NSW GOVERNMENT

Roads and Maritime Services

F6 Extension Stage 1

New M5 Motorway at Arncliffe to President Avenue at Kogarah

Preferred infrastructure report

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Executive Summary

Roads and Maritime Services (Roads and Maritime) is seeking approval to construct and operate the F6 Extension Stage 1 from the New M5 Motorway at Arncliffe to President Avenue at Kogarah (the project). Once complete, the project would improve connections and travel times between the A1 Princes Highway and other arterial roads, south of President Avenue, and commercial areas in Sydney. It would also improve connections for residents and businesses within the broader regional area, promoting and supporting economic development in areas to the south such as Sutherland and the Illawarra.

The project would comprise a new twin motorway tunnel (around four kilometres in length) between the New M5 Motorway at Arncliffe and President Avenue at Kogarah with a tunnel portal and entry and exit ramps connecting the tunnels to the surface. Works would include connection to the New M5 Motorway, line marking of additional travel lanes between the St Peters interchange to the F6 Extension Stage 1 tunnels, an intersection with President Avenue (including widening and raising of President Avenue), and intersection improvements at the President Avenue/Princes Highway intersection. Mainline tunnel stubs would be constructed to allow for connections to future stages of the F6 Extension.

The project would also provide shared cycle and pedestrian pathways connecting Bestic Avenue, Rockdale to Civic Avenue, Kogarah via Rockdale Bicentennial Park (including an on-road cycleway) and extending this pathway to the southeast to Chuter Avenue/O'Connell Street, around Robinson Street.

Ancillary infrastructure and operational facilities would include an Operational Motorway Control Centre, signage, ventilation structures, fire and safety systems, and emergency evacuation and smoke extraction infrastructure.

As per clause 14 and Schedule 3 of State Environmental Planning Policy (State and Regional Development) 2011, the project is State significant infrastructure under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and requires the approval of the Minister for Planning. The project has also been declared as a critical infrastructure project under section 115V of the EP&A Act and is listed in Schedule 5 of State Environmental Planning Policy (State and Regional Development).

An Environmental Impact Statement (EIS) for the project was prepared to address the Planning Secretary's Environmental Assessment Requirements (SEARs). The EIS was exhibited by the Department of Planning and Environment (DP&E) for 37 calendar days from 7 November to 14 December 2018. Public exhibition of the EIS provided the community, interested parties and key stakeholders (including government agencies and councils) with an understanding of the project and provided the opportunity to provide submissions on the EIS.

Consultation activities undertaken during exhibition of the EIS included a series of community information sessions and 'Pop-up' information stands to provide community members an opportunity to discuss the EIS with technical specialists, as well as a series of briefings and the distribution of a range of information materials. The EIS was available to view and download from the DP&E and Roads and Maritime websites and hardcopies were made available to the public at 15 locations. An online EIS navigator tool was also provided to further assist the community in understanding the content of the EIS.

This preferred infrastructure report describes the design refinements that are proposed to address issues raised by key stakeholders and the community during exhibition of the EIS, including:

- President Avenue traffic and access changes - changes to operational access arrangements to and from President Avenue at Lachal Avenue, Traynor Avenue, West Botany Street and Civic Avenue
- Extension of the shared cycle and pedestrian pathway from President Avenue through Scarborough Park North to Chuter Avenue/O'Connell Street in the southern part of the project footprint.

Potential environmental impacts associated with these design refinements have been assessed. The assessment determined that impacts associated with the changes are generally consistent with impacts described in the EIS. Where relevant, additional environmental management measures have been proposed to manage potential impacts not considered in the EIS (refer to Chapter D1 (Environmental management measures) of the submissions report).

Glossary of terms and abbreviations

Term	Meaning
A	
Acid sulfate soils	Naturally occurring soils, sediments or organic substrates (eg peat) that are formed under waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulfides react with oxygen to form sulfuric acid
AEP	Annual Exceedance Probability
AHD	Australian Height Datum. The standard reference level used to express the relative elevation of various features. A height in metres AHD is essentially the height above sea level.
Alluvium	Sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on river beds, floodplains and alluvial fans.
AM peak hour	Unless otherwise stated, this refers to vehicle trips arriving at their destination during the average peak one hour in the AM peak period between 7.00 am–9.00 am on a normal working weekday
Amenity	'The pleasantness of a place as conveyed by desirable attributes including visual, noise, odour etc.' (AILA 2018)
ANZECC	Australian and New Zealand Environment and Conservation Council
ASS	Acid sulfate soil
B	
Background noise level	The ambient sound-pressure noise level in the absence of the sound under investigation exceeded for 90 per cent of the measurement period. Normally equated to the average minimum A-weighted sound pressure level
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BTEXN	Benzene, toluene, ethylbenzene, xylenes, naphthalene
C	
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location
Clearing	The removal of vegetation or other obstacles at or above ground level.
Climate change	A change in the state of the climate that can be identified (for example by statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period of time, typically decades or longer (IPCC 2007)
CLM Act	*Contaminated Land Management Act 1997* (NSW)
Concept design	Initial functional layout of a road/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility and provide basis for estimated and to determine further investigations needed for detailed design
Construction	Includes all physical work required to construct the project.
Construction ancillary facilities	Temporary facilities during construction that include, but are not limited to construction sites (civil and tunnel), sediment basins, temporary water treatment plants, precast yards and material stockpiles, laydown areas, workforce parking, maintenance workshops and offices

Term	Meaning
Construction boundary	The area required for project construction is referred to as the 'construction boundary'.
Construction footprint	The land above and below the ground that is required to construct the project.
Corridor	A substantial segment of the transport network, in which parallel, possibly competing, transport routes (and modes, where appropriate) operate between two locations
Cul-de-sac	A street or road that is open for vehicular traffic at one end only
Culvert	A structure that allows water to flow under a road
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to the project SEARs for cumulative impact assessment requirements.
D	
dB	Decibel - sound level measurement
dB(A)	Decibels (A-weighted)
DECCW	NSW Department of Environment, Climate Change and Water
Detailed design	The phase of the project following concept design where the design is refined, and plans, specifications and estimates are produced, suitable for construction
Discharge	A release of water from a particular source. The volume of water flowing in a stream or through an aquifer past a specific point over a given period of time.
Drainage	Natural of artificial means for the interception and removal of surface or subsurface water.
Earthworks	All operations involving the loosening, excavating, placing, shaping and compacting of soil or rock.
EIS	Environmental Impact Statement
Embankment	An earthen structure where the road (or other infrastructure) is located above the natural surface.
Environment	Includes all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings (from EP&A Act)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
Exposure	Contact with a substance by swallowing, breathing, or touching the skin or eyes. Also includes contact with a stressor such as noise or vibration. Exposure may be short term [acute exposure], of intermediate duration, or long term [chronic exposure].
F	
Feasible and reasonable	Consideration of standard or good practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. 'Feasible' relates to engineering considerations and what is practical to build. 'Reasonable' relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community expectations and nature and extent of potential improvements
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
Floodplain	Area of land which is subject to inundation by floods up to and including the probable maximum flood event (i.e. flood prone land).
G	
Groundwater	Water located within an aquifer or aquitard that is held in the rocks and soil in interconnected pores or fractures located beneath the water table.
H	

Term	Meaning
Hydrogeology	The study of subsurface water in its geological context.
I	
ICNG	Interim Construction Noise Guideline
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment
Inhalation	The act of breathing. A hazardous substance can enter the body this way [see route of exposure].
L	
Landscape character zone	'An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby.' (RMS 2018)
LCZs	landscape character zones
LEP	Local Environmental Plan
Local road	A road or street used primarily for access to abutting properties
LoS	Level of Service
M	
m	Metres
Motorway	Fast, high volume controlled access roads. May be tolled or untolled
N	
NCA	Noise catchment area
NML	Noise management level
NSW	New South Wales
NSW EPA	NSW Environment Protection Authority
NSW OEH	NSW Office of Environment and Heritage (formerly DECCW)
O	
Overland flooding	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.
P	
PAH	Polycyclic aromatic hydrocarbon
PASS	Potential acid sulfate soils
PCT	Plant community type
PM	Particulate matter
PM peak hour	Unless otherwise stated, this refers to trips travelling on the network during the average peak one hour in the PM peak period between 3.00 pm–6.00 pm on a weekday hour
PM_{10}	Particulate matter less than or equal to 10 micrometre diameter
$PM_{2.5}$	Particulate matter less than or equal to 2.5 micrometre diameter
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
Pollutant	Any matter that is not naturally present in the environment.
Portal	The entry and/or exit to a tunnel
President Avenue intersection	A connection between the mainline tunnels and the existing surface road network, including upgrade works to President Avenue required to facilitate the new motorway connection.
President Avenue construction ancillary facility (C3)	A construction ancillary facility for the project within Rockdale Bicentennial Park and 427-441 West Botany Street (including a temporarily diverted West Botany Street), north of President Avenue.
Probability	A statistical measure of the expected chance of flooding (see annual exceedance probability)

Term	Meaning
Project	A new, multi-lane road link between the New M5 Motorway at Arncliffe and President Avenue at Kogarah
Proponent	The person or organisation that proposes to carry out the project or activity. For the purpose of the project, the proponent is NSW Roads and Maritime Services.
R	
Risk	The probability that something would cause injury or harm.
RNP	*NSW Road Noise Policy*
Road reserve	An area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel
Rockdale Bicentennial Park	Park located within Rockdale and Brighton-Le-Sands, comprised of Ilinden Sports Centre, Rockdale Bicentennial Park North and Rockdale Bicentennial Park East.
Rockdale LEP 2011	Rockdale Local Environmental Plan 2011
Runoff	The portion of water that drains away as surface flow.
S	
Scour	The erosion of material by the action of flowing water.
SEARs	Planning Secretary's Environmental Assessment Requirements
Sensitive receiver	A location where a person works or resides, including residential, hospitals, hotels, shopping centres, play grounds, recreational centres or similar.
Spoil	Surplus excavated material
SSI	State significant infrastructure
Stockpile	Temporarily stored materials such as soil, sand, gravel and spoil/waste.
Surface water	Water flowing or held in streams, rivers and other water bodies in the landscape.
Swale	A shallow, grass-lined drainage channel.
TP	Total Phosphorus
TRH	Total recoverable hydrocarbons
Tributary	A river or stream flowing into a larger river or lake.
W	
Waterway	Any flowing stream of water, whether natural or artificially regulated (not necessarily permanent).

Contents

1 Introduction

In accordance with section 115Z(6) of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), a preferred infrastructure report (PIR) has been prepared for the F6 Extension Stage 1 project (the project).

As outlined in Chapter 6 (Project description) of the Environmental Impact Statement (EIS) for the project, the project description and assessment presented in the EIS is based on a concept design and is subject to ongoing refinement. This PIR describes the design changes and refinements that are proposed to address issues raised during public exhibition of the EIS.

This PIR provides a description and assessment of the following proposed changes to the project as assessed in the EIS:

- President Avenue traffic and access changes - changes to operational access arrangements to and from President Avenue at Lachal Avenue, Traynor Avenue, West Botany Street and Civic Avenue
- Extension of the shared cycle and pedestrian pathway from President Avenue through Scarborough Park North to Chuter Avenue/O'Connell Street, south of Robinson Street.

2 President Avenue traffic and access changes

2.1 Overview

During the public exhibition of the EIS, a variety of consultation activities were undertaken including the establishment of a Transport Working Group for residents of Moorefield Estate and the local area. The working group was established to obtain feedback regarding the proposed project access arrangements at President Avenue and consisted of key stakeholders including Bayside Council, local educational facilities and community members.

A meeting with the Transport Working Group was held on 28 November 2018. The meeting included:

- A presentation of the access arrangements proposed in the EIS
- Feedback from stakeholders regarding potential issues and concerns
- A presentation of feasible alternative access arrangements
- Identification of a preferred alternative access option by the working group.

Based on feedback from the working group and in response to submissions on the EIS, changes are proposed to the access arrangements at President Avenue to minimise impacts on traffic access. These changes are described in **section 2.2**. Community feedback identified that these changes would be preferred to both the existing access arrangement and the proposed access arrangements described in section 6.5 of the EIS. Bayside Council has expressed its support of the proposed changes (and the establishment of the Transport Working Group), as noted in their submission on the EIS.

The proposed changes are associated with a number of benefits, including:

- Reduction of potential access and traffic impacts on local residents
- Provision of improved right turn movements to and from President Avenue to reduce potential traffic conflicts.

With regard to concerns raised by the community about future increased traffic along Civic Avenue and Marshall Street, as drivers seek to take alternative routes, the project is making improvements to the operation of President Avenue with clearways considered during peak times to maintain traffic flow on this major route. Some traffic would continue to use Civic Avenue and Marshall Street as a thoroughfare to Rocky Point Road, as currently occurs, however Roads and Maritime, in conjunction with Bayside Council, are proposing additional traffic calming measures along Marshall Street and Civic Avenue to reduce the attractiveness of this route to non-local traffic.

2.2 Description of change

The following key changes are proposed to the access arrangements at President Avenue:

- Lachal Avenue would be converted from one-way northbound to one-way southbound (inbound movements from President Avenue only). A right turn bay and traffic signals would be provided for the right turn into Lachal Avenue from President Avenue, to ensure safe vehicle movements. A pedestrian crossing would be provided across Lachal Avenue
- Traynor Avenue would be converted from one-way southbound to one-way northbound. Only left turn movements out of President Avenue would be permitted. This change would allow Lachal Avenue and Traynor Avenue to continue to operate as a one-way pair
- The cul-de-sac at Moorefield Avenue, as described in the EIS, would not proceed. Following a review of demand, it was determined that Moorefield Avenue could remain open in its existing arrangement as a left in, left out intersection
- An additional 60 metre southbound left turn bay at the existing signalised intersection at West Botany Street and President Avenue would be provided
- A signalised intersection would be provided to allow for safer right turn movements from Civic Avenue into President Avenue. Available traffic movements would remain the same as the existing network configuration, with no right turns permitted from President Avenue into Civic Avenue. The President Avenue/Civic Avenue and the President Avenue/West Botany Street

intersections would operate under one signal controller to allow better control of traffic movements at this section of the President Avenue corridor. A pedestrian crossing would be provided across Civic Avenue.

