveability • Integrated design.
Aboriginal heritage	Deliver a corridor and public domain which provides Connection with Country and incorporates heritage and cultural contexts into the project.	<ul style="list-style-type: none"> • Connectivity and legibility • Integrated design • Living environments • Sustainability.

Illustrations of architectural treatments and urban design proposed for surface connections and other operational infrastructure associated with the project have been outlined within concept masterplans as presented below in Figure 22-1 to Figure 22-4 and in Appendix V (Technical working paper: Urban design, landscape character and visual impact).

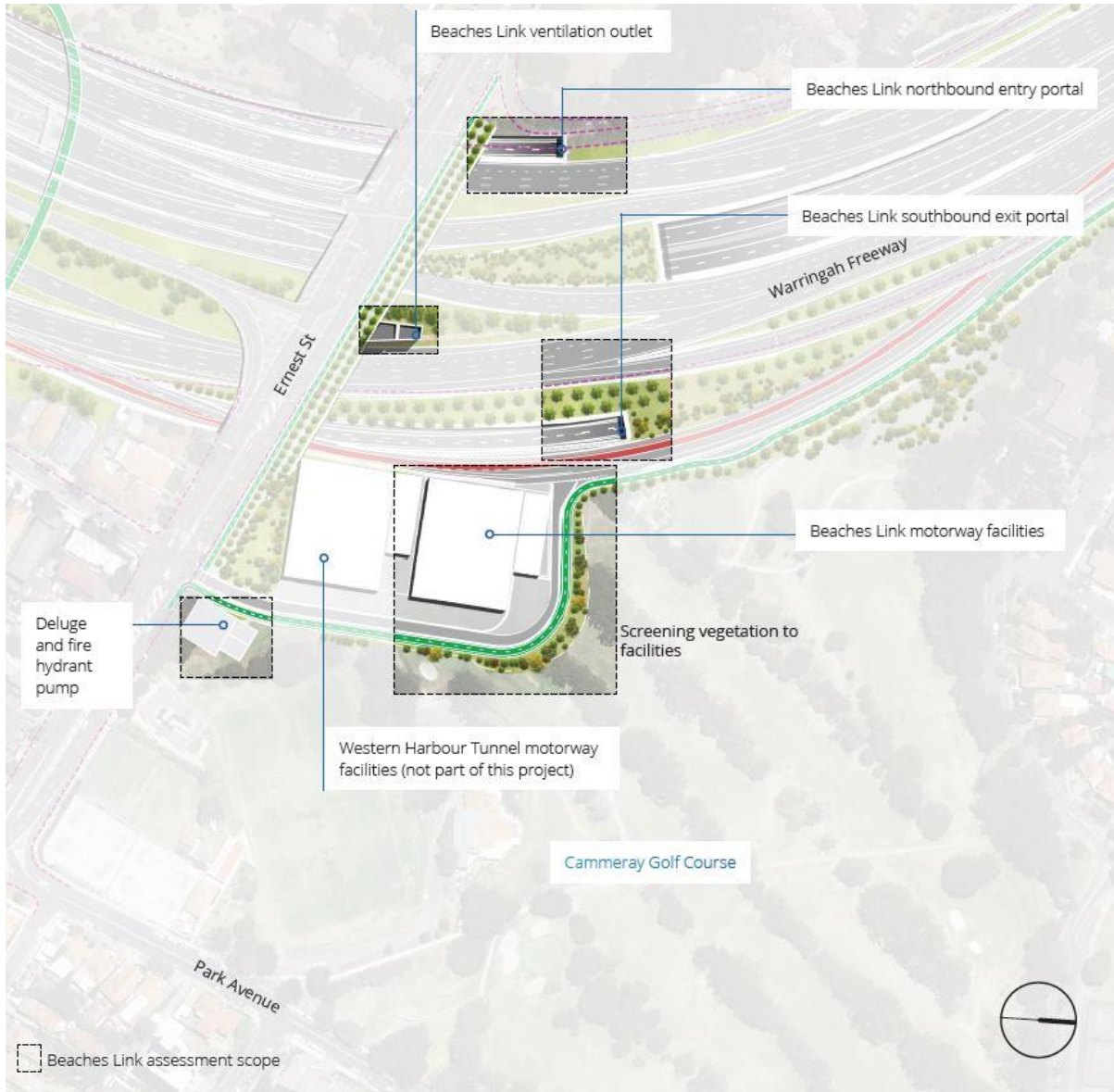


Figure 22-1 North Sydney precinct concept masterplan

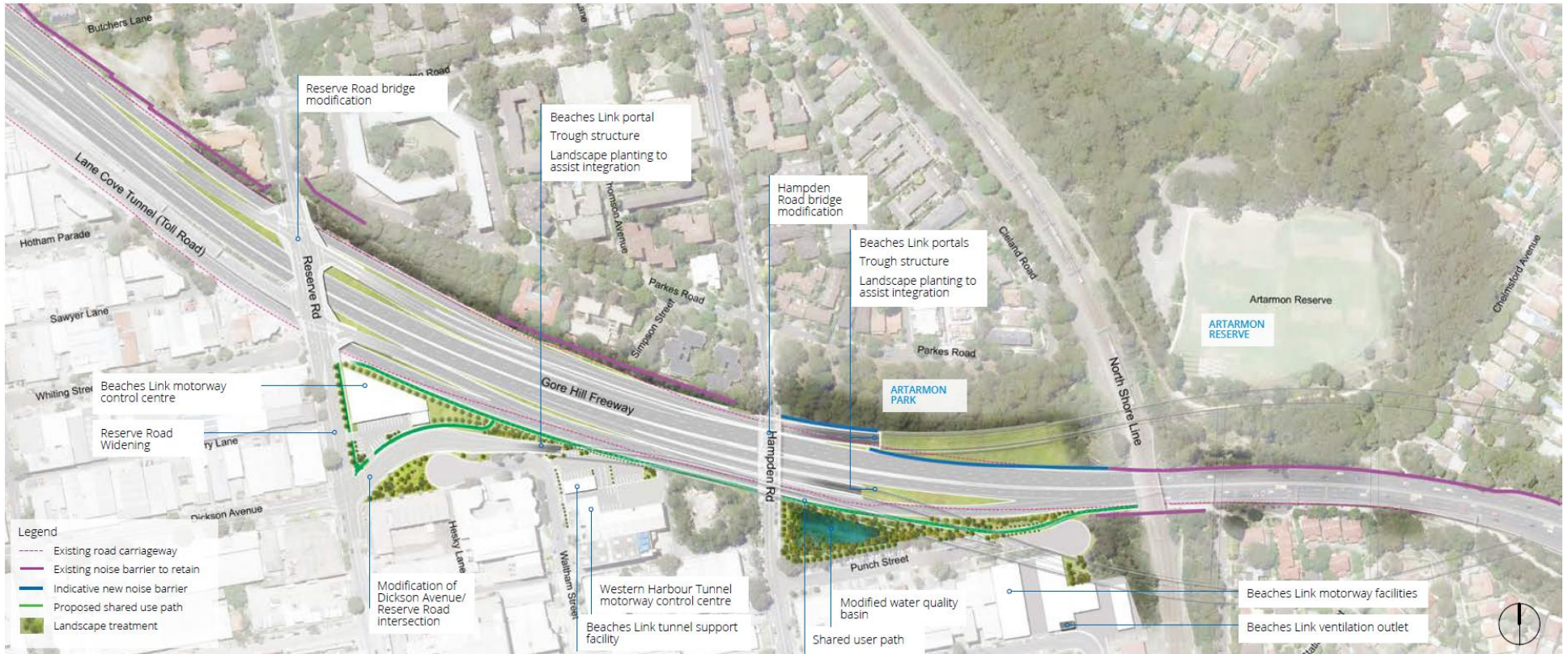


Figure 22-2 Artarmon precinct concept masterplan



Figure 22-3 Balgowlah precinct concept masterplan

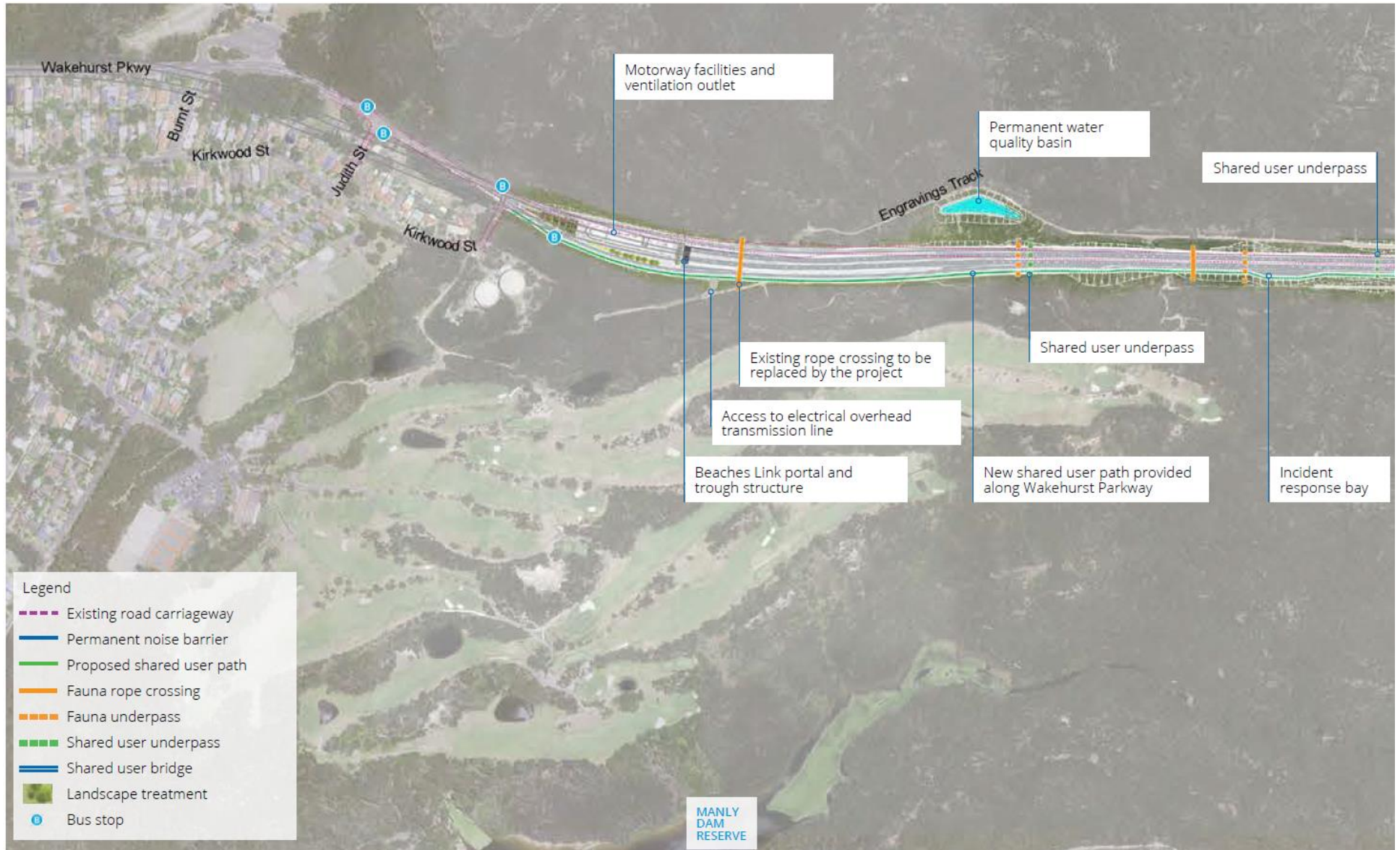


Figure 22-4a Wakehurst Parkway precinct concept masterplan

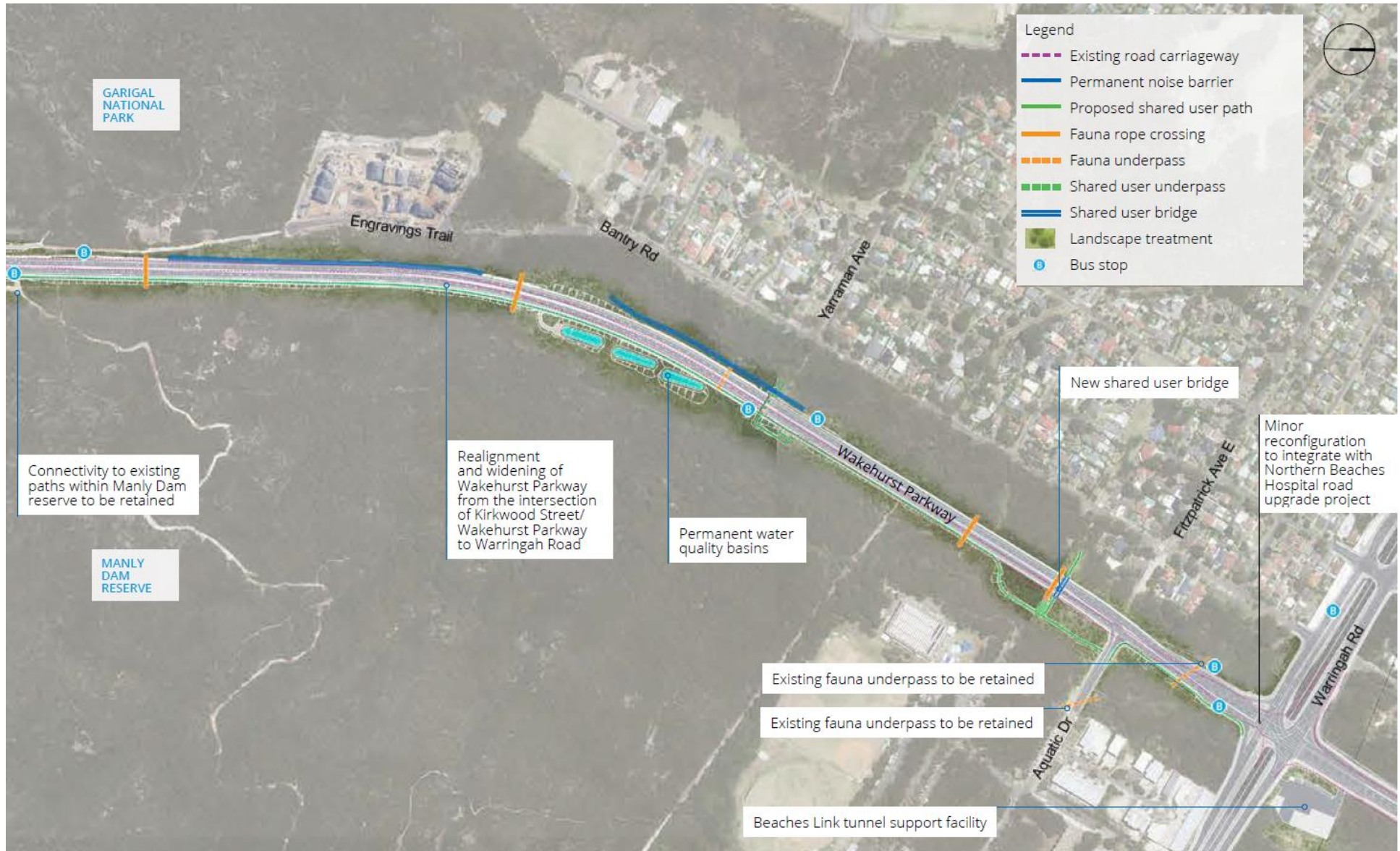


Figure 22 4b Wakehurst Parkway precinct concept masterplan

22.3 Assessment methodology

The landscape character and visual impact assessment presented in this chapter has been carried out in accordance with *Environmental Impact Assessment Practice Note – Guidelines for Landscape Character and Visual Impact Assessment* (Transport for NSW, 2020d).

Assessment of the impacts on landscape character involves an understanding of the built, natural and cultural character or sense of place. Assessment of visual impacts relates to the impacts of the project on public and private views and how people think and feel about the landscape on a day to day basis.

The assessment methodology involved:

- A desktop assessment including:
 - Consideration of relevant legislation and policy requirements
 - Review of the landscape context and study area
 - Determination of sensitive receiver locations and potential viewpoints
- Surveys of the study area to confirm significant landforms and potential viewpoints
- Assessment of potential landscape character and visual impacts (including cumulative impacts)
- Identification of environmental management measures to mitigate potential impacts.

The Western Harbour Tunnel and Warringah Freeway Upgrade project is subject to a separate environment assessment approval. For the purpose of assessing potential operational impacts of the project the Warringah Freeway Upgrade (without the Western Harbour Tunnel) is assumed to be delivered.

The civil construction of the Beaches Link ventilation outlet at the Warringah Freeway would be carried out as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project. As such, only fitout and commissioning works for this particular ventilation outlet would be carried out as part of this project. All other ventilation outlets for the project would be constructed as part of the Beaches Link project.

Any potential cumulative landscape character and visual impacts of both projects being operational together have been considered in this assessment.

