



Transport for NSW

Beaches Link and Gore Hill Freeway Connection

2 – Flat Rock Drive temporary construction support site (BL2) options analysis

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2 Flat Rock Drive construction support site (BL2) options analysis

2.1 Overview

Temporary construction support sites for the Beaches Link and Gore Hill Freeway Connection project would accommodate construction activities such as construction material and equipment storage and staging areas, spoil handling and acoustic sheds, staff offices, worker amenities and car parking. In addition to the construction requirements, environmental investigations and community and stakeholder feedback were used to inform the identification and configurations of appropriate temporary construction support sites. The primary driver for the location of these sites was the objective of minimising environmental and community impacts, while being suitably located to facilitate the construction activities of the project. As outlined in Section 4.5.7 of the environmental impact statement, key factors applied to the identification of potential temporary construction support sites included:

- Locating the temporary construction support sites as close as possible to project construction areas
- Avoiding sensitive environments and community locations where possible
- Avoiding material impacts on heritage sites or items
- Maximising opportunities for direct access to motorways and arterial roads or water transport opportunities for construction traffic, and avoiding the need to use local residential streets if possible
- Minimising direct and indirect property impacts and acquisition requirements, particularly in residential areas.

Consideration of alternative locations for the Flat Rock Drive construction support site (BL2) is outlined in Section 4.5.7 of the environmental impact statement. Multiple sites were considered, and two sites were shortlisted as options to support tunnel construction from Flat Rock Drive:

- On the Flat Rock Baseball Diamond located on the western side of Flat Rock Drive (Option A)
- Within part of Flat Rock Reserve on the eastern side of Flat Rock Drive in land that was revegetated post 1998 (Option B).

Other alternative sites as well as potential additional intermediate tunnelling sites to improve tunnelling efficiency were considered unfavourable as they would have required haulage of spoil on local streets (some of which are narrow), caused local amenity impacts and resulted in the acquisition of a substantial number of private residential and/or commercial properties in addition to those already being acquired for the project.

For a tunnelling project of the scale of the Beaches Link and Gore Hill Connection project, an intermediate temporary construction support site would preferably be sited at a midpoint between Flat Rock Drive, Northbridge and Middle Harbour, for efficiency and construction risk mitigation purposes. Transport for NSW assessed the potential impacts of this option and took the decision to plan for only one site in the Northbridge area however, to ensure impacts to residential areas within the greater Northbridge area are minimised including no heavy vehicles on local streets.

As part of determining the preferred location for the temporary construction support site, Transport for NSW received about 2,186 pieces of feedback when carrying out community consultation on Option A (Flat Rock Baseball Diamond) and Option B (Flat Rock Reserve) between 26 July and

1 December 2018 which were considered during project design development and site selection. Both options would provide direct arterial road access, avoiding heavy and light vehicle movements through local streets and town centres and direct impacts to private properties. Flat Rock Reserve (Option B) was identified as the preferred location for the temporary construction support site, primarily because it avoids impacts to the local operational recreation facilities of Willoughby Leisure Centre, netball courts, the baseball diamond and other recreation spaces on the western side of Flat Rock Drive, which are in high demand for local community use. Flat Rock Reserve (Option B) was also preferred as it would also have a faster construction program due to a shorter tunnel access decline and commencement of excavation of the mainline tunnels much closer to Middle Harbour than Option A. The size of the preferred site would allow the construction of an access decline and the ability to tunnel in three different directions, reducing the number of required intermediate tunnelling sites.

The environmental impact statement included and assessed Option B (Flat Rock Reserve) as the Flat Rock Drive construction support site (BL2). In response to the exhibition of the environmental impact statement, about 360 submissions were received from the community objecting to and regarding the use of the Flat Rock Drive construction support site (BL2).

This section further discusses the necessity of the Flat Rock Drive construction support site (BL2) to the overall project and the stakeholder and community engagement activities that have occurred in the selection of the preferred location for the temporary construction support site. In response to community feedback, the assessment carried out to consider alternative locations for Flat Rock Drive construction support site (BL2) has been documented, including determining the feasibility of relocating Flat Rock Baseball Diamond if Option A was to be pursued. A comparative assessment of Option A and Option B is also provided which informed the site selection process for the temporary construction support site.

2.2 Engagement activities to date

2.2.1 Pre-environmental impact statement exhibition engagement

Between 26 July and 1 December 2018, Transport for NSW conducted an extensive community engagement program for the proposed reference design for the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects. The engagement program sought feedback on a variety of issues including preference for the Option A or Option B mid-tunnel site on Flat Rock Drive, and included:

- Twenty community engagement sessions attended by 2639 people across nine locations
- Six shopping centre pop-up display sessions with over 590 stakeholder interactions
- Eighty eight meetings and briefings including 35 meetings with local precinct committees, schools and school P&Cs, resident groups, special interest groups and sporting associations
- Around 400,000 letterbox drops and 3892 direct doorknocks
- Receipt of over 7300 items of feedback across the Western Harbour Tunnel and Beaches Link program of works.

As part of determining the preferred location for the temporary construction support site, Transport for NSW received 2186 pieces of feedback on Option A (Flat Rock Baseball Diamond) and Option B (Flat Rock Reserve) which were considered during project design development and site selection. There was a comprehensive response from the community to the two proposed sites, with a large number of stakeholders taking advantage of “form” emails to express their views.

Local community and interest groups used a number of different websites to list a wide range of concerns in relation to the sites. Some of these websites were part of a larger opposition campaign used by these community and interest groups in conjunction with materials previously developed by WestConnex opposition groups. Stakeholders were generally negative in their response to both Option A and Option B. These concerns compounded with the potential contamination impacts of excavating the former landfill sites including the disturbance of dumped asbestos, chemical leachates and the associated health concerns for the local community. The overall stakeholder sentiment was that the potential impacts of the temporary construction support sites were unacceptable to the local community.

Stakeholders expressed the view that Transport for NSW should consider using other locations for the temporary construction support site, particularly at the Cammeray Golf Course or Artarmon industrial estate to centralise construction activities further. It was acknowledged by stakeholders however this would considerably delay the construction process, concentrate impacts at one location and increase construction risk to unacceptable levels for Transport for NSW and its contractor/s due to excessive distances for access in the unlikely event of an incident below ground.

Stakeholders in close proximity to Flat Rock Drive were strongly opposed to Option A, especially in regard to traffic and parking impacts for weekend sport. Sporting clubs highlighted that a report commissioned by the Northern Sydney Regional Organisation of Councils identified a 40 per cent shortfall of sporting fields on the North Shore. The North Sydney Leagues Senior Baseball Club and North Sydney Bears Junior Baseball Club voiced concern that a lack of alternative playing/training areas would have meant it would have likely ceased to exist if the Flat Rock Baseball Diamond was used as a temporary construction support site for the project. There was also concern about air pollution associated with this site and its potential impact on other nearby sports facilities such as the netball courts and Willoughby Leisure Centre.

Stakeholders around Flat Rock Drive also expressed concerns in relation to Option B as the area is considered a valuable community asset, with Flat Rock Reserve having been regenerated over the last 20 years from its previous use as a landfill site and is now an integral part of bushland maintained by a dedicated community of volunteers. Stakeholders were concerned about the impacts to flora and fauna, particularly threatened species. A petition addressed to the NSW Speaker and Members of the Legislative Assembly was signed by 404 people opposing the proposed use of Option B.

The top 10 Issues weighted relative to each other in Flat Rock Drive mid-tunnel sites feedback during 2018 community consultation are presented in Figure 2-1.

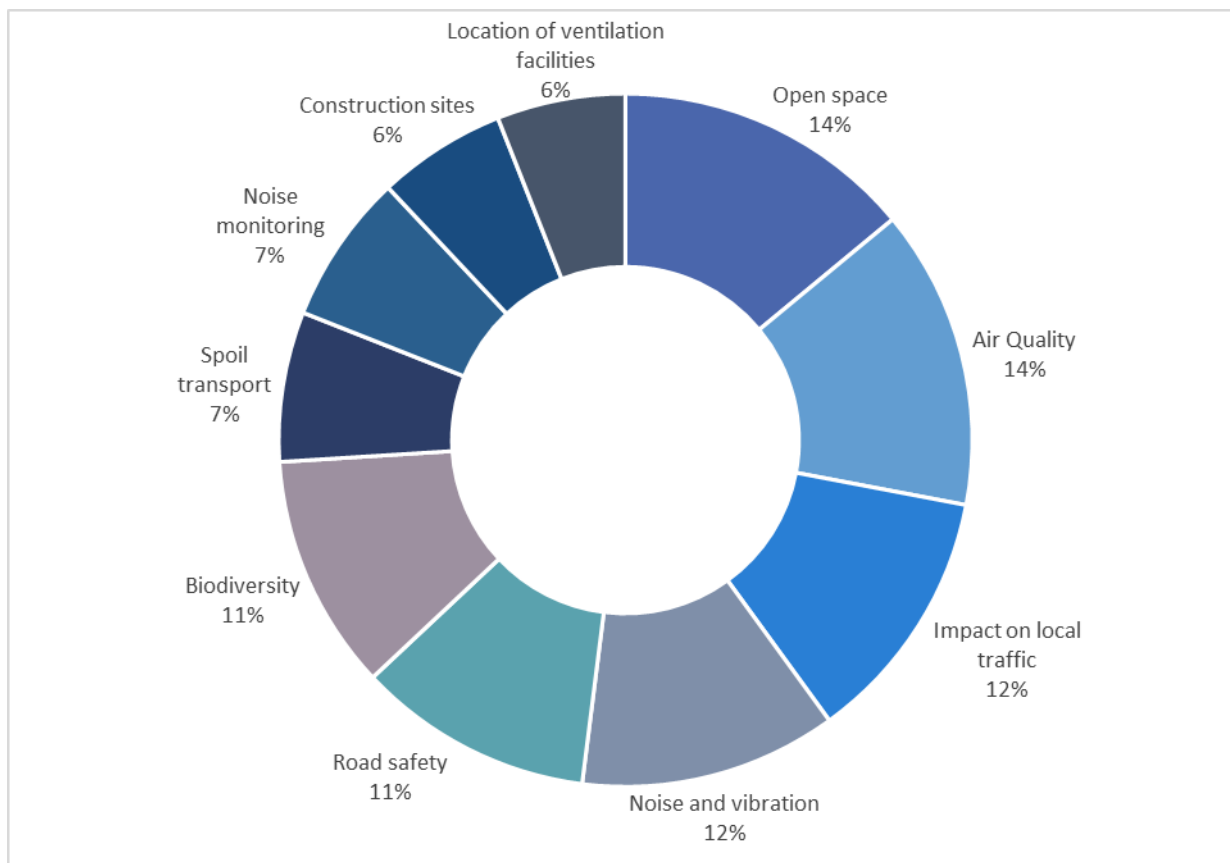


Figure 2-1 Top 10 issues weighted relative to each other in Flat Rock Drive mid-tunnel sites feedback during 2018 community consultation

Table 2-1 Top 10 issues referenced in stakeholder comments for Flat Rock Drive mid-tunnel sites feedback during 2018 community consultation

Environmental impact	Number of stakeholders referencing issue
Open space	1121
Air quality	1097
Impact on location traffic	959
Noise and vibration	946
Road safety	895
Flora/fauna	818
Spoil transport	602
Noise monitoring	619
Construction sites	570
Location of ventilation facilities	551

Transport for NSW met with representatives of the North Sydney Leagues Senior Baseball Club and North Sydney Bears Junior Baseball Club in 2018 to further understand the potential impact the loss of the baseball diamond would have on the sport in the area if Option A were to be used for the project. The clubs observed the following:

- The Flat Rock Baseball Diamond is a world competition standard ground
- Another baseball diamond at Frenchs Forest was potentially being acquired for a new high school, creating a potential cumulative impact on baseball on the north shore
- The next nearest baseball diamond facilities in Ryde are more than a 30 minute drive away and it is likely that multiple facilities would need to use this given the number of players
- Even if an arrangement could be made to share the baseball diamond facilities in Ryde for home games, the distance for most players to travel would likely lead to many giving up the sport
- There would be difficulty in sharing grounds with other sporting codes due to the need for a mound.

Option B was ultimately identified as the preferred location for the temporary construction support site, primarily because it avoids impacts to the local operational recreation facilities of Willoughby Recreation Centre, netball courts, the baseball diamond and other recreation spaces on the western side of Flat Rock Drive, which are in high demand for local community use. Other factors which Transport for NSW considered in selecting Option B as the Flat Rock Drive construction support site (BL2) are outlined in Section 2.6.

2.2.2 Environmental impact statement exhibition engagement

In response to the exhibition of the environmental impact statement about 360 submissions were received from the community objecting to, and regarding the use of, the Flat Rock Drive construction support site (BL2). Many of the comments reiterated the concerns raised by community members in 2018. Additional issues raised in submissions related to:

- Loss of bushland and open space and impacts on recreational uses and community facilities, including tracks used for walking, running and cycling
- Potential disruption to regular activities of various community groups, such as bush care groups, the 1st Northbridge Sea Scout Group and 1st Sailors Bay Sea Scouts
- Potential impacts on residents' amenity due to the clearing of vegetation and use of the temporary construction support site
- Potential for the temporary construction support site to cause contamination downstream, which could impact recreational fishing
- Concern about potential contamination risks at Flat Rock Reserve that could impact recreational areas such as the walking tracks, netball courts, the baseball diamond, and playing fields nearby.

A number of community groups and associations who made submissions on the proposed use of the site at Flat Rock Reserve during the engagement carried out between 26 July and 1 December 2018 also made submissions regarding the proposed use of the site during the environmental impact statement exhibition.

The environmental impact statement did not propose any impact on the Flat Rock Baseball Diamond, although several submissions provided comment on the baseball diamond as an alternative to the site proposed at Flat Rock Reserve. The community also raised concerns that the biodiversity at Flat Rock Reserve should not be impacted to avoid impacting the Flat Rock Baseball Diamond, that there is time to relocate the baseball facilities prior to commencement of construction

and that this task is not costly compared to the overall estimated project costs. The diversity of issues raised by submitters is presented in Figure 2-2. Responses to issues raised by the community are addressed in the following sections of the submissions report, listed from highest percentage of submissions to lowest in Table 2-2. Table 2-2 also provides a summary of the issues raised by the community for each environmental impact. The number of submitters referencing each different issue is outlined in Table 2-3.

Table 2-2 Location of responses to issues raised by the community within the submissions report

Environmental impact	Section within the response to submissions	Summary of issues raised
Biodiversity	C18.2.1, C18.2.2, C18.3.1, C18.3.3, C18.3.5, C18.4, C18.5.1 and C18.6	<ul style="list-style-type: none"> • Concern regarding impacts to fauna and the removal of native vegetation and threatened flora within the construction footprint • Concern about the potential release of landfill gases at the Flat Rock Drive construction support site (BL2) impacting nearby wildlife • Requests for mitigation measures to protect biodiversity from noise, light, and construction traffic impacts at Flat Rock Reserve • Concern about the impact to the wildlife corridor and wildlife connectivity between Middle Harbour and Lane Cove River Catchments (which includes Flat Rock Reserve)
Geology, soils and groundwater	C15.1.1, C15.1.4 and C15.4	<ul style="list-style-type: none"> • Concern regarding whether spoil from Flat Rock construction support site (BL2) would be treated as contaminated • Concern regarding the detail of the contamination assessment and how it aligns with historic records • Concern that potential contaminated materials would be disturbed during construction or from flooding, which could result in contamination impacts on the surrounding environment • Concern regarding the risk of encountering odorous waste and landfill gas and how it will be managed • Requests for regular monitoring and detailed investigation for contamination at the Flat Rock Drive construction support site (BL2) • Concern that proposed tree removal would increase soil erosion and affect soil stability in the long term
Construction traffic and transport	C7.3.1, C7.5, C7.6, C7.7.1 and C7.7.3	<ul style="list-style-type: none"> • Concern that Flat Rock Drive construction support site (BL2) would impact traffic flows, cause delays and impact on resident access to and from local roads and driveways • Concern about safety impacts from construction vehicles accessing the temporary construction support sites and truck marshalling on public roads near temporary construction support sites • Concern that public transport connections (bus services) may be impacted during construction

