



Technical Paper 3

Visual impact assessment



LINDFIELD SUBSTATION

VISUAL IMPACT ASSESSMENT



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LINDFIELD SUBSTATION

VISUAL IMPACT ASSESSMENT

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Executive Summary

A new traction power substation is required to allow for an increase in the capacity along the North Shore Line for additional train services to be run during peak times and to support the delivery of the North West Rail Link. Therefore, a new substation is proposed to be constructed at Lindfield to supply the North Shore Line (the proposal). The proposal also includes ancillary electrical works generally between Killara Station and the Clanville Road overbridge in Lindfield.

The proposal has three main elements in terms of visual changes:

- the construction of the substation and associated works (including access, car parking, stormwater, landscaping and a retaining wall)
- realignment of the existing 33 kilovolt (kV) and 11 kV overhead wiring (OHW), to a new combined services route (CSR), generally between power pole 57 (to the south of Lindfield Station and power pole 49 (to the north of the Clanville Road overbridge) near the intersection with Russell Avenue, Lindfield
- installation of an aerial earth wire to the top of the existing power poles generally between Russell Avenue, Lindfield and Killara Station.

In general, the visual impact of the second element would be that the current OHW which are aboveground would be moved to ground level, which would be seen only from passing trains) or be underground. Therefore there would overall be a beneficial visual impact.

For the installation of the aerial earth wires, a single wire would be added to the top of existing power poles that already have wires in place, and therefore there would be a negligible visual impact.

The main visual changes, and potential for visual impact, relate to the works associated with the substation, and that is therefore the main subject of this report. The report provides a visual impact assessment of the substation, and the other associated elements, both during the construction and operation phases, focussing on two main types of visual impact:

- effect on visual amenity
- effect on key viewpoints.

Visual amenity

The substation site's visual amenity reflects its location as part of an urban railway corridor. The vacant and generally untended nature of the site means that the site itself and railway corridor have a low visual amenity, however, the surrounding residential area of Lindfield, and the general area affected by the other proposal elements beside the substation, exhibit an attractive and moderate visual amenity comparable with other nearby suburbs in the northern parts of Sydney.

Visibility

The current visibility of the substation site is relatively limited when considered that it is within an urban setting, with views towards the site limited due to intervening buildings, vegetation and the configuration of the landform.

The main residential views to the substation site are from those houses on the opposite side of Lindfield Avenue, the residential flat building (RFB) on the western side of the railway corridor and the RFB on the opposite side of Strickland Avenue. Some views are also possible from the houses on the upper parts of Strickland Avenue near where it meets Lindfield Avenue, with views reducing further south-east along Strickland Avenue where it falls away. Public views are possible from Lindfield Avenue, Strickland Avenue, the railway overbridge and from within the railway corridor.

Proposed substation design

The architectural design of the substation building is intended to limit the impact of the building in the residential neighbourhood, to reduce its perceived scale and to provide a landscaped edge treatment between the building and the adjoining street. The landform/contours of the substation site have been used to reduce the overall height of the building by locating the tallest elements to the south, where they sit below natural ground level.

The proposed substation building would be architecturally designed and generally be constructed from concrete panels, with a metal clad roof and would be rectangular in shape. The exterior of the building would be designed to minimise visual intrusion to the surrounding area. The final building materials and finishes for the proposed substation building would be determined during the detailed design phase of the proposal.

As part of the construction of the substation site, a retaining wall approximately three metres in height would be constructed along the western boundary of the substation site between the substation and the up-track of the North Shore Line. This wall would run for the entire length of the substation site.

Access to the substation site would be via a relocated driveway along Lindfield Avenue, approximately 20 metres to the north of its intersection with Middle Harbour Road.