22.3.1 Landscape character impact assessment

To assess the impacts on landscape character, landscape character zones (LCZ) were determined for the study area, particularly within the distinct precincts that have been identified within the study area (see Section 22.4.1 for more information). Landscape character zones are defined as areas having a distinct, recognisable and consistent pattern of elements, including natural elements (eg soil, vegetation, landform) and/or human built form, making one landscape different from another.

22.3.2 Visual impact assessment

Representative viewpoints with the potential to be visually impacted by elements of the project were identified for further analysis. Viewpoints were selected to show:

- A range of receiver types including public and private domain views (residents, motorists and users of public open space)
- A range of view types including elevated, panoramic and filtered views
- A range of viewing distance from the project
- Key or protected views identified in planning documents.

Viewpoints have been assessed for both the construction and operational stages of the project as well as potential night time impacts.

As part of the operational visual impact assessment, the zone of visual influence of new built form elements (including motorway facilities, ventilation outlets and operational infrastructure) has been assessed to identify areas from which these built form elements of the project would be potentially visible. This assessment takes into account topography and built form but excludes natural landscape features above ground level that would affect visibility such as trees, hedgerows or fences. Therefore, the zone of visual influence included as part of this assessment provides a worst-case scenario.

22.3.3 Landscape character and visual impact rating

Landscape character and visual impacts were measured by completing a sensitivity analysis of existing landscape character zones and views and assessing the magnitude of change on those zones and views.

Sensitivity and magnitude ratings are applied according to the landscape character and visual impact rating matrix specified in the *Environmental Impact Assessment Practice Note – Guidelines for Landscape Character and Visual Impact Assessment* (Transport for NSW, 2020d), shown in Table 22-4.

Table 22-4 Landscape character and visual impact rating matrix

Landscape character and visual impact	Magnitude of change				
		High	Moderate	Low	Negligible
Sensitivity of receivers	High	High	High-moderate	Moderate	Negligible
	Moderate	High – moderate	Moderate	Moderate – low	Negligible
	Low	Moderate	Moderate – low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Source: Transport for NSW (2020d)

Landscape character and visual impact ratings represent the potential impact of the project before the environmental management measures outlined in Section 22.8 have been applied. Potential landscape character and visual impact would be reduced by the application of environmental management measures.

22.3.4 Night lighting impact assessment

A broad assessment of the impacts of night lighting during both the construction and operation of the project was carried out by applying the methodology for assessment of visual impacts as described Section 22.3.2 above. Key visual receivers have been separately assessed and include neighbouring residential properties, users of recreational space and motorists in local streets.

The assessment of night lighting impacts is based on the following assumptions:

- Types and extent of lighting likely to be installed for both the construction and operation phases is consistent with applicable guidelines
- Lighting during construction is assumed to be in operation seven days a week and at levels sufficient to meet safety and security standards.

22.4 Existing environment

Visibility of the project would largely be determined by the surrounding topography, vegetation and the existing built environment. The project crosses areas with varied local context, differing built form elements, unique natural characteristics and various land use zones.

Four distinct precincts have been identified, which would have associated surface connections, operational facilities and several temporary construction support sites. These precincts are described further in Section 22.4.1 below. Details of works to occur in the precincts are provided in Section 22.5.1:

- North Sydney precinct
- Artarmon precinct
- Balgowlah precinct
- Wakehurst Parkway precinct.

Additionally, there are sites outside of these precincts which would be utilised temporarily for construction support sites:

- Flat Rock Drive (BL2)
- Middle Harbour Crossing (Middle Harbour south (BL7) and north (BL8) cofferdams) and Spit West Reserve (BL9).

The landscape character and visual amenity within each of the precincts and temporary construction support sites is discussed below.

22.4.1 Precincts

North Sydney precinct

Landscape character

The North Sydney precinct is centred around the North Sydney Central Business District (CBD) commercial hub, interspersed with a mix of residential land uses and areas of open space. It includes the residential neighbourhoods of Cammeray, Cremorne, Neutral Bay and North Sydney.

The precinct is located on the ridge of the Mosman peninsula, with steep slopes to the waterfront to the north and south respectively.

The Warringah Freeway forms a major human-made feature of the area, cutting through the landscape and creating east/west separation of the precinct both visually and physically.

The precinct also contains high quality but fragmented open space, including Cammeray Park (consisting of Cammeray Golf Course and Cammeray Oval), St Leonards Park with its heritage listed landscape and oval, Forsyth Park, ANZAC Park and Jeaffreson Jackson Reserve on the western edge of the Warringah Freeway.

Landscape character zones identified within the North Sydney precinct are shown in Figure 22-5 and comprise the following:

- LCZ 1 – St Leonards Park
- LCZ 2 – Warringah Freeway corridor
- LCZ 3 – Cammeray residential
- LCZ 4 – Cremorne and Neutral Bay residential
- LCZ 5 – Cammeray Park open space.

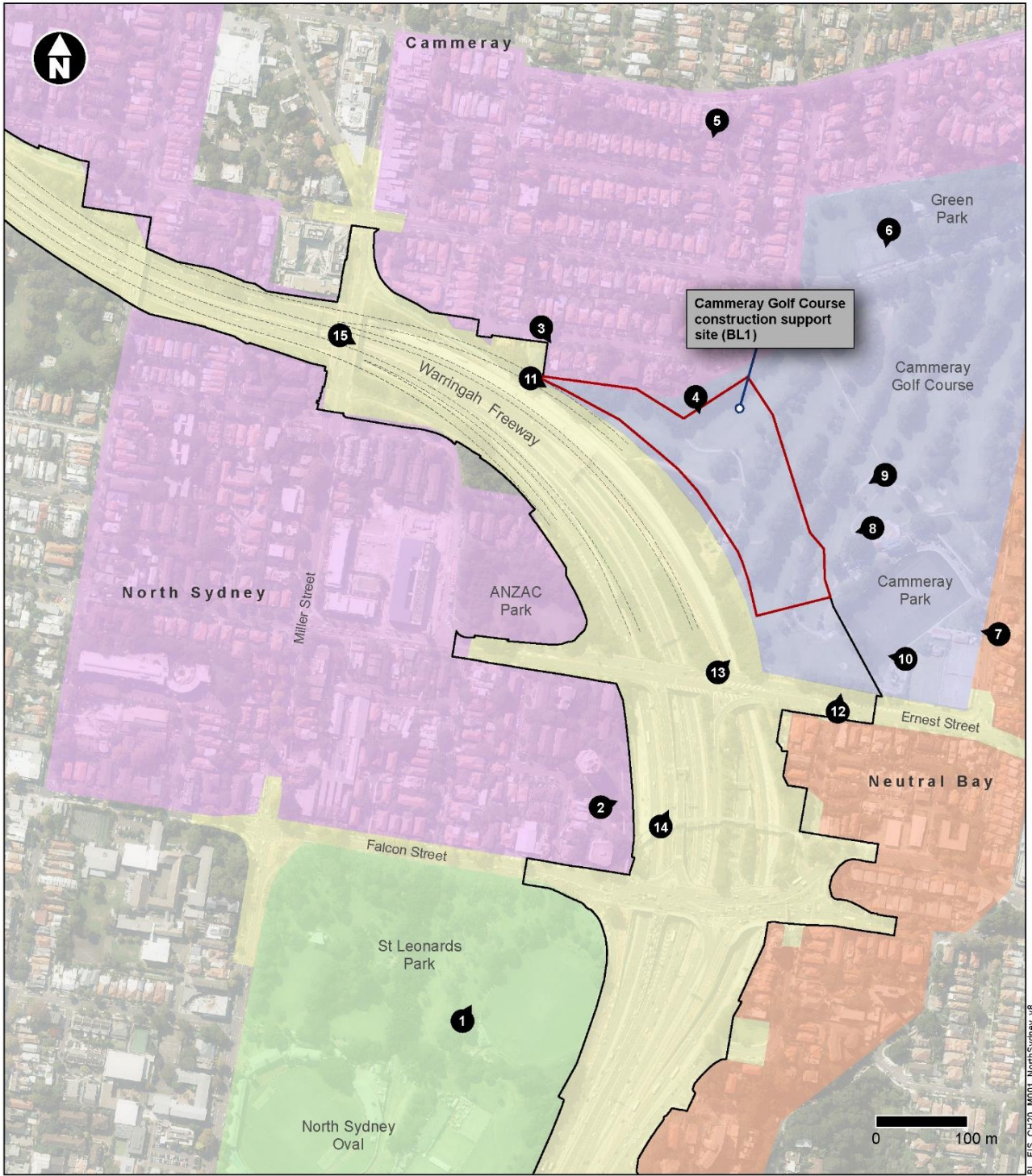
Visual environment

The visual character of the North Sydney precinct is defined by its elevated topography, major infrastructure and built form. North Sydney CBD forms a western edge to the precinct with large towers rising above the Warringah Freeway.

The Warringah Freeway sits within a depressed configuration within the landscape. Due to this position, the Warringah Freeway has limited visual connection to surrounding residential areas.

Viewpoints selected for the North Sydney precinct are also shown in Figure 22-5 and comprise the following:

- Viewpoint 1 – St Leonards Park – Bon Andrews Oval
- Viewpoint 2 – Jeaffreson Jackson Reserve and nearby residential
- Viewpoint 3 – Morden Street residential
- Viewpoint 4 – Warringah Road residential
- Viewpoint 5 – Carter Street lookout
- Viewpoint 6 – Green Park and Warwick Avenue residential
- Viewpoint 7 – Park Avenue residential
- Viewpoint 8 – Cammeray Golf Course club house
- Viewpoint 9 – Cammeray Golf Course footpath
- Viewpoint 10 – Cammeray Park sports facilities
- Viewpoint 11 – Warringah Freeway near Ernest Street
- Viewpoint 12 – Ernest Street residential
- Viewpoint 13 – Ernest Street bridge
- Viewpoint 14 – Falcon Street shared user bridge
- Viewpoint 15 – Miller Street bridge.



- Legend**
- | | |
|------------------------------|--------------------------------------|
| Construction features | Landscape character zones |
| Construction footprint | Cammeray Park open space |
| Construction support site | Cammeray residential |
| Tunnel section | Cremorne and Neutral Bay residential |
| | St Leonards Park |
| | Warringah Freeway corridor |
| | View point and direction |

Figure 22-5 North Sydney precinct landscape character zones and viewpoints

Artarmon precinct

Landscape character

The Artarmon precinct is divided by the Gore Hill Freeway which cuts through the precinct in an east/west direction. Despite significant urban development surrounding the road, the Gore Hill Freeway has a noticeable green edge.

Northern sections of the precinct are comprised mostly of residential streetscapes with a well-vegetated character including numerous mature street trees.

The south of the precinct comprises large industrial lots with a mix of single and double storey warehouses, including a portion of the Artarmon/St Leonards industrial area.

The undulating topography of the precinct is a distinctive feature of the area. Densely vegetated valleys and gullies traverse the precinct, including Bicentennial Reserve (Flat Rock Creek) and Artarmon Reserve.

Landscape character zones identified within the Artarmon precinct are shown in Figure 22-6 and comprise the following:

- LCZ 1 – Artarmon industrial area
- LCZ 2 – Artarmon conservation area
- LCZ 3 – Gore Hill Freeway
- LCZ 4 – Artarmon residential
- LCZ 5 – Artarmon Reserve
- LCZ 6 – Artarmon Park.

Visual environment

The visual character of the precinct is defined by its undulating topography, major roads, mix of land uses, well vegetated streetscapes and dense bushland reserves.

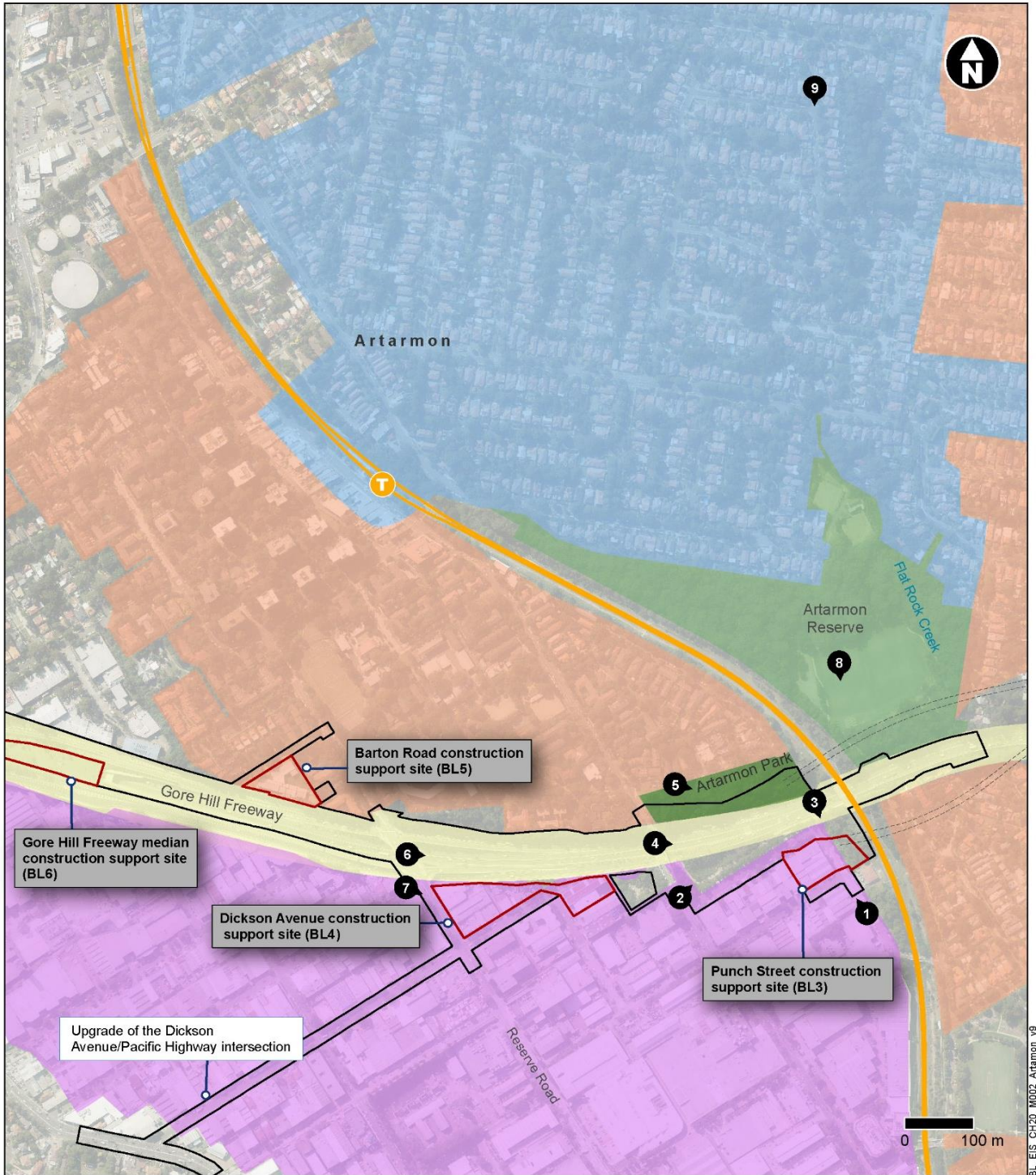
The elevated nature of the topography north of the Gore Hill Freeway offers this residential area some long distance views over the precinct, with some views filtered by tree planting.

Due to its position within the landscape, the Gore Hill Freeway allows visual connectivity across the road. Views within the Gore Hill Freeway are mostly constrained by the topography and dense vegetation either side of the road corridor.

Two transmission towers are located in the precinct, one to the east of Artarmon Reserve and another to the west of Artarmon Station. Where visible, these form strong vertical landmarks in the area.

Viewpoints selected for the Artarmon precinct are also shown in Figure 22-6 and comprise the following:

- Viewpoint 1 – Lambs Road
- Viewpoint 2 – Punch Street
- Viewpoint 3 – Gore Hill Freeway shared user path
- Viewpoint 4 – Hampden Road bridge
- Viewpoint 5 – Parkes Road/Artarmon Park
- Viewpoint 6 – Gore Hill Freeway
- Viewpoint 7 – Reserve Road
- Viewpoint 8 – Artarmon Reserve
- Viewpoint 9 – Godfrey Road residential.



Legend

Construction features

- Construction footprint
- Construction support site
- Tunnel section

Landscape character zones

- Artarmon conservation area
- Artarmon industrial area
- Artarmon Park
- Artarmon Reserve
- Artarmon residential
- Gore Hill Freeway
- Viewpoint and direction

- Sydney train rail
- T Artarmon train station

Indicative only - subject to design development

Figure 22-6 Artarmon precinct landscape character zones and viewpoints

Balgowlah precinct

Landscape character

The Balgowlah precinct contains the Burnt Bridge Creek Deviation and Sydney Road corridors. Despite the amount of road infrastructure in this precinct, it has a distinct leafy character including well vegetated streetscapes and a large area of open space in the form of the Balgowlah Golf Course.