Further detail on the proposed changes is provided in **Table 2-1**, including a comparison of the proposed changes with the existing and EIS access arrangements. The EIS access arrangements are shown in **Figure 2-1** and the proposed access arrangements are shown in **Figure 2-2**. Traffic modelling has confirmed that the proposed access arrangements are satisfactory from a road network perspective, as described further in **section 2.4**.

Table 2-1 Summary of proposed changes to access arrangements at Moorefield Estate

Road (at intersection with President Avenue)	Existing arrangement	EIS arrangement	Proposed arrangement	Justification for change
Lachal Avenue	One-way northbound (outbound movements to President Avenue only).	Lachal Avenue would be converted from one-way northbound to two-way. A right turn bay would be provided to formalise the right turn into Lachal Avenue from President Avenue, and to ensure safe vehicle movements. A refuge bay would be provided for the right turn out of Lachal Avenue onto President Avenue to ensure safe vehicle movements.	Lachal Avenue would be converted from one-way northbound to one-way southbound (inbound movements from President Avenue only). A right turn bay and traffic signals would be provided for the right turn into Lachal Avenue from President Avenue, to ensure safe vehicle movements. A pedestrian crossing would be provided across Lachal Avenue. The proposed arrangement means that on-street parking restrictions would not be required on Lachal Avenue, which would remain as a one-way street.	Provides a signalised right turn movement into the Moorefield Estate area, thereby reducing potential traffic conflicts. Maintaining one-way operation reduces impacts on Lachal Avenue.
Traynor Avenue	One-way southbound (inbound movements from President Avenue only). Left and right turn from President Avenue permitted.	Traynor Avenue would be retained as one-way southbound. Due to the right turn arrangements at Lachal Avenue, the right turn into Traynor Avenue would not be possible, but the left in movement would remain.	Traynor Avenue would be converted from one-way southbound to one-way northbound. Left turn out onto President Avenue only.	Allows Traynor Avenue and Lachal Avenue to operate as a one-way pair, with a right turn in movement allowed at Lachal Avenue. Safe right turn movements onto President Avenue can be made via the proposed signalised Civic Avenue intersection arrangement described below.
Oakdale Avenue	Two-way. All movements allowed.	No change to existing traffic movements.	No change to existing.	No change to existing.
Moorefield Avenue	Two-way. Left in and left out only.	Moorefield Avenue would be converted to a cul-de-sac at President Avenue to relocate movements to a safer location for vehicles as they turn in or out of the upgraded President Avenue.	No change to existing. Two-way. Left in and left out only.	Based on the surveyed and forecast traffic volumes using this intersection, it was determined that it could remain open and not require a cul-de-sac.
West Botany Street	Signalised intersection.	No change to existing traffic movements.	Provision of an additional 60 metre southbound left turn bay at the existing signalised intersection	Reduces the forecast queue length on the West Botany Street approach.

Road (at intersection with President Avenue)	Existing arrangement	EIS arrangement	Proposed arrangement	Justification for change
Civic Avenue	Two-way. Left in only and left/right out.	Civic Avenue would be retained as two-way. Only left in and left out movements would be permitted.	Signalised T-intersection. A continuous left turn bay with a 40m right turn bay would be provided for vehicles turning right out of Civic Avenue. Available traffic movements remain the same as in the existing network configuration. A single signal controller would control the Civic Avenue and West Botany Street intersections, with the signal phase, to hold President Avenue traffic for Civic Avenue, called every second cycle. A pedestrian crossing would be provided across Civic Avenue. The signalisation of the President Avenue/Civic Avenue intersection would mean the loss of three parking spaces along 40 metres of the northbound Civic Avenue approach to the intersection. There would be no loss on the southbound exit due to the width of Civic Avenue.	Provides signalised left and right turn movements out of the Moorefield Estate area, thereby reducing potential traffic conflicts. Also allows for safe movement from Civic Avenue to West Botany Street northbound.
Cross Street	All movements allowed	Right turn out of Cross Street would not be permitted.	Right turn out of Cross Street would not be permitted.	Removing this movement would allow for safe intersection operation as, with the project, right turning vehicles from Cross Street would need to cross three lanes of eastbound traffic as well as wait for a gap in westbound traffic. The number of vehicles expected to make this movement is also low, with modelling indicating that there would be less than 10 vehicles making this movement in the AM and PM peak hours. Access to President Avenue can continue to be made via Green Street, to West Botany Street or to the Princes Highway.

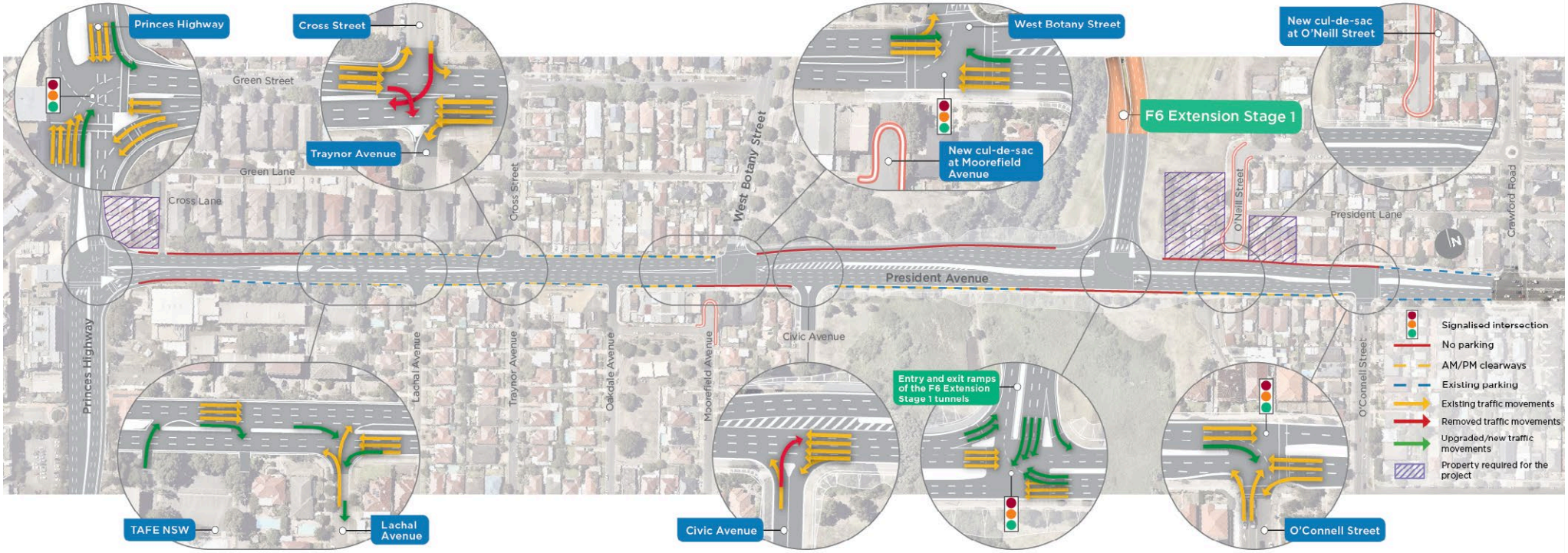


Figure 2-1 Moorefield Estate access arrangements proposed in the EIS

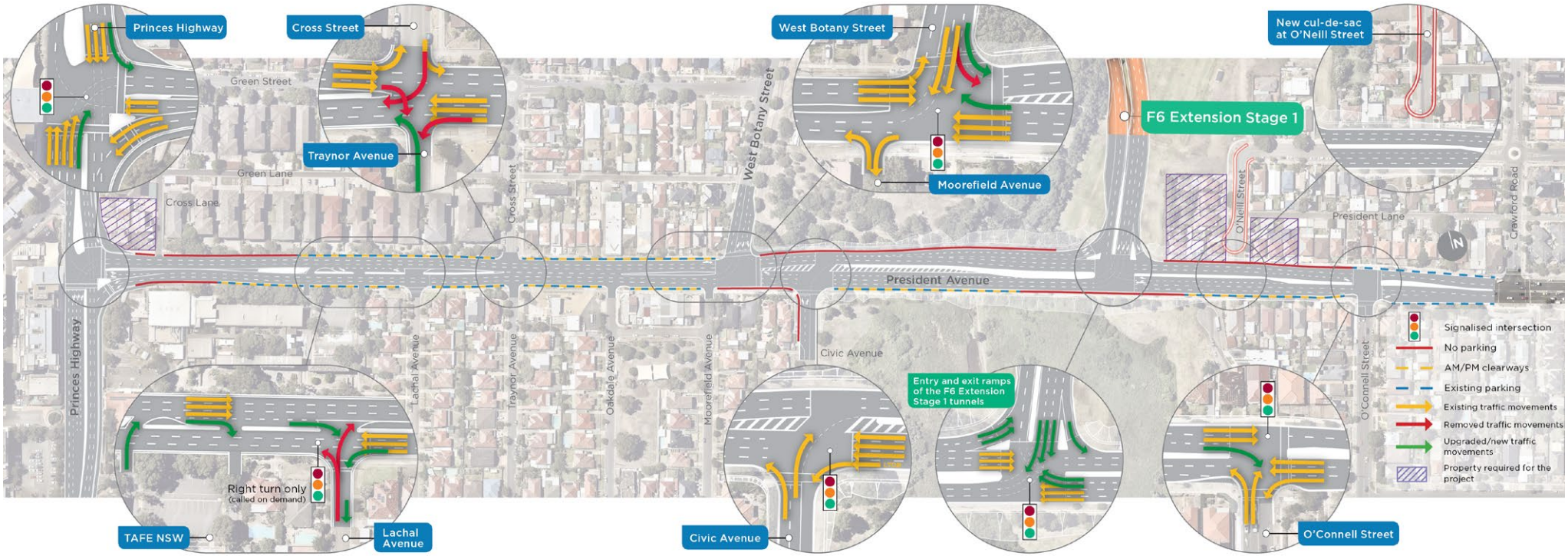


Figure 2-2 Proposed changes to access at Moorefield Estate

2.3 Environmental impact screening

Environmental aspects that were considered in the EIS were evaluated to identify potential impacts associated with the proposed President Avenue access changes. Where potential impacts are anticipated, a detailed assessment of these potential impacts is provided in **section 2.4**.

While the changes proposed in this PIR would change operational traffic access arrangements at President Avenue, the construction works required to facilitate these changes would be of a similar nature to those originally proposed in the EIS (surface road works and tie-in works with local roads at President Avenue) and would be carried out within the project footprint at and around President Avenue, as assessed in the EIS.

Anticipated construction impacts on all aspects are therefore considered to be consistent with the impacts described in the EIS and would be managed by the implementation of the environmental management measures outlined in Chapter D1 (Environmental management measures) of the submissions report.

The expected changes to operational traffic movements in and around President Avenue are considered minor, therefore no material change to operational air quality or noise and vibration impacts are expected. Operational air quality and noise and vibration impacts would be managed in accordance with the environmental management measures outlined in Chapter D1 (Environmental management measures) of the submissions report.

As the changes to the access arrangements have the potential to change travel times and intersection performance along President Avenue during operation, a detailed operational traffic and transport assessment is required to assess the proposed changes. The assessment is summarised in **section 2.4**.

2.4 Further detailed impact assessment

2.4.1 Traffic and transport

2.4.1.1 Methodology

This section presents road network performance under the EIS arrangement for President Avenue local area, compared with performance under the proposed arrangement.

Vissim modelling has been carried out to assess how the road network would perform under the proposed arrangement in the 2036 ‘Do something’ (ie with project) scenario only. The proposed arrangement is part of the project and does not impact on the ‘Do minimum’ (ie without project) scenario.

2.4.1.2 Assessment of operational traffic impacts

Modelling results were evaluated to identify differences in network performance under the proposed arrangement compared to the EIS arrangement. The assessment showed very little change in network performance under the proposed arrangement.

A comparison of forecast travel time and speed along President Avenue (between the Princes Highway and The Grand Parade) is shown in **Table 2-2**. Changes are negligible, with minor changes in travel time on President Avenue, and changes in speed of one per cent or less.

Table 2-2 President Avenue travel time and speed – 2036 'Do something' EIS arrangement vs proposed arrangement

	EIS arrangement		Proposed arrangement		Change from EIS arrangement	
	Travel time (minutes)	Speed (km/h)	Travel time (minutes)	Speed (km/h)	Travel time	Speed
AM peak hour						
Westbound	3.63	25	3.68	25	+1%	no change
Eastbound	3.20	29	3.17	29	-1%	no change
PM peak hour						
Westbound	3.68	25	3.69	25	<1%	no change
Eastbound	3.25	28	3.27	28	+1%	no change

Table 2-3 compares the modelled intersection performance at key President Avenue intersections under the EIS and proposed arrangements. Results show that there is either no change to the Level of Service (LoS) achieved or an improvement in LoS under the proposed arrangement.