Environmental impact	Section within the response to submissions	Summary of issues raised
		<ul style="list-style-type: none"> Concern about impacts of the proposed shared use path detour at Flat Rock Drive construction support site (BL2), including disruptions to existing access and routes between neighbouring suburbs
Socio-economics	C20.1.1, C20.4.1 and C20.7.1	<ul style="list-style-type: none"> Concern that Flat Rock Reserve's social importance and contribution to community health has not been recognised Concern about the loss of recreational areas and facilities at Flat Rock Reserve Concern about traffic congestion during construction affecting businesses along Flat Rock Drive
Construction noise and vibration	C9.1, C9.2.3, C9.3.1, C9.5, C9.8.2, C9.8.3 and C9.8.5	<ul style="list-style-type: none"> Concern regarding construction noise and vibration impacts from Flat Rock Drive construction support site (BL2) on residential properties and nearby recreational uses Concern the loss of existing vegetation that may provide noise attenuation has not been considered Concern regarding construction traffic noise impacts from vehicles accessing the temporary construction support site and use of Brook Street and Flat Rock Drive Concern that the proposed acoustic shed and noise barriers at the Flat Rock Drive construction support site (BL2) would be ineffective
Land use and property	C19.2 and C19.3.2	<ul style="list-style-type: none"> Concern regarding the long-term use of Flat Rock Drive construction support site (BL2) and that it would be re-purposed for sport and recreation instead of being rehabilitated and re-established into an equivalent bushland state Requests that Willoughby City Council be allocated sufficient funds to maintain replacement vegetation Concern regarding loss or changed access to the natural environment and sport and recreation facilities at Flat Rock Reserve during construction
Water quality	C16.2.3, C16.3.2, C16.3.5, C16.4 and C16.5	<ul style="list-style-type: none"> Concerns about pollution of waterways including Middle Harbour due to the disturbance of the former landfill site Concern about potential scour impacts as a result of the watercourse redirection at Flat Rock Reserve Concern that more stormwater is likely to move into Flat Rock Gully during rain events due to the construction footprint having impervious/compacted surfaces
Human health	C12.1.3, C12.2.1, C12.2.2, C12.2.5, C12.2.7 and C12.3.2	<ul style="list-style-type: none"> Concern for the health of surrounding receivers and construction workers at Flat Rock Drive construction support site (BL2) from contaminated leachate, management of contaminated spoil, landfill gas and odour impacts

Environmental impact	Section within the response to submissions	Summary of issues raised
		<ul style="list-style-type: none"> • Concern about the impact of construction traffic emissions on the health and wellbeing of receivers near the Flat Rock Drive construction support site (BL2) • Concern regarding residents' quality of life, mental health, and safety as a result of increased traffic during construction near the Flat Rock Drive construction support site (BL2) • Concerns regarding impacts to the physical and mental health of community members who may be prevented from exercise and recreational activities
Air quality	C11.1.5, C11.2.3 and C11.3.2	<ul style="list-style-type: none"> • Concern that background monitoring of air quality for the area around Flat Rock Gully has not been carried out and that detailed investigations have not been carried out to confirm the impact of potentially odorous materials and landfill gases • Concern regarding how the potential release of odour at the Flat Rock Drive construction support site (BL2) would be addressed • Requests for dust fencing around the Flat Rock Drive construction support site (BL2) to minimise dust impacts on surrounding residents
Construction works	C5.4.1 and C5.4.2	<ul style="list-style-type: none"> • Concern regarding the location of and justification for the Flat Rock Drive construction support site (BL2). Community members suggested alternative locations • Concerns were also raised regarding the temporary construction support site, including the proposed entry and exit to the site and the proximity to residents
Urban design	C21.2, C21.3 and C21.4	<ul style="list-style-type: none"> • Concern regarding impacts to the character of Willoughby due to works at Flat Rock Reserve, night lighting impacts during construction and the extent of tree removal proposed at Flat Rock Reserve
Other	C1.3.2, C6.2.2, C6.4.1, C13.1, C14.1.1, C14.2.3, C17.1.2, C17.1.3, C17.1.4, C17.2, C23.2.3, C23.3.1, C23.3.2, C23.3.3, C24.3.1, C26.1, C26.3.1, C26.3.2 and C26.3.3	<ul style="list-style-type: none"> • Concern that consultation regarding the location of the Flat Rock Drive construction support site (BL2) did not occur with general users of Flat Rock Reserve and community groups • Concern that the project may result in irreversible impacts to Flat Rock Reserve • Concerns regarding stockpiling at Flat Rock Drive construction support site (BL2), increased flood risk for Flat Rock Gully catchment and adequacy of assessment, inadequate assessment of Aboriginal cultural heritage and need for funding of surrounding Aboriginal cultural heritage sites for maintenance and repair for any damage caused by the project, and potential for cumulative impacts including that the cumulative impact of the redevelopment of Willoughby Leisure Centre has not been considered.

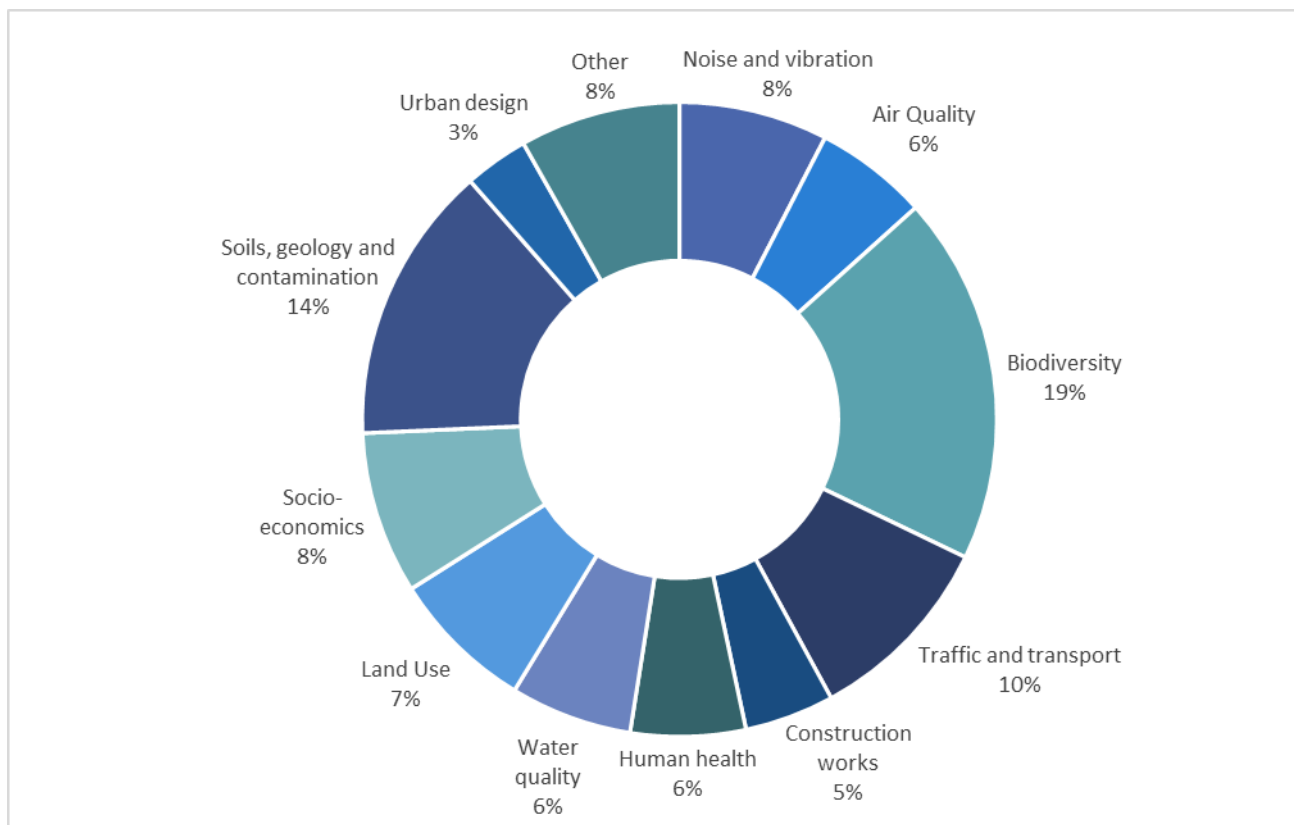


Figure 2-2 Categorisation of issues raised by the community regarding 'Flat Rock' as part of the environmental impact statement exhibition process relative to each other

Table 2-3 Top 10 categories for issues raised by the community for 'Flat Rock' during the environmental impact statement exhibition

Environmental impact	Number of stakeholders referencing issue
Biodiversity	218
Geology, soils and groundwater	165
Construction traffic and transport	115
Socio-economics	96
Construction noise and vibration	88
Land use and property	85
Water quality	72
Human health	68
Air quality	67
Construction works	53

The Department of Planning, Industry and Environment (Environment, Energy and Science Group) raised concerns over the location of the Flat Rock Drive construction support site (BL2) in their submission due to impacts on the bushland rehabilitation that has occurred within Flat Rock Reserve. A response is provided to the concerns raised in Section B4.5.2 of the submissions report. The response details how the project design development process has considered a number of

opportunities to avoid or minimise biodiversity impacts including avoiding impacting the remnant vegetation and how the southern part of the site also includes a large area of cleared, mown exotic grassland. Environmental management measure B1 has been developed to specifically apply to Flat Rock Drive construction support site (BL2) and requires refinement of the site layout during further design development and construction planning to avoid direct impacts on Plant Community Type (PCT) 1841 Coastal Enriched Sandstone Moist Forest, where feasible and reasonable (refer to Appendix C of this preferred infrastructure report).

Transport for NSW has also consulted with Willoughby City Council on an ongoing basis from 2017 to present (2021) providing general project updates and discussion on the locations of temporary construction support sites and other project impacts. Multiple meetings have been held with Willoughby City Council since environmental impact statement exhibition which have discussed the proposed Flat Rock Drive construction support site (BL2) specifically, the site selection process, management of traffic and noise and vibration impacts and the safety of the community during the operation of the temporary construction support site.

2.3 Alternate locations for a temporary construction support site

Transport for NSW carried out a comprehensive options analysis process in the identification of temporary construction support site locations. This process considered environmental, social, traffic, property and construction impacts, and is summarised in Section 4.5.7 of the environmental impact statement.

Over five years, between 2016 and 2020, Transport for NSW investigated options for a mid-tunnel site between Naremburn and Middle Harbour and conducted extensive consultation with the community and other stakeholders. Initially during the development of the reference design, Transport for NSW identified multiple locations which may have provided an appropriate mid-tunnel and temporary construction support site. Five options were nominated for further consideration and the impacts associated with each option were assessed and compared. Two sites on Sailors Bay Road were investigated and discounted due to potential impacts on private properties and heavy vehicles needing to use local roads to access the sites. A third site on Willoughby Road was also discounted due to its impact on private properties and an unacceptable increase to the construction program. Only two of the shortlisted sites were determined to be feasible:

- Option A was located on the Flat Rock Baseball Diamond in Willoughby (and to a lesser extent Naremburn), on the western side of Flat Rock Drive adjacent the Willoughby Leisure Centre, the netball courts and associated car parks. The site is atop a former landfill and infilling materials could comprise historic residential, industrial and furnace waste from the on-site incinerator including the potential for large amounts of putrescible waste. Except for the tunnel access decline which would encounter contaminated material, the remainder of the site would likely require limited excavation works to form a suitable building pad due to the relatively flat nature of the existing site
- Option B was located in Flat Rock Reserve in Northbridge (and to a lesser extent Naremburn), on the eastern side of Flat Rock Drive and opposite the Flat Rock Baseball Diamond. The site is also atop a former landfill site which relative to the Option A site, was more recently filled with predominantly building waste and revegetated since 1998 by Willoughby City Council and the community. The construction site footprint impacts roughly 33 per cent of the area revegetated over the past ~20 years. The site was not expected to uncover substantial amounts of historical putrescible waste at the required excavation depths. The site would require some excavation works to form a suitable building pad due to the sloping nature of the existing site however the design intent would maximise opportunities to build up rather than excavate down to achieve a suitable grade. The site represents a relatively small proportion of the Flat Rock Reserve,

occupying roughly five per cent of the reserve facilitating ongoing use of the rest of the reserve by the community for active and passive recreation.

After further design development including consideration of contamination and further consultation with the community and stakeholders, Transport for NSW elected to proceed with the mid-tunnel site being located at Option B. Option B was preferred for numerous other reasons including:

- No direct impacts to recreational activities and sporting clubs using the Flat Rock Baseball Diamond and lesser indirect impacts to users of the Willoughby Leisure Centre
- A faster construction program at Option B due to a shorter tunnel access decline and commencement of excavation of the mainline tunnels much closer to Middle Harbour than Option A
- Shorter traffic and transport impacts, noise and vibration impacts, air quality and human health impacts, water quality and flooding impacts, land use and property impacts, community and social impacts, visual impacts and cumulative impacts due to the faster construction program at Option B
- No direct impacts on or acquisition of private properties
- The site is a greater distance from residential receivers than Option A.

The Flat Rock Drive construction support site (BL2) was included in and assessed as part of the Beaches Link and Gore Hill Freeway Connection environmental impact statement.

2.4 Necessity of either Option A (Flat Rock Baseball Diamond) or Option B (Flat Rock Reserve)

2.4.1 Why a site is required at Flat Rock Drive

As discussed in Section 2.2, during consultation carried out between 26 July and 1 December 2018, stakeholders expressed the view that Transport for NSW should consider using other construction sites, particularly at the Cammeray Golf Course or Artarmon industrial estate to centralise construction activities further, even though this would considerably delay the construction process and increase construction risk to unacceptable levels due to excessive distances for access in the unlikely event of an incident below ground. In response to the environmental impact statement, the community has raised concerns regarding the location of Flat Rock Drive construction support site (BL2) and suggested it should be moved. Suggested alternative locations included the western side of Flat Rock Drive (eg Flat Rock Baseball Diamond), Artarmon industrial area or North Balgowlah (refer to Section C5.4.2 of the submissions report).

If the project did not have a mid-tunnel site in this area, a one-way drive from Artarmon to Middle Harbour of 3.8 kilometres would be required. Furthermore, a one-way drive from Cammeray to the mainline tunnel connection beneath Strathallen Avenue at Sailors Bay Road of 2.7 kilometres would be required. This would increase the construction program of the project by 18-24 months, significantly extending the duration of construction related impacts on the community, particularly at Artarmon and Cammeray. The construction risk profile associated with this option would also result in unacceptable cost, program and potential construction safety implications for Transport for NSW and create difficulties in obtaining a contractor to carry out these works during procurement.

2.4.2 Why an additional intermediate site between Flat Rock Drive and Middle Harbour would be preferred

For tunnelling in the area from Naremburn to Middle Harbour to be completed, two tunnelling sites would be the preferred strategy for tunnelling logistics. The distance of tunnelling including the

tunnel access decline from Flat Rock Drive construction support site (BL2) to Middle Harbour is around 2.73 kilometres. Excavation of this section of tunnel will be on the critical path for the project as the excavated tunnels will need to connect with the immersed tube tunnels at Middle Harbour before the project can be fully completed for testing and commissioning and subsequently opened to traffic. For a tunnelling project of the scale of the Beaches Link and Gore Hill Freeway Connection project, for efficiency and construction risk mitigation purposes, an intermediate temporary construction support site would preferably be sited between Flat Rock Drive construction support site (BL2) and Middle Harbour. With tunnelling works being preferably shared by two sites in the Northbridge area, the intermediate site would result in:

- Reduced overall program duration, cost and associated construction risk
- Less potential construction risk due to shorter access distances in the unlikely event of an incident below ground
- Overall reduced spoil production and associated potential environmental and community impacts at the single Flat Rock Drive construction support site (BL2).

However, the majority of the project is proposed to pass beneath highly urbanised suburbs including Naremburn, Northbridge and Willoughby, which have limited arterial roads. This presents a significant challenge to the establishment of viable intermediate tunnelling or mid-tunnel sites, as these would likely require acquisition of a significant number of properties, including additional private residential and commercial, and/or construction haulage on local roads. Due to the highly urbanised nature of the suburbs between Naremburn/Northbridge/Willoughby and Middle Harbour, and the depth of the tunnel through this area, limited viable intermediate tunnelling sites were considered to be suitable for the project.

Given this challenge, the project construction strategy has focussed on limiting the number of intermediate tunnelling sites by adopting a single mid-tunnel site on the alignment that maximises spoil productivity. Subsequently, only one mid-tunnelling site is provided in the Northbridge area to ensure impacts to residential areas within the greater Northbridge area are minimised including the commitment of no heavy vehicles on local streets. Option A and Option B, in the Willoughby and Northbridge area respectively, were selected as shortlisted mid-tunnel site options as they provide access to the main junction point in the tunnel (south of Middle Harbour), allowing tunnelling activities to progress in three directions simultaneously if required towards Middle Harbour, Cammeray and Artarmon.

The length of tunnel proposed to be excavated and mechanically and electronically fitted out from either Option A or Option B would be the longest ever attempted from a single intermediate/mid-tunnel site for a road project in Sydney, making a site at this location critical to managing overall program duration, cost and associated construction risk. The one-way drive from Option A to Middle Harbour is 3.05 kilometres long, including the tunnel access decline. The one-way drive from Option B to Middle Harbour is about 2.73 kilometres long, including the tunnel access decline. By way of comparison, the longest one-way tunnelling drive undertaken by roadheader excavation to date on a road tunnel project in Sydney is a roughly 2.3 kilometre drive for the WestConnex M8 (formerly New M5) project.

Should tunnelling be carried out from Cammeray as opposed to Flat Rock Drive construction support site (BL2), a number of cumulative impacts associated with the temporary construction support sites at the Warringah Freeway for the Western Harbour Tunnel and Warringah Freeway Upgrade project would be expected, including increased traffic, construction noise, visual amenity, and social and economic impacts to the surrounding communities.