The precinct generally slopes from south to north, towards Burnt Bridge Creek riparian corridor. Balgowlah Golf Course has a level change of approximately 20 metres across the site. The golf course forms a large area of open space in the centre of the precinct with stands of mature trees spread across the course and along the course boundaries adjoining residential developments. Dense vegetation also occurs along the Burnt Bridge Creek riparian corridor.

Landscape character zones identified within the Balgowlah precinct are shown in Figure 22-7 and comprise the following:

- LCZ 1 – Burnt Bridge Creek Deviation road corridor
- LCZ 2 – Burnt Bridge Creek riparian corridor
- LCZ 3 – Balgowlah Golf Course open space
- LCZ 4 – Balgowlah residential east
- LCZ 5 – Balgowlah residential west
- LCZ 6 – Balgowlah residential south
- LCZ 7 – Education campus.

Visual environment

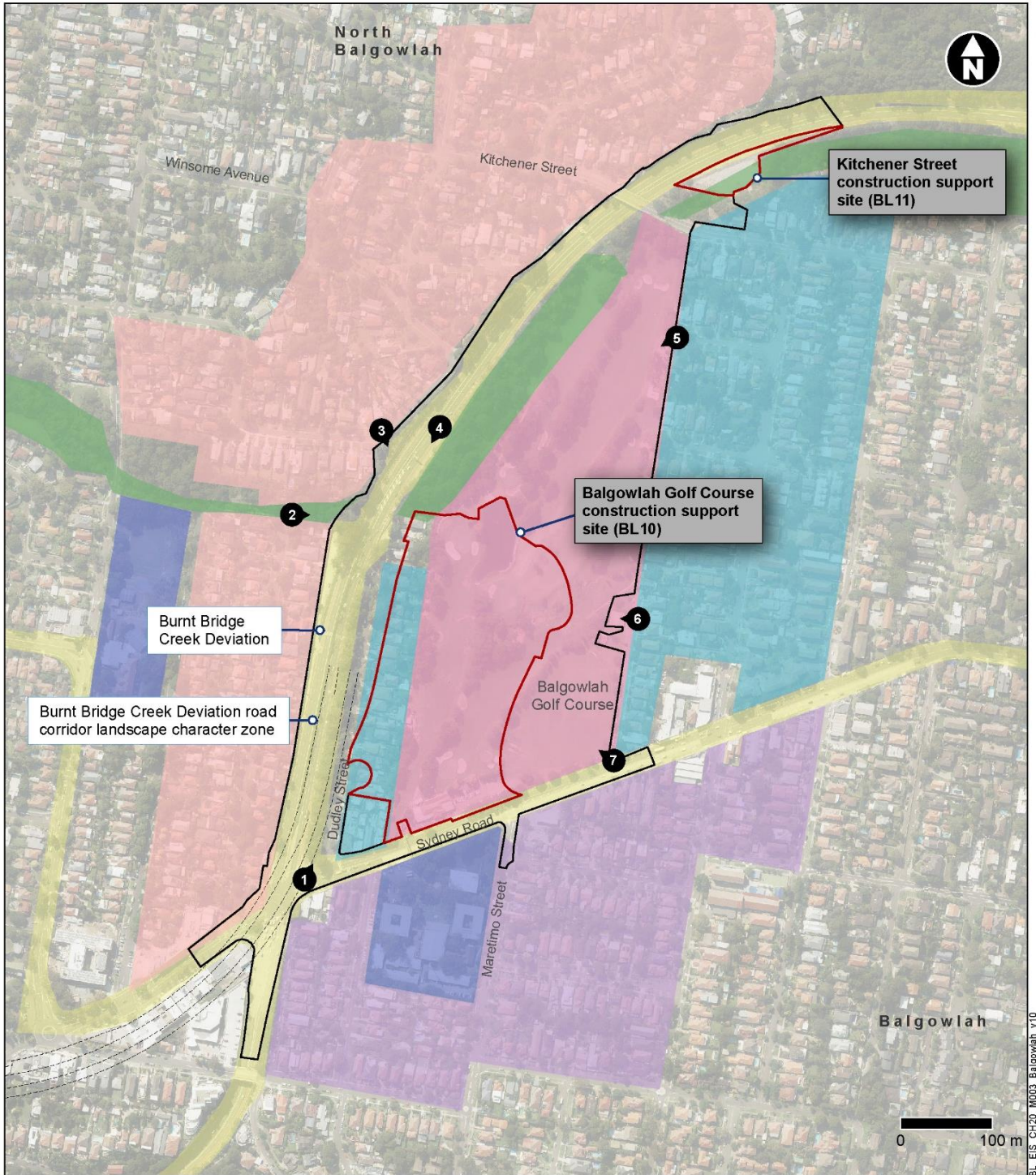
The visual character of the precinct is defined by its sloping topography, major road corridors, leafy streetscapes and vegetated open spaces.

Burnt Bridge Creek Deviation provides a physical barrier across the precinct in an east/west direction. Local views into Balgowlah Golf Course from the road are generally filtered or blocked by dense vegetation along Burnt Bridge Creek riparian corridor.

Local views from the eastern residential edge of the golf course tend to be more open, with some expansive views across the open space of the golf course available. Elevated views of the western edge of the golf course are available from several residential properties along Serpentine Crescent and Dudley Street. Tree planting along sections of the eastern and southern golf course boundaries partially filters views west and north from adjacent residential properties.

Viewpoints selected for the Balgowlah precinct are also shown in Figure 22-7 and comprised of the following:

- Viewpoint 1 – Burnt Bridge Creek Deviation
- Viewpoint 2 – Hope Street
- Viewpoint 3 – Serpentine Crescent
- Viewpoint 4 – Burnt Bridge Creek Deviation existing shared user path
- Viewpoint 5 – Paris Street dwellings
- Viewpoint 6 – Pickworth Avenue dwellings
- Viewpoint 7 – Balgowlah Oval.



Legend

Construction features

- Construction footprint
- Construction support site
- Tunnel section

Landscape character zones

- Balgowlah Golf Course open space
- Balgowlah residential east
- Balgowlah residential south
- Balgowlah residential west
- Burnt Bridge Creek riparian corridor
- Education campus
- Burnt Bridge Creek Deviation road corridor
- Viewpoint and direction

Indicative only - subject to design development

Figure 22-7 Balgowlah precinct landscape character zones and viewpoints

Wakehurst Parkway precinct

Landscape character

The precinct is defined by its hilly, tree-lined streets and distinct bushland character which includes parts of Garigal National Park, Manly Dam Reserve and Bantry Bay Reserve.

Wakehurst Parkway is lined on both sides by dense bushland north of Seaforth Oval. Seaforth Oval is an area of level ground surrounded by bushland.

The precinct sits on a topographical ridge and Wakehurst Parkway has sections of exposed sandstone geology, which is a noticeable feature for road users.

Landscape character zones identified within the Wakehurst Parkway precinct are shown in Figure 22-8 and comprise the following:

- LCZ 1 – Seaforth Oval open space
- LCZ 2 – Seaforth residential
- LCZ 3 – Wakehurst Parkway road corridor
- LCZ 4 – Remnant bushland.

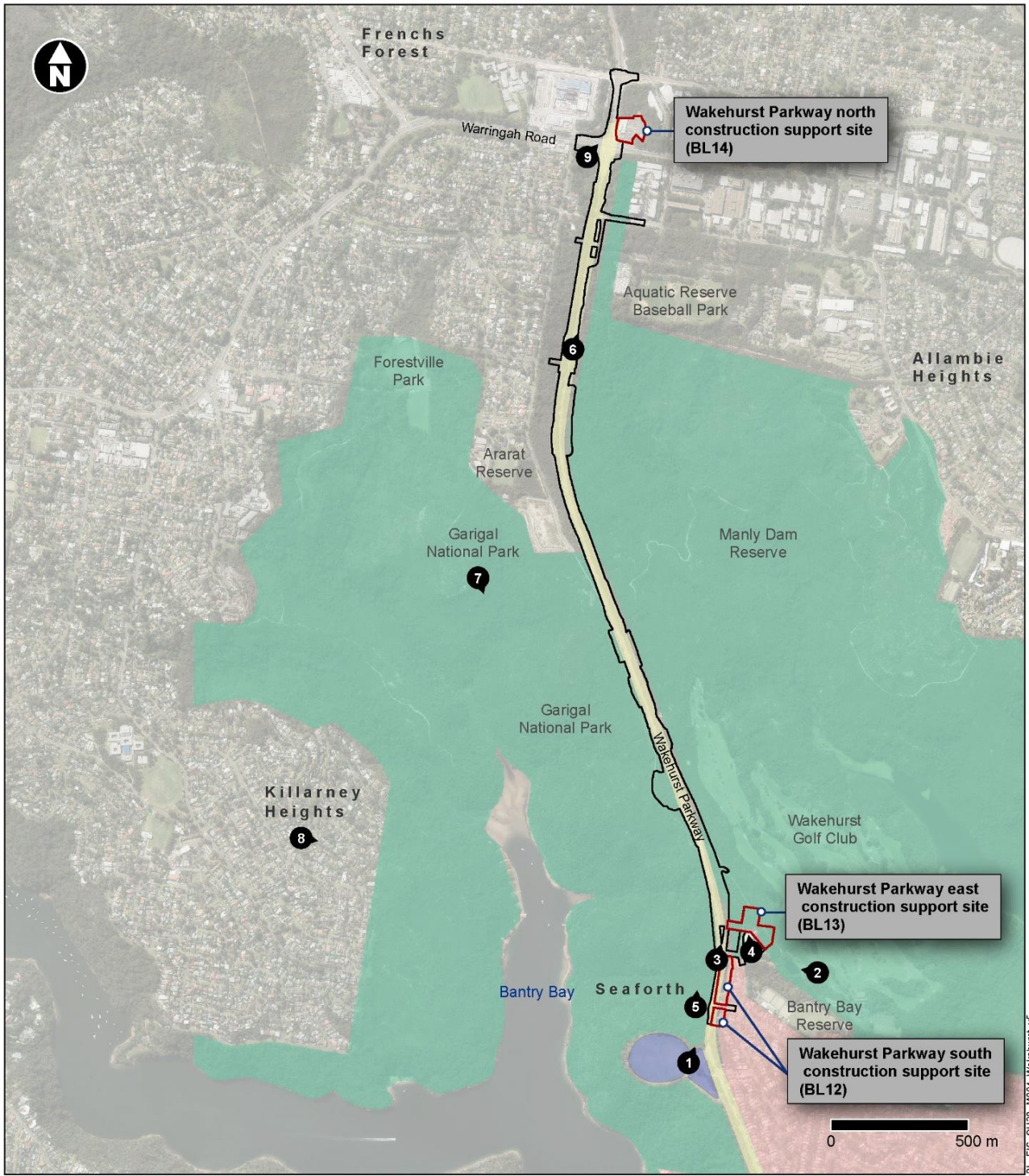
Visual environment

The visual character of the precinct is defined by its elevated topography, limited urban development and surrounding bushland. Views out from the Wakehurst Parkway road corridor are generally constrained by this dense vegetation. Filtered views are available towards Wakehurst Parkway from Seaforth Oval and residential properties to the east of the road corridor.

The elevated nature of the area allows some long distance views into the precinct from surrounding areas of bushland in the west. These include elevated lookouts within Garigal National Park and limited locations within the western residential areas overlooking Sugarloaf Bay such as Northbridge, Castlecrag and Castle Cove.

Viewpoints selected for the Wakehurst Parkway precinct are also shown in Figure 22-8 and comprise the following:

- Viewpoint 1 – Seaforth Oval
- Viewpoint 2 – Wakehurst Golf Course
- Viewpoint 3 – Wakehurst Parkway (south)
- Viewpoint 4 – Kirkwood Street residential
- Viewpoint 5 – Engravings Track
- Viewpoint 6 – Wakehurst Parkway (north)
- Viewpoint 7 – Garigal National Park lookout
- Viewpoint 8 – Killarney Heights residential
- Viewpoint 9 – Wakehurst Parkway/Warringah Road intersection.



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Legend

Construction features

- Construction footprint
- Construction support site
- Tunnel section

Landscape character zones

- Remnant bushland
- Seaforth Oval
- Seaforth residential
- Wakehurst Parkway road corridor

Viewpoint and direction

Figure 22-8 Wakehurst Parkway precinct landscape character zones and viewpoints

22.4.2 Temporary construction support sites (outside precincts)

Flat Rock Drive

Landscape character

The land identified to facilitate the Flat Rock Drive construction support site (BL2) is currently a car park and bushland rehabilitation area within Flat Rock Reserve associated with a historic landfill site.

The site is bounded by Flat Rock Drive to the west and two creeks to the east and south. In this area, the original Flat Rock Creek passes approximately 30 metres below the site in a box culvert installed by the local council as part of the historic land filling operations. Residential development can be found on elevated topography to the east. The site connects to the adjacent Willoughby Leisure Centre and wider Bicentennial Reserve, approximately 11.5 hectares of open space which contains the Walter Burley Griffin designed incinerator, playing field, children's cycle track, Hallstrom Park Playground and shared user paths.

Landscape character zones close to Flat Rock Drive are shown in Figure 22-9 and comprise the following:

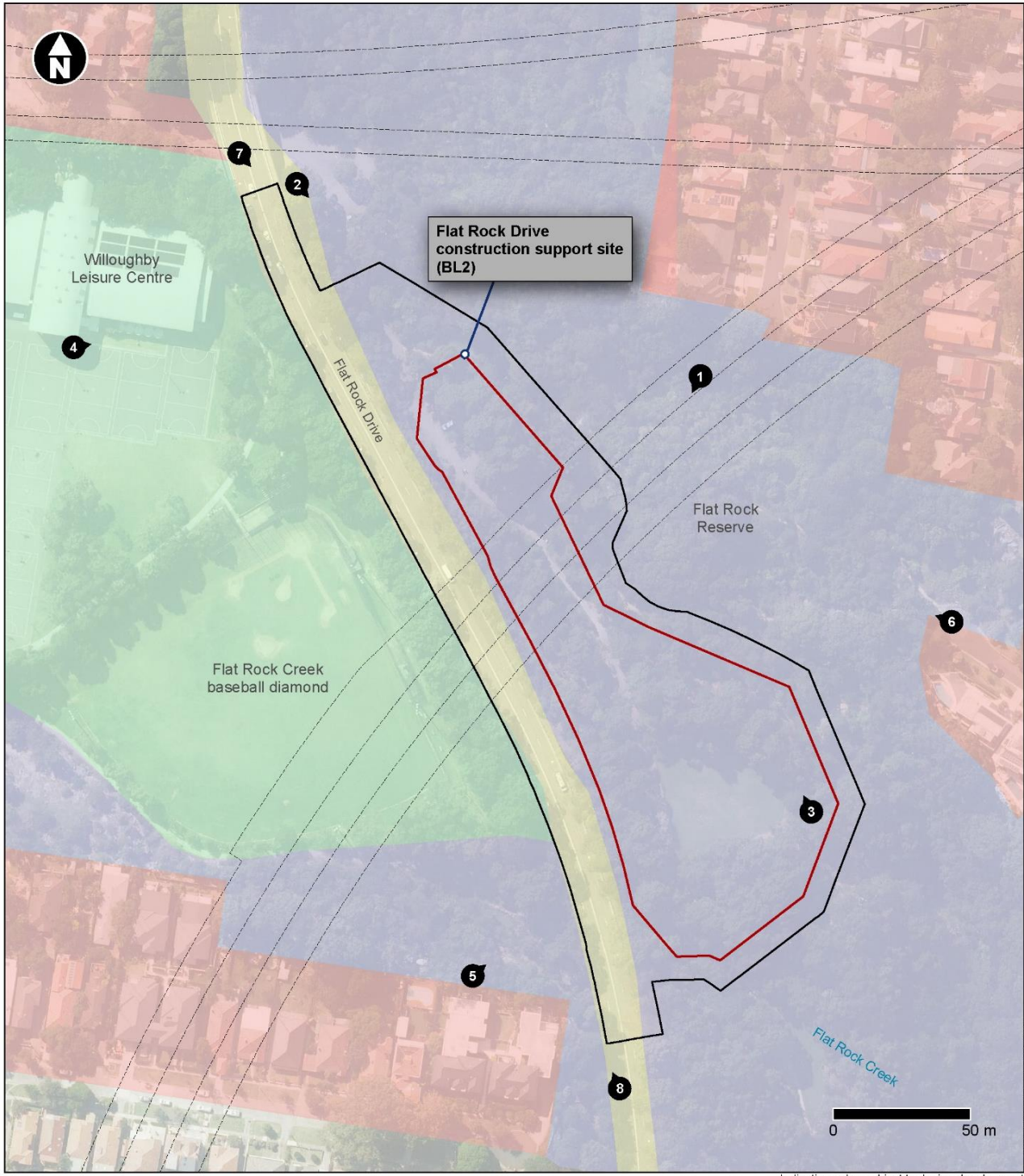
- LCZ 1 – Residential
- LCZ 2 – Flat Rock Reserve open space
- LCZ 3 – Sports precinct
- LCZ 4 – Road corridor.