Table 2-3 President Avenue modelled key intersection performance – 2036 'Do something' EIS arrangement vs proposed arrangement

	EIS arrangement		Proposed arrangement		Change from EIS arrangement	
	Average delay per vehicle (s)	LoS	Average delay per vehicle (s)	LoS	Average delay per vehicle (s)	LoS
AM peak hour						
The Grand Parade / President Avenue	26	B	27	B	+1	no change
President Avenue / Crawford Road	18	B	19	B	+1	no change
President Avenue / O'Connell Street	43	D	42	D	-1	no change
President Avenue / F6 Extension Stage 1	34	C	30	C	-4	no change
President Avenue / West Botany Street	28	B	17	B	-11	no change
Princes Highway / President Avenue	32	C	32	C	0	no change
PM peak hour						
The Grand Parade / President Avenue	30	C	31	C	+1	no change
President Avenue / Crawford Road	10	A	10	A	0	no change
President Avenue / O'Connell Street	20	B	19	B	-1	no change
President Avenue / F6 Extension Stage 1	33	C	19	B	-14	improvement
President Avenue / West Botany Street	19	B	12	A	-7	improvement
Princes Highway / President Avenue	54	D	49	D	-5	no change

Moorefield Estate local area intersection performance

The proposed arrangements include four additional intersections on President Avenue that were not reported in the EIS:

- President Avenue/Lachal Avenue
- President Avenue/Traynor Avenue/Cross Street
- President Avenue/Oakdale Avenue
- President Avenue/Civic Avenue.

Table 2-4 presents the modelled AM and PM average delay per vehicle and LoS for these intersections. Results indicate good performance across all intersections in the AM and PM peak hours, with intersections achieving LoS C or better.

Table 2-4 President Avenue modelled Moorefield Estate local area intersection performance – 2036 'Do something' proposed arrangement

	Average delay per vehicle (s)	LoS
AM peak hour		
President Avenue / Lachal Avenue	2	A
President Avenue/ Traynor Avenue/ Cross Street	40	C
President Avenue / Oakdale Avenue	10	A
President Avenue / Civic Avenue	7	A
PM peak hour		
President Avenue / Lachal Avenue	4	A
President Avenue/ Traynor Avenue/ Cross Street	16	B
President Avenue / Oakdale Avenue	20	B
President Avenue / Civic Avenue	14	A

Impact on 2036 'Do something' scenario

Modelling results for the 2036 'Do something' scenario showed minimal change in traffic performance when comparing the proposed arrangement with the EIS arrangement. As traffic volumes are lower in the 2026 'Do something' scenario compared to the 2036 'Do something' scenario, changes in traffic performance in the 2026 scenario would also be minimal. Modelling of the Moorefield Estate local area intersections in the 2036 'Do something' scenario indicate good intersection performance with LoS C or better achieved at these intersections. With lower traffic volumes in the 2026 scenario, intersections would be expected to perform at a similar or better LoS.

Impact on 2036 'Cumulative' scenario

In the 2036 'Cumulative' scenario, it is assumed that future stages of the F6 Extension between Kogarah and Loftus are complete. Strategic traffic forecasts indicate that there would be a lower volume of traffic on President Avenue, in the vicinity of Moorefield Estate, in the 2036 'Cumulative' scenario compared to the 2036 'Do something' scenario. However, with the changes to traffic patterns and road network changes that would be required in the 2036 'Cumulative' scenario, including around the West Botany Street/President Avenue and Civic Avenue/President Avenue intersections, access arrangements for Moorefield Estate would need to be reviewed in the assessment of future stages of the F6 Extension.

2.4.1.3 Transport impacts

The impacts of the proposed arrangement on public transport, active transport and on-street parking have also been considered. Changes were found to be minimal with some minor impacts.

It is expected that the small change in traffic performance on President Avenue under the proposed arrangement would have minimal impact on bus routes operating along President Avenue. The improvement in safety for access to Civic Avenue would improve access for bus route 947 and the school bus for St George School.

Under the proposed arrangement, a pedestrian crossing of Civic Avenue and a pedestrian crossing of Lachal Avenue would improve safety for pedestrians. No other impacts to pedestrian routes are expected. There are no cycle routes within Moorefield Estate or along President Avenue that would be impacted.

The proposed arrangement means that on-street parking restrictions would not be required on Lachal Avenue, which would remain as a one-way street. The signalisation of the President Avenue/Civic Avenue intersection would mean the loss of three parking spaces along 40 metres of the northbound Civic Avenue approach to the intersection. There would be no loss on the southbound exit due to the width of Civic Avenue.

2.5 Additional environmental management measures

The assessment in **section 2** has determined that impacts associated with the changes to access arrangements at Moorefield Estate are consistent with impacts described in the EIS and would therefore be managed through the implementation of the environmental management measures described in Chapter D1 (Environmental management measures) of the submissions report.

3 Southern extension of the shared cycle and pedestrian pathway

3.1 Overview

During preparation of the EIS, a Stakeholder Liaison Group was formed to provide a forum for discussion between Roads and Maritime Services, Bayside Council and representatives from community groups and organisations that have a direct interest in matters relating to Rockdale Bicentennial Park, East Bicentennial Playing Fields and Brighton Memorial Playing Fields. During Stakeholder Liaison Group meetings, bicycle user groups including Kogarah Bicycle User Group, requested an extension of the shared cycle and pedestrian pathway further south and in particular to the eastern side of Scarborough Park. This option was also identified in Bayside Council's submission on the EIS (refer to Chapter B7 of the submissions report). Additionally, a number of community submissions on the EIS relate to requests for further improvements to the shared cycle and pedestrian pathways in and around the project footprint.

3.2 Description of change

The shared cycle and pedestrian pathways proposed in section 6.8 of the EIS would be extended from President Avenue through Scarborough Park North across to Chuter Avenue/O'Connell Street. The proposed extension would:

- Increase the shared cycle and pedestrian pathway proposed in the EIS by around 600 metres south from the connection to Civic Avenue
- Be constructed as a 3 metre wide boardwalk (or other low impact design) to minimise potential flooding impacts and would generally follow existing informal walking/access tracks within Scarborough Park
- Cross the watercourse in Scarborough Park via a steel bridge structure
- Include an upgraded pedestrian refuge at the connection point with the existing on road cycle network at Chuter Avenue/O'Connell Street, south of Robinson Street.

This description of the southern extension of the shared cycle and pedestrian pathway is based on a concept design and is subject to design refinements during detailed design.

The section of the shared cycle and pedestrian pathway which links the pathway to the west towards Annette Avenue, would be retained. The proposed alignment and the original alignment presented in the EIS are shown in **Figure 3-1**.

The proposed change is referred to as the 'southern extension of the shared cycle and pedestrian pathway' for the remainder of the report.

3.2.1 Construction activities

Construction activities for the proposed southern extension of the shared cycle and pedestrian pathway would be generally consistent with the construction activities required for the shared cycle and pedestrian pathways described in the EIS and would include the following key construction activities:

- Vegetation clearing and removal
- Construction of temporary access roads (if required)
- Excavation of spoil and removal off-site
- Piling of foundations
- Installation of bridge footings/piers
- Installation of prefabricated boardwalk decking units
- Provision of utilities for permanent lighting

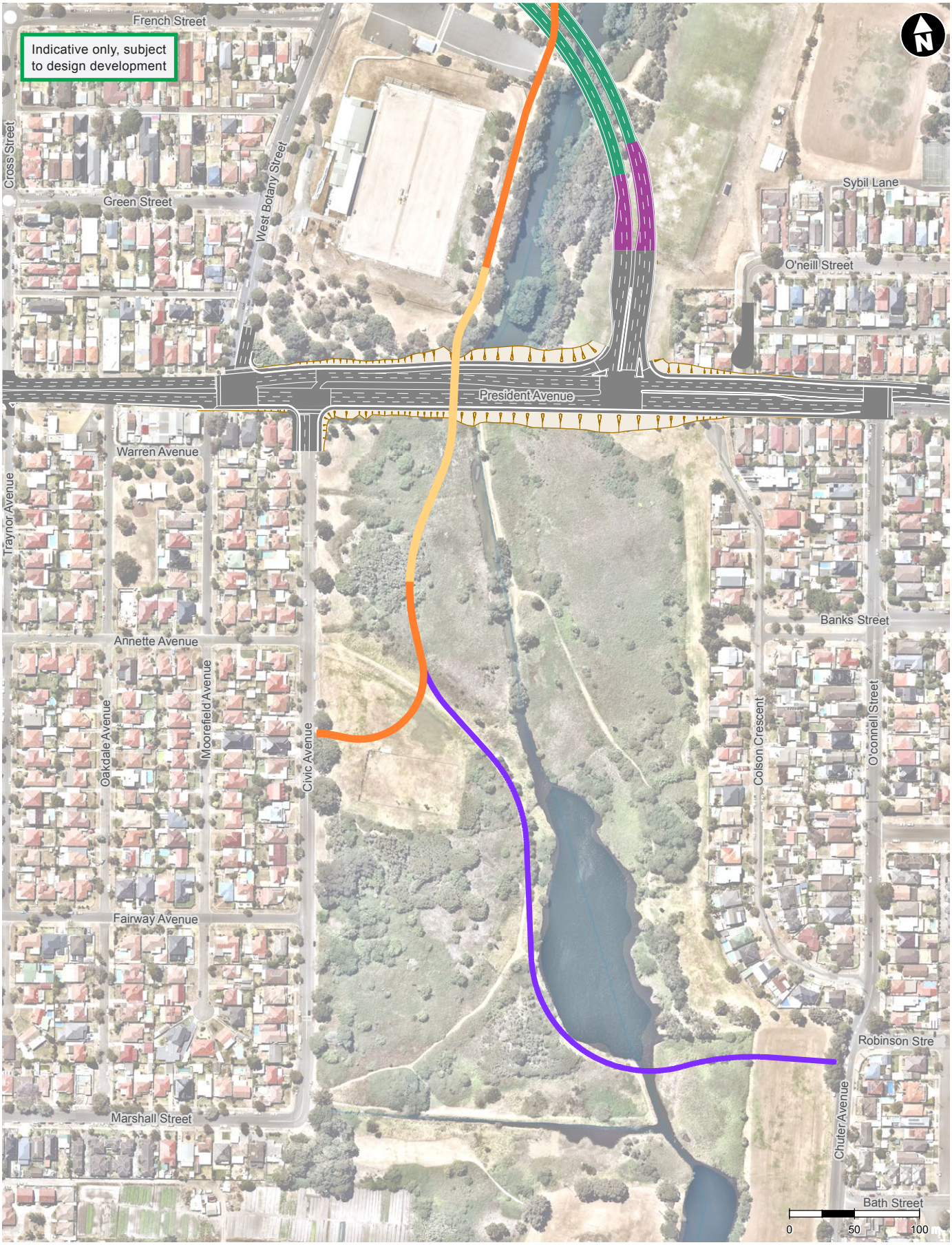
- Finishing works including landscaping, lighting along the finished pathway, handrails, line marking and signage installation.

Machinery used during the construction of the southern extension of the shared pathway would aim to be of low impact (such as rubber tired) and would utilise existing pathways where possible.

The President Avenue construction ancillary facility (C3) located around 150 metres to the north would be used as the construction ancillary facility for the proposed works.

The construction works would occur during standard construction work hours (ie 7.00 am to 6.00 pm on weekdays, 8.00 am to 1.00 pm on Saturdays, no works on Sundays or public holidays).

It is anticipated that the construction works for the southern extension of the shared cycle and pedestrian pathway would take around six months to complete.



LEGEND

- The project in tunnel
- The project on surface
- The project as an open slot
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Shared cycle and pedestrian pathway southern extension

Figure 3-1 Alignment of the proposed shared cycle and pedestrian pathways for the project

3.3 Environmental impact screening

Environmental aspects that were considered in the EIS were evaluated to identify potential impacts associated with the proposed southern extension of the shared cycle and pedestrian pathway. Where potential impacts are anticipated, a detailed assessment of these potential impacts is provided in **section 3.4**.

While the proposed southern extension of the shared cycle and pedestrian pathway would be outside the project footprint assessed in the EIS, the construction works and materials required to facilitate these changes would be of a similar nature to those originally proposed in the EIS. Construction impacts on the following aspects are considered to be generally consistent with the impacts described in the EIS and would be managed by the implementation of the proposed environmental management measures outlined in Chapter D1 (Environmental management measures) of the submissions report:

- Waste management
- Climate change and greenhouse gas
- Traffic and transport
- Air quality
- Health safety and hazards
- Social and economic
- Groundwater and geology
- Property and land use.

The following environmental aspects were identified as having potential environmental impacts that would require further detailed assessment, as outlined in **section 3.4**:

- Noise and vibration – construction impacts
- Landscape and visual – construction and operation impacts
- Soils and contamination – construction impacts
- Biodiversity – construction impacts
- Non-Aboriginal heritage – construction and operation impacts
- Surface water and flooding – construction and operation impacts.

3.4 Further detailed impact assessment of the PIR change

3.4.1 Noise and vibration

The proposed southern extension of the shared cycle and pedestrian pathway is outside of the project footprint assessed in Chapter 11 (Noise and vibration) of the EIS and therefore an assessment of potential construction noise is required to assess the proposed changes.

The proposed southern extension of the shared cycle and pedestrian pathway does not involve changes to permanent noise generating operational facilities and therefore potential noise impacts from fixed facilities operation would be consistent with those described in the EIS.

3.4.1.1 Methodology

The methodology for the assessment is consistent with the noise assessment in Appendix G (Noise and vibration technical report) of the EIS. This assessment should be read alongside Chapter 11 (Noise and vibration) and Appendix G (Noise and vibration technical report) of the EIS which contains detailed descriptions and explanations on the assessment guidelines and methodologies used.

Assumptions

The proposed southern extension of the shared cycle and pedestrian pathway would be constructed as a boardwalk, subject to detailed design. The construction works do not involve the use of vibration intensive equipment. Therefore, the risk of vibration induced human discomfort, regenerated noise and structural damage is extremely low and is not considered further in this assessment.

The construction works would occur during standard construction work hours. As works would not occur during the night-time period, sleep disturbance has not been considered further in this assessment.