2.5 Feasibility of relocating Flat Rock Baseball Diamond users

As discussed in Section 2.2, in response to the exhibition of the environmental impact statement about 360 submissions were received from the public objecting to and regarding the use of the Flat Rock Drive construction support site (BL2). Many submissions suggested the potential option of relocating the temporary support site, with some specifically suggesting the use of Flat Rock Baseball Diamond. Given the concerns raised by the community during the exhibition of the environmental impact statement, as part of this preferred infrastructure report Transport for NSW have documented the investigations carried out in 2018 to consider the feasibility of relocating the Flat Rock Baseball Diamond users to enable the project to temporarily use the baseball diamond during construction. The following sections outline the demand for use of the Flat Rock Baseball Diamond by the community and had Flat Rock Baseball Diamond been proposed as a temporary construction support site, the feasibility of relocating the baseball diamond.

2.5.1 Demand for recreational facilities

Sport and outdoor recreation provide a forum for community development and social interaction. Engaging in sport provides people with an opportunity to socialise and build community networks in a relaxed atmosphere. Sports facilities also have value as informal meeting places which enhance social interaction within the community and may be used as a refuge in times of emergency. Recreation is becoming an increasingly important value for individuals and the wider community as people are realising the benefits of recreation in achieving quality of life (Willoughby City Council, 2020).

A significant proportion of Willoughby local government area residents are involved in sport. In 2017 about 37,500 people were registered in Willoughby-based sporting clubs. This does not include casual sporting users or people using sports facilities for informal recreation. Willoughby local government area has 147 open space areas covering about 424 hectares, including 22 sports grounds with the type of land available for open space and recreation composed of:

- Bushland, foreshores and harbour beaches – 64 per cent, totaling 242 hectares
- Developed parkland, sportsgrounds and 47 playgrounds – 36 per cent, totaling 182 hectares (Willoughby City Council, 2013).

Existing sports facilities are operating at or over capacity, especially during the peak winter sports season when wear and tear on grass surfaces occurs (Willoughby City Council, 2020).

The Northern Sydney Regional Organisation of Councils (NSROC) is comprised of seven local government areas in the northern part of Sydney which voluntarily came together to address regional issues, work collaboratively for the benefit of the region, and advocate on agreed regional positions and priorities. The member councils include Hornsby, Hunters Hill, Ku-ring-gai, Lane Cove, North Sydney, Ryde and Willoughby. NSROC has identified a shortage of sportsgrounds within member council areas, including Willoughby City Council. Key issues regarding sportsgrounds in the region identified are:

- Shortage of sportsgrounds results in overuse of grounds in winter and poor condition. The current shortage of grounds will be exacerbated in future as population grows and numbers of people wanting to play sport increases
- Demand for established sports (soccer, cricket, rugby union, rugby league, hockey) exceeds supply of facilities on which to play. Growth in these sports, especially womens teams, means that new ways have to be sought to manage and provide sportsgrounds across the region

- Non-club 'pay as you play' sports such as touch football, and fitness programs/personal training use sportsgrounds which also need to be accommodated
- The ability for NSROC Councils to address current and future gaps in supply is limited by:
 - Limited funds for maintenance to required standards
 - Minimal land available for development of new sportsgrounds
 - High demand for open space by non-competitive social and physical recreation
 - Activities such as casual ball games and dog walking
 - High property prices meaning higher costs for development of new sportsgrounds.

There are 17 baseball fields and nine softball fields within the NSROC area. Studies in the area have found that existing sportsgrounds (including baseball) are already over capacity and will not be able to cater for additional population growth and participation numbers. Forecasts have shown that councils will need to increase the capacity of sportsgrounds by over 40 per cent to cope with existing and future demands (NSROC, 2017).

Bicentennial Reserve is located within Willoughby local government area and comprised of developed parkland, Hallstrom Park Playground, Bicentennial Oval, 17 district netball courts including four multi-purpose courts also used for basketball, Flat Rock Baseball Diamond, the Willoughby Leisure Centre, former Griffin Incinerator/Incinerator Art Space, shared user paths, car parks and bushland. Bicentennial Reserve is used for organised sport, informal recreation and community recreation and leisure at Willoughby Leisure Centre (Willoughby City Council, 2021).

Organised sport during the week and weekends which are supported by Bicentennial Reserve include:

- Netball courts for district competitions, also used for basketball and other court-based sports
- Baseball diamonds for seniors and juniors (Flat Rock Baseball Diamond) and juniors (Bicentennial Oval)
- Football and rugby training (Bicentennial Oval)
- Indoor swimming, netball, basketball, volleyball, futsal and badminton (Willoughby Leisure Centre).

As outlined in the Bicentennial Reserve Plan of Management sporting facilities are heavily utilised by organised sport (baseball, netball, basketball, football) and there is a high demand for parking and access to the sports grounds. There is an increasing need for upgrades to facilities and increased access. The demand for sporting grounds within the area is expected to grow as population density within the area increases. Organised sport in the area caters for juniors (from five years) through to all ages of adults (Willoughby City Council, 2021).

Willoughby City Council has pool area upgrades to Willoughby Leisure Centre which would involve alterations and additions to existing pool facilities as the pool hall has been operating at capacity and has limited opportunities to increase the number and range of programmes provided. A development application for the upgrades was lodged in early 2021 (Urbis, 2021) and approved by the Sydney North Planning Panel in August 2021.

The Flat Rock Baseball Diamond is used all year round with peak use occurring in summer by senior baseball clubs, with junior clubs using primarily Bicentennial Oval but also Flat Rock Baseball Diamond. The main club that uses Flat Rock Baseball Diamond is the North Sydney Leagues Senior Baseball Club. Use includes weekday afternoon and evening training and Saturdays and

Sundays for district matches. North Sydney Bears Junior Baseball Club also holds 'Try Baseball' events during the winter months and the facilities are also used by North Sydney Boys High School and have been used by the Japan Baseball Club. The North Sydney Bears Junior Baseball Club use the Bicentennial Reserve Oval and depending on the number of registered players, which fluctuates annually, use the Flat Rock Baseball Diamond as required. With the exception of the junior baseball diamond facilities at the nearby Bicentennial Reserve Oval, there are no other baseball diamonds in the Willoughby local government area. Bicentennial Reserve Oval is used by both the North Sydney Bears Junior Baseball Club and Dragons Baseball Club creating further capacity constraints on the facilities.

The adjacent netball courts within Bicentennial Reserve are used throughout April to September between 4pm and 9.30pm Monday to Friday, 7.30am to 5.30pm on Saturdays and 9am to 12pm on Sundays. From September to March the courts are booked Mondays between 5pm and 9pm. Additionally, the courts have bookings during school terms in school hours all year round. Of the 17 netball courts four are multi-purpose providing linemarking and hoops for basketball. They are booked for basketball training, a small number of competition games and are also used by casual users.

There are limits on the use of the area for organised competitions including:

- Floodlit sportsground for organised sports competitions which includes Flat Rock Baseball Diamond:
 - Saturday 8.00am – 9pm (lights permitted until 9.15pm for pack up)
 - Sundays 9.00am – 5.00pm
- No more than three weekday evenings until 9pm (with lights permitted until 9.15pm for pack up)
- All sportsgrounds will have a minimum one rest night per week (Willoughby City Council, 2020).

2.5.2 Relocation options considered

During investigations in 2018 into the use of Option A as a mid-tunnel site for the project, Transport for NSW considered the supply of recreational facilities within the local area and the demand for the use of the Flat Rock Baseball Diamond. These investigations explored opportunities to temporarily play games at other baseball diamonds and the relocation of the baseball diamond to an existing area of public open space. These assessments have been supplemented by additional assessments in 2021 as part of this preferred infrastructure report.

Relocation to an existing facility

A desktop review of other baseball facilities identified 26 baseball facilities within a 20 kilometre radius of Flat Rock Baseball Diamond. These are shown on Figure 2-3 and listed in Table 2-4 along with their distance travelling by road (direct route) from Flat Rock Baseball Diamond.

With the geographical divide provided by Sydney Harbour and Middle Harbour, the Flat Rock Baseball Diamond serves one of the largest catchment areas of all baseball diamonds identified within the study area. Feedback from the North Sydney Leagues Senior Baseball Club and North Sydney Bears Junior Baseball Club during consultation prior to the finalisation of the environmental impact statement identified concerns about the potential for some players to be discouraged from playing baseball if they are required to travel further to participate in training or home games. This is most likely to impact on younger players, including use of the facility by North Sydney Boys High School, who are more likely to face barriers in relation to transport access. Whilst players frequently have to travel for away games, given the size of the catchment area, it is anticipated players would

not be willing to travel an additional 10 kilometres by road than they otherwise would in accessing the Flat Rock Baseball Diamond for training and home games.

There are only four baseball diamond facilities within 10 kilometres by road of Flat Rock Baseball Diamond and while these baseball facilities could potentially be used by the North Sydney Leagues Senior Baseball Club, North Sydney Boys High School and the North Sydney Bears Junior Baseball Club for home games or training if Flat Rock Baseball Diamond was unavailable, these facilities accommodate existing baseball clubs as well as other sports such as soccer. The Riverview Baseball Association is a junior club with its home ground located on the grounds of St Ignatius College Riverview. Necessary upgrades to the existing facilities are unlikely to be feasible and may not be compatible with planned uses by the school. Similarly, it would not be possible to upgrade the baseball diamonds within Bicentennial Reserve, without impacting on other users including junior baseball and soccer. Baseball diamonds for senior baseball are available at both North Ryde RSL Club Ground and Magdala Park however both these diamonds already support senior baseball clubs. Therefore, no facilities could cater for the additional demand if the North Sydney Leagues Senior Baseball Club, North Sydney Boys High School and the North Sydney Bears Junior Baseball Club were to be displaced.

Table 2-4 Baseball diamond facilities within a 20 kilometre radius of Flat Rock Baseball Diamond

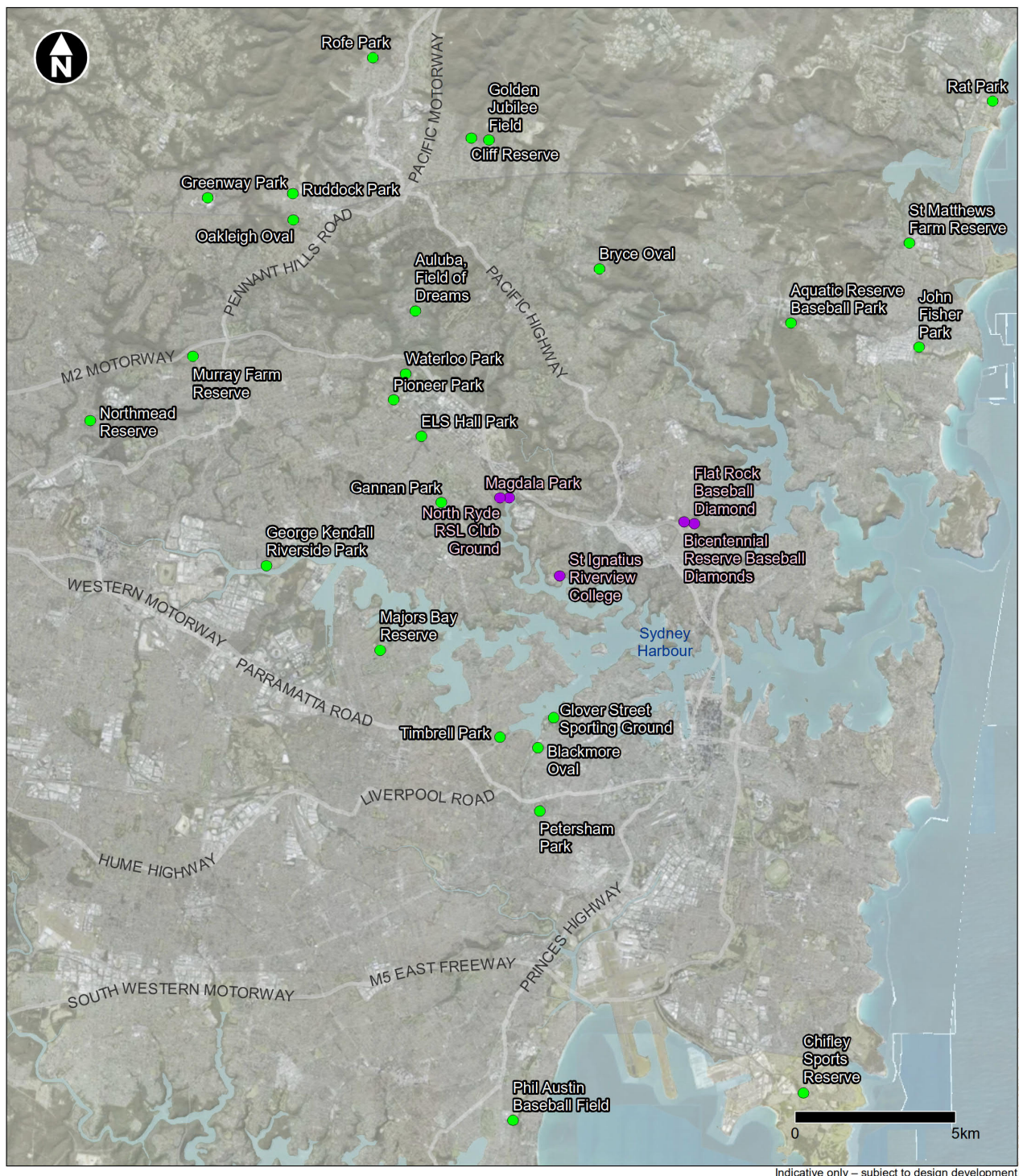
Location	Club	Facilities ⁺	Distance* in kilometres
Bicentennial Reserve Oval, Willoughby	North Sydney Bears Junior Baseball Dragons Baseball Club (Junior)	Four diamonds (overlapping)	-
St Ignatius College Riverview, Lane Cove	Riverview (Junior)	One diamond	6.2
North Ryde RSL Club Ground, North Ryde	North Ryde RSL Baseball Club (Junior and senior)	One diamond	9.0
Magdala Park, North Ryde	North Ryde RSL Baseball Club (Junior and senior)	Four diamonds (two senior and two junior, overlapping)	9.6
Gannan Park, Ryde	Ryde Hawks Baseball Club (14 years and over)	One diamond	10.8
Bryce Oval, St Ives	Dragons Baseball Club (Junior)	Two diamonds	11.3
Aquatic Baseball Complex/Aquatic Reserve	Forest Baseball Club (Junior and senior) Manly Warringah Minor League (14 years old and over) North Shore Baseball Club (Junior and senior)	Five diamonds (four overlapping)	12.5
ELS Hall Park, North Ryde	Ryde Hawks Baseball Club (14 years and over)	Two diamonds (one senior and one junior, overlapping)	12.0
Pioneer Park and Waterloo Park, Marsfield	Macquarie Saints Baseball (Junior and senior)	One diamond (Waterloo Park) Four diamonds (Pioneer Park, overlapping)	12.3

Location	Club	Facilities ⁺	Distance* in kilometres
Blackmore Oval, Leichhardt	West Boomers Baseball Club	One diamond	12.9
Glover Street Sporting Ground, Lilyfield	West Boomers Baseball Club	Three diamonds (one senior and two junior, overlapping)	13.0
Timbrell Park	Five Dock Falcons Baseball Club (Junior and senior)	Three diamonds	13.9
John Fisher Park, North Curl Curl	Manly Seaside Baseball Club (Junior and senior)	Five diamonds	15.0
Petersham Park, Petersham	Petersham-Leichhardt Baseball Club (14 years and over)	One diamond	15.1
Auluba – Field of Dreams, South Turramurra	Kissing Point Baseball Club (Junior and senior)	Two diamonds (overlapping)	15.3
St Matthews Farm	Warringah Baseball Club (up to 18 years old)	Four diamonds	16.7
Cliff Reserve	Ku-Ring-Gai Stealers Baseball & Softball Club (Junior and senior)	Two diamonds (overlapping)	16.4
Golden Jubilee Fields, North Wahroonga	Ku-Ring-Gai Stealers Baseball & Softball Club (Junior and senior)	Two diamonds (overlapping)	16.6
Majors Bay Reserve, Concord	Concord Baseball Club (Junior and senior)	Three diamonds (overlapping)	18.1
George Kendall Riverside Park, Ermington	Tigers Baseball & Softball Club (Junior and senior)	Three diamonds (overlapping)	18.5
Chifley Baseball Fields	Eastern Suburbs Junior Baseball League Inc (Junior and senior)	Two diamonds	19.5
Ruddock Park, Westleigh	Thornleigh Baseball Club (Junior and senior)	Three diamonds (overlapping)	19.9
Oakleigh Oval, Westleigh	Thornleigh Baseball Club (Junior and senior)	Two diamonds	20.1
Murray Farm Reserve	Carlingford Baseball Club (Junior and senior)	Three diamonds (overlapping)	21.2
Rofe Park, Hornsby Heights	Rangers Baseball Club (Junior and senior)	Six diamonds (overlapping)	21.2
Rat Park, Warriewood	Pittwater Baseball Club Inc. (Junior and senior)	Six diamonds (overlapping)	22.4
Greenway Park, Cherrybrook	Greenway Giants (Junior and senior)	Four to eight diamonds (two senior and two junior) (overlapping)	23.9
Phil Austin Fields	Arncliffe Scots Baseball Club (Junior and senior)	Two diamonds	24.7

Location	Club	Facilities ⁺	Distance* in kilometres
	UNSW Baseball & Softball Club (14 years old and over)		
Northmead Reserve	Baulkham Hills Baseball Club (Junior and senior)	Six diamonds (overlapping)	25.4

⁺Based on review of latest aerial imagery (Google Maps, September 2021) and information available from council and/or club websites

*Distance by road calculated using Google Maps



- Legend
- Baseball diamonds within 10 kilometres by road
 - Baseball diamonds within 20 kilometres by road

Figure 2-3 Baseball diamonds within 20 kilometres of Flat Rock Baseball Diamond

Given the lack of viable options for collocating the North Sydney Leagues Senior Baseball Club, North Sydney Boys High School and the North Sydney Bears Junior Baseball Club with another club in the immediate vicinity of the Flat Rock Baseball Diamond, the feasibility of Transport for NSW providing a new baseball diamond facility at an alternate location was explored.