Visual environment

The visual character of the study area is influenced by its undulating topography and vegetation. Dense bushland within Flat Rock Reserve mostly constrains and filters local views, although occasional breaks in the vegetation allowing sight lines across turfed open space. There are far reaching district views available from dwellings sitting on a ridgeline to the east of Flat Rock Reserve. Filtered views of the temporary construction support site are available from the Flat Rock Drive road corridor. Dense tree planting along the road boundary mostly obscures views of the site from Willoughby Leisure Centre.

Viewpoints for the Flat Rock Drive site are also shown in Figure 22-9 and comprise the following:

- Viewpoint 1 – Pyalla Street
- Viewpoint 2 – Flat Rock Drive
- Viewpoint 3 – Flat Rock Reserve walking/cycle paths
- Viewpoint 4 – Willoughby Leisure Centre
- Viewpoint 5 – Garland Road residential
- Viewpoint 6 – Calbina Road residential
- Viewpoint 7 – Flat Rock Drive southbound
- Viewpoint 8 – Flat Rock Drive northbound.



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Legend

Construction features

- Construction footprint
- Construction support site
- Tunnel section

Landscape character zones

- Flat Rock Reserve open space
- Residential
- Road corridor
- Sports precinct
- Viewpoint and direction

Figure 22-9 Flat Rock Drive landscape character zones and viewpoints

Middle Harbour Crossing and Spit West Reserve

Landscape character

At the point between Clive Park in Northbridge and Seaforth Bluff in Seaforth, Middle Harbour is about 400 metres wide.

The character of Middle Harbour is heavily influenced by the mature tree canopies and steep topography along the adjacent foreshore. The extent of vegetation cover contributes to the sense of enclosure to the bay, beaches and inlets enhance the scenic value and visual dominance of the natural landscape features.

Spit West Reserve is located on the western side of the Spit peninsula in Mosman. It contains public parking and playing fields utilised by local schools. The reserve itself consists of a flat, open grassed area interspersed with mature plantings and a row of pines along Spit Road. It is located on an area of reclaimed land bounded by a sea wall. To the east and south of the site, yacht club facilities and rowing sheds provide for boating and water access.

Built elements on Spit West Reserve include Mosman Rowing Club, sporting fields, a children's playground and toilets. Currently there are sports pitches that support cricket and junior soccer, as well as a small oval.

Landscape character zones identified close to Middle Harbour Crossing and Spit West Reserve are shown in Figure 22-10 and comprise the following:

- LCZ 1 – Foreshore public open space and environmental
- LCZ 2 – Low density residential and environmental management
- LCZ 3 – Middle Harbour – open water.

Visual environment

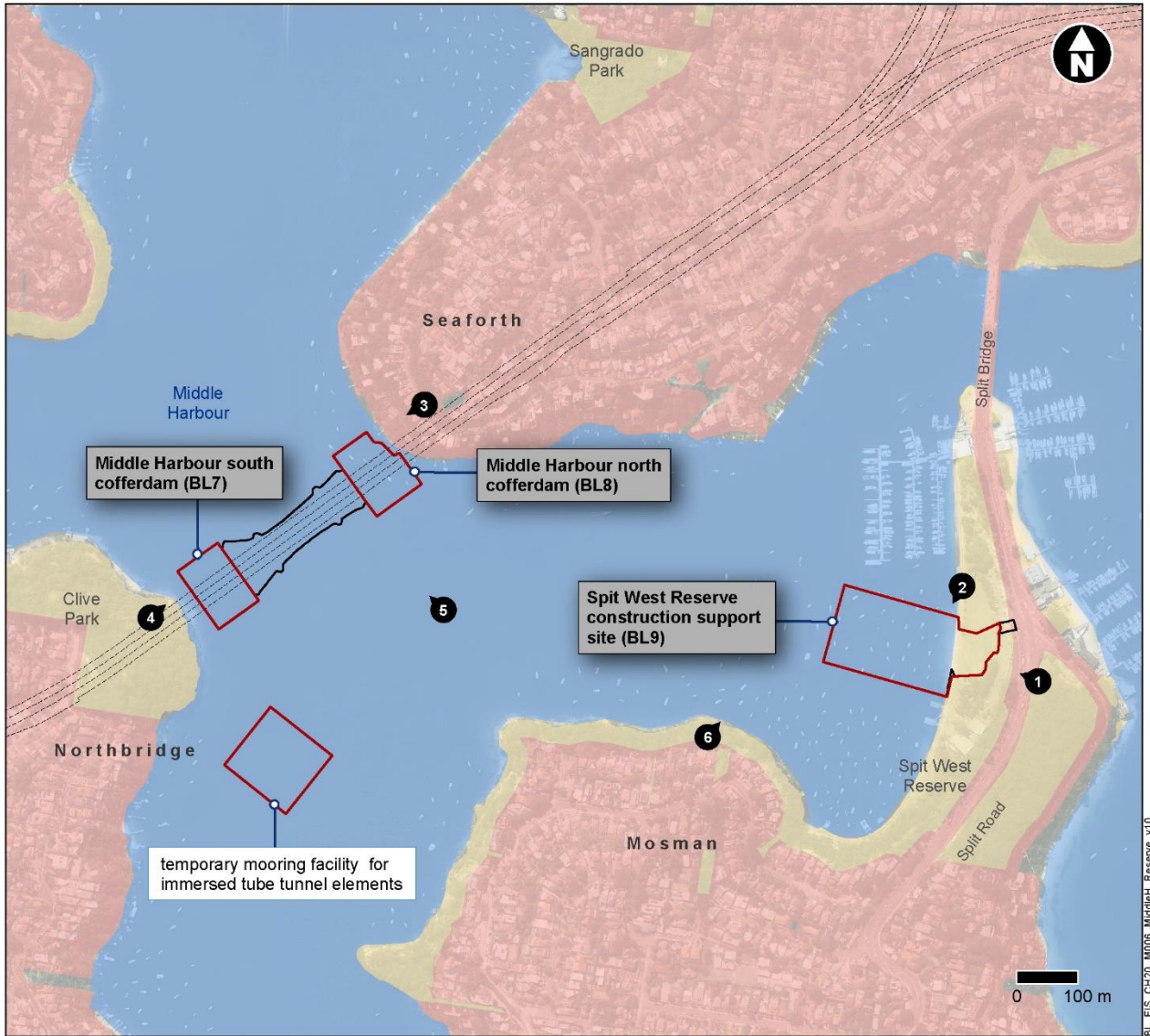
The section of Middle Harbour being assessed as part of the project is visually accessible from residential development bordering the water within the suburbs of Seaforth, Northbridge, Beauty Point and Castlecrag. It is also visible from areas of public open space along this section of the Harbour such as Clive Park and Spit West Reserve, as well as from the water itself.

The foreshore area of Spit West Reserve includes a promenade with water views to the west over Middle Harbour. The reserve is visually separated from Spit Road by mature tree planting and earth mounding. The nearby elevated sandstone bluff and bushland of Parriwi Park and foreshore paths have far reaching views west across Spit West Reserve and Middle Harbour.

Where not blocked by built form and vegetation, sections of residential development along the edge of Middle Harbour within the suburbs of Seaforth, Northbridge and Beauty Point have elevated views towards Spit West Reserve.

Viewpoints for Middle Harbour and Spit West Reserve are also shown in Figure 22-10 and comprise the following:

- Viewpoint 1 – Parriwi Park
- Viewpoint 2 – Spit West Reserve
- Viewpoint 3 – Seaforth Crescent dwellings
- Viewpoint 4 – Clive Park, Northbridge
- Viewpoint 5 – Middle Harbour – on water
- Viewpoint 6 – Beauty Point.



Indicative only - subject to design development

Legend

Construction features

- Construction footprint
- Construction support site
- Tunnel section

Landscape character zones

- Foreshore public open space & environmental
- Low density residential & environmental management
- Middle Harbour open water
- Viewpoint and direction

Figure 22-10 Middle Harbour and Spit West Reserve landscape character zones and viewpoints

22.5 Project elements

22.5.1 Precincts

North Sydney precinct

The project would connect to the Warringah Freeway and proposed Western Harbour Tunnel north of the Ernest Street overbridge at Cammeray. A motorway facility building would be constructed within the Cammeray Golf Course site, near the connection of the Beaches Link tunnels with the Warringah Freeway Upgrade and Western Harbour Tunnel.

Project elements within the North Sydney precinct would include:

- Motorway facility building
- A ventilation outlet next to Ernest Street within the Warringah Freeway corridor. The ventilation outlet at the Warringah Freeway would be constructed as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project, with fitout and the ventilation tunnel connection of this structure completed by the Beaches Link and Gore Hill Freeway Connection project
- Entry and exit portals for the Beaches Link tunnel within the Warringah Freeway road corridor
- Associated road widening, trough structures and retaining walls within the Warringah Freeway.

The construction footprint and temporary construction support sites of the project within the North Sydney precinct are shown in Figure 22-5. Further details of proposed construction work within the precinct are provided in Chapter 6 (Construction work).

Artarmon precinct

The project within the Artarmon precinct is focused on upgrading and reconfiguring the Gore Hill Freeway and providing direct connections to the Lane Cove Tunnel and Reserve Road.

Project elements within the Artarmon precinct would include:

- Two lane eastbound and westbound ramps to the Beaches Link mainline tunnel
- Separate cut and cover tunnels for both eastbound and westbound ramps
- Open trough structures on the Gore Hill Freeway ranging in depth up to ten metres
- Modifications to the Reserve Road and Hampden Road bridges
- A number of new retaining walls and modification to existing retaining walls for the Gore Hill Freeway to cater for the new traffic flow arrangements
- Conversion of Punch Street to a cul-de-sac, and removal of the existing connection between Punch Street and Lambs Road
- Motorway facilities and ventilation outlet located on the southern side of the Gore Hill Freeway, adjacent to Punch Street
- Motorway control centre adjacent to Reserve Road and the Gore Hill Freeway on a site currently occupied by commercial properties including the Freeway Hotel
- Tunnel support facility adjacent to Waltham Street
- The existing shared user path along the southern side of the Gore Hill Freeway would be replaced in areas directly disturbed by the project and connect with the existing active transport network.

The construction footprint and temporary construction support sites of the project within the Artarmon precinct are shown in Figure 22-6. Further details of proposed construction work within the precinct are provided in Chapter 6 (Construction work).

Balgowlah precinct

The project would connect to Burnt Bridge Creek Deviation between Kitchener Street and Sydney Road at Balgowlah. Connections to the local road network would be via a new access road through the existing Balgowlah Golf Course that connect to Sydney Road.

The connection would provide linkages to and from the project with the southern areas of the Northern Beaches, including Seaforth, Manly and Brookvale.

Portals would be located parallel to Burnt Bridge Creek Deviation, south of Burnt Bridge Creek. Burnt Bridge Creek Deviation would be realigned and widened to the east, adjacent to Burnt Bridge Creek and at Dudley Street, to accommodate the portals and ramps.

Project elements within the Balgowlah precinct would include:

- Minor changes to local road conditions including a revised cul-de-sac at the truncated southern end of Dudley Street
- Motorway facilities and a ventilation outlet located within Balgowlah Golf Course. Motorway facilities would be buried eight metres into the ground to assist integration
- A northbound and a southbound bus lane would be maintained along the Burnt Bridge Creek Deviation as part of the realignment and widening of that road
- A new access road between Burnt Bridge Deviation and Sydney Road, providing direct access to Beaches Link and providing connection to new and improved open space and recreation facilities.
- Extension of the existing pedestrian underpass beneath the Burnt Bridge Creek Deviation to the north of Dudley Street
- A new shared user path along the eastern side of the new access road between Burnt Bridge Creek Deviation and Sydney Road
- A new at-grade pedestrian crossing of the new access road at the intersection with Sydney Road.

Construction and operation of the project would require the closure of Balgowlah Golf Course. The project would return an area, equivalent to around 90 per cent of the current open space, to the community as new and improved public open space and recreation facilities.

A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council would take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities at Balgowlah. As part of this consultation process, a community reference group would be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space.

Land not required for operation of the project to the east and north of the access road would be progressively converted to new open space and recreation facilities following its use for construction. This would allow it to be handed over progressively for use by the community. The land to the west of the proposed access road, between the access road and Burnt Bridge Creek Deviation, is required for the Balgowlah Golf Course construction support site (BL1) through to the completion of the project. The new open space and recreation facilities proposed for this land would be constructed after completion of the project and then handed over to Northern Beaches Council.

Outside the support site and operational footprint areas, the existing mature vegetation would be retained where appropriate to suit final open space and recreation facilities layout as determined by consultation. Disturbed landforms within the former Balgowlah Golf Course and outside the support site and operational footprint areas would be progressively re-vegetated with an appropriate mix of native trees, shrubs and groundcovers. Early re-vegetation works would occur along the project boundaries where feasible, ensuring an extended time period for planting establishment to provide visual screening and improve public amenity.

The construction footprint and temporary construction support sites of the project within the Balgowlah precinct are shown in Figure 22-7. Further details of proposed construction work within the precinct are provided in Chapter 6 (Construction work).

Wakehurst Parkway precinct

Wakehurst Parkway would be realigned and upgraded to two lanes each way, to provide north facing ramps that would connect the Beaches Link mainline tunnel with Wakehurst Parkway.

Project elements within the Wakehurst Parkway precinct would include:

- Two lane entry and exit ramps to the Beaches Link mainline tunnel
- Cut and cover tunnel within the Wakehurst Parkway road corridor likely to comprise a twin box structure (about 130 metres in length)
- Motorway facilities and ventilation outlet located directly above the portal
- Permanent tunnel support facilities on eastern side of Wakehurst Parkway at the Warringah Road/Wakehurst Parkway intersection
- Beaches Link maintenance facility south of Seaforth Oval
- Realignment and upgrade of Wakehurst Parkway in the vicinity of the portal
- New drainage network designed to minimise the amount of water approaching the tunnels
- Reinstatement of northbound and southbound bus stops
- Fauna rope crossings and fauna underpasses where appropriate along road corridor
- Widening of Wakehurst Parkway, facilitated mostly on the eastern side to avoid impacts on the Garigal National Park. The existing road would become the new northbound carriageway
- Water quality basins along the Wakehurst Parkway road corridor
- A new shared user path along the eastern side of the Wakehurst Parkway, from the northern end of Kirkwood Street at Seaforth to the intersection with Warringah Road at Frenchs Forest. The new shared user path includes a new bridge over a drainage culvert and fauna underpass (constructed as part of Northern Beaches Hospital road upgrade project), about 150 metres south of the intersection with Warringah Road
- A new shared user underpass beneath the Wakehurst Parkway about 700 metres north of Kirkwood Street to connect Garigal National Park and the Engravings Trail to the Manly Dam Reserve
- A new shared user underpass beneath the Wakehurst Parkway about 1150 metres north of Kirkwood Street to connect Garigal National Park to the Manly Dam Reserve
- A new shared user underpass beneath the Wakehurst Parkway about 750 metres south of the intersection with Warringah Road
- Reconstruction and lengthening of the existing shared user bridge across the Wakehurst Parkway opposite the Warringah Aquatic Centre.

The construction footprint and temporary construction support sites of the project within the Wakehurst Parkway precinct are shown in Figure 22-8. Further details of proposed construction work within the precinct are provided in Chapter 6 (Construction work).

22.5.2 Temporary construction support sites (outside precincts)

Flat Rock Drive

A small portion of Flat Rock Reserve to the east of Flat Rock Drive would be temporarily leased for use as the Flat Rock Drive construction support site (BL2).

Public access to areas of the reserve outside of the temporary construction support site would be maintained during construction. The existing shared user path would be temporarily realigned along the western perimeter of the temporary construction support site. Pedestrian pathways would be maintained with two minor temporary diversions required.

The site has been located to generally limit clearing impacts to areas of vegetation re-growth, which were established in 1998 on the historical land fill area east of Flat Rock Drive.

Land affected by construction would be rehabilitated following construction, as determined through consultation with Willoughby City Council and the community, and is not expected to impact on the long-term use of Flat Rock Reserve.

The Flat Rock Drive construction support site is shown in Figure 22-9.

Further details of proposed construction work within the support site are provided in Chapter 6 (Construction work).

Middle Harbour Crossing and Spit West Reserve

The Spit West Reserve construction support site (BL9) would be located primarily in the water west of Spit West Reserve, with a small adjoining land-based site in Spit West Reserve. The proposed support site works would include construction of a temporary floating immersed tube tunnel casting facility that would be connected to Spit West Reserve by two temporary fixed jetties. The floating facility and fixed jetties would require the installation of temporary piling and associated marine structures.

The Beaches Link tunnel would cross Middle Harbour between Clive Park and Seaforth Bluff where the harbour is approximately 400 metres wide. Temporary cofferdams would be constructed at each end of the Middle Harbour crossing and within the harbour off the shore at Northbridge to the south and Seaforth to the north. Access would be from the Spit West Reserve construction support site (BL9). A ferry barge would be used to transport materials from the casting facility adjacent to Spit West Reserve to the Middle Harbour cofferdam construction support sites. A work barge (flat top barge) would support the construction of the interface structure and would be permanently moored parallel to the cofferdam during the installation.