New landscaping would also be provided around the perimeter of the substation site following the completion of the main building works to assist with screening of the new substation structure

Conclusion

The current project design and site attributes have contributed to reducing the potential visual impact, including:

- the substation site is within an existing rail corridor and is currently vacant
- a minimal amount of vegetation would be removed, with that vegetation of low visual and ecological importance
- there are no street trees affected by the proposal (assuming none are affected by the relocation of any street lights or power poles, with those locations yet to be determined)
- the site of the substation building would be excavated so that the building sits as low as possible when viewed from outside the rail corridor
- the substation building would be of high quality materials and coloured in recessive, dark colours to minimise visual contrast with the surrounding area and blend with the new vegetation
- landscape planting would be established along the Lindfield Avenue and Strickland Avenue boundaries to partially screen the substation

- the security fence would have a high quality design and finish, being a black, palisade fence.

Although there would be a minor effect on the visual amenity of the surrounding area, it is considered that this change is overall not a negative one, yet merely a transformation of a currently vacant part of the rail corridor to a relatively small-scale substation facility.

Of the key viewpoints to the substation assessed, none were assessed as having a visual impact considered greater than moderate which is considered a reasonable outcome.

There would be an overall beneficial visual impact as a result of a proposed reduction in overhead wiring between power pole 57 (to the south of Lindfield Station near the intersection with Russell Avenue, Lindfield) and power pole 49 (to the north of the Clanville Road overbridge) and a negligible impact associated with the proposed installation of the aerial earth wires. No other visual impacts of note are anticipated.

Some further mitigation in terms of materials and finishes and landscape design have been recommended to improve the overall visual amenity of the substation site and its surrounds.

1. Introduction

1.1 Background

The NSW Government has developed a plan to transform and modernise Sydney's rail network so that it can grow with the city's population and meet the needs of customers into the future. The NSW Government has identified that Sydney's rail system is reaching the limits of its capacity.

In future, Sydney Trains intends to operate increasing train services along the North Shore Line. A new traction power substation is required to allow for an increase in the capacity along the North Shore Line for these additional train services to be run and will support the delivery of the North West Rail Link (a new rapid transit network). Therefore, a new substation is proposed to be constructed at Lindfield to supply the North Shore Line.

1.2 Description of Proposal and subject site

The proposal site comprises the main works site and the electrical works site. The main works site (where the substation will be constructed) is located on Lindfield Avenue at the intersection with Strickland Avenue in Lindfield, approximately 300 metres to the south of Lindfield Station.

The site is within the existing rail corridor between the North Shore Line up-track (i.e. travelling towards Sydney central business district (CBD)) and Lindfield Avenue. The site is within the existing North Shore Railway corridor, situated at the north-west corner of Lindfield Avenue and Strickland Avenue, Lindfield. In addition, the works comprise ancillary electrical works, including the installation of aerial earth wires to existing power poles, generally between Killara Station and Russell Avenue, Lindfield and the realignment of existing overhead wiring generally between Russell Avenue and the Clanville Road overbridge.

1.3 Purpose of this report

This report provides a visual impact assessment of the potential visual changes associated with substation and associated works during the construction and operation phases, focussing on two main types of visual impact:

- effect on visual amenity
- effect on key viewpoints.

The report has been prepared for Parsons Brinckerhoff on behalf of Transport for NSW as part of the assessment required for a Review of Environmental Factors under Part 5 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

1.4 Structure of report

The structure of the report is as follows:

- description of the context of the site in terms the visual environment
- description of the main visual changes as a result of the substation
- assessment of the potential visual impact of the changes to the visual amenity and views from surrounding key viewpoints

- provision of recommended mitigation measures to address any identified potential visual impacts of sufficient concern.

2. Assessment methodology

2.1 Overall methodology

The methodology used for this visual impact assessment is adapted from those used by the NSW Roads and Maritime Services (2013) *Environmental Impact Assessment Practice Note - Guideline for Landscape Character and Visual Impact Assessment* and the United Kingdom's Landscape Institute and the Institute of Environmental Management and Assessment (2002 and 2013) *Guidelines for Landscape and Visual Impact Assessment*. The methodology has been adapted and designed to address the specific issues of this project.

This assessment focusses on two main types of visual impact:

- effect on visual amenity
- effect on surrounding viewpoints.