Provision of a new facility

A spatial analysis was carried out to determine the availability of open space of an appropriate size to support a baseball diamond within 10 kilometres of Flat Rock Baseball Diamond to investigate the feasibility of providing an alternative baseball diamond for the duration of construction of the project. Several criteria were considered including the size of the land (12,000 square metres or greater), gradient of the land (ie less than five per cent), extent of vegetation, heritage listings (including local, State, national, Commonwealth and world). With the exception of Cammeray Golf Course and Balgowlah Golf Course, golf courses, reserves, educational facilities, private land and open space along the foreshore were removed from consideration. In addition, to minimise potential travel constraints, areas south of Sydney Harbour were also discounted.

Table 2-5 presents the results of this analysis and considers the viability of the identified sites for an alternate baseball diamond facility.

Figure 2-4 shows the identified sites. A range of factors were used in determining whether an identified public open space was considered to be potentially viable for an alternate baseball diamond facility. Limiting factors included:

- The displacement of sporting groups and/or schools using the existing facilities
- The loss of key community amenities and facilities, eg barbeque and picnic facilities, dog off-leash areas, etc
- Impacts to newly renovated facilities
- Different local government areas with different sporting and recreational demands.

Table 2-5 Potential locations for a new baseball diamond facility

Public open space	Viability as a baseball diamond
Balgowlah Golf Course	Nine-hole configuration golf course which will cease to operate during construction and operation of the project. Further consideration of this location as a potentially viable alternate baseball diamond facility is warranted.
Bicentennial Reserve	Bicentennial Oval (baseball and soccer), 17 district netball courts including four multi-purpose courts also used for basketball, Flat Rock Baseball Diamond, the Willoughby Leisure Centre, former Griffin Incinerator/Incinerator Art Space, shared user paths and car parks and bushland. Further consideration of this location as a potentially viable alternate baseball diamond facility is warranted.
Cammeray Golf Course	Nine-hole configuration golf course which will be reconfigured for the construction and operation of the Western Harbour Tunnel and Beaches Link program of works. Further consideration of this location as a potentially viable alternate baseball diamond facility is warranted.
Tunks Park	The sports fields cater for cricket, football and soccer, as well as for training and school sport and carnivals. Further consideration as a potentially viable alternate baseball diamond facility warranted.
Artarmon Reserve	The reserve currently supports touch football, cricket with one synthetic wicket and four practice nets. The reserve also has changing facilities, a canteen and barbeque facilities.

Public open space	Viability as a baseball diamond
	This public open space is not considered to be viable for an alternate baseball diamond facility.
Bales Park	The park currently supports mini and junior soccer, cricket (two synthetic pitches) and bocce users. This public open space is not considered to be viable for an alternate baseball diamond facility.
Balgowlah Oval	The project has committed to preserving the use of Balgowlah Oval for the community for the duration of construction. This public open space is not considered to be viable for an alternate baseball diamond facility.
Beverly Job Park	Current users include Manly Warringah Football Association and Harbord United Junior Rugby League Football Club. This public open space is not considered to be viable for an alternate baseball diamond facility.
Blenheim Park	City of Ryde currently has plans to upgrade the park including upgraded regional playground, walking and cycling paths, picnic and barbeque facilities, new multi-use courts and skate facility, new fenced dog off-leash area, new radio control car track, fitness equipment, improved parking, recreation areas and other general park improvements. This public open space is not considered to be viable for an alternate baseball diamond facility.
Castle Cove Park	Currently supports two full sized sports fields including a central turf cricket pitch as well as other recreational facilities. This public open space is not considered to be viable for an alternate baseball diamond facility.
Christie Park	Christie Park is a major sporting facility in the City of Ryde featuring a new state-of-the-art facility with new all-weather synthetic sports fields. Reconfiguration as a baseball diamond would displace current users and undo the work of previous upgrades. This public open space is not considered to be viable for an alternate baseball diamond facility.
Dunbar Park	Dunbar Park has an athletics field which is popular for local schools and Little Athletics. This public open space is not considered to be viable for an alternate baseball diamond facility.
East Gordon Park	The park contains a synthetic cricket wicket, soccer fields and playground and is also a popular destination for rock climbers and abseilers. This public open space is not considered to be viable for an alternate baseball diamond facility.
Fontenoy Park	Fontenoy Park features a large soccer field. This public open space is not considered to be viable for an alternate baseball diamond facility.
Frenchs Forest Showground	The showground provides an off-leash dog park, playground and skate park and is adjacent to Lionel Watts Park. The facility also includes bioswales to mitigate stormwater runoff and 21 new Blackbutt trees planted in 2020 as part of the restoration of a remnant section of Duffys Forest endangered ecological community. This public open space is not considered to be viable for an alternate baseball diamond facility.

Public open space	Viability as a baseball diamond
Gannan Park	Gannan Park has a large sports field and car park and picnic shelters. The park is popular with local schools and in summer is well used for cricket, with baseball played in the winter months. The park is currently subject to the Gannan Park and McCauley Park Masterplan to upgrade the parks. This public open space is not considered to be viable for an alternate baseball diamond facility.
Gore Hill Park	Gore Hill Park has a synthetic field for AFL, cricket and summer soccer, half basketball court, handball courts, perimeter walking track, two exercise equipment stations and a playground. This public open space is not considered to be viable for an alternate baseball diamond facility.
Harbord Park	Current users include Manly Warringah Football Association. The park contains a cricket wicket. This public open space is not considered to be viable for an alternate baseball diamond facility.
Keirle Park	Current users include Manly Roos Junior Rugby Club. The park contains two cricket wickets. This public open space is not considered to be viable for an alternate baseball diamond facility.
Killarney Oval	Current users include Manly Warringah Football Association and Harbord United Junior Rugby League Football Club. This public open space is not considered to be viable for an alternate baseball diamond facility.
Koola Park	Koola Park supports cricket with both turf and synthetic wickets and three practice nets and also contains rugby and soccer playing fields. This public open space is not considered to be viable for an alternate baseball diamond facility.
Ku-Ring-Gai Bicentennial Park	Bicentennial Park provides two sportsgrounds – Lofberg Oval and Norman Griffiths Oval complete with three cricket nets, synthetic wicket, soccer/rugby field, four netball courts, fitness equipment and dog off-leash area. This public open space is not considered to be viable for an alternate baseball diamond facility.
Lionel Watts Park	Synthetic sports fields currently cater for a variety of sports including combination of two senior football fields, a separate junior field, senior AFL and two junior AFL fields all permanently marked. The facility also provides four new cricket nets and a centre cricket wicket that is covered during the winter season. The park caters for the many local schools in the area and for other sports such as futsal, Oz-tag and touch football. This public open space is not considered to be viable for an alternate baseball diamond facility.
Loyal Henry Park	This is a multi-purpose sports facility with synthetic wicket and two practice nets for cricket, soccer fields, two tennis courts, playground and barbeque facilities. This public open space is not considered to be viable for an alternate baseball diamond facility.
Melwood Oval	This is a multi-use facility catering for most sports including a combination football/Rugby Union field with permanent line marking for both sports, a dedicated football field, a full size AFL field, senior cricket field, Oz-tag, touch football and many other sports. The facility also provides four new

Public open space	Viability as a baseball diamond
	<p>cricket nets and a centre cricket wicket that is covered during the winter season.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Morrisons Bay Park	<p>This park has an expansive open area for sports including soccer and cricket and recreation as well as a playground and fitness equipment. The park includes six fields and three cricket wickets. Upgrades to the park were carried out in 2020.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Naremburn Park	<p>This park contains two fields used for rugby, soccer, cricket, frisbee, two netball/basketball courts, bocce and a cricket net.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Pottery Green Oval	<p>This oval provides a cricket pitch and soccer facilities.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Princes Park/Primula Oval	<p>This oval provides a cricket pitch with synthetic wicket and soccer facilities.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Santa Rosa Park	<p>Santa Rosa Park has a main sports field used for soccer and two mini soccer fields. It is part of the Shrimpton's Creek parklands, with recently planted natural areas.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Tania Park	<p>Tania Park functions as a suburban park containing large dog exercise areas, sporting facilities and playground.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Tantallon Oval	<p>The oval is used for club cricket in summer and used for rugby union and rugby league during winter.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Tuckwell Park	<p>Tuckwell Park features a soccer field, cricket wicket basketball court and playground and is popular for corporate sport events.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Westminster Park	<p>A popular sports field for schools, used for soccer in the winter and cricket in the summer. The park is subject to the Westminster Park Masterplan.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>
Willoughby Park	<p>The park is used for rugby and cricket with one turf wicket.</p> <p>This public open space is not considered to be viable for an alternate baseball diamond facility.</p>



Legend
 ● Baseball diamond

Figure 2-4 Potential locations for a new baseball diamond

As acknowledged in Section 2.5.1, sportsgrounds in the wider northern Sydney area currently experience high demand and are already over capacity. The availability and access to quality land (that is, large and level areas) for sportsgrounds is becoming rarer as development takes place, reducing the effectiveness and efficiency of resulting facilities and increasing the relative cost to develop and manage the land (NSROC, 2017).

The *Recreation Needs Study* completed by North Sydney Council in 2015 identified that changes in preferences and increased demand for facilities for baseball, softball and other less 'traditional' organised sports was a priority (North Sydney Council, 2015). The opportunity was therefore identified for the establishment of a baseball facility in North Sydney for use by the North Sydney Leagues Senior Baseball Club, North Sydney Bears Junior Baseball Club and North Sydney Boys High School during the five year construction period which may also provide an opportunity to address longer term demand for baseball and softball facilities in the local government area by making the facility a permanent fixture. As outlined in Table 2-5, two locations within North Sydney were identified for further consideration as a potentially viable alternate baseball diamond facility. Table 2-6 considers a temporary facility at Tunks Park or Cammeray Golf Course, a portion of which is used by the project as a temporary construction support site. Both sites would be within the North Sydney local government area rather than the Willoughby local government area however they are in relatively close proximity to the current Flat Rock Baseball Diamond.

Bicentennial Reserve was considered as a potentially viable alternate baseball diamond location due to its proximity to the current Flat Rock Baseball Diamond.

Balgowlah Golf Course has also been considered in Table 2-6 as a potentially viable alternate baseball diamond location as the site is used by the project as part of a temporary construction support site. This site was identified by the Department of Planning, Industry and Environment as a potentially viable alternate baseball diamond location which Transport for NSW have assessed as part of this preferred infrastructure report.

Figures to support further consideration of the abovementioned areas have also been prepared (refer to Figure 2-5 to Figure 2-8). For Tunks Park, Cammeray Golf Course, Bicentennial Reserve and Balgowlah Golf Course this has included overlaying a baseball diamond consistent in size with the current Flat Rock Baseball Diamond to determine any space constraints.

Other sites from Table 2-4 were not considered to be feasible in the first instance due to their distance from Flat Rock Baseball Diamond making them unfavourable as a training ground and home ground for teams based within the Willoughby, Naremburn and Northbridge area. Additionally, the use of these sites including the potential need to upgrade existing facilities to support senior baseball competitions with a pitcher's mound and larger baseball diamond may displace sporting groups and/or schools using the existing facilities or impact on newly renovated facilities provided by councils to support the needs of local communities. Different local government areas have different sporting and recreational demands and provision of key community amenities and facilities, eg barbeque and picnic facilities, dog off-leash areas, etc as required by their local communities.

Table 2-6 Potential site for a replacement baseball diamond facility

Proposed site	Summary of potential social constraints and opportunities
<p>Bicentennial Reserve Oval (see Figure 2-5)</p>	<ul style="list-style-type: none"> • The Bicentennial Reserve Oval is located about 250 metres west of the Flat Rock Baseball Diamond and forms part of the wider Bicentennial Reserve precinct. Other facilities include Hallstrom Park playground, 17 district netball courts, the Willoughby Leisure Centre, former Griffin Incinerator/Incinerator Art Space, shared paths, three car parks and bushland • Bicentennial Reserve comprises 27 land parcels, of which 24 lots are owned by Willoughby City Council. The remaining three lots comprise NSW Government owned land • Bicentennial Oval has four overlapping baseball diamonds, which are currently used by the North Sydney Bears Junior Baseball Club and Dragons Baseball Club for junior baseball. The oval is also used for organised soccer competitions and rugby training. The Bicentennial Reserve Plan of Management (Willoughby City Council, 2021) outlines a range of issues for organised sport at Bicentennial Oval. These include: <ul style="list-style-type: none"> - Sports available for community, including baseball and football, are heavily used - High demand for access to sports grounds - Extended hours for sportsground lighting is an issue for the community - Changing rooms needed at Bicentennial Oval - Growth in sport is expected as population density in the district increases • Opportunities in relation to the use of this site for the development of temporary baseball facilities include: <ul style="list-style-type: none"> - Near to the existing Flat Rock Baseball Diamond facility - Good access to existing off-road car parking areas, which would minimise potential impacts on surrounding streets - Surrounding residents are familiar with this location being used for organised sporting activities, and associated impacts of this • Constraints in relation to the use of this site for the development of temporary baseball facilities include: <ul style="list-style-type: none"> - Displacement of organised sports that currently use the oval such as football as part of the North Suburbs Football Association competition and junior baseball teams. The field has been recently renovated in 2019 including the installation of floodlights, additional users may impact the ability of council to maintain the condition of the grounds - The current size of Flat Rock Baseball Diamond is larger than available cleared land. The baseball diamond to be provided would either have to be reduced in size or vegetation would likely need to be cleared.
<p>Tunks Park (see Figure 2-6)</p>	<ul style="list-style-type: none"> • Tunks Park is located about 1.4 kilometres (2.6 kilometres by road) south east of Flat Rock Baseball Diamond within the North Sydney Council local government area. The park comprises 64 land parcels, including Crown Land, Council owned land, land owned by public authority and privately owned land • The park offers local communities and other users a range of active and passive recreation facilities, including playing fields and open lawn areas. It also provides access to the harbour for water-based recreation activities such as boating and fishing, and foreshore areas for passive recreation • The playing fields cater for organised sporting competitions for clubs and schools (eg rugby union, rugby league, football and cricket) and informal

Proposed site	Summary of potential social constraints and opportunities
	<p>sports. Tunks Park also has a strong level of community use for informal community activities. Key sporting and recreation facilities include:</p> <ul style="list-style-type: none"> - Four synthetic turf wickets and one grass wicket for summer cricket - Three football fields, and five mini fields for soccer, rugby league and rugby union in winter - Ancillary facilities such as exercise equipment, change rooms, picnic and barbeque facilities, canteen, toilets, and parking for 65 cars and 29 boat trailers - Children's playground - Boat ramp and associated boat storage and fishing facilities (North Sydney Council, 2019) <ul style="list-style-type: none"> • The <i>Tunks Park Plan of Management</i> (North Sydney Council, 2019) identifies existing issues with traffic congestion and the availability of car parking to cater for users of the sports fields during times of high demand on Saturday morning • Key community issues for Tunks Park identified through consultation on the <i>Tunks Park Plan of Management</i> (North Sydney Council, 2019) included: <ul style="list-style-type: none"> - The park is used by a variety of people and accommodates a range of uses including sport, dog walking, recreational use by families and fishing - Noise from boat and trailer users is an issue for surrounding residents, as is the availability of parking for sports ground users during peak times on weekends - Conflicting parking needs of passive recreational users and boating users and use of the carpark by sporting users and general park - The need for traffic and parking solutions to manage high volumes of traffic, narrow road access and limited parking spaces, all of which cause tension during peak times of access to and from the park • Opportunities in relation to the use of this site for the development of temporary baseball facilities include: <ul style="list-style-type: none"> - It is relatively close to the existing Flat Rock Baseball Diamond facility and is likely to be accessible by most club members - A baseball diamond would align with the recreational needs of communities in the North Sydney local government area • Constraints in relation to the use of this site for the development of temporary baseball facilities include: <ul style="list-style-type: none"> - The playing fields are currently subject to high demand and development for temporary baseball facilities would displace or conflict with organised sports that currently use Tunks Park including rugby, soccer and cricket - Traffic and parking congestion are currently issues for park users and surrounding residents, and increased sporting use has potential to further exacerbate these issues - The playing fields are not currently lit and providing like for like lighting consistent with that already provided at the Flat Rock Baseball Diamond would cause a new impact to those stakeholders that overlook the valley - The current size of Flat Rock Baseball Diamond is larger than available cleared land. The baseball diamond to be provided would either have to be reduced in size or vegetation would likely need to be cleared.