The Middle Harbour cofferdams and Spit West Reserve construction support sites are shown in Figure 22-10. Further details of proposed construction work within the support site are provided in Chapter 6 (Construction work).

22.6 Assessment of potential construction impacts

Landscape character and visual impacts during construction would result from the introduction of activities at construction sites and temporary construction support sites into the existing landscape. This would include night lighting at sites that involve tunnelling activities or support tunnelling activities and where surface roadworks are required to be carried out at night.

Receivers who are likely to be impacted include:

- Residents that adjoin and/or have views of the construction sites and/or temporary construction support sites
- Workers in commercial properties that adjoin and/or have views of the project
- Road users and pedestrians
- Users of recreation areas/reserves with views of the project.

Construction activities that would take place at the construction sites and temporary construction support sites are discussed in Chapter 6 (Construction work). In general, visible construction activities and equipment would include (where required):

- Surface roadworks and associated activities, such as vegetation removal, earthworks, bridgeworks, the construction of retaining walls, noise barriers, traffic barriers, flood walls and stormwater drainage, road pavement works, signage and linemarking works, installation and modification of new and existing lighting and lighting structures, construction of fauna connectivity structures, the construction/reconstruction of shared user paths and other pedestrian and cyclist transport facilities and surface finishing works
- The construction of permanent motorway facilities and ancillary infrastructure on land, including the construction of:
 - Driven tunnels, which would include the construction of access declines, on and off ramps, cross passages, cut and cover and trough structures
 - Motorway control centre and tunnel support facilities, which would include the demolition of existing structures, construction of buildings, car parking, hardstand areas and access to the public road network and security fencing
 - Tunnel ventilation systems including the excavation of ventilation tunnels, motorway facilities buildings, connections to utilities, car parking, hardstand areas, access to the public road network and the fitout of ventilation outlets
 - An operational wastewater treatment plant
 - Substations
- Immersed tube tunnel works, including the construction of the cofferdams, transportation and construction of immersed tube tunnel units, dredging, tunnel fitout and finishing works
- The construction of new and improved public open space and recreation facilities at Balgowlah
- Stockpile and laydown areas and storage containers
- The operation of plant and equipment, including cranes
- Heavy and/or light construction vehicle movements
- Temporary noise barriers, hoarding, fencing, staff offices and amenities, workshops, acoustic shed, wastewater treatment facility and car parking
- Lighting for night time works
- Water storage tanks.

In general, potential construction impacts would be temporary in nature and localised to the area subject to construction activities. Potential impacts would be managed through the implementation of appropriate environmental management measures, as outlined in Section 22.8.

22.6.1 Landscape character impacts at precincts during construction

North Sydney precinct

Construction activities within the North Sydney precinct would include surface roadworks (such as road widening and the construction of retaining walls), the installation of fencing and the construction of trough structures, motorway facilities and entry and exit portals for the Beaches Link tunnel within the Warringah Freeway road corridor. The Cammeray Golf Course construction support site (BL1) would be located in the Cammeray Park open space landscape character zone (LCZ 5), as shown in Figure 22-5.

Construction equipment, surface roadworks, site hoardings and increased vehicle movements would be visible within the landscape, leading to a greater exposure to built form and a potential reduction in landscape amenity.

Impacts on landscape character within the North Sydney precinct are likely to be high to moderate for Cammeray residential (LCZ 3), Cremorne and Neutral Bay residential (LCZ 4) and Cammeray Park open space (LCZ 5) landscape character zones due to altered traffic conditions, increased congestion, site hoardings and construction equipment within the landscape and high sensitivity to changes within the landscape.

The Warringah Freeway Corridor (LCZ 2) landscape character zone would be moderately impacted since, as a major road corridor, it is able to accommodate change without a major impact on its character.

While potential impacts of a high to moderate rating are anticipated for landscape character zones within the North Sydney precinct, such impacts are expected to be temporary in nature and localised to the specific areas in which they are likely to occur.

Since the St Leonards Park (LCZ 1) landscape character zone would only have very limited views of the proposed construction sites, impacts on landscape character would be negligible.

A summary of the landscape character impacts during construction for each landscape character zone within the North Sydney precinct is provided in Table 22-5.

Table 22-5 Landscape character impacts during construction – North Sydney precinct

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 – St Leonards Park	High	Negligible	Negligible
LCZ 2 – Warringah Freeway Corridor	Low	High	Moderate
LCZ 3 – Cammeray residential	High	Moderate	High – moderate
LCZ 4 – Cremorne and Neutral Bay residential	High	Moderate	High – moderate
LCZ 5 – Cammeray Park open space	Moderate	High	High – moderate

Artarmon precinct

Construction activities within the Artarmon precinct would include surface roadworks (such as earthworks, bridgeworks, installation of retaining walls and fencing) and the construction of cut and cover and trough structures, motorway facilities, ventilation outlet, motorway control centre and a tunnel support facility. The Punch Street (BL3), Dickson Avenue (BL4), Barton Road (BL5) and Gore Hill Freeway median (BL6) construction support sites would be located within the Artarmon industrial area (LCZ 1) landscape character zone, as shown in Figure 22-6.

Impacts on landscape character within the Artarmon precinct are likely to be high to moderate for the Artarmon Park (LCZ 6) landscape character zone due to the removal of vegetation, presence of construction equipment and site hoardings within the park during construction. For the Gore Hill Freeway (LCZ 3) and Artarmon residential (LCZ 4) landscape character zones, moderate impacts are expected due to altered traffic conditions, increased congestion and the presence of construction equipment.

While potential impacts of a high to moderate rating are anticipated for landscape character zones within the Artarmon precinct, such impacts are expected to be temporary in nature and localised to the specific areas in which they are likely to occur. Low and negligible impacts are anticipated for the remaining landscape character zones.

A summary of the landscape character impacts during construction for each landscape character zone within the Artarmon precinct is provided in Table 22-6.

Table 22-6 Landscape character impacts during construction – Artarmon precinct

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 – Artarmon industrial area	Low	Low	Low
LCZ 2 – Artarmon conservation area	High	Negligible	Negligible
LCZ 3 – Gore Hill Freeway	Low	High	Moderate
LCZ 4 – Artarmon residential	Moderate	Moderate	Moderate
LCZ 5 – Artarmon Reserve	High	Negligible	Negligible
LCZ 6 – Artarmon Park	Moderate	High	High – moderate

Balgowlah precinct

Construction activities within the Balgowlah precinct would include surface roadworks (such as earthworks, road widening and the construction of a new access road, new shared user path and pedestrian crossing), excavation of an access decline and the ramp tunnel alignment between Seaforth and Balgowlah and the construction of motorway facilities and a ventilation outlet adjacent to the new access road within Balgowlah Golf Course. The staged construction of the new and improved open space and recreation facilities within Balgowlah Golf Course, including a car park, would also be delivered progressively, subject to a dedicated consultation process as described in Section 22.5.1.

The Balgowlah Golf Course construction support site (BL10) would be located within the Balgowlah Golf Course open space landscape character zone (LCZ 3). The Kitchener Street construction support site (BL11) would be located within the Burnt Bridge Creek riparian corridor landscape character zone. The locations of the temporary construction support sites are shown in Figure 22-7.

Impacts on landscape character are expected for the majority of landscape character zones within the Balgowlah precinct. This is due to large scale construction activities, including vegetation removal, earthworks and surface roadworks, increased vehicle movements and the presence of construction equipment and temporary noise walls, which would temporarily increase the built form of the area.

There would be a high to moderate impact to the Balgowlah Golf Course open space (LCZ 3) landscape character zone, due to the construction of a new access road, motorway facilities, ventilation outlet and new and improved open space and recreation facilities within the landscape. Moderate impacts are expected for the Balgowlah residential east (LCZ 4), Balgowlah residential west (LCZ 5) and Balgowlah residential south (LCZ 6) landscape character zones due to vegetation removal, earthworks, temporary noise walls and the presence of construction equipment.

While potential impacts of a high to moderate rating are anticipated on landscape character zones within the Balgowlah precinct, such impacts are expected to be temporary in nature and localised to the specific areas in which they are likely to occur. Furthermore, these impact ratings may reduce as replacement planting matures over the duration of the construction period. Early re-vegetation works would occur along the construction footprint boundaries where feasible, ensuring an extended time period for planting establishment to provide visual screening and improve public amenity.

Moderate to low impacts are anticipated for the Burnt Bridge Creek Deviation road corridor (LCZ 1), Burnt Bridge Creek riparian corridor (LCZ 2) and Education campus (LCZ 7) landscape character zones.

A summary of the landscape character impacts during construction for each landscape character zone within the Balgowlah precinct is provided in Table 22-7.

Table 22-7 Landscape character impacts during construction – Balgowlah precinct

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 – Burnt Bridge Creek Deviation road corridor	Low	Moderate	Moderate – low
LCZ 2 – Burnt Bridge Creek riparian corridor	Moderate	Low	Moderate – low
LCZ 3 – Balgowlah Golf Course open space	Moderate	High	High – moderate
LCZ 4 – Balgowlah residential east	Moderate	Moderate	Moderate
LCZ 5 – Balgowlah residential west	Moderate	Moderate	Moderate
LCZ 6 – Balgowlah residential south	Moderate	Moderate	Moderate
LCZ 7 – Education campus	Moderate	Low	Moderate – low

Wakehurst Parkway precinct

Construction activities within the Wakehurst Parkway precinct would include surface roadworks and associated activities (such as earthworks, bridgeworks, installation of retaining walls, new shared user path and underpasses, fauna rope crossings and fauna underpasses) and the construction of a cut and cover tunnel, two entry and exit ramps to the tunnel, motorway facilities, ventilation outlet, maintenance facility and tunnel support facilities.

Three temporary construction support sites would be located within the precinct. The Wakehurst Parkway south construction support site (BL12) would be located at the interface of Seaforth residential (LCZ 2) and Wakehurst Parkway road corridor (LCZ 3) landscape character zones, on the eastern side of Wakehurst Parkway between Kirkwood Street and the area just south of Judith Street. The Wakehurst Parkway east construction support site (BL13) would be located further north to the rear of the existing Sydney Water Bantry Bay Reservoir site, within the Remnant bushland (LCZ 4) landscape character zone. The Wakehurst Parkway north construction support site (BL14) would be located on the eastern side of Wakehurst Parkway at the Warringah Road/Wakehurst Parkway intersection. The locations of the temporary construction support sites are shown in Figure 22-8.

High to moderate impacts are anticipated for the Seaforth residential (LCZ 2), Wakehurst Parkway road corridor (LCZ 3) and Remnant bushland (LCZ 4) landscape character zones during construction, due to the removal of vegetation, an increased visibility of construction activities, vehicle movements, earthworks, surface roadworks and exposure to built form in these landscapes.

Temporary construction support sites would be rehabilitated after construction and revegetated with appropriate native species. Landscape character impact ratings may therefore reduce as replacement planting matures over the duration of the construction period. The retention and re-establishment of vegetation along the road corridor would also assist in reducing landscape character impacts.

Landscape character impacts have been assessed as negligible for Seaforth Oval open space (LCZ 1) due to existing screen vegetation surrounding the oval.

While potential impacts of a high to moderate rating are anticipated for landscape character zones within the Warringah Parkway precinct, such impacts are expected to be temporary in nature and localised to the specific areas in which they are likely to occur.

A summary of the landscape character impacts during construction for each landscape character zone within the Wakehurst Parkway precinct is provided in Table 22-8.

Table 22-8 Landscape character impacts during construction – Wakehurst Parkway precinct

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 – Seaforth Oval open space	Moderate	Negligible	Negligible
LCZ 2 – Seaforth residential	Moderate	High	High – moderate
LCZ 3 – Wakehurst Parkway road corridor	Moderate	High	High – moderate
LCZ 4 – Remnant bushland	High	Moderate	High – moderate

22.6.2 Landscape character impacts at temporary construction support sites (outside precincts)

Flat Rock Drive

The Flat Rock Drive construction support site (BL2) would be located within Flat Rock Reserve.

High impacts are anticipated on the Flat Rock Reserve open space (LCZ 2), east of Flat Rock Drive, as a result of vegetation removal, the introduction of new built form and the diversion of existing walking and cycling trails.

Moderate impacts on landscape character are expected for the Residential (LCZ 1) landscape character zone, due to its physical separation from, but limited views of, the temporary construction support site.

Moderate to low impacts are anticipated for the Sports precinct (LCZ 3), due to the presence of screening vegetation along the western side of Flat Rock Drive, and for the Flat Rock Drive Road corridor landscape character zone (LCZ 4), as a result of the temporary reduction in vegetation along the eastern side of the road.

Following construction, the site would be re-vegetated or re-purposed subject to consultation with Willoughby City Council and other relevant stakeholders. Residual impacts may remain until planted vegetation has matured, however residual impacts are considered minor and following maturity, there would be no permanent impacts to the landscape character of the site.

A summary of the landscape character impacts during construction within the Flat Rock Drive construction support site is provided in Table 22-9.

Table 22-9 Landscape character impacts during construction – Flat Rock Drive

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 - Residential	High	Low	Moderate
LCZ 2 - Flat Rock Reserve open space	High	High	High
LCZ 3 - Sports precinct	Moderate	Low	Moderate – low
LCZ 4 - Road corridor	Moderate	Moderate	Moderate – low

Middle Harbour Crossing and Spit West Reserve

The Spit West Reserve construction support site (BL9) would be a combined land and water-based site and would make use of land within Spit West Reserve. Additionally, the Middle Harbour south cofferdam (BL7) and Middle Harbour north cofferdam (BL8) would be located within Middle Harbour.

High to moderate impacts are expected for the Foreshore public open space and environmental (LCZ 1) and Low density residential and environmental management (LCZ 2) landscape character zones near the proposed temporary construction support sites, due to the increased exposure to built form.

Moderate impacts are expected on the Middle Harbour – open water landscape character zone (LCZ 3) surrounding the temporary construction support sites. There would be a temporary increase in built form on the waterways in the form of the cofferdam structure, dredging machinery, immersed tube tunnel piles/headstocks and immersion equipment (Middle Harbour) and casting facility (Spit West Reserve), which may lead to adverse impacts on the character of the waterway in close proximity to the works.

All construction plant and equipment would be removed following construction works, therefore the project is not expected to cause any permanent impacts to the landscape character post construction.

A summary of the landscape character impacts during construction within the Spit West Reserve and Middle Harbour is provided in Table 22-10.

Table 22-10 Landscape character impacts during construction – Middle Harbour and Spit West Reserve

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 - Foreshore public open space and environmental	High	Moderate	High – moderate
LCZ 2 - Low density residential and environmental management	High	Moderate	High – moderate
LCZ 3 - Middle Harbour – open water	Moderate	Moderate	Moderate

22.6.3 Visual impacts at precincts during construction

Visual impacts on representative receiver locations during construction are summarised below for each precinct. The location of viewpoints for each precinct is shown in Section 22.4. Visual impacts at temporary construction support sites not located in precincts are discussed in Section 22.6.4.

Appendix V (Technical working paper: Urban design, landscape character and visual impact) provides further detail on the sensitivity, magnitude of change and overall impact rating for each viewpoint.

North Sydney precinct

Construction activities within the North Sydney precinct would include surface roadworks (such as road widening and the construction of retaining walls), the installation of fencing and the construction of trough structures, motorway facilities and entry and exit portals for the Beaches Link tunnel within the Warringah Freeway road corridor. The Cammeray Golf Course construction support site (BL1) would be located within this precinct, as shown in Figure 22-5. Prior to the commencement of works at the site, it would initially be established as a temporary construction support site for the Western Harbour Tunnel and Warringah Freeway Upgrade project, supporting construction works in the precinct area.

High to moderate visual impacts are expected for six viewpoints during construction of the project. These would include users of Jeaffreson Jackson Reserve and nearby residential receivers (Viewpoint 2), residential receivers at Morden Street, Warringa Road and Ernest Street (Viewpoints 3, 4 and 12), and users of the Cammeray Golf Course club house and footpath (Viewpoints 8 and 9). This would be due to the temporary presence of site hoardings, stockpiles, construction equipment and increased vehicle movements during construction of the motorway facilities

While construction activities are likely to be most visible within the Warringah Freeway itself, major adverse visual impacts are not expected on road users due to the functional nature of the road and a lower level of receiver sensitivity. Moderate visual impacts are therefore expected for receivers at the Warringah Freeway near Ernest Street (Viewpoint 11) and users of the Ernest Street, Falcon Street shared use and Miller Street bridges (Viewpoints 13, 14 and 15).

Moderate visual impacts are also expected for users of the Carter Street lookout (Viewpoint 5), Green Park and Warwick Avenue residential receivers (Viewpoint 6), and users of the Cammeray Park sports facilities (Viewpoint 10) due to the potential visibility of equipment associated with the construction of the motorway facilities.