Assessment of construction traffic noise

Works for the proposed southern extension of the shared cycle and pedestrian pathway would generate negligible additional construction traffic movements compared to that assessed in Appendix G (Noise and vibration technical report) of the EIS, however the works may lead to a longer duration of construction traffic impacts. Appendix G (Noise and vibration technical report) of the EIS indicated that noise generated by construction traffic associated with the shared cycle and pedestrian pathway works would comply with the *Road Noise Policy*[1] screening criterion. Therefore, no additional assessment is required.

Construction noise modelling and prediction

Noise levels from construction activities have been predicted at nearby residences considering the local ground topography, buildings and structures and using representative construction noise sources in the noise model.

It can be expected that measured noise levels may be lower than predicted noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment. The acoustic shielding calculated in the model due to fixed building structures would also vary as the construction equipment moves around the area. Neutral weather conditions were assumed for all construction scenarios.

3.4.1.2 Existing environment

The existing noise environment around the proposed southern extension of the shared cycle and pedestrian pathway is dominated by traffic movement on President Avenue and the Princes Highway. Residential areas that back onto wetland areas within the project footprint, including Scarborough Park, would have comparatively lower levels of noise.

Sensitive receivers in this area are predominantly one and two-storey residential properties. An additional noise catchment area (NCA), in addition to the eight identified for the shared cycle and pedestrian pathways in Appendix G (Noise and vibration technical report) of the EIS (NCA 9 – NCA11 and NCA 14-NCA 17), has been included for this assessment (ie NCA 18).

The location of NCA18 is shown in **Figure 3-2**.

[1]DECCW (2011) NSW *Road Noise Policy*

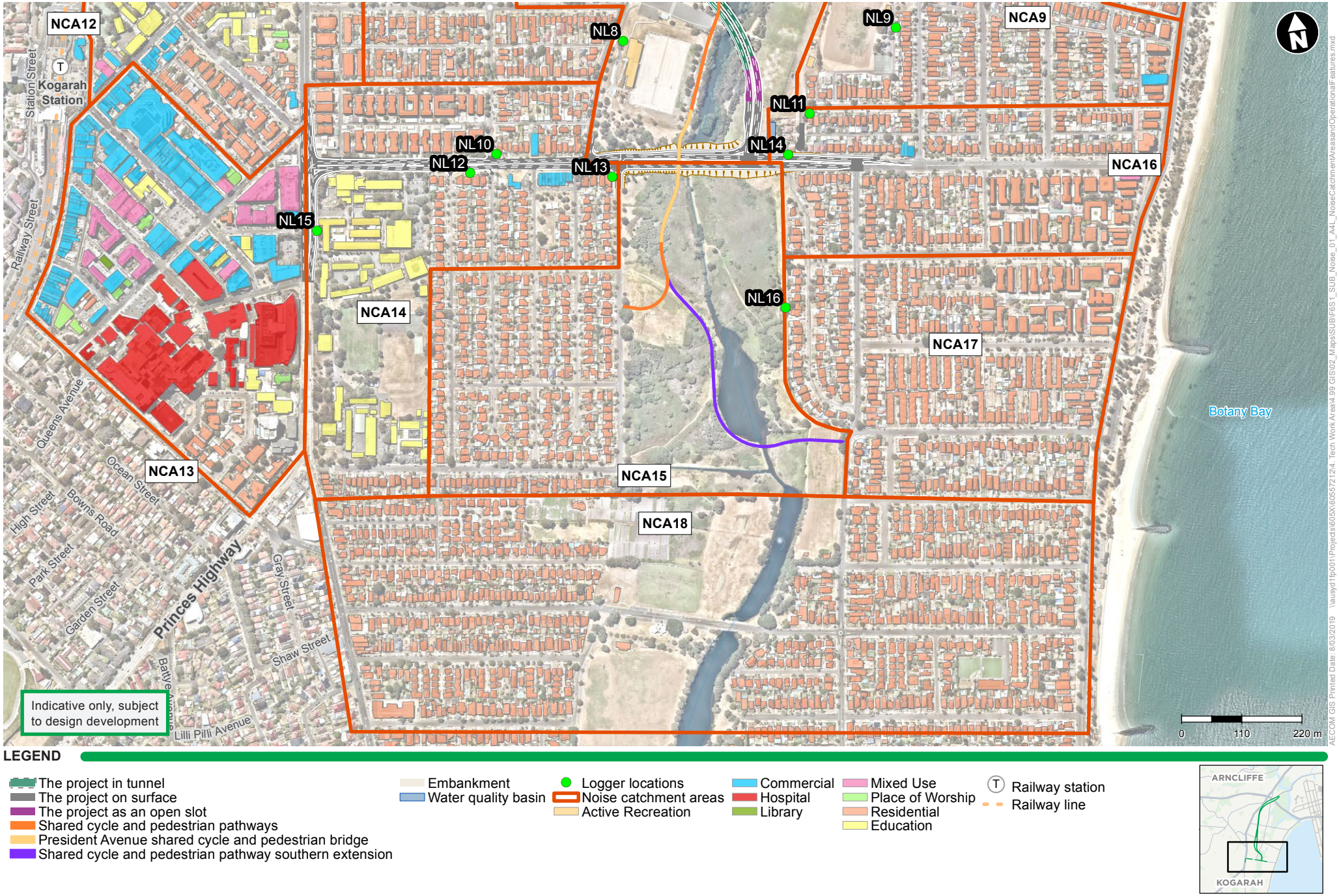


Figure 3-2 Noise Catchment Areas

Background noise data

Ambient noise monitoring data collected for the EIS has been used in this assessment (refer to section 3 of Appendix G (Noise and vibration technical report) of the EIS. The noise levels indicate that the noise environment is typical of urban/suburban noise environments that have through traffic with characteristically heavy and continuous traffic flows during peak periods.

The background noise levels were used to define the appropriate construction noise management levels (NMLs) for the project (refer to **Table 3-1**).

Table 3-1 Noise catchment areas and construction noise management levels

NCA	Representative logger	Period	Rating background level, dB(A)	Construction NML [1,2]
NCA 9	NL09	Day	38	48
		Evening	38	43
		Night	32	37
NCA 10	NL08	Day	53	63
		Evening	47	52
		Night	38	43
NCA 11	NL08	Day	53	63
		Evening	47	52
		Night	38	43
NCA 14	NL15	Day	66	76
		Evening	66	71
		Night	56	61
NCA 15	NL16	Day	42	52
		Evening	40	45
		Night	32	37
NCA 16	NL14	Day	57	67
		Evening	50	55
		Night	37	42
NCA 17	NL16	Day	42	52
		Evening	40	45
		Night	32	37
NCA 18	NL16	Day	42	52
		Evening	40	45
		Night	32	37

Note 1: Day NMLs= RBL + 10 dB(A)
Note 2: Evening/night NMLs = RBL + 5 dB(A)

3.4.1.3 Assessment of construction noise impacts

Construction equipment

The construction of the proposed southern extension of the shared cycle and pedestrian pathway would comprise three main stages. The equipment that would be used in each stage is shown in **Table 3-2**, along with the typical sound power levels of the proposed construction equipment.[2] The range and types of equipment used may be subject to change and would be confirmed during the detailed design phase. The ICNG advises that 5 dB should be added to predicted levels where 'particularly annoying' activities are to be undertaken. No 'particularly annoying' activities are proposed for these works.

For a worst-case assessment, all construction equipment within the work package has been assumed to operate simultaneously.

Table 3-2 Sound power levels of proposed construction stages

Scenario	Equipment	SWL, dB(A)	Overall[1] SWL, dB(A)
Construction of the southern extension of the shared cycle and pedestrian pathway			**111**
	Micropiler (Bored piling rig)	105	
	Concrete truck	106	
	Flatbed truck	105	
	Mobile crane	98	
	Backhoe	97	
	Hand/electric tools	98	
Rehabilitation and landscaping			**107**
	Tipper truck	105	
	Hand tools	94	
	Franna crane	98	
	Mobile crane	98	
	Backhoe	97	

Note 1: The overall level is the logarithmic sum of all equipment that has been assumed to be operating simultaneously

Construction noise assessment

Construction noise modelling results are provided in **Table 3-3**. The table presents the NMLs and the highest predicted construction noise levels at a noise sensitive receiver for each noise catchment area. The table also presents the number of receivers where the construction noise levels are predicted to exceed the NML (and to what extent) and the highly noise affected level for each noise catchment area.

No other sensitive receivers, such as places of worship, schools and child care centres are identified in the impacted area. Therefore, no results have been presented for these receiver types.

[2] Sound power levels are typical values taken from data provided in the *Australian Standard 2436-2010, Guide to noise control on construction, demolition and maintenance sites* and the UK Department for Environment, Food and Rural Affairs (DEFRA) noise database and assume equipment is modern and in good working order.

Table 3-3 Predicted construction noise levels

NCA	L_{Aeq} NML dB(A)	Maximum L_{Aeq} noise level dB(A)	NML exceedance 1 10 dB(A)	NML exceedance 11 20 dB(A)	NML exceedance > 20 dB(A)	Number of highly noise affected receivers
Construction of the southern extension of the shared cycle and pedestrian pathway						
NCA 9	48	47	0	0	0	0
NCA 10	63	48	0	0	0	0
NCA 11	63	48	0	0	0	0
NCA 14	76	60	0	0	0	0
NCA 15	52	60	34	0	0	0
NCA 16	67	54	0	0	0	0
NCA 17	52	74	59	11	2	0
NCA 18	52	58	9	0	0	0
Rehabilitation and landscaping						
NCA 9	48	43	0	0	0	0
NCA 10	63	44	0	0	0	0
NCA 11	63	44	0	0	0	0
NCA 14	76	56	0	0	0	0
NCA 15	52	56	8	0	0	0
NCA 16	67	50	0	0	0	0
NCA 17	52	70	32	5	0	0
NCA 18	52	54	1	0	0	0

Construction noise levels are predicted to comply with the NMLs at receivers within NCA 9, NCA 10, NCA 11 NCA 14 and NCA 16 during all construction activities. Receivers in NCA 15 and NCA 18 are likely to experience noise levels up to 10 dB(A) above the NMs during both construction activities.

Receivers in NCA 17 may experience construction noise levels more than 20 dB(A) over the NML during construction of the pathway and up to 20 dB(A) above the NMLs during the rehabilitation and landscaping stage.

For the entire construction period, no receivers are predicted to be highly-affected.

The assessment is representative of the worst case 15 minute period of construction activity, while the construction equipment is at the nearest location to each sensitive receiver location. The assessed scenarios do not represent the ongoing day to day noise impact at noise sensitive receivers for an extended period of time.

During the construction period, all equipment would be unlikely to operate simultaneously as has been assessed. As such, the results presented are conservative and would not occur for the entire six month construction period.

The predictions use the shortest separation distance to each sensitive receiver, however in reality separation distances would vary between plant and sensitive receivers. As the works are linear the noise exposure at each receiver would peak when works are closest and would then reduce as the works progress further away along the alignment of the pathway. Typical noise levels could be five to 10 dB(A) lower dependent on the site and nature of works.

Assessment of cumulative impacts

The construction of the proposed southern extension of the shared cycle and pedestrian pathway would not increase the duration of the overall construction period for the project. The southern extension of the shared cycle and pedestrian pathway would be constructed outside of the project footprint describe in the EIS however the works would not occur in proximity to other planned developments identified in section 7.2 of Appendix G (Noise and vibration technical report) of the EIS

Cumulative construction noise impacts for the project would therefore be consistent with the cumulative impacts described in section 7.2 of Appendix G (Noise and vibration technical report) of the EIS.

Simultaneous noise from works within the President Avenue construction ancillary facility (C3) and the proposed southern extension of the shared cycle and pedestrian pathway has the potential to increase noise levels at nearby sensitive receivers. As noted in section 7.2 of Appendix G (Noise and vibration technical report) of the EIS, noise levels as a result of the cumulative impact could increase by as much as 3 dB(A) however this noise level increase is generally considered just discernible. The cumulative impact of noise would be managed as far as possible by the contractor to ensure that the potential for adverse impacts at sensitive receivers is minimised.

3.4.1.4 Management of impacts

The construction noise assessment has detailed a number of exceedances of the NMLs, however no receivers are expected to be 'highly noise affected'. These impacts are generally consistent with the construction noise impacts described in the EIS and would therefore be managed through the implementation of the environmental management measures described in Chapter D1 (Environmental management measures) of the submissions report.

3.4.2 Landscape and Visual

The proposed southern extension of the shared cycle and pedestrian pathway is outside of the project footprint assessed in the landscape and visual assessment in Chapter 13 (Landscape and visual) of the EIS and therefore further assessment of construction and operational impacts is required.

3.4.2.1 Methodology

The methodology for the assessment is consistent with the landscape and visual assessment in Appendix C2 (Landscape and visual impact assessment) of the EIS. This assessment should be read alongside Chapter 13 (Landscape and visual) and Appendix C2 (Landscape and visual impact assessment) of the EIS which contains detailed descriptions and explanations on the assessment guidelines and methodologies used.

3.4.2.2 Policy and planning setting

The policy and planning setting for the project is described in section 13.3 of the EIS and is relevant to the proposed southern extension of the shared cycle and pedestrian pathway. The proposed southern extension of the shared cycle and pedestrian pathway is located on land within the Bayside Council local government area and is subject to the Rockdale LEP 2011.

The proposed southern extension of the shared cycle and pedestrian pathway is located in Scarborough Park North which is listed as a local heritage landscape in the Rockdale LEP, known as Patmore Swamp. The aesthetic significance of this landscape includes the wetlands, with ponds, melaleuca scrub and aquatic sedgelands which provide '*high visual amenity contrasting with surrounding suburbs*' (NSW State Heritage Register description, 2010).