Proposed site	Summary of potential social constraints and opportunities
<p>Cammeray Golf Course (see Figure 2-7)</p>	<ul style="list-style-type: none"> • Cammeray Golf Course is located about 1.9 kilometres (about 2.7 kilometres by road) south east of the Flat Rock Baseball Diamond • Part of the golf course is proposed to be used as a temporary construction support site for the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects. A commitment of the project is to maintain a nine-hole golf course during the construction phase of both projects • Opportunities in relation to the use of the site for the development of temporary baseball facilities include: <ul style="list-style-type: none"> - It is relatively close to the existing Flat Rock Baseball Diamond facility and is likely to be accessible by most club members - A baseball diamond would align with the recreational needs of communities in the North Sydney local government area • Constraints in relation to the use of this site for the development of temporary baseball facilities include: <ul style="list-style-type: none"> - A reduced ability to also maintain a nine-hole golf course during construction or avoid impacting other recreational uses if baseball facilities were also provided at this site. Additionally, the site is leased as a golf course until 2026 - Establishment of the baseball diamond is likely to require removal of additional established trees within the golf course, which are likely to be a concern for some community members and may further impact the visual and landscape amenity of the surrounding area - The golf course is not currently lit and providing like for like lighting consistent with that already provided at the Flat Rock Baseball Diamond would cause a new impact to those stakeholders that overlook the course - Due to the topography of the site, significant earthworks would likely be required to accommodate a baseball diamond - Including a baseball diamond within the golf course is inconsistent with the requirements of Condition E101 of the Western Harbour Tunnel and Warringah Freeway Upgrade project approval
<p>Balgowlah Golf Course (see Figure 2-8)</p>	<ul style="list-style-type: none"> • Balgowlah Golf Course is located about 5.3 kilometres (about 9.1 kilometres by road) north east of the Flat Rock Baseball Diamond • The golf course is proposed to be used as a temporary construction support site for the Beaches Link and Gore Hill Freeway Connection project. The golf course would cease to operate, although a commitment of the project is for the progressive development of new and improved open space and recreation facilities, in consultation with Northern Beaches Council and the community. The project has also committed that Balgowlah Oval would continue to operate until such time the proposed new open space is constructed and ready for use • Balgowlah Oval provides a sports field, including cricket pitch and synthetic practice wickets and accommodates games by various cricket clubs • Opportunities in relation to the use of the site for the development of temporary baseball facilities include: <ul style="list-style-type: none"> - It is unlikely to require the displacement of existing sporting facilities, assuming the baseball facilities could be located within areas outside of Balgowlah Oval • Constraints in relation to the use of this site for the development of temporary baseball facilities include:

Proposed site	Summary of potential social constraints and opportunities
	<ul style="list-style-type: none"> - The commitment to maintain Balgowlah Oval during construction would limit the amount of available land that could potentially be used for a baseball facility. Establishment of the baseball facility on the oval would displace existing organised sporting uses of this facility - Establishment of the baseball facilities would require reconfiguration of the Balgowlah golf course site which would take roughly two and a half years to complete, as outlined in Table 6-26 of the environmental impact statement. This would not be completed prior to impacts on the Flat Rock Baseball Diamond. As outlined in Section 2.5.1, there are no alternate facilities that the North Sydney Leagues Senior Baseball Club, North Sydney Boys High School and the North Sydney Bears Junior Baseball Club could train or play home games at. This would therefore lead to a period of roughly two and a half years during which these groups would be unable to operate - Due to the topography of the site, significant earthworks would likely be required to accommodate a baseball diamond - Additional travel requirements for club members may discourage some members from playing baseball if they are required to travel further to participate in training and home games, possibly resulting in some players giving up playing baseball altogether. These impacts are most likely to affect younger players such as teenagers who are more likely to experience barriers to travel and who are generally more reliant on public transport, walking, cycling or car sharing with others for their transport needs - While the <i>Northern Beaches Council Sportsground Strategy</i> (Northern Beaches Council, 2017a) identified the need to improve the capacity and resilience of existing softball facilities, the need for additional baseball diamond facilities was not identified in the <i>Northern Beaches Council Sportsground Strategy 2017</i> (Northern Beaches Council, 2017a) and may not meet the recreational needs of communities in the Northern Beaches Council - Transport for NSW has committed to a separate dedicated consultation process jointly led with Northern Beaches Council to give the community an opportunity to provide input to the final layout of the new and improved open space and recreation facilities at Balgowlah. Allocating a portion of these new and improved open space and recreation facilities for a baseball diamond, which has not been determined in consultation with Northern Beaches Council and the community, would undermine the dedicated consultation process.



Figure 2-5 Potential location for a baseball diamond at Bicentennial Reserve



Legend


 Baseball diamond

Figure 2-6 Potential location for a baseball diamond at Tunks Park



Legend



-  Construction site boundary
-  Baseball diamond

Figure 2-7 Potential location for a baseball diamond at Cammeray Golf Course



Note: The staging is indicative only and is subject to the dedicated consultation process to be carried out with the community, jointly led by Transport for NSW and Northern Beaches Council

Figure 2-8 Indicative staging at Balgowlah Golf Course for construction and delivery of new and improved open space and recreation facilities including potential location for a baseball diamond

2.5.3 Relocation options analysis

The information and analysis presented in sections 2.5.1 and 2.5.2 confirms there are no opportunities to collocate the users of Flat Rock Baseball Diamond with other clubs in the area and that there are no suitable locations for the provision of an alternate baseball diamond facility. These conclusions support the feedback received from the North Sydney Leagues Senior Baseball Club and the North Sydney Bears Junior Baseball Club in 2018.

Acknowledging that utilising Option A for the Flat Rock Drive construction support site (BL2) for the project would have a detrimental impact on baseball across the lower north shore, Transport for NSW has undertaken a comparative analysis for utilising Option A or Option B to consider other potential environmental impacts.

2.6 Comparative analysis

As outlined in Section 2.2, for tunnelling in the area between Naremburn and Middle Harbour, two tunnelling sites would be the preferred strategy for tunnelling logistics. However, due to the highly urbanised nature of the suburbs between Willoughby/Naremburn/Northbridge and Middle Harbour, and the depth of the tunnel through this area, limited viable intermediate tunnelling sites were considered to be suitable for the project and only one tunnelling site has been proposed. Of all the potential sites considered only two sites were considered to be feasible, Flat Rock Baseball Diamond (Option A) and Flat Rock Reserve (Option B). This section provides a comparative assessment of these two proposed options to support the site selection process.

The location of Option A would be within Bicentennial Reserve and located on the Flat Rock Baseball Diamond. The site would be made up by the temporary lease of multiple lots (3/DP522788, 1/DP524253, 1/DP334861, 1/DP81035, 113/DP129029, 7/DP666241) from Willoughby City Council. A new signalised intersection would provide access to the site from Flat Rock Drive. The location of Option A is presented in Figure 2-9 and a cross section of the site in relation to the surrounding residential area in Figure 2-10. Residential properties along Garland Road overlooking the Option A site will have direct and unconstrained views into the site as demonstrated in Figure 2-11.

The location of Flat Rock Drive construction support site (BL2) (Option B) as presented within the environmental impact statement would be within Flat Rock Reserve and made up by the temporary lease of multiple lots (22/3/DP977176, 1/DP399, 7/DP666241, C/DP360612, 1/DP963964, 1/DP81035) from Willoughby City Council. A new signalised intersection would provide access to the site from Flat Rock Drive. The location of Option B is presented in Figure 2-12 and a cross section of the site in relation to the surrounding residential area in Figure 2-13. Residential properties along Calbina Road overlooking the Option B site will have direct views into site as demonstrated in Figure 2-14 however these views will largely be screened by vegetation retained around the site perimeter.

Table 2-7 provides a comparison between the two shortlisted options to support tunnel construction from Flat Rock Drive, Option A and Option B. For each of the assessed categories, a risk rating (low, medium, high) is provided to allow for the comparison of each category between the two options. The mitigation measures specific to Flat Rock Drive construction support site (BL2) which will be implemented to address these risks are outlined in sections 2.7.2 and 2.7.3.

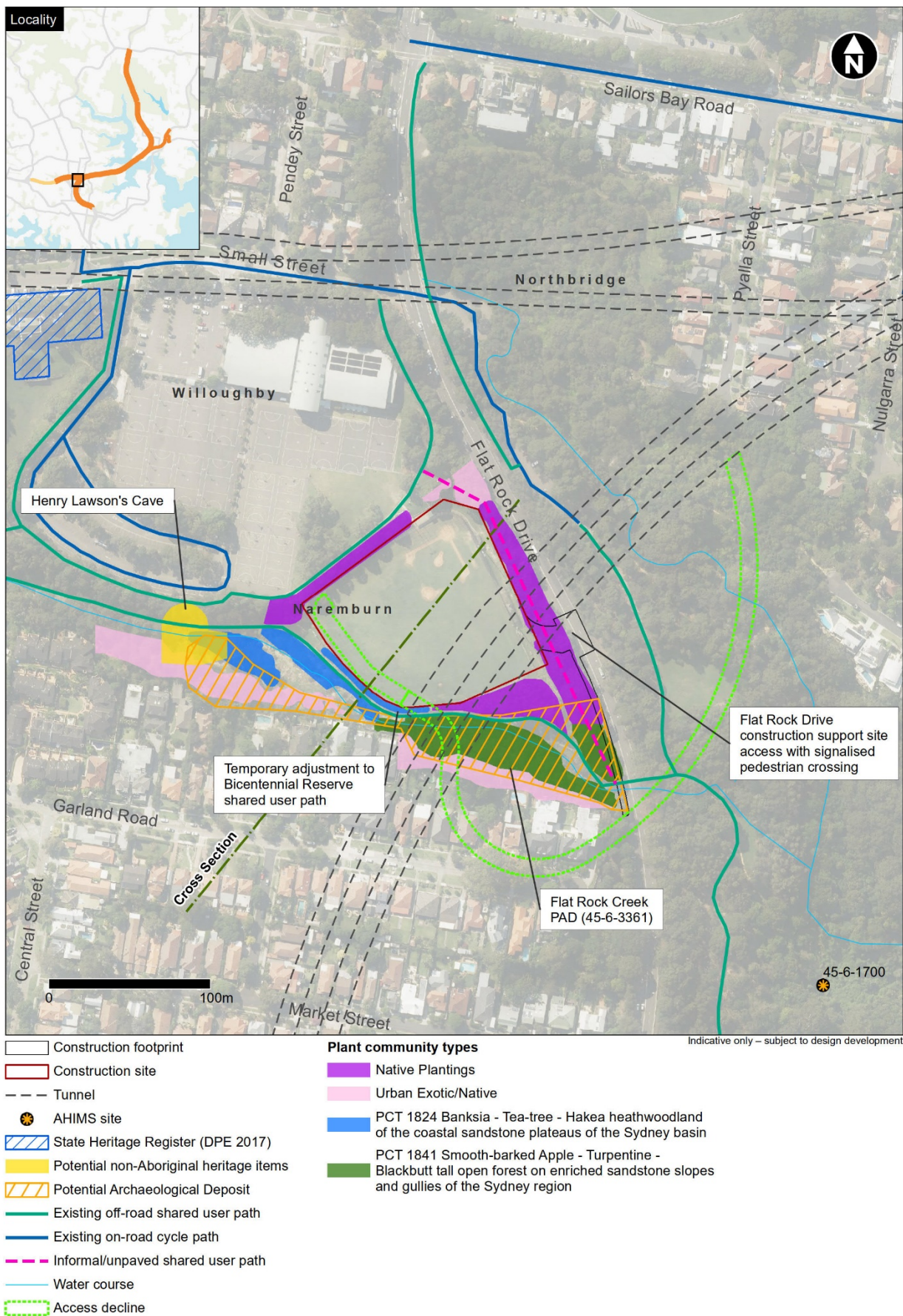


Figure 2-9 Location and environmental constraints for Option A Flat Rock Baseball Diamond

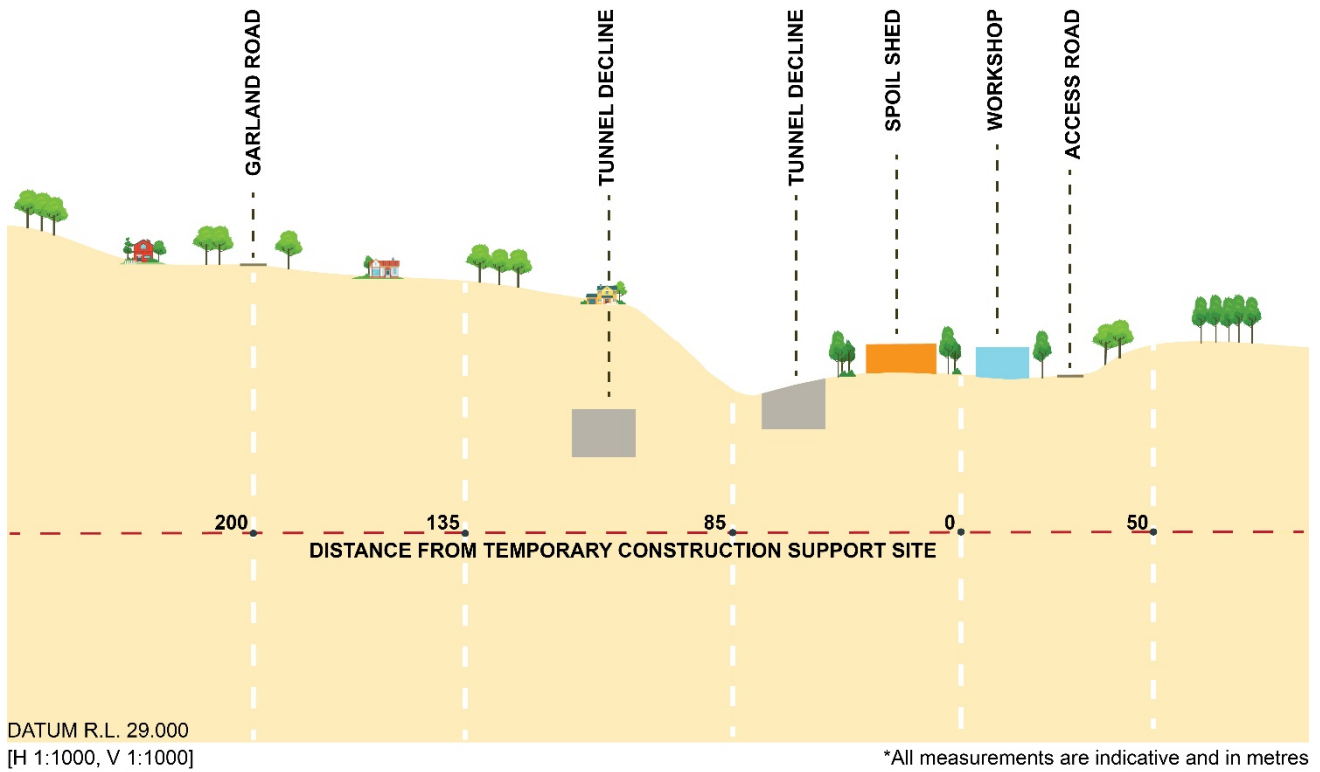


Figure 2-10 Cross section of Option A Flat Rock Baseball Diamond



Figure 2-11 Garland Road residential properties overlooking Option A Flat Rock Baseball Diamond



Legend

- Construction footprint
 - Construction site
 - Tunnel
 - AHIMS site
 - Potential non-Aboriginal heritage items
 - Potential Archaeological Deposit
 - Flat Rock Reserve shared user path detour
 - Existing off-road shared user path
 - Existing on-road cycle path
 - Water course
 - Access decline
- Plant community types**
- PCT 1841 Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
- Other vegetation**
- Native Revegetation

Figure 2-12 Location and environmental constraints for Option B Flat Rock Reserve