While potential impacts of a high to moderate rating are anticipated for landscape character zones within the North Sydney precinct, such impacts are expected to be temporary in nature and localised to the specific areas in which they are likely to occur.

Negligible visual impacts are anticipated for users of St Leonards Park Bon Andrews Oval (Viewpoint 1) and for residential receivers at Park Avenue (Viewpoint 7).

Table 22-11 Visual impacts during construction – North Sydney precinct

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – St Leonards Park – Bon Andrews Oval	High	Negligible	Negligible
Viewpoint 2 – Jeaffreson Jackson Reserve and nearby residential	Moderate	High	High – moderate
Viewpoint 3 – Morden Street residential	High	Moderate	High – moderate
Viewpoint 4 – Warringah Road residential	Moderate	High	High – moderate
Viewpoint 5 – Carter Street lookout	High	Low	Moderate
Viewpoint 6 – Green Park and Warwick Avenue residential	Moderate	Moderate	Moderate
Viewpoint 7 – Park Avenue residential	High	Negligible	Negligible
Viewpoint 8 – Cammeray Golf Course club house	High	High	High – moderate
Viewpoint 9 – Cammeray Golf Course footpath	Moderate	High	High – moderate
Viewpoint 10 – Cammeray Park sports facilities	Moderate	Moderate	Moderate
Viewpoint 11 – Warringah Freeway near Ernest Street	Low	High	Moderate
Viewpoint 12 – Ernest Street residential	Moderate	High	High – moderate
Viewpoint 13 – Ernest Street bridge	Low	High	Moderate
Viewpoint 14 - Falcon Street shared user bridge	Low	High	Moderate
Viewpoint 15 – Miller Street bridge	Low	High	Moderate

Artarmon precinct

Construction activities within the Artarmon precinct would include surface roadworks (such as earthworks, bridgeworks, installation of retaining walls and fencing) and the construction of cut and cover and trough structures, motorway facilities, ventilation outlet, motorway control centre and a tunnel support facility. The Punch Street (BL3), Dickson Avenue (BL4), Barton Road (BL5) and Gore Hill Freeway median (BL6) construction support sites would be located within the precinct, as shown in Figure 22-6.

High to moderate impacts are expected for users of the shared user path along the Gore Hill Freeway (Viewpoint 3) which would be directly impacted during construction and may require rerouting. There would also be views of construction equipment, site hoardings, a temporary noise wall and increased vehicle movements from the shared user path. Receivers at Parkes Road/Artarmon Park (Viewpoint 5) would also experience temporary high to moderate impacts as vegetation is removed within Artarmon Park along the boundary of the Gore Hill Freeway and site hoardings, construction equipment, vegetation removal and increased vehicle movements become visible.

While construction activities are likely to be highly visible within the Gore Hill Freeway itself (Viewpoint 6), major visual impacts are not expected on road users due to the functional nature of the road and shorter duration of view. Moderate to low impacts are anticipated for receivers at Lambs Road (Viewpoint 1), Punch Street (Viewpoint 2), Hampden Road bridge (Viewpoint 4) and Reserve Road (Viewpoint 7), due to the likely visibility of temporary site hoardings, construction equipment and increased vehicle movements.

Negligible impacts are expected for receivers at Artarmon Reserve (Viewpoint 8) and Godfrey Road residential receivers (Viewpoint 9).

Table 22-12 Visual impacts during construction – Artarmon precinct

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – Lambs Road	Low	Moderate	Moderate – low
Viewpoint 2 – Punch Street	Low	Moderate	Moderate – low
Viewpoint 3 – Gore Hill Freeway shared user path	Moderate	High	High – moderate
Viewpoint 4 – Hampden Road bridge	Low	Moderate	Moderate – low
Viewpoint 5 – Parks Road/Artarmon Park	High	Moderate	High – moderate
Viewpoint 6 – Gore Hill Freeway	Low	Moderate	Moderate – low
Viewpoint 7 – Reserve Road	Moderate	Low	Moderate – low
Viewpoint 8 – Artarmon Reserve	High	Negligible	Negligible
Viewpoint 9 – Godfrey Road residential	High	Negligible	Negligible

Balgowlah precinct

Construction activities within the Balgowlah precinct would include surface roadworks (such as earthworks, road widening and the construction of a new access road, new shared user path and pedestrian crossing), excavation of an access decline and the ramp tunnel alignment between Seaforth and Balgowlah, and the construction of motorway facilities and a ventilation outlet adjacent to the new access road within Balgowlah Golf Course. The construction of the new and improved open space and recreation facilities within Balgowlah Golf Course, including a car park, would also be staged, subject to a dedicated consultation process as described in Section 22.5.1. The Balgowlah Golf Course construction support site (BL10) and Kitchener Street construction support site (BL11) would be located within the precinct, as shown in Figure 22-7.

Temporary high visual impacts are expected from residences on Pickworth Avenue (Viewpoint 6) due to the direct views of construction activities and the high sensitivity and magnitude of change at this location.

High to moderate visual impacts are expected at Balgowlah Oval (Viewpoint 7), due to potential direct views of temporary site hoardings, earthworks and construction equipment.

For receivers at Burnt Bridge Creek Deviation existing shared user path (Viewpoint 4) and residential receivers along Paris Street (Viewpoint 5), the visual impacts have been assessed as moderate. Receivers using the Burnt Bridge Creek Deviation existing shared user path (Viewpoint 4) would have direct views of temporary site hoardings, construction equipment and increased vehicle movements. Earthworks required for the open space and recreation facilities would be visible to receivers at Paris Street (Viewpoint 5) while turf and planting is being established.

Moderate to low visual impacts are expected for residential receivers at the Burnt Bridge Creek Deviation (Viewpoint 1), Hope Street (Viewpoint 2) and Serpentine Crescent (Viewpoint 3) due to potential views of temporary site hoardings, construction activities and equipment, and increased vehicle movements. However, views at Hope Street towards the road corridor and construction activities would be partially blocked by the existing noise wall and mature vegetation on the western side of the Burnt Bridge Creek Deviation.

Table 22-13 Visual impacts during construction – Balgowlah precinct

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – Burnt Bridge Creek Deviation	Low	Moderate	Moderate – low
Viewpoint 2 – Hope Street	Moderate	Low	Moderate – low
Viewpoint 3 – Serpentine Crescent	Moderate	Low	Moderate – low
Viewpoint 4 – Burnt Bridge Creek Deviation existing shared user path	Low	High	Moderate
Viewpoint 5 – Paris Street dwellings	High	Low	Moderate
Viewpoint 6 – Pickworth Avenue dwellings	High	High	High
Viewpoint 7 – Balgowlah Oval	Moderate	High	High – moderate

Wakehurst Parkway precinct

Construction activities within the Wakehurst Parkway precinct would include surface roadworks and associated activities (such as earthworks, bridgeworks, installation of retaining walls, new shared user path and underpasses, fauna rope crossings and fauna underpasses) and the construction of a cut and cover tunnel, two entry and exit ramps to the tunnel, motorway facilities, ventilation outlet, maintenance facility and tunnel support facilities. The Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites would be located within this precinct, as shown in Figure 22-8.

As shown in the table below (Table 22-14), temporary high to moderate visual impacts are expected along Wakehurst Parkway including Wakehurst Parkway south (Viewpoint 3) and Wakehurst Parkway north (Viewpoint 6) due to the removal of vegetation and direct views on temporary site hoardings, construction equipment, surface roadworks (including bridgeworks), construction of cut and cover and trough structures and increased vehicle movements within the Wakehurst Parkway road corridor.

High to moderate visual impacts are also expected for residential receivers at Kirkwood Street (Viewpoint 4) and users of the Engravings track (Viewpoint 5). Residential receivers at Kirkwood Street (Viewpoint 4) would have direct views of site hoardings, increased vehicle movements, road realignment and construction equipment associated with the Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites. There would also be the discernible removal of vegetation across the two sites, increasing exposure to the Wakehurst Parkway road corridor. Users of the Engravings track (Viewpoint 5) are likely to have filtered views of temporary site hoardings and construction equipment and are considered to have high sensitivity to visual impacts.

Moderate visual impacts are anticipated for receivers at Wakehurst Golf Course (Viewpoint 2), due to the removal of vegetation along the golf course boundary at the Sydney Water Bantry Bay Reservoir site, exposing filtered views of project elements such as the acoustic shed. The site would be returned to its existing condition at the end of the construction phase.

Residential receivers at the western edge of Killarney Heights (Viewpoint 8) would experience moderate to low visual impacts due its large viewing distance from the construction footprint and panoramic nature of views at this location.

Negligible visual impacts are anticipated for receivers at Seaforth Oval (Viewpoint 1), Garigal National Park lookout (Viewpoint 7) and the Wakehurst Parkway/Warringah Road intersection (Viewpoint 9).

Table 22-14 Visual impacts during construction – Wakehurst Parkway precinct

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – Seaforth Oval	Moderate	Negligible	Negligible
Viewpoint 2 – Wakehurst Golf Course	Moderate	Moderate	Moderate
Viewpoint 3 – Wakehurst Parkway (south)	Moderate	High	High – moderate
Viewpoint 4 – Kirkwood Street residential	Moderate	High	High – moderate
Viewpoint 5 – Engravings Track	High	Moderate	High – moderate
Viewpoint 6 – Wakehurst Parkway (north)	Moderate	High	High – moderate
Viewpoint 7 – Garigal National Park lookout	High	Negligible	Negligible

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 8 – Killarney Heights residential	High	Low	Moderate – low
Viewpoint 9 – Wakehurst Parkway/Warringah Road Intersection	Low	Negligible	Negligible

22.6.4 Visual impacts at temporary construction support sites (outside precincts)

Visual impacts on representative receiver locations during construction are summarised below for temporary construction support sites that have not been considered as part of the broader precinct assessment. The location of viewpoints for each temporary construction support site is shown in Section 22.4. Appendix V (Technical working paper: Urban design, landscape character and visual impact) provides further detail on the sensitivity, magnitude of change and overall impact rating for each viewpoint.

Flat Rock Drive

The Flat Rock Drive construction support site (BL2) would be a tunnelling support site.

At Flat Rock Reserve shared user paths (Viewpoint 3) a temporary high visual impact is expected during construction as a result of an increase in the amount of built form in the area from the development and operation of the temporary construction support site but also the area of vegetation removal that is required to facilitate the site.

During construction at Pyalla Street (Viewpoint 1) and Calbina Road (Viewpoint 6) temporary high to moderate visual impacts are expected as both viewpoints are situated on elevated positions in respect to the temporary construction support site while receivers are also anticipated to have direct views of the site. The impacted portion of the reserve would be revegetated and rehabilitated as determined through further consultation by Willoughby City Council with the community.

Moderate to low visual impacts are anticipated for the rest of the selected viewpoints for the Flat Rock Drive construction support site (BL2), ie Flat Rock Drive (Viewpoint 2), Willoughby Leisure Centre (Viewpoint 4), Garland Road residential (Viewpoint 5), Flat Rock Drive southbound (Viewpoint 7) and Flat Rock Drive northbound (Viewpoint 8), since views of the temporary construction support site at these locations would be constrained by dense bushland vegetation during construction.

The temporary construction support site would be in use 24 hours a day with an associated increase in light emission that would result in some temporary impacts to surrounding receivers, including moderate night time impacts for receivers within residential properties on Pyalla Street (Viewpoint 1) and Calbina Road (Viewpoint 6), which are located above the Flat Rock Drive construction support site (BL2). The impacts of night time lighting would be low or negligible for all other viewpoints assessed.

The Flat Rock Drive construction support site (BL2) would be located primarily at road level with visual impacts largely contained to Flat Rock Drive itself. Existing vegetation would be retained surrounding the site, where possible, and would provide visual screening from other directions.

The site would be reinstated or re-purposed (subject to consultation) post construction. Depending on this outcome, varying levels of residual impact would be expected. Where reinstatement occurs, residual visual impacts would exist until vegetation has matured.

A summary of the anticipated visual impacts during construction at Flat Rock Drive construction support site (BL2) is provided in Table 22-15.

Table 22-15 Viewpoint impacts during construction – Flat Rock Drive construction support site

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – Pyalla Street	High	Moderate	Daytime hours: High – moderate
			Night time hours: Moderate
Viewpoint 2 – Flat Rock Drive	Low	Moderate	Daytime hours: Moderate – low
			Night time hours: Negligible
Viewpoint 3 – Flat Rock Reserve shared user paths	High	High	Daytime hours: High
			Night time hours: Low
Viewpoint 4 – Willoughby Leisure Centre	Moderate	Low	Daytime hours: Moderate – low
			Night time hours: Negligible
Viewpoint 5 – Garland Road residential	High	Low	Daytime hours: Moderate – low
			Night time hours: Low
Viewpoint 6 – Calbina Road	High	Moderate	Daytime hours: High – moderate
			Night time hours: Moderate
Viewpoint 7 – Flat Rock Drive southbound	Low	Moderate	Daytime hours: Moderate – low
			Night time hours: Negligible
Viewpoint 8 – Flat Rock Drive northbound	Low	Moderate	Daytime hours: Moderate – low
			Night time hours: Negligible

Middle Harbour Crossing and Spit West Reserve

The Middle Harbour south cofferdam (BL7), Middle Harbour north cofferdam (BL8) and Spit West Reserve (BL9) construction sites would support the construction of the immersed tube tunnel units including a casting facility for the units at Spit West Reserve (BL9).

As outlined in Table 22-16 below, for this construction support site temporary high visual impacts are expected at Spit West Reserve (Viewpoint 2) and Clive Park, Northbridge (Viewpoint 4). At Spit West Reserve (Viewpoint 2), there would be direct views of both the Spit West Reserve and more distant Middle Harbour crossing construction sites, including site hoardings within the reserve. There would be a reduction in the amount of clear water visible within the foreshore area adjacent to the reserve and the foreshore shared user path would need to be temporarily relocated, reducing access to views over the water. Although views at Clive Park (Viewpoint 4) towards the Spit West Reserve construction site would be distant, there would likely be direct views of the Middle Harbour construction site including cranes, coffer dams, dredging equipment, immersed tube tunnel piles and headstock and barge movements.

Where direct views of the Middle Harbour crossing construction sites are available at Seaforth Crescent dwellings (Viewpoint 3), a temporary high to moderate visual impact is expected on these receivers during the construction period due to the visibility of the cranes, coffer dams, dredging equipment, immersed tube tunnel piles and headstock and barge movements.

Moderate visual impacts are expected for users of Parriwi Park (Viewpoint 1), due to the increase in built form and a temporary reduction in the extent of clear water visible. Moderate visual impacts are also expected for users of the waterway within Middle Harbour (Viewpoint 5) due to the visibility of cranes and cofferdams.

Moderate to low visual impacts are anticipated for receivers at Beauty Point (Viewpoint 6), due to the visibility of cranes and cofferdams. However, views north east to Spit West Reserve would be heavily filtered by existing vegetation.

Night time visual impacts would be low for receivers at Spit West Reserve (Viewpoint 2) and Seaforth Crescent dwellings (Viewpoint 3) and negligible for all other viewpoints assessed, since the level of night time lighting emittance is expected to be minimal.

No lasting visual impacts are expected post construction as the temporary construction support sites would be returned to their existing condition.

A summary of the anticipated visual impacts during construction at the Middle Harbour south cofferdam (BL7), Middle Harbour north cofferdam (BL8) and Spit West Reserve (BL9) construction sites is provided in Table 22-16.

Table 22-16 Viewpoint impacts during construction – Middle Harbour and Spit West Reserve construction support sites

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – Parriwi Park	High	Moderate	Daytime hours: Moderate
			Night time hours: Negligible
Viewpoint 2 – Spit West Reserve	High	High	Daytime hours: High
			Night time hours: Low
Viewpoint 3 – Seaforth Crescent dwellings	High	Moderate	Daytime hours: High – moderate
			Night time hours: Low
Viewpoint 4 – Clive Park, Northbridge	High	High	Daytime hours: High
			Night time hours: Negligible
Viewpoint 5 – Middle Harbour – on water	Moderate	Moderate	Daytime hours: Moderate
			Night time hours: Negligible
Viewpoint 6 – Beauty Point	Moderate	Low	Daytime hours: Moderate – low
			Night time hours: Negligible

22.7 Assessment of potential operational impacts

The operational landscape character and visual impacts (including impacts on landscape character, views and night lighting) for the North Sydney, Artarmon, Balgowlah and Wakehurst Parkway precincts have been assessed and are outlined below.

The majority of the temporary construction support sites and other sites utilised during construction that are not required for operational infrastructure post construction would be rehabilitated following the completion of construction works. As such, there would be no permanent landscape character or visual impacts at the temporary construction support sites.

The mitigation of operational impacts would be considered through the strategic urban design framework (see Section 22.2 and Appendix V (Technical working paper: Urban design, landscape character and visual impact)) and the implementation of relevant environmental management measures (see Section 22.8 and Appendix V (Technical working paper: Urban design, landscape character and visual impact)). Based on this, it can be expected that the landscape character and visual impact assessment ratings derived below (considered to be day one of operation) would improve as project landscape works mature and buildings and other infrastructure associated with

the project (designed in accordance with the strategic urban design framework) blend into the surrounding environment over time.