Scarborough Park North also contains the Toomevara Lane Chinese Market Garden, a State heritage listed landscape located in the southwestern part of the park. The gardens are one of only five surviving 19th century market gardens in the Sydney metropolitan region which is largely in its original form and still employing traditional cultivation practices.

3.4.2.3 Landscape character impact assessment

The extension of the shared cycle and pedestrian pathway is located within the Landscape Character Zone (LCZ) 4: Rockdale Bicentennial and Scarborough Parks as described in section 13.2.1 of the EIS. The pathway also extends to some minor pedestrian crossing works on Civic Avenue within the LCZ6: Kogarah residential and local centre landscape character zone, and on Chuter Avenue within the LCZ5: Brighton-Le-Sands coastal residential area landscape character zone. The location of these LCZs is shown in **Figure 3-3**.

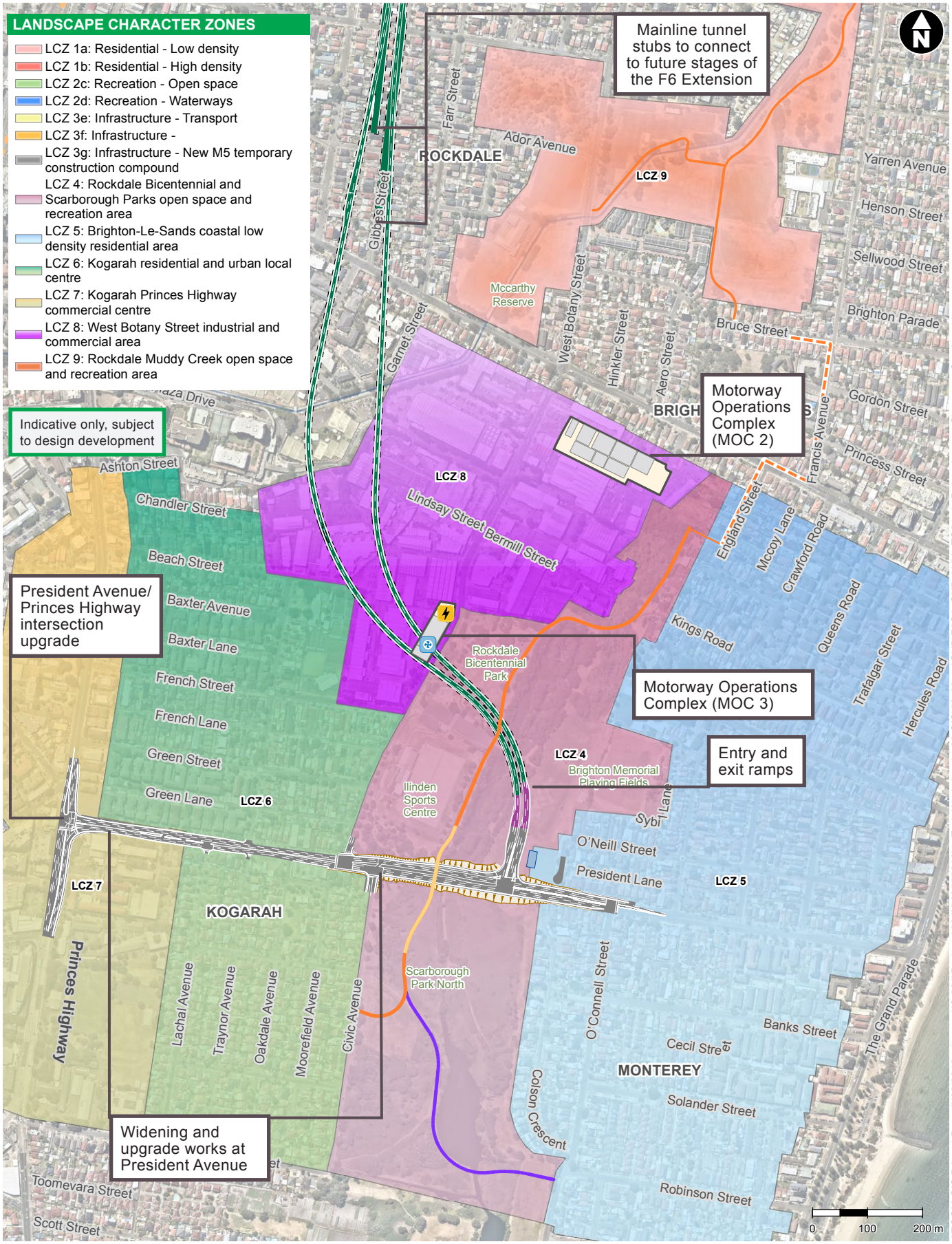


Figure 3-3 Landscape character zones -southern surface works

3.4.2.4 Assessment of landscape character impact

LCZ4: Rockdale Bicentennial and Scarborough Parks

Existing conditions and sensitivity

The land within this zone is generally low lying and flat and associated with wetlands which are considered to be of '*high visual quality*'. This zone includes several open spaces and a variety of opportunities for passive and active recreation. Refer to section 13.2.1 of the EIS for further details and character imagery.

This landscape character zone is identified as being of moderate sensitivity as it is locally valued for its '*high visual quality*' and includes several community facilities and passive recreation areas, attracting visitors from within and outside the region. The northern part of Scarborough Park includes Patmore Swamp which is a locally listed heritage landscape of high visual amenity. Dense vegetation encloses views to Patmore Swamp which creates a landscape and visual buffer between low density residential areas to the west at Kogarah and east at Brighton-Le-Sands.

Impacts during construction

The EIS identified a high-moderate landscape character impact on this landscape character zone (refer to section 13.6.2 of the EIS). This is because a substantial portion of this landscape zone would be affected, considerably altering the valued attributes of this landscape character zone during the construction period including the removal of mature trees and wetland areas and the loss of access to some recreation facilities during construction.

The proposed southern extension of the shared cycle and pedestrian pathway would extend the footprint of the construction works further south and east within Scarborough Park North. This work would be relatively minor in scale and result in the removal of some areas of vegetation and some restriction of access. This additional construction work would be largely absorbed into the character of this landscape.

Overall, it is expected that there would continue to be a high magnitude of change to this landscape character zone during construction, which is of moderate sensitivity, resulting in a high-moderate landscape character impact. The proposed southern extension of the shared cycle and pedestrian pathway would therefore not change the overall impact to LCZ4 during construction as described in section 13.6.2 of the EIS.

Impacts during operation

The EIS identified a high-moderate landscape character impact to the LCZ4 as the proposed operational scenario for this area would result in a large section of the southeastern corner of the Rockdale Bicentennial Park being transformed into road infrastructure, and a permanent loss of access to this area of existing open space (refer to section 13.7.2 of the EIS).

The extension of the shared cycle and pedestrian pathway would improve access to open space and passive recreation areas to the south of the project footprint, somewhat revitalising the area. This would result in localised improvements to the landscape character of this area of open space.

Overall, it is expected that there would continue to be a high magnitude of change to the landscape character during operation, which is of moderate sensitivity, resulting in a high-moderate landscape character impact to LCZ4. The proposed southern extension of the shared cycle and pedestrian pathway would therefore not change the overall impact to LCZ4 during operation as described in section 13.7.2 of the EIS.

LCZ5: Brighton-Le-Sands coastal residential area

Existing conditions and sensitivity

This zone consists of low-density suburban development, located between the Rockdale Wetlands and Brighton-Le-Sands coastal strip. This landscape character zone is identified as being of low sensitivity, as described in section 13.2.1 of the EIS. The connection of the proposed southern extension of the shared cycle and pedestrian pathway with the existing on road cycle network at Chuter Avenue would be located within the western extent of LCZ25.

Impacts during construction

The EIS identified a low landscape character impact on this landscape character zone. It was considered that the project would extend across a small part of LCZ5 and would be of a scale that would contrast with the predominantly residential landscape character of this zone (refer to section 13.6.2 of the EIS).

The proposed extension of the shared cycle and pedestrian pathway would extend the footprint of the construction works further south and east within Scarborough Park North, and not increase the intensity of construction activity in the northern areas of the site, where the effects on landscape character were identified in the EIS.

This construction work would be relatively minor in scale and include works to construct a pedestrian crossing. This additional construction work would be largely absorbed into the character of this landscape zone.

Overall, there would continue to be a low magnitude of change to this landscape character zone which is of low sensitivity and has a low landscape character impact. The proposed southern extension of the shared cycle and pedestrian pathway would therefore not change the overall impact to LCZ5 during construction as described in section 13.6.2 of the EIS.

Impacts during operation

The EIS identified a low landscape character impact with the main adverse effect of the project being the introduction of a widened road corridor and the President Avenue intersection. Offsetting this would be the replacement of several residential properties (nine in total) on O'Neill Street and President Avenue with open space, and improvements to pedestrian and cyclist connectivity with the introduction of a shared cycle and pedestrian pathway.

The additional extension to the shared cycle and pedestrian pathway would be in character with this landscape character zone and would provide further improvements to the pedestrian and cyclist connectivity with this zone. Overall, there would be a low landscape character impact on this landscape zone. The proposed southern extension of the shared cycle and pedestrian pathway would therefore not change the overall impact to LCZ5 during operation as described in section 13.7.2 of the EIS.

LCZ6: Kogarah residential and local centre

Existing conditions and sensitivity

This zone consists of low-density suburban development, bound to the east by the Rockdale Wetlands and extends west to the Princes Highway. This landscape character zone is identified as being of low sensitivity in section 13.2.1 of the EIS.

Impacts during construction

The EIS identified a low landscape character impact on this landscape character zone as a small portion of this landscape zone would be changed during construction. These effects were mainly associated with works along President Avenue.

The proposed extension of the shared cycle and pedestrian pathway would extend the footprint of the construction works further south and east within Scarborough Park North, and in the vicinity of the pathway proposed in the EIS which would link the cycle and pedestrian bridge over Presidents Avenue to Civic Avenue. It would not further increase the intensity of construction activity in the vicinity of Presidents Avenue, where the effects on landscape character were identified in the EIS. This construction work would be relatively minor in scale and include works to construct a pedestrian crossing. This additional construction work would be largely absorbed into the character of this landscape zone.

Overall, there would continue to be a low magnitude of change to this landscape character area which is of low sensitivity and has a low landscape character impact. The proposed southern extension of the shared cycle and pedestrian pathway would therefore not change the overall impact to LCZ6 during construction as described in section 13.6.2 of the EIS.

Impacts during operation

During operation there was a low landscape character impact identified for LCZ6. The main landscape character effects of the project would be in the vicinity of President Avenue. This impact is due to the increased width and increased traffic along the corridor which would be somewhat lessened by new streetscape planting where space allows (in consultation with Bayside Council) and over time as this vegetation matures.

The additional extension to the shared cycle and pedestrian pathway would not have an adverse effect on the character of this landscape character zone and would provide further improvements to the pedestrian and cyclist connectivity with this zone. Overall, there would continue to be a low landscape character impact on this landscape zone. The proposed southern extension of the shared cycle and pedestrian pathway would therefore not change the overall impact to LCZ5 during operation as described in section 13.7.2 of the EIS.

Table 3-4 provides a summary of the impacts on the landscape character zones of the southern surface works area (this includes the works assessed it the EIS plus the proposed extend shared cycle and pedestrian pathway).

Table 3-4 Southern surface works area (President Avenue) - summary of landscape character impacts

		Construction		Operation	
Landscape character zone	**Sensitivity**	**Magnitude of change**	**Impact level**	**Magnitude of change**	**Impact level**
LCZ4: Rockdale Bicentennial and Scarborough Parks	Moderate	High	High-moderate	High	High-moderate
LCZ5: Brighton-Le-Sands coastal residential area	Low	Low	Low	Low	Low
LCZ6: Kogarah residential and local centre	Low	Low	Low	Low	Low

3.4.2.5 Assessment of visual impact

Potential visibility of the project

A visual envelope map (VEM) was provided in Figure 7-1 of the EIS. This figure has been updated to include the southern extension of the shared cycle and pedestrian pathway in **Figure 3-4**.

The proposed southern extension of the shared cycle and pedestrian pathway would be located on a relatively flat, low-lying area of land within Scarborough Park North. The pathway would be seen in views from residential areas to the east and west, including from Civic Avenue, Chuter Avenue and Colson Crescent. In these views the pathway would be seen across existing fields and wetlands, through scattered trees and low vegetation.

LEGEND

- The project in tunnel
- The project on surface
- The project as an open slot
- Motorway operations complex
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Shared cycle and pedestrian pathway southern extension
- Building
- Water quality basin
- Embankment
- Substation
- Rockdale ventilation facility
- Visual Envelope Map
- Railway station
- Railway line
- Waterbody

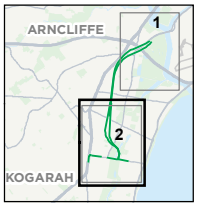


Figure 3-4 Visual envelope map southern surface works

Viewpoint assessment

Fifteen viewpoints were assessed in Chapter 13 (Landscape and visual) of the EIS to represent the range of potential views to the project in the southern surface works area.