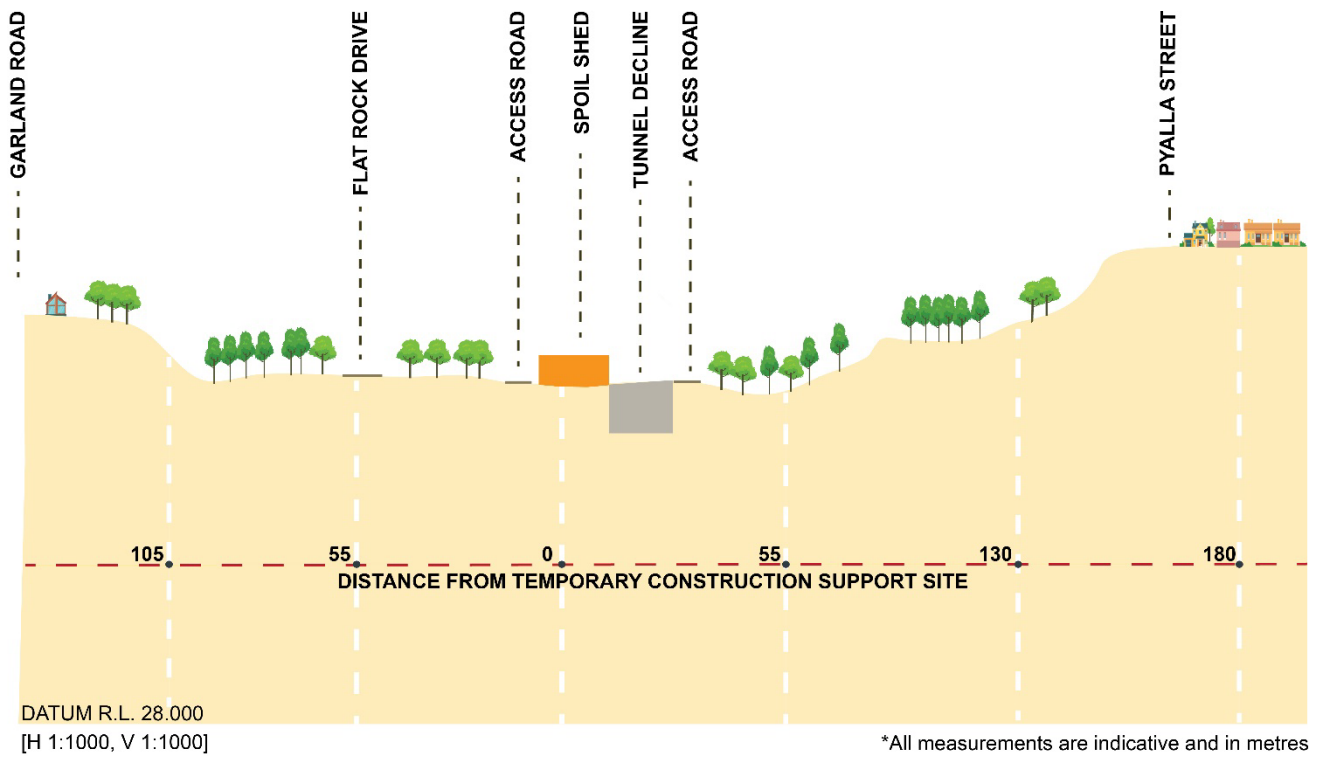


Figure 2-13 Cross section of Option B Flat Rock Reserve



Figure 2-14 View from Calbina Road residential properties overlooking Option B Flat Rock Reserve

Table 2-7 Site comparison

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
<p>Traffic and transport</p>	<p>Access to Warringah Freeway via Flat Rock Drive and Brook Street from the site. Small Street would not be used. Impacts due to construction traffic:</p> <ul style="list-style-type: none"> • Warringah Freeway/Brook Street interchange would worsen from LoS B to LoS C during the AM peak. • Brook Street/Merrenburn Avenue would worsen from LoS C to LoS D during the PM peak. • A new signalised intersection would also be provided for access to the site and would operate at LoS A during construction. <p>Car parking areas for construction workers would be provided at the site.</p> <p>Spoil generation would be greater than Option B due to a longer tunnel access decline with an extra 525 truck movements required for spoil haulage during the construction program.</p> <p>Public transport</p> <p>Negligible increase in bus travel times along Flat Rock Drive and Brook Street due to the use of traffic signals for access to the site.</p> <p>Active transport</p> <p>The temporary adjustment of the Bicentennial Reserve shared user path running parallel to Flat Rock Creek would be required during establishment of the site.</p> <p>The shared pedestrian and cyclist pathway linking Bicentennial Reserve to Artarmon Reserve and Flat Rock Gully would remain open and would not be directly impacted during construction.</p> <p>The temporary adjustment of an informal shared user path (parallel to Flat Rock Drive, on the eastern side of the temporary construction support site) would be required to accommodate the site.</p>	<p>Low</p>	<p>Access to Warringah Freeway via Flat Rock Drive and Brook Street from the site. Small Street would not be used. Impacts due to construction traffic:</p> <ul style="list-style-type: none"> • Warringah Freeway/Brook Street interchange would worsen from LoS B to LoS C during the AM peak. • Brook Street/Merrenburn Avenue would worsen from LoS C to LoS D during the PM peak. • A new signalised intersection would also be provided for access to the site and would operate at LoS A during construction. <p>Car parking areas for construction workers would be provided at the site.</p> <p>The site would include the reconfiguration of an existing carpark at Flat Rock Reserve used by the community.</p> <p>Public transport</p> <p>Negligible increase in bus travel times along Flat Rock Drive and Brook Street due to the use of traffic signals for access to the site.</p> <p>Active transport</p> <p>The temporary adjustment of the Flat Rock Reserve shared user path (parallel to Flat Rock Drive, on the western side of the temporary construction support site) would be required to accommodate the site. This shared user path would be reinstated post completion of construction during the rehabilitation of the site.</p> <p>Other shared user paths within Flat Rock Reserve would remain unchanged for community use during construction.</p>	<p>Low</p>

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	Traffic and transport impacts would continue for 3-4 months longer at Option A than Option B due to the longer tunnel access decline which also joins the mainline tunnels further from Middle Harbour meaning it will take longer to meet this excavation endpoint.			
Noise and vibration	<p>The closest residential receiver is about 18 metres to the south along Garland Road.</p> <p>Airborne noise</p> <p>During early works, site establishment including utility works and night time intersection modification works:</p> <ul style="list-style-type: none"> Up to 147 residential receiver buildings are predicted to be noise affected (ie greater than noise management level) during standard construction hours which is slightly fewer receivers than Option B No receivers are expected to be highly noise affected (ie greater than 75 dB(A)) Receivers are predicted to potentially be exposed to maximum noise levels above the sleep disturbance screening level during works outside standard construction hours. Of those, five receivers could potentially receive noise levels that result in awakening reactions. One commercial building, one childcare receiver and two active recreation receiver areas are predicted to be noise affected by work at the site. <p>During the longer term tunnel support and tunnel fit-out works noise impacts would be less:</p> <ul style="list-style-type: none"> Up to 31 noise affected receiver buildings during standard construction hours Up to three residential receivers on Garland Road, Naremburn, could be marginally noise affected outside standard construction hours Up to 95 receivers are predicted to potentially be exposed to maximum noise levels above the sleep disturbance screening level (predicted noise 	Medium	<p>The closest residential receiver is about 40 metres to the west along Garland Road. There are also residential receivers overlooking the site about 65 metres to the east along Calbina Road.</p> <p>Airborne noise</p> <p>During early works and site establishment (utility modification, vegetation clearing, access decline excavation and short term road modification works of Flat Rock Drive about six months):</p> <ul style="list-style-type: none"> Up to 174 residential receiver buildings) are predicted to experience noise levels greater than the relevant noise management level during standard construction hours. Three residential receiver buildings are predicted to experience noise levels greater than 75 dB(A) Residential receiver buildings are predicted to exceed noise management levels during works outside standard construction hours. The majority of the exceedances (88 per cent) would be less than 15 dB(A). A greater number of receivers would be impacted than Option A as the extent of works along Flat Rock Drive is longer Maximum noise levels at night could exceed the sleep disturbance screening level at receiver buildings across several NCAs One commercial building, two childcare receivers and five recreation receivers are predicted to be noise affected by work at the site. <p>During the longer term tunnelling and tunnel fit-out noise impacts would be less:</p>	Medium

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<p>levels up to LAmax 66 dB(A)) due to concrete deliveries. One receiver is predicted to be exposed to maximum noise levels above the awakening reaction level.</p> <p>Traffic noise</p> <ul style="list-style-type: none"> Night time heavy vehicle movements to and from this site would be limited to one vehicle per hour (no more than five trucks in total). The predicted noise levels from construction vehicles travelling on Flat Rock Drive and Brook Street would be insignificant and the number of maximum noise events that could disturb sleep are not likely to substantially increase. As spoil generation would be greater than Option B, additional heavy vehicle movements would be required to transport about an additional 200,000 cubic metres of spoil which result in an additional four heavy vehicle movements per day over the construction program. <p>Vibration</p> <ul style="list-style-type: none"> One building within Noise Catchment Area (NCA) 37.1 (Naremburn) has been identified within the minimum working distance for cosmetic damage (sound structures). One heritage item in NCA 37.1 (Flat Rock Creek PAD (45-6-3361)) is predicted to be within the minimum working distances for cosmetic damage (unsound structures). Up to 18 properties may be exposed to vibration levels above the human response screening level (ie residents may feel vibration) from rock hammering during early works and site establishment works. <p>Noise and vibration impacts would continue for 3-4 months longer at Option A than Option B due to the longer tunnel access decline which also joins the</p>		<ul style="list-style-type: none"> Up to 65 noise affected receiver buildings during standard construction hours with no receivers expected to be highly noise affected (ie >75 dB(A)) No residential receivers are predicted to be noise affected, during out of hours works Up to 143 receiver buildings are predicted to potentially be exposed to maximum noise levels above the sleep disturbance screening level (predicted noise levels up to LAmax 65 dB(A)) due to concrete deliveries or delivery trucks; however, no receiver is predicted to be exposed to maximum noise levels above the awakening reaction level. <p>Traffic noise</p> <ul style="list-style-type: none"> Night time heavy vehicle movements to and from this site would be limited to one vehicle per hour (no more than five trucks in total). The predicted noise levels from construction vehicles travelling on Flat Rock Drive and Brook Street would be insignificant and the number of maximum noise events that could disturb sleep are not likely to substantially increase. <p>Vibration</p> <ul style="list-style-type: none"> Two buildings within NCAs 36.1 (Willoughby) and 37.1 (Naremburn) west of Flat Rock Drive have been identified within the minimum working distance for cosmetic damage (sound structures) One heritage item in NCA 37.1 (Flat Rock Creek PAD (45-6-3361)) is predicted to be within the minimum working distances for cosmetic damage (unsound structures) Up to 11 properties may be exposed to vibration levels above the human response screening level (ie residents may feel vibration) from rock hammering during early works and site establishment works which is less than those effected by Option A. 	

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	mainline tunnels further from Middle Harbour meaning it will take longer to meet this excavation endpoint.			
Air quality and human health	<ul style="list-style-type: none"> • Odour generated during handling and management of material excavated which may include putrescible waste materials and the release of landfill gases from the former landfill site. • Medium risk of dust settlement, human health and ecological impacts as a result of demolition, earthworks, construction and track-out activities. • The site would be nearby to recreational facilities including netball courts and Willoughby Leisure Centre. • Flat Rock Baseball Diamond potentially contains contaminated soils and other hazardous substances, which may be disturbed during construction. Potential air quality impacts during construction are unlikely to result in any health related impacts however there would be heightened community sensitivity to potential air quality impacts due to the proximity to the nearby recreational facilities including netball courts and Willoughby Leisure Centre. • A lack of space or access to sporting facilities is expected to lead to increasing numbers of participants being turned away from sport, resulting in increased levels of physical inactivity and associated health and disease impacts, and reducing benefits brought about by participation in sport and physical activity (eg health and wellbeing, social connections). • Air quality and human health impacts would continue for 3-4 months longer at Option A than Option B due to the longer tunnel access decline which also joins the mainline tunnels further from Middle Harbour meaning it will take longer to meet this excavation endpoint. 	Medium	<ul style="list-style-type: none"> • Odour generated during handling and management of material excavated from the former landfill site. However, works are unlikely to encounter substantial amounts of putrescible waste. • Medium risk of dust settlement, human health and ecological impacts as a result of demolition, earthworks, construction and track-out activities. • Flat Rock Reserve potentially contains contaminated soils and other hazardous substances, which may be disturbed during construction. Potential air quality impacts during construction are unlikely to result in any health related impacts. • Feedback as part of the response to submissions on the environmental impact statement indicated concern about risks of contaminated leachate, landfill gas and odour impacts to health of receivers and construction workers from works at the site. Contamination risks are expected to be less than those at Option A. • The construction site footprint would occupy roughly five per cent of the Flat Rock Reserve facilitating ongoing use of the rest of the reserve by the community for active and passive recreation. 	Low

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
Heritage	<p>Aboriginal</p> <ul style="list-style-type: none"> Flat Rock Creek PAD (45-6-3361), within 50 metres of surface works and above the alignment of the mainline tunnels at the site, no impact expected from the mainline tunnel excavation. The tunnel access decline is extremely shallow beneath the Flat Rock Creek PAD (45-6-3361). Further investigations required to determine the extent of potential impacts. <p>Non-Aboriginal</p> <ul style="list-style-type: none"> Henry Lawson’s Cave is about 50 metres to the west of the site. However, it is considered to be a sufficient distance outside the construction footprint and beyond the influence of indirect impacts related to vibration and settlement. 	Low	<p>Aboriginal</p> <ul style="list-style-type: none"> Flat Rock Creek PAD (45-6-3361), within 50 metres of surface works and above the alignment of the mainline tunnels at the site, no impact expected from either the mainline tunnel excavation or tunnel access decline excavation. <p>Non-Aboriginal</p> <ul style="list-style-type: none"> Henry Lawson’s Cave is located on the western side of Flat Rock Drive within Bicentennial Reserve and would be in the vicinity of low impact work and impact to these items from settlement and vibration would be negligible. 	Low
Contamination	<ul style="list-style-type: none"> Requires excavation of the tunnel access decline through former landfill sites, including industrial, domestic and putrescible waste beneath the Flat Rock Baseball Diamond and primarily demolition waste beneath Flat Rock Reserve. Historical landfill activities carried out within the areas surrounding the Willoughby Leisure Centre and Bicentennial Reserve Baseball Diamond are likely to result in contaminated soil, groundwater and gas within the buried waste mass. Hallstrom refrigerator factory is a potential contamination risk. The factory was located about 550 metres west of the site. High potential contamination risk associated with known contamination which would be encountered during excavation activities for the temporary construction support site and tunnel access decline. The waste mass beneath the site and the adjacent Willoughby Leisure Centre may present 	High	<ul style="list-style-type: none"> Requires excavation of the tunnel access decline through former landfill site however this decline is unlikely to encounter substantial amounts of putrescible waste, with the majority of waste expected to be demolition waste. Flat Rock Reserve is within an area of disturbed ground (artificial fill). Soils/wastes and groundwater beneath this site may be contaminated with a variety of contaminant compounds. Hallstrom refrigerator factory is a potential contamination risk. The factory was located about 650 metres west of the site. At Flat Rock Creek there is a known history of dumping industrial and domestic waste in both whole and incinerated form. Interpretation of historical records indicate that up to 40 metres of fill have been placed along Flat Rock Creek while the landscaped area on the east side of Flat Rock Drive is situated on about 30 metres of fill. Moderate potential contamination risk associated with the possible presence of contamination 	Medium

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<p>a source of landfill gas. There is the potential for landfill gas to migrate both vertically and laterally.</p> <ul style="list-style-type: none"> At Flat Rock Creek there is a known history of dumping industrial and domestic waste in both whole and incinerated form. Interpretation of historical records indicate that up to 40 metres of fill have been placed along Flat Rock Creek. 		<p>beneath the site and known groundwater contamination in adjoining areas (Willoughby Leisure Centre and Bicentennial Reserve). Feedback as part of the response to submissions on the environmental impact statement indicated concern about contamination risks that may impact nearby recreational areas including Bicentennial Reserve. Contamination risks are expected to less than those at Option A.</p> <ul style="list-style-type: none"> It is possible that the waste mass beneath the site may present a source of landfill gas but risk is lower than Option A. 	
Water quality and flooding	<p>Water quality</p> <ul style="list-style-type: none"> Flat Rock Creek is wholly within a box culvert about 30 metres below the site. There is a constructed surface creek directly above the site connecting to the Flat Rock Creek outlet about 180 metres southeast of the site. The constructed surface creek adjacent to the site and Flat Rock Creek downstream may be impacted by earthworks if not appropriately managed but is of a lower risk than Option B. Stockpiles within 500 metres of a waterway (Flat Rock Creek). Discharge of construction wastewater from the treatment plant into Flat Rock Creek downstream. <p>Flooding</p> <ul style="list-style-type: none"> Some facilities including the site offices would be subject to depths of 0.2 metres in the 1% AEP event, but are not located within the extent of events more frequent than and including the 5% AEP event. Potential displacement of water by bunding of ramps to prevent floodwater ingress, as well as the presence of temporary buildings/hoardings, 	Medium	<p>Water quality</p> <ul style="list-style-type: none"> Flat Rock Creek is located wholly within a box culvert about 30 metres below the site. A constructed surface creek alongside the eastern side of the site flows into Flat Rock Creek downstream. The constructed surface creek adjacent to the site and Flat Rock Creek downstream may be impacted by earthworks if not appropriately managed. Stockpiles within 500 metres of a waterway (Flat Rock Creek). The removal of riparian vegetation and instream habitat has the potential to impact bank stability and surface water quality if environmental management measures are not implemented along the existing aboveground watercourse within the northern extent of Flat Rock Reserve. Environmental management measures will be appropriately implemented, therefore impacts would be unlikely. Discharge of construction wastewater from the treatment plant into Flat Rock Creek downstream. 	Medium