Photomontages for each key project view impacted by operational infrastructure are provided in Section 22.7.2. Further photomontages are provided in Appendix V (Technical working paper: Urban design, landscape character and visual impact).

22.7.1 Landscape character impacts during operation

North Sydney precinct

The landscape character impact assessment for the North Sydney precinct identified the potential for a high to moderate landscape character impact for Cammeray Park open space (LCZ 5), in particular Cammeray Golf Course, due to the introduction of a large area of new built form (the Beaches Link motorway facilities) next to the Western Harbour Tunnel motorway facilities. The motorway facilities would be located near, but not encroaching, residential and public open space receivers. This impact is likely to reduce over time as replacement planting matures and partially screens the facilities.

The project would have moderate impacts on the landscape character of the Cammeray residential (LCZ 3) and Cremorne and Neutral Bay residential (LCZ 4) landscape character zones, due to the proposed motorway facilities and ventilation outlet at Warringah Freeway.

Impacts on the landscape character of the Cammeray residential (LCZ 3), Cremorne and Neutral Bay residential areas (LCZ 4) and Cammeray Park open space (LCZ 5) landscape character zones are likely to reduce over time as replacement planting matures and partially screens the motorway facilities and ventilation outlet.

The character of the St Leonards Park (LCZ 1) landscape character zone is unlikely to be adversely impacted by the project due to distance from the works and the presence of screening vegetation throughout the park that would block the majority of views to the proposed works.

The character of the Warringah Freeway corridor (LCZ 2) landscape character zone is unlikely to be considerably impacted by the project due to its low sensitivity to change and ability to absorb the proposed operational structural elements of the project.

A summary of the landscape character impacts during operation of the project within the North Sydney precinct are provided in Table 22-17.

Table 22-17 Landscape character impacts during operation – North Sydney precinct

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 – St Leonards Park	High	Negligible	Negligible
LCZ 2 – Warringah Freeway corridor	Low	Low	Low
LCZ 3 – Cammeray residential	High	Low	Moderate
LCZ 4 – Cremorne and Neutral Bay residential	High	Low	Moderate
LCZ 5 – Cammeray Park open space	Moderate	High	High – moderate

Artarmon precinct

The landscape character impact assessment for the Artarmon precinct identified the potential for a moderate landscape character impact for Artarmon Park (LCZ 6) landscape character zone adjacent to the Gore Hill Freeway, due to the reduction in vegetation in this area and the introduction of a noise wall along the road boundary.

There would likely be moderate to low impacts to the Artarmon residential area (LCZ 4) landscape character zone due to the introduction of new elements within the outlook of this landscape character zone, including potential views to the new motorway facilities and ventilation outlet along the Gore Hill Freeway, and the removal of adjacent vegetation (particularly along Parkes Road).

Since the proposed built form within the Artarmon industrial area (LCZ 1) and Gore Hill Freeway corridor (LCZ 3) landscape character zones would be similar to that of the existing environment, visual impacts within these landscape character zones would be low.

The Artarmon Reserve (LCZ 5) and Artarmon conservation area (LCZ 2) landscape character zones are spatially separated from the project works by dense tree planting and undulating landform and are not expected to be impacted by the project.

A summary of the landscape character impacts during operation of the project within the Artarmon precinct are provided in Table 22-18.

Table 22-18 Landscape character impacts during operation – Artarmon precinct

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 – Artarmon industrial area	Low	Low	Low
LCZ 2 – Artarmon conservation area	High	Negligible	Negligible
LCZ 3 – Gore Hill Freeway	Low	Low	Low
LCZ 4 – Artarmon residential	Moderate	Low	Moderate – low
LCZ 5 – Artarmon Reserve	High	Negligible	Negligible
LCZ 6 – Artarmon Park	Moderate	Moderate	Moderate

Balgowlah precinct

The landscape character impact assessment for the Balgowlah precinct identified the potential for a high to moderate landscape character impact for the Balgowlah Golf Course open space (LCZ 3) landscape character zone during the operation of the project. This would be due to the clearing of vegetation, remodelling of parts of the existing landform and introduction of new built form elements such as the access road and associated retaining walls which would alter the character of this open space.

The project would return an area, equivalent to around 90 per cent of the current open space, to the community as new and improved public open space and recreation facilities. Residual land, primarily to the east and north of the new access road, would progressively become available through the construction period, which would facilitate re-purposing it to the new and improved public open space and recreation facilities. This would allow it to be handed over progressively for use by the community. The new and improved open space and recreation facilities to the west of the proposed access road, between the access road and the widened Burnt Bridge Creek

Deviation, would be constructed and handed over to Northern Beaches Council after completion of the project.

A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council would take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities at Balgowlah. Assessments of landscape character impact have been undertaken using an indicative layout of the new and improved open space and recreation facilities. A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council would take place to give the community an opportunity to provide input on the final layout.

There would be moderate impacts to the Balgowlah residential east (LCZ 4) and Balgowlah residential west (LCZ 5) landscape character zones due to the clearing of vegetation and the introduction of new built form elements. Impacts would be limited to residences that border the Balgowlah Golf Course (including residences on Dudley Street, Pickworth Avenue and Sydney Road), or are in close proximity to the golf course (including residences along Serpentine Crescent, Hope Street and Boronia Street). As replacement planting matures, the impact on landscape character is likely to reduce from that recorded. Due to the removal of vegetation and the introduction of new built form elements and road infrastructure, moderate to low landscape character impacts are expected in the Burnt Bridge Creek riparian corridor (LCZ 2) and the Balgowlah residential south (LCZ 6) landscape character zones. Burnt Bridge Creek would be re-aligned, potentially impacting its current scenic qualities. As before, the impact on landscape character is likely to reduce from that recorded as replacement planting matures.

The Educational campus (LCZ 7) landscape character zone, including Northern Beaches Secondary College, is likely to experience moderate to low impacts to its landscape character due to the removal of vegetation within Balgowlah Golf Course and the introduction of new built form elements, including the new and improved open space and recreation facilities within the golf course. The widening of the road corridor in proximity to the school (to facilitate the new access road intersection) would be on the northern side of Sydney Road but may, however, indirectly impact the northern college boundary. This section of the campus would be exposed to more extensive road infrastructure associated with a new traffic light intersection.

Low landscape character impacts are expected for the Burnt Bridge Creek Deviation road corridor (LCZ 1) landscape character zone. Despite the clearing of vegetation along its eastern boundary, the introduction of new built form elements within and adjacent to the corridor and realignment and widening of the road corridor, the road corridor is considered to have low sensitivity to change and the new built form elements would be mostly consistent with that of the existing road environment.

A summary of the outcomes of the landscape character impact assessment are provided in Table 22-19.

Table 22-19 Landscape character impacts during operation – Balgowlah precinct

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 – Burnt Bridge Creek Deviation road corridor	Low	Low	Low
LCZ 2 – Burnt Bridge Creek riparian corridor	Moderate	Low	Moderate – low
LCZ 3 – Balgowlah Golf Course open space	Moderate	High	High – moderate
LCZ 4 – Balgowlah residential east	Moderate	Moderate	Moderate
LCZ 5 – Balgowlah residential west	Moderate	Moderate	Moderate
LCZ 6 – Balgowlah residential south	Moderate	Low	Moderate – low
LCZ 7 – Education campus	Moderate	Low	Moderate – low

Wakehurst Parkway precinct

The landscape character impact assessment for the Wakehurst Parkway precinct identified the potential for a high to moderate landscape character impact for the Remnant bushland (LCZ 4) landscape character zone surrounding the Wakehurst Parkway road corridor, due to the widening of the road and removal of vegetation. There would likely be moderate impacts on the landscape character of the Wakehurst Parkway road corridor (LCZ 3), due to the reduced scenic nature of the corridor associated with the increased scale of the road corridor, and the addition of associated motorway facilities, ventilation outlet and tunnel support facilities as part of the project. The impact on these landscape character zones is likely to reduce from that recorded as replacement planting matures.

Moderate to low landscape character impacts are anticipated for the Seaforth residential (LCZ 2) landscape character zone. Despite the zones residential land use, retained dense vegetation is expected to screen the majority of views towards the project.

Negligible impacts on landscape character are anticipated for Seaforth Oval open space (LCZ 1) landscape character zone, primarily due to the physical separation of the oval from the project along with existing screening vegetation.

Despite the removal of vegetation either side of the road, the density of planting in this area would retain its bushland character, especially as replacement planting matures.

Although there would be some initial impacts as a result of the project due to vegetation removal along the residential boundary with Wakehurst Parkway, this is expected to be replaced following construction works which would reduce the operational impact of the project.

A summary of the outcomes of the landscape character impact assessment are provided in Table 22-20.

Table 22-20 Landscape character impact during operation – Wakehurst Parkway precinct

Landscape character zone	Sensitivity	Magnitude of change	Overall impact rating
LCZ 1 – Seaforth Oval open space	Moderate	Negligible	Negligible
LCZ 2 – Seaforth residential	Moderate	Low	Moderate – low
LCZ 3 – Wakehurst Parkway road corridor	Moderate	Moderate	Moderate
LCZ 4 – Remnant bushland	High	Moderate	High – moderate

22.7.2 Visual impacts during operation

Visual impacts on representative receiver locations during operation are summarised below. The location of viewpoints for each precinct is shown in Section 22.4. Appendix V (Technical working paper: Urban design, landscape character and visual impact) provides further detail on the sensitivity, magnitude of change and overall impact rating for each viewpoint.

North Sydney precinct

Visual impacts of the project within the North Sydney precinct would generally be moderate to low since much of the built form of the project (including portals, motorway facilities and ventilation outlet) would be congruous with the existing major infrastructure of the Warringah Freeway road corridor. The largest visual impacts would be experienced by residential and public open space receivers in close proximity to the motorway facilities within Cammeray Golf Course and elevated receivers that have clear views of the project. While the motorway facilities and ventilation outlet would be the most visible elements of the project, the presence of screening vegetation along the boundary of Cammeray Park would assist in filtering or blocking many views of the ventilation outlet and motorway facilities from street level. In addition, the impact on more distant, district views of the ventilation outlet would be somewhat reduced by the presence of existing vertical

elements within the view, including the North Sydney sewer outlet and the Neutral Bay/North Sydney CBD towers.

High to moderate visual impacts are expected for residential receivers at Jeaffreson Jackson Reserve (Viewpoint 2) and Ernest Street (Viewpoint 12) with clear views of the proposed built elements of the project, including the motorway facilities, substation and ventilation outlet. Users of the Cammeray Golf Course club house (Viewpoint 8) with clear views of the motorway facilities are also anticipated to experience high to moderate visual impacts. Impacts are likely to reduce as replacement planting matures and screens some parts of the motorway facilities. A comparison of the existing view north east over Warringah Freeway from Jeaffreson Jackson Reserve (Viewpoint 2) with the expected views of the project is provided in Figure 22-11 to Figure 22-13. Existing and proposed views from Ernest Street dwellings north to Cammeray Golf Course (Viewpoint 12) are shown in Figure 22-14 to Figure 22-16.

Moderate visual impacts are expected for residential properties along Morden Street (Viewpoint 3) and Carter Street (Viewpoint 5) that have elevated view corridors over Cammeray Park. Although the presence of retained foreground vegetation would likely assist in reducing the amount of proposed built form visible, views of the upper sections of the motorway facilities and ventilation outlet are still likely above the tree line. Users of the Cammeray Golf Course footpath (Viewpoint 9) with clear views of the motorway facilities are also anticipated to experience moderate visual impacts.

The removal of vegetation by the Western Harbour Tunnel and Warringah Freeway Upgrade project along the road corridor is likely to increase visibility of both existing and proposed infrastructure for receivers in proximity to the Warringah Freeway. Replacement screening vegetation would reduce these impacts over time as the vegetation matures. Moderate visual impacts are therefore also expected for Warringah Road residential receivers (Viewpoint 4) and users of the Cammeray Park sports facilities (Viewpoint 10), Warringah Freeway near Ernest Street (Viewpoint 11) and Ernest Street bridge (Viewpoint 13).

The retention of screening vegetation along the boundary of Cammeray Park would help to reduce visual impacts of new built form from street level viewpoints surrounding the park. Moderate to low visual impacts are therefore expected for residential receivers at Green Park and Warwick Avenue (Viewpoint 6). Moderate to low impacts are also anticipated for users of the Falcon Street shared user bridge (Viewpoint 14) and Miller Street bridge (Viewpoint 15), whereas impacts on views from St Leonards Park Bon Andrews Oval (Viewpoint 1) and Park Avenue (Viewpoint 7) are expected to be negligible.

While the project would likely lead to an increase in night time light emissions, the presence of numerous existing light sources within the mostly urbanised precinct would mostly reduce impacts to negligible or low. Exceptions to this would be receivers with local views into Cammeray Park and the golf course club house (Viewpoints 4, 8 and 9), where increased light emittance associated with the new infrastructure is likely to have moderate impacts to night time visual amenity.

A summary of the anticipated visual impacts during the operation of the project within the North Sydney precinct is provided in Table 22-21 below.

Table 22-21 Visual impacts during operation – North Sydney precinct

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – St Leonards Park – Bon Andrews Oval	High	Negligible	Daytime: Negligible
			Night time: Negligible
Viewpoint 2 – Jeaffreson Jackson Reserve and nearby residential	Moderate	High	Daytime: High – moderate
			Night time: Low
Viewpoint 3 – Morden Street residential	High	Low	Daytime: Moderate
			Night time: Low
Viewpoint 4 – Warringa Road residential	Moderate	Moderate	Daytime: Moderate
			Night time: Moderate
Viewpoint 5 – Carter Street lookout	High	Low	Daytime: Moderate
			Night time: Low
Viewpoint 6 – Green Park/Warwick Avenue residential	Moderate	Low	Daytime: Moderate – low
			Night time: Low
Viewpoint 7 – Park Avenue residential	High	Negligible	Daytime: Negligible
			Night time: Low
Viewpoint 8 – Cammeray Golf Course club house	High	Moderate	Daytime: High – moderate
			Night time: Moderate
Viewpoint 9 – Cammeray Golf Course footpath	Moderate	Moderate	Daytime: Moderate
			Night time: Moderate
Viewpoint 10 – Cammeray Park sports facilities	Moderate	Moderate	Daytime: Moderate
			Night time: Low
Viewpoint 11 – Warringah Freeway near Ernest Street	Low	High	Daytime: Moderate
			Night time: Negligible
Viewpoint 12 – Ernest Street residential	Moderate	High	Daytime: High – moderate
			Night time: Low
Viewpoint 13 – Ernest Street bridge	Low	High	Daytime: Moderate
			Night time: Negligible
Viewpoint 14 - Falcon Street shared user bridge	Low	Moderate	Daytime: Moderate – low
			Night time: Negligible
Viewpoint 15 – Miller Street bridge	Low	Moderate	Daytime: Moderate – low
			Night time: Negligible



Figure 22-11 Existing view north east over Warringah Freeway from Jeффreson Jackson Reserve



Figure 22-12 Proposed view (year 1 of operation) north east over Warringah Freeway from Jeффreson Jackson Reserve



Figure 22-13 Proposed view (year 10 of operation) north east over Warringah Freeway from Jeaffreson Jackson Reserve



Figure 22-14 Existing view from Ernest Street dwellings north to Cammeray Golf Course



Figure 22-15 Proposed view (year 1 of operation) from Ernest Street dwellings north to Cammeray Golf Course



Figure 22-16 Proposed view (year 10 of operation) from Ernest Street dwellings north to Cammeray Golf Course

Artarmon precinct

Visual impacts of the project within the Artarmon precinct would generally be moderate to low since much of the built form of the project (including portals, trough structures, noise walls, motorway control centre and motorway facilities) would be congruous with the existing large scale road infrastructure of the Gore Hill Freeway road corridor and the industrial nature of the precinct. The ventilation outlet would be the most visible element of the project with visibility of the upper sections extending to elevated residential receivers in the north. However, the impact of the ventilation outlet on wider, district views would be reduced by the presence of existing vertical elements within the view, including the two transmission towers.

High to moderate visual impacts are expected for residential and public open space receivers along Parkes Road/Artarmon Park (Viewpoint 5), where vegetation is likely to be removed. This would reduce the current green buffer between these receivers and the Gore Hill Freeway.

Moderate visual impacts are likely for users of the shared user path alongside the Gore Hill Freeway (Viewpoint 3) due to a reduction in vegetation along the path, increasing exposure to the Gore Hill Freeway.

Moderate to low visual impacts are expected for users of Hampden Road Bridge (Viewpoint 4) as the project works would generally be congruous with the existing road infrastructure and nearby industrial development. Moderate to low impacts are also expected for users of the Gore Hill Freeway road corridor (Viewpoint 6) as vegetation removal reduces the green buffer currently present on either side of the road. A comparison of the existing view east over Gore Hill Freeway from Hampden Road Bridge with the expected views of the project is provided in Figure 22-17 to Figure 22-19.