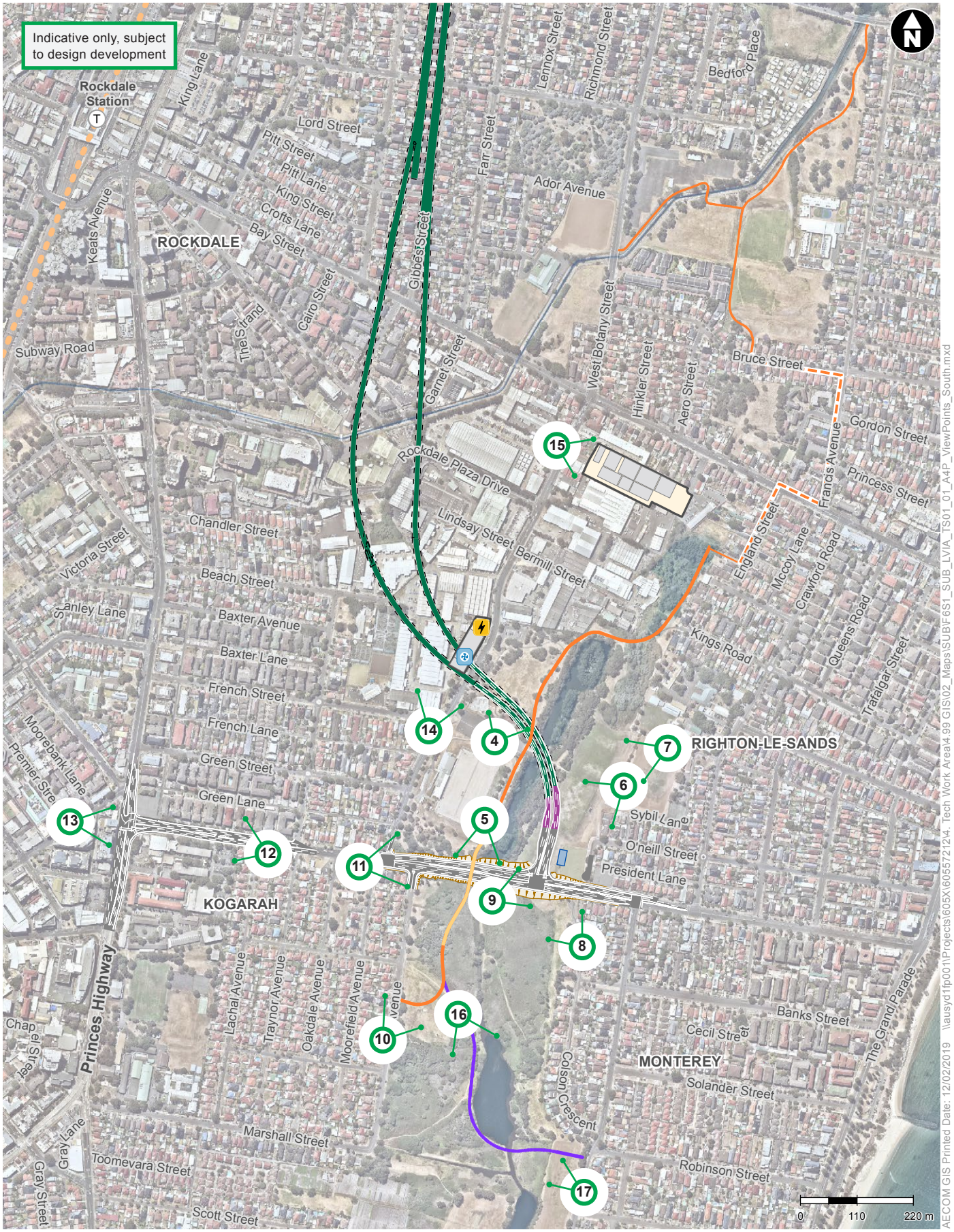
The proposed southern extension of the shared cycle and pedestrian pathway would be visible in one view that was assessed in the EIS:

- Viewpoint 10: View east from Civic Avenue.

Two additional representative viewpoints have been identified to capture the potential visual impacts of the proposed southern extension of the shared cycle and pedestrian pathway including:

- Viewpoint 16: View southeast from within Scarborough Park North
- Viewpoint 17: View northwest from AS Tanner Reserve.

The assessment of these three views is detailed in the sections below. The location of these viewpoints is shown in **Figure 3-5**.



LEGEND

- The project in tunnel
- The project on surface
- The project as an open slot
- Motorway operations complex
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Shared cycle and pedestrian pathway southern extension
- Building
- Embankment
- Water quality basin
- Substation
- Rockdale ventilation facility
- Viewpoint location
- Railway station
- Railway line

Figure 3-5 Viewpoint locations southern surface works

Viewpoint 10: View east from Civic Avenue

Figure 3-6 Viewpoint 10 - View east from Civic Avenue

Table 3-5 Viewpoint 10 - Impact assessment table

	Daytime	Night time
Existing condition	The topography is low lying and flat, allowing expansive views across the Rockdale and Scarborough Wetlands. This view includes the heritage listed Patmore Swamp in the foreground. Views to traffic travelling along President Avenue are shielded by street trees and vegetation within the parkland and wetlands, leaving only the upper parts of the street lights visible. Vegetation in the distant background of view within the Rockdale Bicentennial Park and Rockdale Bicentennial Park East can also be seen.	The street lights and lights of vehicles travelling along President Avenue and Civic Avenue is the main light source in this view. The light from adjacent residential areas of Kogarah is also visible. The flood lights of the Brighton Memorial Playing Fields create a sky glow in the distance, above the vegetation within the parkland.
Sensitivity	**Low** - This view is experienced by a small number of residential properties and local recreational users.	**Low** - Medium district brightness area with light spill and sky glow from adjacent residential areas and roads.
Construction - Magnitude	**Moderate** – Construction of the proposed southern extension of the shared cycle and pedestrian pathway through Scarborough Park would be visually prominent, extending south on a boardwalk structure from the President Avenue bridge to Civic Avenue. This would include works extending south and east for a southern extension to the shared cycle and pedestrian pathway. There would also be works on Civic Avenue (left of view) to construct a pedestrian crossing. The mature street trees along Civic Avenue would be unaffected. There would be some vegetation cleared to accommodate the works within Scarborough Park North, however, the new path would largely follow the existing cleared route. Construction activity along President Avenue, including the intersection, would also be visible in the distant background.	**Moderate** – There would be construction sites along the shared cycle and pedestrian pathway. The President Avenue construction ancillary facility would also add to the sky glow in the background. This would contrast with the darker parkland setting. There would not be any additional lighting as part of the works to construct the proposed southern extension of the shared cycle and pedestrian pathway.

Impact level	Moderate-low visual impact	Moderate-low visual impact
Operation - Magnitude	**Low** – The proposed southern extension of the shared cycle and pedestrian pathway would be a new feature in this view. The boardwalk structure would be visually integrated into the open space setting with new plantings. The proposed southern extension to the shared cycle and pedestrian pathway would be consistent in character with the surrounding parkland, and largely absorbed into the view as it disappears into the vegetation in the middle ground of the view. The President Avenue intersection would be in the far background of the view, including on the road on a raised embankment.	**Low** – Lighting to ensure the security of users of the proposed southern extension of the shared cycle and pedestrian pathway would be a new source of light in this view, contrasting with the dark parkland setting. The signalised intersection at the President Avenue intersection would also be seen in the background of this view. Street trees and vegetation along President Avenue and within the park would filter views to the lighting over time as it matures. However, there would be an overall increase in the lighting seen in this view. The pathway lighting would continue along the southern extension of the shared cycle and pedestrian pathway, adding further direct light sources to the background of this view. This path lightning would be directed downward and shielded to minimise light spill.
Impact level	**Low visual impact**	**Low visual impact**

Viewpoint 16: View southeast from within Scarborough Park North

Figure 3-7 Viewpoint 16 - View southeast from within Scarborough Park North

Table 3-6 Viewpoint 16 - Impact assessment table

	Daytime	Night time
Description of setting	This view is located on a mown track on a small embankment within the grass field adjacent to the dog exercise park, within Civic Avenue Reserve (Scarborough Park North). The topography is low lying and flat, however, low wetland vegetation with mixed trees encloses views to the south and into the park.	This area of the park is not lit. There is some illumination from nearby street lights and lights from adjacent residential areas and streets in Brighton-Le-Sands (in the background) and Kogarah (behind the viewer).
Sensitivity	**Moderate**	**Low**
Construction - Magnitude	**Moderate** – Works to construct the proposed southern extension of the shared cycle and pedestrian pathway would be visible in the centre, fore and middle ground of this view. While the route would mostly follow the existing cleared area, there would be some vegetation clearing, including some small trees. There would be some minor earthworks to raise the path above the flood level and forming of the pathway. This work would alter a substantial part of this view temporarily and contrast with the parkland character of the view.	**Negligible** – The construction works would not be lit and therefore there would be no change to this view during construction.
Impact level	**Moderate** visual impact	**Negligible** visual impact
Operation - Magnitude	**Low** – There would be a new shared pathway in the centre of this view, extending into the existing parkland. This pathway would be in keeping in character with a developed parkland setting. While some vegetation would have been removed, the path would curve through the retained vegetation to the north (left) and south (right) of the view.	**Moderate** – The shared cycle and pedestrian pathway would be lit to allow for the safe use of this facility at night. The lighting would be directed downwards and shielded to minimise light spill. This lighting would contrast with the otherwise dark middle and foreground of this view.
Impact level	**Low** visual impact	**Moderate-low adverse** visual impact

Viewpoint 17: View northwest from AS Tanner Reserve

Figure 3-8 Viewpoint 17 – View northwest from AS Tanner Reserve

Table 3-7 Viewpoint 17 - Impact assessment table

	Daytime	Night time
Description of setting	This view is across the AS Tanner Reserve, a relatively flat, mown field. The flat topography and vegetation within the centre background of the view encloses the view to the north and west. To the north, residential gardens are visible, backing onto the parkland.	This area of the park is not lit, however, there would be some lighting in the adjacent residential properties and from the street lights on Barton Street, behind the viewer. In the background of view, there would be lights associated with Kogarah.
Sensitivity	**Moderate**	**Low**
Construction - Magnitude	**Moderate** – Works to construct the proposed southern extension of the shared cycle and pedestrian pathway would be visible in the centre, fore and middle ground of this view. This would include the clearing of vegetation, including some small trees. There would also be some minor earthworks to raise the path above the flood level and in the forming of the pathway. This work would alter a substantial part of this view temporarily.	**Negligible** – The construction works would not be lit and therefore there would be no change to this view during construction.
Impact level	**Moderate** visual impact	**Negligible** visual impact
Operation - Magnitude	**Low** – There would be a new shared pathway in the centre of this view, extending into the existing parkland. This pathway would be in keeping with the character of a developed parkland setting, and while some vegetation would have been removed, the path would curve through the retained vegetation to the north (left) and south (right) of the view.	**Moderate** – The shared cycle and pedestrian pathway would be lit to allow for the safe use of this facility at night. The lighting would be directed downwards and shielded to minimise light spill. This lighting would be seen in the context of the moderately lit residential areas, adding light to this view towards the predominantly dark area of parkland.
Impact level	**Low** visual impact	**Moderate-low adverse** visual impact

Summary of visual impacts, views to the Rockdale Bicentennial and Scarborough Parks

Table 3-8 provides a summary of the visual impact associated with the proposed southern extension of the shared cycle and pedestrian pathway. As identified in the table, visual impacts are anticipated to be negligible or low for surrounding receivers.

Table 3-8 Summary of visual impacts

		Construction		Operation	
Viewpoint	**Sensitivity**	**Magnitude of change**	**Impact level**	**Magnitude of change**	**Impact level**
Daytime					
VP10: View east from Civic Avenue	Low	Moderate	Moderate-low	Low	Low
VP16: View southeast from within Scarborough Park North	Moderate	Negligible	Negligible	Moderate	Moderate-low
VP17: View northwest from AS Tanner Reserve	Low	Negligible	Negligible	Moderate	Moderate-low
Night-time					
VP10: View east from Civic Avenue	Low	Moderate	Moderate-low	Low	Low
VP16: View southeast from within Scarborough Park North	Moderate	Moderate	Moderate	Negligible	Negligible
VP17: View northwest from AS Tanner Reserve	Low	Low	Low	Negligible	Negligible

3.4.2.6 Management of impacts

Landscape and visual impacts associated with the proposed southern extension of the shared cycle and pedestrian pathway are generally consistent with impacts described in the EIS and would therefore be managed through the implementation of the proposed management measures described in **Chapter D1** (Environmental management measures).

3.4.3 Soils and contamination

The proposed southern extension of the shared cycle and pedestrian pathway is outside of the project construction footprint assessed in the soils and contamination assessment in Chapter 16 (Soils and contamination) of the EIS and further assessment of potential impacts during construction is required.

No contamination impacts are anticipated from the operation of the proposed southern extension of the shared cycle and pedestrian pathway.

3.4.3.1 Methodology

The methodology for the assessment is consistent with the contamination assessment in Appendix J (Contamination technical report) of the EIS. This assessment should be read alongside Chapter 16 (Soils and contamination) and Appendix J (Contamination technical report) of the EIS which contains detailed descriptions and explanations on the assessment guidelines and methodologies used.

3.4.3.2 Existing environment

The footprint of the proposed southern extension of the shared cycle and pedestrian pathway is located within land zoned as RE1 Public Recreation and SP2 Infrastructure (Classified Road) under the Rockdale LEP 2011. The current land use is recreational, consisting of Civic Avenue Reserve (Scarborough Park North) and is part of the Rockdale Wetlands and Recreation Corridor. Surrounding land uses are summarised in **Table 3-9**.

Table 3-9 Surrounding land use

Direction	Description of surrounding land use
North	• President Avenue, Ilinden Sports Centre, Bicentennial Park, Memorial Playing Fields (former landfill) • Rockdale Industrial Area 450 metres to the north.
South	• AS Tanner Playing Field, market gardens and Scarborough North playing fields.
East	• Olsen Crescent, O'Connell Street and low to medium residential.
West	• Civic Avenue and then low density residential • BP service station 330 m northwest.

Previous investigations

There have been no previous investigation locations within the footprint of proposed southern extension of the shared cycle and pedestrian pathway. However, the following investigations have been undertaken in proximity:

- *WestConnex Stage 2: New M5 Factual Contamination Assessment*[3]
- *F6 Extension Stage 1 Geotechnical Investigations Draft Geotechnical Factual Report*[4].