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<p>stockpiles and other structures would be unlikely to impact any nearby properties.</p> <p>Water quality and flooding impacts would continue for 3-4 months longer at Option A than Option B due to the longer tunnel access decline which also joins the mainline tunnels further from Middle Harbour meaning it will take longer to meet this excavation endpoint.</p>		<p>Flooding</p> <ul style="list-style-type: none"> • Would be subject to flooding during storms more frequent than 10% AEP. • Depths of flow would be greater than 0.5 metres in a 10% AEP flood event. • Construction activities within the site would not have an impact on flood behaviour in existing development. However, changes in natural surface levels within the confines of the site have the potential to alter flooding patterns in the area. 	
<p>Biodiversity</p>	<p>Flat Rock Baseball Diamond is surrounded by native and exotic vegetation and bushland associated with Flat Rock Creek, however the majority of the site is cleared and landscaped with grass.</p> <p>Vegetation within the construction footprint would be cleared, vegetation communities include:</p> <ul style="list-style-type: none"> • Native plantings representative of the Sydney Turpentine Ironbark Forest threatened ecological community occur on both sides of Flat Rock Drive. These native plantings are not considered to be listed as part of the threatened ecological community. <p>Threatened species:</p> <ul style="list-style-type: none"> • Powerful Owls were recorded in bushland at Hallstrom Park and in bushland adjacent to Option B. <p>Urban and landscape areas provide habitat for highly mobile species which are capable of using small, isolated patches of habitat within disturbed urban environments.</p> <p>The tunnel access decline is extremely shallow beneath the riparian vegetation along Flat Rock Creek. Further investigations required to determine the extent of potential impacts.</p>	<p>Low</p>	<p>Vegetation within the construction footprint would be cleared, vegetation communities include:</p> <ul style="list-style-type: none"> • Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region (PCT 1841). Option B would impact about 6% of PCT 1841 within Flat Rock Gully. • Native revegetation of Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region (PCT 1841) planted since 1998. <p>Threatened species:</p> <ul style="list-style-type: none"> • Magenta Lilly Pilly (Endangered (Biodiversity Conservation Act 2016) and Vulnerable (Environment Protection and Biodiversity Conservation Act 1999)): two planted individuals were also recorded about 18 metres to the east of the construction footprint at Flat Rock Reserve. • Powerful Owls were recorded in bushland at Hallstrom Park and in bushland adjacent to Option B. • Large Bent-winged Bat recorded in bushland near the site. • Little Bent-winged Bat recorded in bushland near the site. 	<p>High</p>

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
			<p>Vegetated areas within and near the site provide fauna habitat resources for a range of mammals, birds, reptiles and bats including potential sheltering and foraging habitat for the Large-eared Pied Bat, Brown Antechinus, Bush Rat, Red-crowned Toadlet, Rosenberg's Goanna and Gully Skink.</p> <p>The existing aboveground watercourse within Flat Rock Reserve would be diverted for around 100 metres through a newly constructed culvert at the north eastern perimeter of the site. Aquatic habitat impacts associated with these drainage works are anticipated to be minor.</p> <p>Opportunities to avoid or minimise impacts have been considered. Of the area of regenerated bushland that was planted since 1998 by Willoughby City Council and bush care volunteers as shown in Figure 2-15, 33 per cent of the regenerated bushland would be impacted by the construction site footprint. The site has avoided impacting the remnant vegetation and the southern part of the site also includes a large area of cleared, maintained exotic grassland, a carpark and shared user paths equating to about 27 per cent of the site area.</p>	
<p>Land use and property</p>	<ul style="list-style-type: none"> • About 14,350 m² of Willoughby City Council land would be temporarily occupied for the construction support site. • The Flat Rock Baseball Diamond is a world competition standard ground. • Leased areas include land zoned RE1 Public Recreation. • The entirety of the Flat Rock Baseball Diamond would be occupied and the use of the site for sporting and recreational activities would be precluded. • No direct private property impacts. 	<p>High</p>	<ul style="list-style-type: none"> • About 11,760 m² of Willoughby City Council land would be temporarily occupied for the construction support site. • Leased areas includes land zoned E2 Environmental Conservation. • Only about five per cent of Flat Rock Reserve would be occupied by the construction site resulting in a negligible impact on the continued use of the wider Flat Rock Reserve area and Flat Rock Gully area for public open space and recreational use. • No direct private property impacts. 	<p>Medium</p>

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<ul style="list-style-type: none"> No impact on sporting and recreational activities carried out at the adjoining Willoughby Leisure Centre and netball courts. The baseball diamond would be rehabilitated at the completion of construction however land use and property impacts would continue for 3-4 months longer at Option A than Option B due to the longer tunnel access decline which also joins the mainline tunnels further from Middle Harbour meaning it will take longer to meet this excavation endpoint. 		<ul style="list-style-type: none"> No impact on sporting and recreational activities carried out at the nearby Bicentennial Reserve and Willoughby Leisure Centre. After construction the impacted section of the reserve would be rehabilitated in line with the land use zoning and in consultation with Willoughby City Council and the community. 	
Community and social	<ul style="list-style-type: none"> The Flat Rock Baseball Diamond would be temporarily leased for use. Subsequently, the baseball diamond would be closed to the public. Use of the Flat Rock Baseball Diamond would result in the loss of an international competition standard baseball facility for a period of about 64 months which has been assessed as a moderate impact. Feedback as part of the response to submissions on the environmental impact statement indicated concern that the biodiversity of Flat Rock Reserve should not be sacrificed which cannot be easily replaced, relocated or recreated unlike nearby playing fields. Submissions on the environmental impact statement considered that there is time to relocate facilities prior to construction. Clubs who use the Flat Rock Baseball Diamond would have no alternate baseball facilities to use and this could lead to many giving players joining other clubs or giving up the sport. While there are several baseball facilities nearby, these are currently used by existing baseball clubs and in some instances, other sports. Concerns were identified by North Sydney Leagues Senior Baseball Club and North Sydney Bears Junior Baseball Club in consultation for the 	High	<ul style="list-style-type: none"> Avoids direct and results in reduced indirect impacts to the local operational recreation facilities of Willoughby Recreation Centre, netball courts, the baseball diamond and other recreation spaces on the western side of Flat Rock Drive, which are in high demand for local community use. Use of Flat Rock Reserve would impact on facilities used for community and recreational activities and passive recreation, including walking, running and cycling tracks, areas used for environment-related pursuits such as bird watching, bush care and picnicking. As the construction site facilities equate to only about five per cent of Flat Rock Reserve however, these activities could continue in other areas of the reserve throughout the duration of construction. Feedback as part of the response to submissions on the environmental impact statement indicated that the Flat Rock Reserve is highly used by local communities. Temporary walking, running and cycling tracks would be provided during construction to maintain access for users of these facilities, although noise and dust from construction activities and subsequent amenity impacts may deter people from using these facilities. 	High

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<p>project that there is potential that some members would be discouraged from playing baseball if they are required to travel further to participate in games, possibly resulting in some players giving up playing baseball altogether.</p> <ul style="list-style-type: none"> Impacts associated with requirements to travel further are most likely to affect younger players such as teenagers who are more likely to experience barriers to travel and who are generally more reliant on public transport, walking, cycling or car sharing with others for their transport needs. Multiple residential properties are located on higher ground immediately south of the temporary construction support site (about 18 metres from the construction worksite boundary). Adverse impacts on amenity would result for residents of these dwellings due to noise, dust and potential light spill from construction activities within the temporary construction support site (refer to Figure 2-10). Noise and light-spill from evening and night-time use of the temporary construction support site also has potential to cause sleep disruptions for some residents. Sleep disturbance over extended periods have potential to impact on the health and wellbeing of affected residents. The temporary construction support site would be located next to netball courts, the closest of which would be about 25-30 metres from the boundary of the temporary construction support site, with 16 courts located within 200 metres of the site. The netball courts are used for competitions organised by the Northern Suburbs Netball Association with regular competitions held on weekday evenings and Saturday. Noise and dust from construction activities within the temporary construction support site have 		<ul style="list-style-type: none"> The construction site footprint would impact around 33 per cent of the area of regenerated bushland that was planted since 1998 by Willoughby City Council and bush care volunteers. Bush care volunteers are likely to feel a sense of loss relating to their efforts to regenerate this area. The loss of the bushland is also likely to impact on the sense of connection and sense of place that the volunteers have to this location. Public access to areas of the reserve outside of the temporary construction support site would be maintained during construction. The existing shared user path running north to south through the site would be temporarily realigned along the western perimeter of the temporary construction support site adjacent to Flat Rock Drive. Pedestrian pathways would be maintained with two minor temporary diversions required. There are two plaques within the vicinity of the site; a memorial plaque, which is located within the construction footprint but outside of the Flat Rock Drive construction support site (BL2) footprint and Wilksch Walk plaque is located outside the construction footprint and temporary support site footprint. Both plaques are commemorating members of the community who contributed to the revegetation of the bushland at Flat Rock Reserve. There would be no impact to the Wilksch Walk plaque due to construction. Regarding the memorial plaque Transport for NSW are investigating opportunities to avoid impacts such that it does not need relocating. However, Transport for NSW have also advised Willoughby City Council of the plaque and are in the process of contacting the associated family to determine whether they would like to temporarily or permanently relocate the memorial, 	

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<p>potential to impact on the amenity for users of the netball courts. The potential for construction dust and/or odour to adversely impact on the health and wellbeing of people participating in netball competitions is likely to be a concern for some community members. Community concerns about potential noise, dust and odour impacts on netball players and other recreational users were previously raised in consultation for the proposal.</p> <ul style="list-style-type: none"> • The temporary construction support site would impact on the amenity of the Bicentennial Reserve for informal and passive recreational users (eg people walking, riding or playing non-organised sports) and may impact on the use and enjoyment of the reserve for these users. • Temporary closure of the shared path running parallel to Flat Rock Creek during site establishment. • Potential risks to human health from construction dust are expected to be appropriately managed with the implementation of dust management measures, although community perceptions about potential health impacts are likely to be ongoing. • Prolonged temporary minor landscape and visual impacts for residential receivers at Nareburn and Willoughby due to demolition and vegetation clearing works at the Channel 9 site and establishment of the site. • Community and social impacts would continue for 3-4 months longer at Option A than Option B due to the longer tunnel access decline which also joins the mainline tunnels further from Middle Harbour meaning it will take longer to meet this excavation endpoint. 		<p>notwithstanding an intention to protect it within the construction footprint (refer to Section A5.1.9 of the submissions report).</p> <ul style="list-style-type: none"> • The amenity of other areas outside of the site would be diminished during construction and may detract from the enjoyment of people visiting accessible parts of the parks or nearby facilities. • Feedback as part of the response to submissions on the environmental impact statement indicated concern about indirect impacts to the immediate area surrounding Flat Rock Reserve such as the baseball diamond, netball courts and Willoughby Leisure Centre. Option B is further from these community facilities than Option A, noting also Option A directly impacts the baseball diamond. • The significance of potential impacts on Flat Rock Reserve during construction are assessed as moderate, with the sensitivity of the park and magnitude of the impact considered moderate. • Several residential properties are located on higher ground about 40 metres immediately east of the boundary of the temporary construction support site (refer to Figure 2-12 and Figure 2-14) • Adverse impacts on amenity would result for residents of these dwellings due to noise, dust and potential light spill from construction activities within the temporary construction support site noting however retained vegetation around the site perimeter will provide some screening. • Noise from evening and night-time use of the temporary construction support site also has potential to cause sleep disruptions for some residents. Sleep disturbance over extended periods have potential to impact on the health and wellbeing of affected residents. • Noise, dust and construction traffic would diminish the amenity of these areas potentially detracting 	

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
			<p>from the enjoyment of people visiting the reserve or nearby facilities.</p> <ul style="list-style-type: none"> • Clearing of trees would be required for establishment of the temporary construction support site. The loss of these trees would temporarily impact on the landscape and visual amenity of the reserve until new trees or landscaping becomes established or other recreation facilities are established. The site makes use of a mown area of exotic grass, existing carpark and shared user paths equating to about 27 per cent of the total site area. • Prolonged temporary minor landscape and visual impacts for residential receivers at Naremburn and Willoughby due to demolition and vegetation clearing works at the Channel 9 site and establishment of the site. 	
Visual	<ul style="list-style-type: none"> • The baseball diamond is overlooked by the netball courts to the north and residential receivers to the south. • The baseball diamond is generally open, although local views out from the field are blocked by surrounding vegetation and elevated topography to the south. Dense tree planting along the boundary with Flat Rock Drive currently screens views of this road corridor. • Moderate to high construction impacts due to the increase in the amount of built form visible within the baseball field, which would be inaccessible during construction. • Multiple residential properties are located on higher ground about 18 metres south of the temporary construction support site. Adverse impacts on visual amenity would result for residents of these dwellings due to amount of built form visible within the site (refer to Figure 2-10). 	High	<ul style="list-style-type: none"> • Land is currently a car park and bushland rehabilitation area within Flat Rock Reserve associated with a historic landfill site. • High visual impacts are anticipated on the Flat Rock Reserve open space as a result of vegetation removal, the introduction of new built form and the diversion of existing walking and cycling trails. • The loss of trees would temporarily impact on the landscape and visual amenity of the reserve until new trees or landscaping or other recreation facilities becomes established. The clearing of trees in the reserve is also likely to be a concern for the local community. • Increase in light emission that would result in some temporary impacts to surrounding receivers. • Several residential properties are located on higher ground about 40 metres east of the boundary of the temporary construction support site. Adverse impacts on visual amenity would result for residents of these dwellings due to the amount of 	High

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<ul style="list-style-type: none"> • Increase in light emission that would result in some impacts to surrounding receivers, including moderate night time impacts for receivers within residential properties on Garland Road. • No lasting visual impacts are expected post construction as the site would be returned to its existing condition. • Visual impacts would continue for 3-4 months longer at Option A than Option B due to the longer tunnel access decline which also joins the mainline tunnels further from Middle Harbour meaning it will take longer to meet this excavation endpoint. 		<ul style="list-style-type: none"> • built form visible within the site (refer to Figure 2-13). • Feedback as part of the response to submissions on the environmental impact statement indicated concern that the amenity of nearby residents would be impacted. However, existing vegetation would be retained surrounding the site, where possible, and would provide visual screening along the eastern side of Flat Rock Drive (between the road and the site). Construction site hoarding would be installed and be sympathetic to the surrounding bushland environment to minimise the visual impact. • Whilst rehabilitation of the site would take longer than Option A, no lasting visual impacts are expected post construction as the site would be returned to its existing condition as outlined in Section 2.7. 	
Constructability and engineering	<ul style="list-style-type: none"> • Site is an adequate size with reasonable access • A mostly level site allows access to tunnel at location efficient for construction, construction of a tunnel access decline and the ability to tunnel in three different directions if required, reducing the impact of not having an intermediate tunnelling site in Northbridge further north towards Middle Harbour. • Spoil generation would be about 945,780 m³ of sandstone requiring additional heavy vehicle movements in comparison to Option B (929,880m³). • Due to the vertical and horizontal alignment of the Gore Hill Freeway ramp tunnels and mainline tunnels from Cammeray, topography of the area, the need to avoid the underground Flat Rock Creek box culvert and optimum layout of Option A, a significantly longer tunnel access decline would be required for Option A comparable with 	Medium	<ul style="list-style-type: none"> • Site is an adequate size with reasonable access. • The sloped site requires some levelling works but allows access to tunnel at a location efficient for construction, construction of a tunnel access decline and the ability to tunnel in three different directions if required, reducing the impact of not having an intermediate tunnelling sites in Northbridge further north towards Middle Harbour. • Spoil generation would be about 929,880 m³ of sandstone requiring less heavy vehicle movements in comparison to Option A (945,780m³). • The tunnel access decline is depicted in Figure 6-31 of the environmental impact statement. • The tunnel access decline would be much deeper at 70 metres beneath residential properties on Pyalla Street reducing potential ground borne noise and vibration impacts compared with the relatively shallow decline for Option A. 	Low

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<p>Option B. From the construction support site Option A, the tunnel access decline would sweep south as far as Garland Road before sweeping northbound as far east as the Calbina Road cul-de-sac, to connect in with the mainline tunnel from Cammeray as shown in Figure 2-9.</p> <ul style="list-style-type: none"> The tunnel access decline would be 25 metres beneath residential properties on Garland Road. The tunnel access decline for Option A is ~495 metres (30 metres of open trough and 465 metres of tunnel below ground), compared to a 230 metre tunnel access decline for Option B. The Option A tunnel access decline joins the mainline tunnel from Cammeray, creating a 3050 metre excavation drive from Option A to Middle Harbour. Excavation of the tunnel access decline will take roughly 1 month per 100 metres (5 months) and as excavation of the mainline tunnel commences further from Middle Harbour, an additional 3-4 months would be added to the tunnel construction activity program outlined in Table 6-12 of the environmental impact statement, with associated flow on program implications for the tunnel fitout, testing, commissioning and site rehabilitation activities. The longer tunnel access decline proposed for Option A would interact with both the landfill area beneath the Flat Rock Baseball Diamond and the landfill area beneath the Flat Rock Reserve. 		<ul style="list-style-type: none"> The decline for Option B is 230 metres (35 metres of open trough and 195 metres of tunnel below ground, compared to a 495 metre decline for Option A. The Option B decline joins the Gore Hill Freeway ramp tunnel which then connects to the mainline tunnel, creating a shorter, more efficient and preferred 2730 metre excavation drive from Option B to Middle Harbour. Excavation of the decline tunnel will take roughly 1 month per 100m (~2.5 months) and as excavation of the mainline tunnel to Middle Harbour commence closer to Middle Harbour, the construction program for excavation of the tunnels would be generally in accordance with Table 6-12 of the environmental impact statement. 	
Cumulative impact	<ul style="list-style-type: none"> There is an approved development application for alterations and additions to the existing pool hall of Willoughby Leisure Centre. These works would be adjacent to the site and are likely to cause cumulative impacts for the community. There is the potential for additional and prolonged temporary increase in construction noise from construction works. 	Medium	<ul style="list-style-type: none"> There is an approved development application for alterations and additions to the existing pool hall of Willoughby Leisure Centre. These works would be adjacent to the site and likely to cause cumulative impacts for the community. There is also potential impact to public parking availability at the Flat Rock Reserve car park. The Willoughby Leisure Centre pool area upgrade proposes construction 	Low