Views from the south from Lambs Road (Viewpoint 1), Punch Street (Viewpoint 2) and Reserve Road (Viewpoint 7) are expected to have moderate to low impacts due to the built up nature of the existing environment. Landscape planting associated with the Freeway Hotel, a visually prominent built form element on the corner of the Gore Hill Freeway, contributes to the amenity value of the existing views from Reserve Road and would be replaced through mitigation planting.

While the motorway facilities and ventilation outlet may also be visible from some residential properties within the elevated areas of the northern part of the precinct, such as along Godfrey Road (Viewpoint 9), the presence of extensive screening vegetation and the reasonably large viewing distance would reduce the visual impact to negligible. Other views of the motorway facilities and ventilation outlet would be somewhat reduced by the presence of existing vertical elements within view, including two transmission towers. The motorway facilities and ventilation outlet are unlikely to be visible from Artarmon Reserve (Viewpoint 8) due to the presence of tall screening vegetation.

While the project would likely lead to a slight increase in night time light emissions associated with the motorway control centre and road upgrades, the majority of receivers' night time visual amenity is unlikely to be adversely affected. The presence of numerous existing light sources within the mostly urbanised precinct would generally reduce the impact to negligible. Exceptions to this would include receivers along Parkes Road and Artarmon Park (Viewpoint 5) which may be impacted by an increased light emittance associated with removal of vegetation along the road boundary (moderate visual impact).

A summary of the anticipated visual impacts during the operation of the project within the Artarmon precinct is provided in Table 22-22 below.

Table 22-22 Visual impacts during operation – Artarmon precinct

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – Lambs Road	Low	Moderate	Daytime: Moderate – low
			Night time: Negligible
Viewpoint 2 – Punch Street	Low	Moderate	Daytime: Moderate – low
			Night time: Negligible
Viewpoint 3 – Gore Hill Freeway shared user path	Moderate	Moderate	Daytime: Moderate
			Night time: Negligible
Viewpoint 4 – Hampden Road Bridge	Low	Moderate	Daytime: Moderate – low
			Night time: Negligible
Viewpoint 5 – Parkes Road/Artarmon Park	High	Moderate	Daytime: High – moderate
			Night time: Moderate
Viewpoint 6 – Gore Hill Freeway	Low	Moderate	Daytime: Moderate – low
			Night time: Negligible
Viewpoint 7 – Reserve Road	Moderate	Low	Daytime: Moderate – low
			Night time: Negligible
Viewpoint 8 – Artarmon Reserve	High	Negligible	Daytime: Negligible
			Night time: Negligible
Viewpoint 9 – Godfrey Road residential	High	Negligible	Daytime: Negligible
			Night time: Negligible



Figure 22-17 Existing view east over Gore Hill Freeway from Hampden Bridge towards the motorway facilities and ventilation outlet



Figure 22-18 Proposed view (year 1 of operation) east over Gore Hill Freeway from Hampden Bridge towards the motorway facilities and ventilation outlet



Figure 22-19 Proposed view (year 10 of operation) east over Gore Hill Freeway from Hampden Bridge towards the motorway facilities and ventilation outlet

Balgowlah precinct

Visual impacts of the project within the Balgowlah precinct would generally be moderate to low since much of the built form of the project (including the motorway facilities, ventilation outlet and access road) would be congruous with the road infrastructure of the Burnt Bridge Creek Deviation road corridor. The largest visual impacts would be experienced by residential receivers near the eastern boundary of the Balgowlah Golf Course, due to the removal of vegetation and introduction of new built form within the golf course. The project would return an area within Balgowlah Golf Course, equivalent to around 90 per cent of the current open space, to the community as new and improved public open space and recreation facilities.

A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council would take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities. Assessments of visual impact have been undertaken using an indicative layout of the new and improved open space and recreation facilities. Provided that the consultation process has been completed, portions of the land at Balgowlah Golf Course not required for construction (to the east and north of the new access road) would be re-purposed progressively from the commencement of the project construction phase, which would make facilities available for public use early on in the project program. The land to the west of the proposed access road, between the access road and the widened Burnt Bridge Creek Deviation, is required for the Balgowlah Golf Course construction support site (BL10). The new and improved open space and recreation facilities proposed for this land would be constructed after completion of the project and then handed over to the Northern Beaches Council.

Residential receivers at Pickworth Avenue (Viewpoint 6) are expected to experience high to moderate visual impacts, due to their close proximity and direct views to new built form of the project, including the new access road, motorway facilities, ventilation outlet and recreation facilities, and the reduction in the naturalistic setting of Balgowlah Golf Course. Screen planting along the golf course boundary would reduce these impacts over time. A comparison of the existing view west from Pickworth Avenue towards the motorway facilities and ventilation outlet at Burnt Bridge Creek Deviation with the expected views of the project is provided in Figure 22-20 to Figure 22-22.

Several receivers within the precinct are expected to experience moderate visual impacts as a result of project works. These include residential receivers in close proximity to the Balgowlah Golf Course along the eastern and western boundaries, including the southern end of Paris Street (Viewpoint 5) and users of Balgowlah Oval (Viewpoint 7). From these locations, the introduction of new built form within Balgowlah Golf Course and the removal of vegetation along Burnt Bridge Creek and within the golf course would be visible. However, impacts would be lessened as the overall parkland character of the golf course is retained. Existing and proposed views south from dwellings in Paris Street (Viewpoint 5) towards the motorway facilities and ventilation outlet at Burnt Bridge Creek Deviation is provided in Figure 22-23 to Figure 22-25.

Moderate visual impacts are also expected for residential receivers along Serpentine Crescent (Viewpoint 3) and users of the shared user path along Burnt Bridge Creek Deviation (Viewpoint 4) due to the removal of vegetation and the visibility of the new built form of the project. Replacement planting along the road corridor and Burnt Bridge Creek would likely assist in reducing these impacts over time and the new built form in these locations would generally be congruous with the existing road environment.

Moderate to low impacts are expected for users of Hope Street (Viewpoint 2) due to the presence of an existing noise wall and vegetation. Low visual impacts are expected for receivers at Burnt Bridge Creek Deviation (Viewpoint 1) as the project works would generally be congruous with the existing environment.

The precinct currently has relatively low night time light emissions with very few light sources located within the Balgowlah Golf Course area. During operation, the project would result in an increase in night time lighting, especially along the new access road proposed through the Balgowlah Golf Course open space. There would also be lighting associated with the new portal within the Burnt Bridge Creek Deviation road corridor, which currently has limited light sources.

The most impacted receivers would be residential receivers located along the eastern boundary of the Balgowlah Golf Course, such as receivers in Pickworth Avenue (Viewpoint 6) and Paris Street (Viewpoint 5). These properties would likely have increased visibility of street lighting and vehicle headlights along the new access road, resulting in high and moderate to high night time visual impacts. Low to negligible night time visual impacts are expected at the remaining viewpoints.

A summary of the anticipated visual impacts during the operation of the project within the Balgowlah precinct is provided in Table 22-23 below.

Table 22-23 Visual impacts during operation – Balgowlah precinct

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – Burnt Bridge Creek Deviation	Low	Low	Daytime: Low
			Night time: Negligible
Viewpoint 2 – Hope Street	Moderate	Low	Daytime: Moderate – low
			Night time: Low
Viewpoint 3 – Serpentine Crescent dwellings	Moderate	Moderate	Daytime: Moderate
			Night time: Low
Viewpoint 4 – Burnt Bridge Creek Deviation existing shared user path	Low	High	Daytime: Moderate
			Night time: Negligible
Viewpoint 5 – Paris Street dwellings	High	Moderate	Daytime: Moderate
			Night time: High – moderate
Viewpoint 6 – Pickworth Avenue dwellings	High	Moderate	Daytime: High – moderate
			Night time: High
Viewpoint 7 – Balgowlah Oval	Moderate	Moderate	Daytime: Moderate
			Night time: Negligible



Figure 22-20 Existing view west over Balgowlah Golf Course from dwellings in Pickworth Avenue Creek



Figure 22-21 Proposed view (year 1 of operation) west over Balgowlah Golf Course from dwellings in Pickworth Avenue



Figure 22-22 Proposed view (year 10 of operation) west over Balgowlah Golf Course from dwellings in Pickworth Avenue



Figure 22-23 Existing view south over Balgowlah Golf Course from dwellings in Paris Street



Figure 22-24 Proposed view (year 1 of operation) south over Balgowlah Golf Course from dwellings in Paris Street



Figure 22-25 Proposed view (year 10 of operation) south over Balgowlah Golf Course from dwellings in Paris Street

Wakehurst Parkway precinct

Visual impacts of the project within the Wakehurst Parkway precinct would generally be negligible or moderate to low since views of the new built form of the project (including the motorway facilities, ventilation outlet and portal) would be mostly screened by existing vegetation and replacement planting. The largest visual impacts are expected on residential development and bushland in close proximity to the realigned and upgraded Wakehurst Parkway. The retention and re-establishment of vegetation along the road corridor, where possible, would assist in reducing these impacts as the vegetation matures and provides a visual buffer to pedestrians, motorists and residential receivers.

Moderate impacts are expected for the Wakehurst Parkway road corridor (Viewpoints 3 and 6). This would be due to the widening of Wakehurst Parkway, the introduction of new built form (including the motorway facilities and ventilation outlet) within the road corridor and the removal of vegetation along the road corridor, which may increase visibility of the road and the proposed motorway facilities and ventilation outlet. The retention of foreground vegetation, where possible, to the south of the motorway facilities would help to screen views from the southern approach, including dwellings along Kirkwood Street. A comparison of the existing and proposed views to the south and north along Wakehurst Parkway is provided in Figure 22-26 to Figure 22-29.

Users of the Engravings walking track (Viewpoint 5) are expected to be moderately impacted by works associated with the proposed drainage basins and road widening, due to the associated vegetation removal near some areas of the track and increased exposure to the Wakehurst Parkway road corridor. Over time, replacement planting would assist in reducing visual impacts for the majority of receivers impacted.

Moderate impacts are also expected for residential receivers at Killarney Heights (Viewpoint 8), since the top of the ventilation outlet may be discernible above the treeline, forming a new built form element within the view. However, the large viewing distance and panoramic nature of the view ensures the ventilation outlet would form a relatively small part of the wider view frame.

Elsewhere, moderate to low visual impacts are expected for users of Wakehurst Golf Course (Viewpoint 2) and residential receivers at Kirkwood Street (Viewpoint 4). These impacts would result from removal of vegetation along Wakehurst Parkway, and potential filtered views to the top of the ventilation outlet from Wakehurst Golf Course.

Negligible visual impacts are anticipated for users of Seaforth Oval (Viewpoint 1) and the Garigal National Park lookout (Viewpoint 7), and receivers at the Wakehurst Parkway/Warringah Road intersection (Viewpoint 9). Additional landscape planting at the Wakehurst Parkway/Warringah Road intersection (Viewpoint 9) is expected to improve visual amenity of the site.

The precinct currently has low night time light emissions, with the greatest source being cars on Wakehurst Parkway. The widened road corridor and the removal of vegetation along the boundary of the road may expose residential receivers along Kirkwood Street (Viewpoint 4) to slightly increased light emittance resulting in a low impact, however these impacts would likely reduce as replacement screening vegetation matures. Low visual impacts are also expected along Wakehurst Parkway (south) (Viewpoint 3) due to the presence of lighting at the vent shaft. However, this view would only be experienced for a relatively short duration and in a localised position. Negligible night time visual impacts are expected for all other viewpoints.

A summary of the anticipated visual impacts during the operation of the project within the Wakehurst Parkway precinct is provided within the table below.

Table 22-24 Visual impacts during operation – Wakehurst Parkway precinct

Viewpoint	Sensitivity	Magnitude	Overall impact rating
Viewpoint 1 – Seaforth Oval	Moderate	Negligible	Daytime: Negligible
			Night time: Negligible
Viewpoint 2 – Wakehurst Golf Course	Moderate	Low	Daytime: Moderate – low
			Night time: Negligible
Viewpoint 3 – Wakehurst Parkway (south)	Moderate	Moderate	Daytime: Moderate
			Night time: Low
Viewpoint 4 – Kirkwood Street residential	Moderate	Low	Daytime: Moderate – low
			Night time: Low
Viewpoint 5 – Engravings Track	High	Low	Daytime: Moderate
			Night time: Negligible
Viewpoint 6 – Wakehurst Parkway (north)	Moderate	Moderate	Daytime: Moderate
			Night time: Negligible
Viewpoint 7 – Garigal National Park lookout	High	Negligible	Daytime: Negligible
			Night time: Negligible
Viewpoint 8 – Killarney Heights residential	High	Low	Daytime: Moderate
			Night time: Negligible
Viewpoint 9 – Wakehurst Parkway/Warringah Road Intersection	Low	Negligible	Daytime: Negligible
			Night time: Negligible



Figure 22-26 Existing view north along Wakehurst Parkway near Kirkwood Street



Figure 22-27 Proposed view (year 1 of operation) north with the project along Wakehurst Parkway near Kirkwood Street



Figure 22-28 Existing view south along Wakehurst Parkway near the Warringah Aquatic Centre



Figure 22-29 Proposed view (year 1 of operation) south with the project along Wakehurst Parkway near the Warringah Aquatic Centre

22.8 Environmental management measures

The project has aimed to limit its visual impact by situating project elements within or adjacent to major transport corridors and built-up urban areas. Project elements have been designed with consideration of the surrounding areas and landscape treatments have been proposed to reduce the visual impacts of new infrastructure.

Environmental management measures have been developed with the aim of avoiding significant visual impacts and, where impacts are unavoidable, to effectively reduce and alleviate impacts. Environmental management measures relating to urban design and visual amenity impacts during design and construction phases are outlined in Table 22-25 below.

As noted previously, no specific environmental management measures are outlined in this section in respect to potential operational impacts as the mitigation of such potential impacts would be considered through the strategic urban design framework (see environmental management measure V1, Section 22.2 and Appendix V (Technical working paper: Urban design, landscape character and visual impact)).

Table 22-25 Environmental management measures – Urban design and visual amenity

Ref	Phase	Impact	Environmental management measure	Location
V1	Design	Vegetation/landscaping	The urban design and landscape plan will be further developed during further design development and implemented in line with the strategic urban design framework for the project and appropriate operational mitigation measures (Appendix V (Technical working paper: Urban design, landscape character and visual impact)). The urban design and landscape plan will detail built and landscape features to be implemented during construction and rehabilitation of disturbed areas during construction of the project. The urban design and landscape plan will be made available to the public for feedback.	BL/GHF
V2	Construction	Built form	Construction support sites will be developed to minimise visual impacts for adjacent receivers where feasible and reasonable.	BL/GHF
V3	Construction	Built form	Storage areas and associated works will be located in cleared or otherwise disturbed areas away from residential areas where feasible and reasonable.	BL/GHF
V4	Construction	Built form	Site hoardings will be in neutral colours and designs, in proximity to open space, to help them blend into surrounding environment.	BL/GHF
V5	Construction	Built form	Site hoarding and perimeter site areas will be maintained regularly to include the prompt removal of graffiti.	BL/GHF
V6	Construction	Built form	Site lighting will be designed to minimise glare issues and light spillage into adjoining properties and be generally consistent with the requirements of Australian Standard	BL/GHF

Ref	Phase	Impact	Environmental management measure	Location
			4282-2019 <i>Control of the obtrusive effects of outdoor lighting.</i>	
V7	Construction	Built form	Hoardings and temporary noise walls will be erected as early as possible within the site establishment phase to provide visual screening.	BL/GHF
V8	Construction	Built form	High quality fencing suitable for parks and public spaces will be used where construction support sites are located in close proximity to sensitive residential receivers and users of recreational space.	BL/GHF
V9	Construction	Vegetation/landscaping	Existing trees adjacent to the works will be retained and protected where possible to screen construction works.	BL/GHF
V10	Construction	Vegetation/landscaping	Where possible, trees will be trimmed rather than removed. Works will be supervised by a qualified arborist.	BL/GHF
V11	Construction	Vegetation/landscaping	All areas disturbed by construction and not required for operation of the project will be restored as soon as practicable to their existing condition or in accordance with the urban design and landscape plan where applicable (environmental management measure V1).	BL/GHF
V12	Construction	Vegetation/landscaping	Early planting works will be considered to provide a screening buffer that has time to mature before the project is fully operational.	BL/GHF
V13	Construction	Vegetation/landscaping	Where amenity trees are removed as a result of the establishment of construction support sites, they will be replaced at a ratio equal to or greater than 1:1. The replacement trees will consist of local native provenance species from the vegetation community that once occurred in the locality (rather than plant exotic or non-local native trees) where available and subject to the urban design and landscape plan. Where replacement trees cannot be accommodated within the operational footprint of the project, consultation will be carried out with the adjacent land owner and relevant local council (where appropriate) to determine if they can accommodate the replacement tree(s).	BL/GHF

Note: BL = Beaches Link, GHF = Gore Hill Freeway Connection