The data for the locations closest to the proposed southern extension of the shared cycle and pedestrian pathway footprint is summarised in **Table 3-10**.

[3] AECOM (2015) WestConnex Stage 2: New M5 Factual Contamination Assessment
[4] SMEC (2018) F6 Extension Stage 1 Geotechnical Investigations Draft Geotechnical Factual Report – Contract 17.000302526.1197, Reference No. 30012161-023-RevA-Draft GFR

Table 3-10 Summary of previous investigations

Report	Location	Description
AECOM (2015)	WCX_BH_200 100m west of alignment in Civic Avenue	• Fill comprising dark grey silty sand to 2 m below ground level (bgl) • Alluvium compromising clayey sand, sandy clay and quartz sand from 2 m bgl • Groundwater encountered at 1 m bgl • No observations of contamination noted • No contamination analytical data.
	WCX_BH_201a/BH201 190 m north east of alignment in Colson Crescent Reserve	• Alluvium comprising sand and clayey sand from surface • No observations of contamination noted • No contamination analytical data.
SMEC (2018)	TP1306	• Fill comprising silty sand and sane with inclusions of trace brick, ceramic and rubber fragments to 1.5 m bgl • Alluvium from 1.5 m comprising silty clay • Residual soil at 2.3 m and then sandstone bedrock at 2.9 m. • Soil samples analysed for contaminants of potential concern (CoPC)[1]: no exceedances of adopted assessment criteria[2] for soil analytical results • Results indicate potential acid sulfate soils (PASS) in alluvial soils.
	TP1304	• Fill comprising silty sand and sand with trace basalt gravel to 1 m bgl • Alluvium from 1.0 m comprising silty clay, silty sand and sand • Groundwater encountered at 1 m bgl • Soil samples analysed for CoPC[1]: no exceedances of adopted assessment criteria[2] for soil analytical results • Results indicate PASS in alluvial soils.
	TP1305	• Fill comprising silty sand and sand with trace basalt gravel to 1 m bgl • Alluvium from 1.5 m comprising clay and then sand • Groundwater encountered at 1.6 m bgl • Soil samples analysed for CoPC[1]: no exceedances of adopted assessment criteria[2] for soil analytical results • Results indicate PASS in alluvial soils.

Notes: 1: Contaminants of Potential Concern (CoPC): Heavy metals, total recoverable hydrocarbons (TRH), semi volatile organic compounds (SVOCs), volatile organic compounds (VOCs) and asbestos 2: NEPM (2013) Health investigation levels (HIL) for recreational land use (HIL C) and CRC CARE (2011) Health screening level (HSL) for direct contact recreational land use (HSL C) and intrusive maintenance worker.

Site history

A review of historic land uses at the site of the proposed southern extension of the shared cycle and pedestrian pathway is summarised in **Table 3-11**. Based on the review of information there is potential for contamination associated with historical filling of the former swamp, potential illegal dumping or storage of unknown waste/spoil, and historical use of herbicides.

Table 3-11 Review of historic land uses

Source	Summary
Historical aerials	• 1943: the eastern end of the Moorefield Race Course track was within the northern part of the alignment and the reminder the alignment was within swamp land. Market gardens were located around 70 metres south and residential housing to the east • 1961 to 1965: Moorefield Race Course had been demolished and low-density residential housing constructed in blocks to the west. The curve of the race track within the alignment was still visible. Ponds had been constructed to the east and south of the alignment. Filling with unknown materials was evident by the presence of small stockpiles along the former race track and at the northern end of Tanner Reserve. • 1970: extensive stockpiles of spoil/unknown material were present along the alignment that was formerly park of the Moorefield Race Course track. The source of the stockpiles was not apparent. There appeared to be earthworks or ground disturbance within Civic Avenue Reserve. • 1986 to 2015: the alignment appeared the same as the present day with increased vegetation growth since 1970. The fenced dog park in Civic Avenue present in 2015.
Contaminated sites currently or formerly regulated by the NSW EPA (Record of Notices)	• The are no currently or formerly regulated sites within 200 metres • There are currently no licensed facilities within 200 metres • Former licenced activities under the POEO Act (now revoked or surrendered) comprise activities conducted on waterways including Scarborough Ponds which included application of herbicides.
Contaminated sites notified to the NSW EPA under Section 60 of the CLM Act 1997	• There are no notified sites within 200 meters of the alignment
Other NSW EPA records	• There are no other records of sites within 200 metres of the alignment
National Waste Management site database	• There are no other records of sites within 200 metres of the alignment

Subsurface conditions, topography and drainage

The descriptions of the topography, drainage, soils, geology and hydrogeology at the site of the proposed southern extension of the shared cycle and pedestrian pathway are summarised in **Table 3-12**.

Table 3-12 Subsurface conditions, topography and drainage

Source	Summary
Topography	• The proposed southern extension of the shared cycle and pedestrian pathway alignment consists of relatively flat topography at an elevation of around 1 to 2 m Australian Height Datum (AHD).
Drainage	• The alignment is located alongside the Scarborough Ponds • Surface water within the alignment drains into Scarborough Ponds. Scarborough Ponds flow to the south and discharge into Botany Bay around 1.25 km southeast of the alignment • A pond aeration system is in Scarborough Ponds, around 150 metres south of the alignment.

Source	Summary
Geology and Soils	• The geology mapped within the alignment comprises: – Quaternary alluvium (Qhs) unit consisting of peat, sandy peat and mud mapped along most of the alignment to Tanner Playing Field – Quaternary alluvium (Qhbr) unit consisting of quartz sand, minor shell content, interdune (swale) silt and fine sand mapped at the section of alignment on the north side of Tanner Playing Field. • The soil units mapped within the alignment comprise: – Warriewood Swamp (SWwa) soil landscape along most of the alignment along most of the alignment to Tanner Playing Field – Tuggerah Aeolian (AEtg) soil landscape at the section of alignment on the north side of Tanner Playing Field.
Acid sulfate soils	• The alignment is mapped as high probability (>70%) of occurrence of acid sulfate soils in the Atlas of Australian Acid Sulphate Soils • Rockdale LEP 2011 acid sulfate soil risk maps: – Class 2: mapped along most of the alignment to Tanner Playing Field, works below the natural ground surface present an environmental risk where greater than 1 tonne of soil is disturbed – Class 3: mapped at the section of alignment on the north side of Tanner Playing Field, works 1 metre below the ground surface present an environmental risk where greater than 1 tonne of soil is disturbed.
Hydrogeology	• Aquifers under the alignment are expected be shallow, porous, extensive of low to moderate productivity • Groundwater has been encountered at depths of 1 m bgl during previous investigations.

Areas and contaminants of concern

The areas and contaminants of concern for the proposed southern extension of the shared cycle and pedestrian pathway based on the information reviewed are summarised **in Table 3-13**.

Table 3-13 Areas and contaminants of concern

Area of concern	Contaminants of concern
Uncontrolled fill and illegal dumping	• TRH/BTEXN, potential aromatic hydrocarbons (PAHs), Metals, polychlorinated biphenyls (PCB), organophosphate (OP)/ organochlorine (OC) Pesticides • Asbestos.
Historical use of herbicides and pesticides	• OP/OC Pesticides.
Acid sulfate soils	• Potential acid sulfate soils (pH).

3.4.3.3 Assessment of construction impacts

The construction works relevant to the assessment of contamination impacts would comprise:

- Vegetation clearing and removal
- Excavation of spoil and removal off-site
- Piling of foundations
- Finishing works including landscaping, lighting along the finished pathway, handrails, line marking and signage installation.

There is a potential for soil contamination to be present due to historical filling along the alignment and historical use of pesticides. Potential acid sulfate soils are also present below the ground surface. The works would disturb shallow soils.

During construction there is a potential for leaks and spills from plant and machinery. Cross contamination associated with incorrect handling or disposal and importation of spoil is a potential impact during construction if appropriate controls/handling procedures are not implemented.

Potential pathways between the contamination source and receptors are:

- Direct contact, ingestion and inhalation of soil and dust by construction workers
- Off-site transport via dust, vehicle/plant movements
- Surface water runoff, erosion and discharge to the receiving environment.

The pathway between contamination sources and receptors could be potentially complete if appropriate mitigation measures are not implemented.

3.4.3.4 Management of impacts

Potential contamination impacts associated with the proposed southern extension of the shared cycle and pedestrian pathway are generally consistent with impacts described in the EIS and would therefore be managed through the implementation of the environmental management measures described in Chapter D1 (Environmental management measures) of the submissions report.

3.4.4 Biodiversity

The proposed southern extension of the shared cycle and pedestrian pathway is outside of the project construction footprint assessed in the biodiversity assessment in Chapter 12 (Biodiversity) of the EIS and further assessment of potential impacts during construction is required.

No biodiversity impacts are anticipated from the operation of the proposed southern extension of the shared cycle and pedestrian pathway.

3.4.4.1 Methodology

The methodology for the assessment is consistent with the biodiversity assessment in Appendix H (Biodiversity development assessment report) of the EIS. This assessment should be read alongside Chapter 12 (Biodiversity) and Appendix H (Biodiversity development assessment report) of the EIS which contains detailed descriptions and explanations on the assessment guidelines and methodologies used.

Vegetation mapping and plot data prepared for Appendix H (Biodiversity development assessment report) of the EIS were used to amend the ecosystem credit calculations.

3.4.4.2 Existing environment

A total of two plant community types (PCTs) were identified within the construction boundary for the proposed southern extension of the shared cycle and pedestrian pathway (this includes a one metre buffer either side of the existing pathway). The PCTs are listed threatened ecological communities under the *Biodiversity Conservation Act 2016* (BC Act). **Table 3-14** outlines potential maximum impacts to these ecological communities. These impacts would be confirmed during detailed design.

Table 3-14 Plant Community Types within the construction footprint of the southern extension of the shared cycle and pedestrian pathway

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area (ha)	Percent cleared
1232	Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Coastal Swamp Forest	Forested Wetlands	0.02	95
1808	Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline	Coastal Freshwater Lagoons	Freshwater Wetlands	0.20	41

Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion

Coastal Freshwater Swamp Forest is located at Scarborough Park North, along the drainage line. This community is in a disturbed condition, with a high occurrence of weeds in the understorey. Much of the community is weed invaded.

The canopy is dominated by *Casuarina glauca* (Swamp oak) forming an open to dense canopy along the reedlands adjacent to open water in Scarborough Park North.

Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline

This PCT is present as a treeless vegetation type, along the edges of the drainage line south of President Avenue. The community is in a disturbed condition with a high occurrence of weeds, such as *Rubus fruticosus* (Blackberry) and *Lantana camara* (Lantana).

The reedlands were dominated by *Phragmites australis* (Common Reed) with *Typha orientalis* occurring less frequently. A canopy layer was very sparse and consisted of the occasional low growing *Casuarina glauca* (She Oak) on the banks of the drainage line. This PCT includes areas where the canopy may be absent due to inundation and hydrological cycles.

Vegetation mapping in the vicinity of the proposed southern extension of the shared cycle and pedestrian pathway is shown in **Figure 3-9**.

Figure 3-9 Vegetation communities within the study area for the southern extension of the shared cycle and pedestrian pathway

Vegetation integrity assessment

A vegetation integrity assessment using the Biodiversity Assessment Method (BAM) Calculator was undertaken and the results are outlined in **Table 3-15**. These results are for the areas affected by the proposed southern extension of the shared cycle and pedestrian pathway only.

Table 3-15 Vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	1232	moderate to good	0.02	24.7	27.5	48	32
4	1808	moderate to good	0.20	25.6	15.4	n/a	19.9

Threatened species

No additional threatened species were present in the area affected by the proposed southern extension of the shared cycle and pedestrian pathway. Therefore, no calculations for species credits are required.

Aquatic habitats

The waterway entering Scarborough Park North is narrow then widens to a broader waterway with riparian vegetation on both banks. Riparian vegetation consisted of dense reedland of *Typha orientalis* (Typha) and *Phragmites australis* (Common Reed) which extended westward of the channel, while the eastern bank supported scattered *Casuarina glauca* (She Oak) trees. Dissolved oxygen concentration was poor (7 per cent saturation) and unlikely to support fish life. Salinity was high (22 ppt), indicating saline input from groundwater (no tidal influence was observed). This waterway extended south for about 2 kilometres before entering a stormwater culvert beneath Ramsgate. The area affected by the proposed southern extension of the shared cycle and pedestrian pathway is not mapped as Key Fish Habitat by DoI - Fisheries. The southern portion of the system (from about 800 metres south of President Avenue) is mapped as Key Fish Habitat by the Department of Industries (DoI) - Fisheries.

3.4.4.3 Potential impacts on biodiversity

The proposed southern extension of the shared cycle and pedestrian pathway would have direct impacts on native vegetation and aquatic habitats. The project has taken advantage of using informal managed tracks for the proposed alignment pathway. The biodiversity values present are modified and are already affected by human presence and frequent use including mowing and management of the track.

Construction of the proposed southern extension of the shared cycle and pedestrian pathway would change the vegetation integrity score for the native vegetation present. The future integrity score would be zero. This assumes that all the vegetation within the footprint would be removed. There are not anticipated to be any additional prescribed biodiversity impacts compared to the impacts described in Chapter 12 (Biodiversity) of the EIS.

The proposed southern extension of the shared cycle and pedestrian pathway may potentially result in some injury or mortality of some common peri-urban fauna species, but is unlikely to cause a substantial increase in fauna injury or mortality incidents. The land surrounding the pathway is highly urbanised. Implementation of mitigation measures would reduce the chances or injury or mortality of fauna during construction. Actions such as fauna rescue and relocation during works to construct the pathway would reduce potential injury to aquatic fauna (e.g. Eastern Long-necked Turtle, eels). Mortality of fish and turtles are expected to be minimised through standard rescue and release protocols.