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<ul style="list-style-type: none"> Additional amenity impacts would be experienced by residential receivers and users of recreational facilities due to concurrent construction at Flat Rock Baseball Diamond and Willoughby Leisure Centre. Willoughby Leisure Centre pool area upgrades would require temporary use of a netball court as part of construction which would result in a greater cumulative impact to sporting clubs with Option A compared to Option B. Cumulative impacts would continue for 3-4 months longer at Option A than Option B due to the longer tunnel access decline which also joins the mainline tunnels further from Middle Harbour meaning it will take longer to meet this excavation endpoint. 		<p>worker parking to be located at the Flat Rock Reserve car park.</p>	
Cost and program	<ul style="list-style-type: none"> Cost and program for site establishment would be similar to Option B As excavation of the mainline tunnel commences further from Middle Harbour and the tunnel access decline is longer, an additional 3-4 months would be added to the indicative tunnel construction activity program outlined in Table 6-12 of the environmental impact statement, with associated flow on program implications for the tunnel fitout, testing, commissioning and site rehabilitation activities. As stated in Section 2.4.2 above, excavation of the mainline tunnel from Flat Rock Drive to Middle Harbour is on the critical path for the project. Noting the longer construction program associated with Option A comparable with Option B, there would be cost and program implications for utilising this option as the site would be operating for longer during the construction phase. 	Medium	<ul style="list-style-type: none"> Cost and program for site establishment would be similar to Option A. Cost and program during construction phase would be generally in accordance with the indicative program provided at Table 6-12 of the environmental impact statement Costs for Option B during construction phase would be lower than Option A. 	Low

Category	Option A (Flat Rock Baseball Diamond)	Risk	Option B (Flat Rock Reserve)	Risk
	<ul style="list-style-type: none"> The longer tunnel access decline would increase the total number of heavy vehicles required to remove spoil from the site by 525 during the construction program, with associated haulage costs. As Option A requires excavation of the tunnel access decline through former landfill sites, including industrial, domestic and putrescible waste beneath the Flat Rock Baseball Diamond and primarily demolition waste beneath Flat Rock Reserve, there would be associated costs to dispose of the increased volume of contaminated material/spoil. 			



Figure 2-15 Aerial of the area revegetated since 1998 by Willoughby City Council and the community, with proposed project footprint

2.7 Conclusion

Both Option A and Option B would have impacts on the community. However, the use of Option B as a temporary construction support site would impact on community and recreational activities and bushland management whereas Option A would remove the use of Flat Rock Baseball Diamond for a period of about 64 months. Relocation of the users would not be feasible due to the limited availability of sporting facilities within the area and the current levels of demand. Option A would be in closer proximity than Option B to other recreational users of Willoughby Leisure Centre and Bicentennial Reserve. Additionally, Option A would be located in closer proximity to existing contamination being located directly on top of the landfill site.

Although Option B would involve the removal of vegetation regenerated by the community since 1998, a considered effort has been made to reduce impacts to vegetation in this location locating and minimising the site to take advantage of the existing carpark and cleared maintained exotic grass areas. Future regeneration of the site would be carried out in consultation with the community as required by new environmental management measures LP8 (refer to Appendix C of this preferred infrastructure report) and tailored management measures would be implemented to further mitigate and offset social impacts as outlined in Section 2.7.2.

A direct comparison between the feedback received between 26 July and 1 December 2018 and the number of submissions received during the exhibition of the environmental impact statement is not possible as the same options, being Option A or Option B were not presented to the community for consideration in the environmental impact statement. It is not possible to determine the level of opposition which would have been generated or how many submissions the project would have received if Option A was presented as the Flat Rock Drive construction support site (BL2) in the environmental impact statement.

Given the assessment undertaken during the design development in 2018 and additional assessment documented in this preferred infrastructure report in response to community and stakeholder feedback, Option B continues to be the preferred option for the Flat Rock Drive construction support site (BL2) for the following reasons:

- Reduced impact to the community as there would be no impact to organised sporting facilities within Bicentennial Reserve and community and recreational activities at Flat Rock Reserve will still be feasible throughout construction of the project
- A greater distance between the site and the sporting facilities at Bicentennial Reserve including Willoughby Leisure Centre indoor facilities, netball courts or car park reducing amenity impacts to and community enjoyment of these facilities
- Reduced risk of contamination impacts at Option B. There would also be a lower human health risk associated with exposure of the potential release of landfill gases at Option B compared to Option A
- A faster construction program at Option B due to a shorter tunnel access decline and commencement of excavation of the mainline tunnels much closer to Middle Harbour than Option A
- Shorter traffic and transport impacts, noise and vibration impacts, air quality and human health impacts, water quality and flooding impacts, land use and property impacts, community and social impacts, visual impacts and cumulative impacts due to the faster construction program at Option B
- Fewer heavy vehicle movements due to shorter tunnel access decline and less spoil generation

- Option B would require less land to be temporarily leased from Willoughby City Council

2.7.1 Ongoing engagement

Ongoing engagement as part of the project would be carried out in accordance with Appendix E (Community consultation framework) which has been prepared to guide the planning and delivery of communication and stakeholder engagement activities across the project. Further engagement would occur with the community regarding traffic management including property access and pedestrian access, landscaping and urban design matters, construction activities including out of hours works and noise and vibration mitigation and management.

In consultation with Willoughby City Council (refer to sections B12.5.3, B12.17.2 and B12.20.3 of the submissions report) a new environmental management measure LP8 has also been developed (refer to Appendix C of this preferred infrastructure report) to further describe consultation which would be carried out with Council for the rehabilitation of the Flat Rock Drive construction support site (BL2).

2.7.2 Offsetting social impacts

As discussed in Section 2.6, the establishment Flat Rock Drive construction support site (BL2) would impact on regenerated bushland planted by Willoughby City Council and bush care volunteers. Bush care volunteers are likely to feel a sense of loss relating to their efforts to regenerate this area. The loss of the bushland is also likely to impact on the sense of connection and sense of place that the volunteers have to this location. A number of environmental management measures discussed in Table 2-8 have been proposed or revised in acknowledgement of this loss and would be implemented to offset the loss of bushland and maximise the social and environmental value of the Flat Rock Reserve. These have been summarised below:

- The area required and layout of Flat Rock Drive construction support site (BL2) will be refined during further design development and construction planning to minimise clearing of native vegetation and avoid direct impacts on PCT 1841, where feasible and reasonable, as required by environmental management measures B1 and B6 (refer to Appendix C of this preferred infrastructure report)
- Flat Rock Drive construction support site (BL2) will be rehabilitated in line with the land use zoning. Transport for NSW will consult with Willoughby City Council and the community (including with bush care volunteers) to determine the vegetation and landscaping which will be used for rehabilitation, eg selection of plant species and the final alignment of walking tracks (as required by new environmental management measure LP8, refer to Appendix C of this preferred infrastructure report). These rehabilitation measures will be implemented as soon as practicable at the completion of construction, including investigating opportunities to progressively rehabilitate the temporary construction support site. Consultation with the community will allow for those previously invested in the rehabilitation of Flat Rock Reserve to maintain their connection to the site and participate in its future rehabilitation maintaining their sense of connection to the place
- Mature amenity trees (other than trees offset under the NSW Biodiversity Offsets Scheme, established under Part 6 of the *Biodiversity Conservation Act 2016*) removed during the establishment of Flat Rock Drive construction support site (BL2) will be replaced by the project at a 2:1 ratio (as required by revised environmental management measure V13 refer to Appendix C of this preferred infrastructure report) which would support the future enjoyment of the area by the community
- The project has committed to the reuse of vegetation waste that may be cleared by the project for habitat enhancement and rehabilitation work. However, bush care groups and Willoughby

City Council will be consulted on whether there is any interest in the reuse of suitable timber and root balls not used by the project (as required revised environmental management measure WM8 refer to Appendix C of this preferred infrastructure report). This would support the ongoing activities of community groups within areas surrounding the project

- Transport for NSW will provide funding to Willoughby City Council for the ongoing maintenance of the rehabilitated Flat Rock Drive construction support site (BL2) until the area is established, 10 years post the completion of construction
- Transport for NSW will develop a Flat Rock Drive Social Value Strategy within one year of commencement of construction at the Flat Rock Drive construction support site (BL2) (in accordance with new environmental management measure SE6 in Appendix C of this preferred infrastructure report). The strategy will be developed in consultation with Willoughby City Council and relevant community groups and include initiatives which enhance the social and environmental value of the Flat Rock Reserve. These initiatives, which will be implemented during construction and for three years post the completion of construction, will seek to:
 - a) Enhance the Flat Rock Reserve, including in the areas of access, amenity and facilities, eg increasing vegetation bordering the Flat Rock Drive construction support site (BL2) to provide further screening and accelerate its rehabilitation
 - b) Support existing Council and community outcomes, initiatives and programs, eg contribute to the implementation of the Flat Rock Reserve Action Plan, salvage and translocate plants for reuse by Council and community groups, and implement a seed collection program for reuse by the project, Council and community groups
 - c) Partner with educational facilities and other stakeholders in research, eg the climate resilience of landscape communities, new software which tracks the performance of rehabilitation and performance of rehabilitation as fauna habitat.

2.7.3 Environmental management measures

The assessment in Section 2.6 has determined that impacts associated with Flat Rock Drive construction support site (BL2) are consistent with impacts described in the environmental impact statement and would therefore be managed through the implementation of the environmental management measures described in Appendix C of this preferred infrastructure report. A construction environmental management plan would be prepared for the project in accordance with *QA Specification G36: Environmental Protection* (Transport for NSW, 2020) prior to construction of the project and would provide the overarching framework for construction environmental management and the implementation of environmental management measures. Environmental management measures specific to Flat Rock Drive construction support site (BL2) have been outlined in Table 2-8.

Table 2-8 Environmental management measures specific to Flat Rock Drive construction support site (BL2)

Ref	Phase	Impact	Environmental management measure
AQ2	Pre-construction and construction	Odour	Further site investigations will be carried out during the detailed design and construction planning phase to determine the potential to encounter odorous gases or materials during the proposed excavations at the Flat Rock Drive construction support site (BL2). If the investigations indicate that there is potential for odorous materials to be uncovered or odorous gases to be released, the potential for off-site impacts (informed by meteorological studies and modelling as required) will be investigated. If unacceptable off-site impacts are predicted, appropriate mitigation and management measures will be identified to minimise potential impacts, with consideration of the investigation results, proposed site activities and meteorological conditions, and the identified measures will be implemented during relevant site activities. Odour monitoring will be carried out during relevant site activities and mitigation and management measures adjusted as required to minimise potential off-site impacts.
AQ4	Construction	Odour	Any areas of exposed material at the Flat Rock Drive construction support site (BL2) that have the potential to generate odour will be kept to a minimum during site establishment works and while the area is uncovered. If odorous areas are to remain uncovered at the end of the work shift, temporary cover or other suitable measures to minimise odour emissions will be implemented.

Ref	Phase	Impact	Environmental management measure
SG8	Pre-construction and construction	Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material	<p>Potentially contaminated areas directly affected by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the <i>Contaminated Land Management Act 1997 2008</i>.</p> <p>This includes, but is not limited to, further investigations in potential areas of environmental interest in the project footprint, including:</p> <p>Warringah Freeway (from North Sydney to Cammeray)</p> <ol style="list-style-type: none"> Punch Street, Artarmon Willoughby Leisure Centre and Bicentennial Reserve, Willoughby Flat Rock Reserve, Northbridge Spit West Reserve, Mosman Balgowlah Golf Course, Balgowlah Wakehurst Parkway (from Seaforth to Frenchs Forest). <p>Subject to the outcomes of the investigations, a Remediation Action Plan will be implemented in the event that site remediation is warranted.</p> <p>The Remediation Action Plan will be prepared in accordance with <i>Managing Land Contamination: Planning Guidelines SEPP 55 - Remediation of Land</i> (Department of Urban Affairs and Planning and Environment Protection Authority, 1998). If Remediation Action Plan(s) are required for works at Flat Rock Drive (BL2), Balgowlah Golf Course (BL10) construction support sites and surface works and construction support site locations along the Wakehurst Parkway (BL12, BL13 and BL14) these will be developed with consideration of environmental management measure WM9 WM6.</p> <p>An independent NSW EPA Accredited Site Auditor will be engaged where contamination is complex to review applicable contamination reports and evaluate the suitability of sites for a specified use as part of the project.</p>
SG15	Construction	Ground gas impacts	<p>Ground gas investigations will be carried out in Flat Rock Reserve to further assess the potential presence of landfill generated gas which could impact on the construction and/or operation of the project.</p> <p>Ground gas investigations will be carried out in accordance (where applicable) with the <i>Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases Assessment and management of hazardous ground gases: Contaminated land guidelines</i> (NSW EPA, 2012 2020). If ground gas risks are established, appropriate design and/or management measures will be developed and implemented to remove or reduce the associated risk.</p>

Ref	Phase	Impact	Environmental management measure
WQ13	Construction	Watercourse geomorphology	During construction, the drainage and adjustment works associated with Burnt Bridge Creek and an existing aboveground constructed open channel drainage line within Flat Rock Reserve will be staged to ensure creek flows and velocities are not substantially changed and to avoid downstream erosion and bed and bank stability impacts.
B1	Design	Removal of native vegetation and threatened species habitat	The area required and layout of Flat Rock Drive construction support site (BL2) will be refined during further design development and construction planning to avoid direct impacts on PCT 1841, where feasible and reasonable.
BL6	Pre-construction	Removal of native vegetation and threatened species habitat	Vegetation removal including the clearing of native vegetation and fauna habitat will be further minimised during further design development and construction planning to the extent reasonably practicable , where feasible and reasonable.
LP8	Design	Vegetation/ landscaping	Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community. The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.
SE6	Construction	Social value	Transport for NSW will develop a Flat Rock Drive Social Value Strategy within one year of commencement of construction at the Flat Rock Drive construction support site (BL2). The strategy will be developed in consultation with Willoughby City Council and relevant community groups and include initiatives which enhance the social value of the Flat Rock Reserve. These initiatives, which will be implemented during construction and for three years post the completion of construction, will seek to: <ol style="list-style-type: none"> a) Enhance the Flat Rock Reserve, including in the areas of access, amenity and facilities b) Support existing community outcomes, initiatives and programs c) Partner with educational facilities and other stakeholders in research.

Ref	Phase	Impact	Environmental management measure
V13	Construction	Vegetation/ landscaping	Where mature amenity trees (other than trees offset under the NSW Biodiversity Offsets Scheme, established under Part 6 of the Biodiversity Conservation Act 2016) are removed as a result of the establishment of construction support sites, they will be replaced at a ratio equal to or greater than 1 of 2:1 . The replacement trees will consist of local native provenance species from the vegetation community that once occurred in the locality (rather than plant exotic or non-local native trees) where available and subject to the urban design and landscape plan. Where replacement trees cannot be accommodated within the operational footprint of the project, consultation will be carried out with the adjacent government land owners and the relevant local council (where appropriate) to determine if they can accommodate the replacement tree(s).
WM8	Construction	Reuse of vegetation waste	Where reasonable and feasible, salvaged logs from the clearing process will be reused on site and/or reused as part of the fauna connectivity structures with consideration of the <i>Guide 5: Re-use of woody debris and bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> . Prior to clearing, local community restoration/rehabilitation groups, Landcare groups, relevant councils and National Parks and Wildlife Service will be consulted with to determine if there is an interest in the reuse of suitable timber and root balls not used by the project for habitat enhancement and rehabilitation work. If there is an interest, Transport for NSW will facilitate collection of native trees (greater than 25-30 centimetres in diameter and three metres in length) and root balls where reasonable and feasible.
WM9	Construction	Waste disposal	Further investigations will be carried out at the Flat Rock Drive (BL2), Balgowlah Golf Course (BL10) construction support sites and surface works and construction support site locations along the Wakehurst Parkway (BL12, BL13 and BL14) to determine the feasibility of encapsulation of contaminated materials on site. Where contaminated soils and other materials are to be encapsulated on-site, encapsulation will be designed in accordance with the requirements detailed in the <i>Guidelines for the Assessment of On-site Containment of Contaminated Soil (ANZECC, 1999)</i> .
CI2	Pre-construction	Construction fatigue	Multi-party engagement and cooperation will be established prior to construction to coordinate with the following projects to manage construction fatigue impacts where possible: <ul style="list-style-type: none"> a) Western Harbour Tunnel and Warringah Freeway Upgrade b) Sydney Metro City & Southwest c) Channel 9 site staged residential redevelopment- d) Willoughby Leisure Centre pool area upgrades.