The potential impact from lighting of the shared cycle and pedestrian pathway would not be at a level that would greatly impact fauna. Fauna present are likely to persist in an environment that is artificially lit such as streets or surrounding residences. Additionally, the lighting is not likely to make the habitat less desirable and no longer usable by existing fauna.

No other additional impacts on biodiversity values are anticipated.

Ecosystem credits required

A number of additional ecosystem credits are required to offset the unavoidable impacts on native vegetation. These are outlined in **Table 3-16**. Only one of the PCTs requires an offset, because the area of impact is larger than the PCT not requiring additional credits. Only two additional ecosystem credits are required to offset the unavoidable impacts.

Table 3-16 Ecosystem credits required

PCT ID	PCT Name	Vegetation formation	Direct impact (ha)	Additional credits required
1232	Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Coastal Swamp Forest	0.02	0
1808	Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline	Freshwater Wetlands	0.20	2

3.4.4.4 Management of impacts

Potential biodiversity impacts associated with the proposed southern extension of the shared cycle and pedestrian pathway are generally consistent with impacts described in the EIS and would therefore be managed through the implementation of the environmental management measures described in Chapter D1 (Environmental management measures) of the submissions report.

3.4.5 Non-aboriginal heritage

3.4.5.1 Methodology

The methodology for the assessment is consistent with the non-Aboriginal heritage assessment in Appendix N (Statement of heritage impact) of the EIS. This assessment should be read alongside Chapter 19 (Non-Aboriginal heritage) and Appendix N (Statement of heritage impact) of the EIS which contains detailed descriptions and explanations on the assessment guidelines and methodologies used.

3.4.5.2 Existing environment

The proposed southern extension of the shared cycle and pedestrian pathway traverses Scarborough Park and Patmore Swamp, which a local heritage item listed under the Rockdale LEP 2011. Patmore Swamp is technically significant for its contribution to the Central Scarborough wetland area which is an integral part of the wetlands corridor. The place also has historical value for its role in the depression era program of public works. The wetland reserve contributes to amenity and character of the area.

3.4.5.3 Assessment of construction impacts

This section of the proposed southern extension of the shared cycle and pedestrian pathway would need to be raised above the current ground level of Patmore Swamp. The pathway would be around 600 metres long and up to three metres at its widest point through the swamp. The construction of the pathway would include the removal of the existing vegetation as described in **section 3.4.4**.

The construction of the proposed southern extension of the shared cycle and pedestrian pathway would be associated with potential air quality, biodiversity, contamination impacts. There would also be a moderate-low visual impact on views from Patmore Swamp due to the removal of vegetation, earthworks, roadworks and construction of the President Avenue shared cycle and pedestrian bridge resulting in a moderate level of modification to these low sensitivity views

3.4.5.4 Assessment of operational impacts

Potential impacts on the swamp (either direct or indirect) during the operation of the project largely relate to impacts on urban design landscape character and visual amenity.

The design of the project, including post construction landscaping works, would rehabilitate the portion of Patmore Swamp area that would be impacted during construction works. The project has the potential to have a positive heritage outcome through promoting the aesthetic significance of the swamp.

3.4.5.5 Management of impacts

Potential non-Aboriginal heritage impacts associated with the proposed southern extension of the shared cycle and pedestrian pathway are generally consistent with impacts described in the EIS and would therefore be managed through the implementation of the environmental management measures described in Chapter D1 (Environmental management measures) of the submissions report.

3.4.6 Surface water and flooding

The proposed southern extension of the shared cycle and pedestrian pathway is outside of the project footprint assessed in the surface water and flooding assessment in Chapter 18 (Surface water and flooding) of the EIS and therefore further assessment of impacts during construction and operation is required.

3.4.6.1 Methodology

The methodology for the assessment is consistent with the surface water assessment in Appendix L (Surface water technical report) and Appendix M (Flooding technical report) of the EIS. This assessment should be read alongside Chapter 18 (Surface water and flooding) and appendices L and M of the EIS which contain detailed descriptions and explanations on the assessment guidelines and methodologies used.

3.4.6.2 Existing environment

The southern extension of the shared cycle and pedestrian pathway would be located in proximity to the Scarborough Ponds which comprises a series of three pond systems including Rockdale Bicentennial pond (north of President Avenue), the Northern Scarborough Ponds (between President Avenue and Barton Street) and the Southern Scarborough Pond (south of Barton Street).

The southern extension of the shared cycle and pedestrian pathway would be located on primarily the western side of the Northern Scarborough Pond. The southern extent of the extended pathway would cross to the eastern side of the waterway via a bridge structure over the channel that links the two ponds that make up the Northern Scarborough Pond.

The majority of the alignment of the southern extension of the shared cycle and pedestrian pathway is inundated by floodwaters during storms more frequent than 1 Exceedance Per Year (EY). Depths of ponding along the proposed alignment are sufficient to result in hazardous flooding conditions for persons and property arising during a storm with an Annual Exceedance Probability (AEP) of 1 per cent (or 1 in 100).

The reach of Scarborough Ponds that runs between President Avenue and Barton Street acts principally as a flood storage area for events up to 1 per cent AEP due to the relatively low velocity of the floodwater.

Scarborough Ponds catchment covers an area of around 400 hectares. The western and eastern sides of the catchment predominantly comprise medium density residential development with some industrial development situated around the northern edges of the Rockdale Wetland. Stormwater runoff from urbanised areas is conveyed by a pit and pipe network into Scarborough Ponds via a series of piped outlets.

Both the Northern Scarborough Pond and Southern Scarborough Pond are highly disturbed waterbodies with a moderate level of sensitivity as described in **Table 3-17**.

Table 3-17 Sensitivity of receiving environments

Surface water feature	Description of surface water feature	Condition	Sensitivity
Northern Scarborough Ponds	Tidally influenced, modified open water body, poor water quality, provides ecological habitat and passive recreational use.	Highly disturbed	Moderate
Southern Scarborough Ponds	Tidally influenced, modified open water body, provides ecological habitat and passive recreational use.	Highly disturbed	Moderate

Surface water monitoring was undertaken at the Northern Scarborough Ponds to inform the surface water and flooding assessment in the EIS (refer to Chapter 18 (Surface water and flooding) of the EIS). The results of surface water monitoring are indicative of a highly disturbed urban waterway:

- Median concentrations of total nitrogen, total phosphorus, copper and zinc exceeded the relevant Australian and New Zealand Environment and Conservation Council (ANZECC) (2000) estuarine/marine trigger levels for slightly to moderately disturbed waterways
- All ammonia concentrations exceeded the ANZECC (2000) recreational water quality criteria recreational water quality criteria
- Iron concentrations exceeded the ANZECC (2000) recreational water quality criteria on some occasions
- The pH was outside the trigger levels range on some occasions.

Given the waterbodies are connected and have similar catchment land uses, water quality within Southern Scarborough Pond would generally be similar to the Northern Scarborough Pond water quality.

There are existing odour issues at the Scarborough Ponds associated with temperature inversions (a natural phenomenon common to lakes and waterways).

3.4.6.3 Potential impacts - construction

Construction activities, including vegetation clearing and minor excavations that would be carried out in proximity to the Northern Scarborough Pond, would have the potential to disturb sediment and result in direct sediment and erosion impacts on the Northern Scarborough Pond and downstream impacts on the Southern Scarborough Pond. These sediments could potentially contain toxicants and elevated nutrients.

In order to construct the raised boardwalk structure for the southern extension of the shared cycle and pedestrian pathway, it may be necessary to install a temporary access road

The inundation of the construction area by floodwater has the potential to cause the transport of sediment and construction materials into the receiving waterways, as well as result in damage to machinery and delays to the project timetable. The construction of the raised boardwalk structure would therefore need to be staged in a manner that manages the extent of temporary works within flood prone areas and/or includes procedures for their removal during times of flood.

The construction of the bridge structure as part of the extended pathways could result in direct waterway disturbance to the channel linking the two sections of the Northern Scarborough Pond. Physical structures such as footings could potentially be constructed within the waterway and disturb the bed and banks of the channel which would increase the turbidity and has the potential to result in erosion and mobilisation of bed and bank sediments downstream.

Where feasible and reasonable, bridge structures would be designed to fully span the watercourse channel. This would limit disturbance to the bed and banks during construction.

Dewatering is unlikely to be required for construction of piles or footings for the bridge or elevated portions of the active transport corridor. If required, dewatered groundwater would be captured and treated prior to release to the Northern Scarborough Pond or collected and disposed of off-site at a licensed wastewater facility.

The project footprint for the extended pathways would be relatively small and therefore there would be negligible hydrologic impact associated with surface water discharges during construction. Given the minor footprint associated with in-ground structures, such as piles, which may require dewatering, treated groundwater volumes would be relatively minor. Therefore treated groundwater discharges to Northern Scarborough Pond would have a negligible hydrologic impact on the tidal waterway. Dissipation and scour protection measures would be provided at discharge locations to prevent scour and erosion impacts.

Other potential water quality impacts during construction would include the mobilisation of pollutants associated with general construction activities:

- Dust, litter and other pollutants associated with building materials
- Leakage or spills of petroleum hydrocarbons, oils and greases from machinery, equipment or plant or during refuelling.

Measures to manage potential water quality and flood related impacts during construction are discussed further below.

3.4.6.4 Potential impacts - operation

The southern extension of the shared cycle and pedestrian pathway would be located on land which is inundated by floodwaters during storms more frequent than 1 EY, while depths of ponding during a 1 per cent (1 in 100) AEP storm are sufficient to result in hazardous flooding conditions for persons and property.

Table 3-2 of the Appendix M (Flooding technical report) of the EIS sets out the following criteria for managing the risk and consequence of flooding to proposed shared cycle and pedestrian pathways:

- *'A 1 EY hydrologic standard has been adopted for shared cycle and pedestrian pathways in accordance with the current standard adopted by Roads and Maritime for cycleways and shared user paths that are separated from the road corridor*
- *Consideration is to also be given to the flood risk to cyclists and pedestrians during larger floods (eg 1% AEP event) as a result of high hazard flooding conditions.'*

The peak 1 EY and 1% AEP flood levels along the reach of Scarborough Ponds that is crossed by the southern extension of the shared cycle and pedestrian pathway are 1.7 m AHD and 2.5 m AHD, respectively. In order to provide a 1 EP hydrologic standard it would be necessary to locate the shared path at a minimum elevation of 1.7 m AHD. This would also limit the depth of ponding in a 1% AEP event to no greater than 0.8 m, which would be classified as low provisional hydraulic hazard in accordance with the NSW Floodplain Development Manual[5] .

The construction of the southern extension of the shared cycle and pedestrian pathway as a raised boardwalk structure would limit the extent of fill within the floodplain and therefore the potential to displace floodwater and exacerbate flood behaviour in adjacent development. Further flood assessment would be required during the detailed design stage to determine the extent of compensatory storage that would be required to offset the displacement of floodwater caused by the raised boardwalk structure and its approach embankments.

The extended pathways would result in a slight increase in impervious areas in Scarborough Park. Increases in impervious area exposed to direct rainfall has the potential to contribute to an increase in runoff volume and pollutant mobilisation, which has the potential to impact water quality in the Northern Scarborough Pond.

The increase in impervious area associated with the extended pathways is considered to be minor and opportunities to implement passive stormwater treatments for the extended pathways would be investigated during detailed design. This could include diverting stormwater to a grass or vegetated buffer adjacent to the pavement or through use of a permeable pavement system.

[5] Department of Infrastructure, Planning and Natural Resources (2005) *Floodplain development manual*

3.4.6.5 Management of impacts

Potential surface water and flooding impacts associated with the proposed southern extension of the shared cycle and pedestrian pathway are generally consistent with impacts described in the EIS and would therefore be managed through the implementation of the environmental management measures described in Chapter D1 (Environmental management measures) of the submissions report.

One additional environmental management measure is proposed which is summarised in **section 3.5**.

3.5 Additional environmental management measures

The assessment in **section 3** has determined that impacts associated with the proposed southern extension of the shared cycle and pedestrian pathway are generally consistent with impacts described in the EIS and would therefore be managed through the implementation of the environmental management measures described in Chapter D1 (Environmental management measures) of the submissions report.

However, the following additional or amended environmental management measures are proposed to specifically manage potential impacts associated with the proposed southern extension of the shared cycle and pedestrian pathway:

- Soil investigations comprising shallow soil sampling will be undertaken within the footprint of the southern extension of the shared cycle and pedestrian pathway where soil disturbance and excavation would occur, where necessary
- The shared pedestrian and cycle bridge structure over the channel within Scarborough Park will be designed in accordance with the *Controlled activities on waterfront land – guidelines for watercourse crossings on waterfront land*[6] and where feasible and reasonable, the bridge structure will fully span the waterway channel.

3.6 Summary and conclusion

In response to this EIS consultation, an extension to the shared cycle and pedestrian pathway is proposed between President Avenue and Barton Street and would connect to the existing on-road cycle network at Chuter Avenue/O'Connell Street.

The assessment in **section 3** has determined that impacts associated with proposed southern extension of the shared cycle and pedestrian pathway are generally consistent with impacts described in the EIS. Potential impacts will be managed through the implementation of the environmental management measures described in Chapter D1 (Environmental management measures) of the submissions report, including two additional management measures developed specifically for the proposed southern extension of the shared cycle and pedestrian pathway. These are described in **section 3.5** above.

[6] NSW Department of Primary Industries (2012) *Controlled activities on waterfront land – guidelines for watercourse crossings on waterfront land*

4 References

NSW Department of Primary Industries (2012) *Controlled Activities on Waterfront Land guidelines*

NSW Department of Infrastructure, Planning and Natural Resources (2005) *Floodplain Development Manual – The management of flood liable land*

AECOM 2015) WestConnex Stage 2: *New M5 Factual Contamination Assessment*

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