An assessment of those two effects (or impacts) depends on the combination of two main factors:

- visual sensitivity (of the visual amenity or viewpoints)
- the magnitude of the visual change.

The consideration of both of these factors is necessary to arrive at an overall level of effect or impact.

The assessment therefore determines the potential level of impact to both visual amenity of the site and its surrounds, as well as more specific impact to key surrounding viewpoints such as from public roads and residential locations.

2.2 Detailed terminology and methodology process

2.2.1 Assessing the effect on visual amenity

Step 1: Determine the visual amenity

Visual amenity reflects how valued a landscape is from a human point of view in terms of its aesthetics. By its nature visual amenity is subjective to a degree, yet can be estimated based on general perceptions and any evident natural, cultural and heritage values.

The value of visual amenity normally increases as the extent of natural features increase and human interference decreases. In urban environments such as Sydney, areas with substantial vegetation, varied landform, views and attractive buildings are more likely to be valued over landscapes with less of these attributes.

Step 2: Determine the visual sensitivity of the amenity

The potential effect, or impact, on visual amenity is a function of how 'visually sensitive' a landscape is, which takes into account both the level of visual amenity and the visibility of it. Visibility describes how easily a place is seen and the number of potential viewers. Places most visible tend to be those that are elevated, have minimal surrounding screening and located near transport routes and/or popular recreational and other high use community areas.

As a broad rule, generally the more natural a landscape, and the greater the visibility, the higher the visual sensitivity. For urban landscapes such as that affected, areas with pleasant streets, parks, street trees and attractive housing are likely to be more visually sensitive than industrial areas, commercial uses and infrastructure corridors.

For this project the following definitions for visual sensitivity, as related to visual amenity, have been used:

- Very high – visual amenity exceptional
- High – visual amenity high to moderate and site seen by a high number of viewers
- Moderate – visual amenity high to moderate and site seen by a moderate number of viewers
- Low or insignificant – visual amenity less than moderate and site seen by a low number of viewers.

Note that these are general rankings, and in some instances visual sensitivity rankings may differ from these definitions where such variation can be justified.

Step 3: Determine 'magnitude of visual change'

Once the level of visual sensitivity (of the visual amenity) is determined, then the 'magnitude of visual change' needs to be combined with it to arrive at an overall level of impact to visual amenity.

Magnitude of visual change relates to aspects such as how extensive the alteration is to the natural or existing landform, any vegetation loss, the difference in scale of new structures to the surrounding area and the contrast in colour and materials. The rankings used in this assessment are described below in **Section 2.2.3**.

Step 4: Assess overall effect on visual amenity

The general relationship of the two factors of visual sensitivity and the magnitude of visual change together determine the likely effect, or impact, on the existing visual amenity as described in **Section 2.2.3**.

2.2.2 Effects on surrounding viewpoints

Step 1: Identify key viewpoints

Key viewpoints include those from public roads, parks, residential areas and other surrounding land uses.

Step 2: Determine visual sensitivity of key viewpoints

Visual sensitivity is related to the type of viewpoint (whether it is public, private, permanent or transient) and the number of viewers. Taking into account the context of the site and the scale and type of the proposal, for this assessment the following definitions have been used:

- Very high – a public viewpoint with a very high number of viewers
- High – a public viewpoint with a moderate to high number of viewers
- Moderate – a private viewpoint within 100m or public viewpoint with a low number of viewers
- Low – a private viewpoint greater than 100m and any other viewpoint not covered above.

Step 3: Determine 'magnitude of visual change'

Once the level of visual sensitivity of the key viewpoints is determined, then the 'magnitude of visual change' needs to be combined with it to arrive at an overall level of impact to key viewpoints.

Magnitude of visual change relates to aspects such as how extensive the alteration is to the natural or existing landform, any vegetation loss, the difference in scale of new structures to the surrounding area and the contrast in colour and materials. The rankings used in this assessment are described below in **Section 2.2.3**.

Step 4: Assess overall effect of key viewpoints

The general relationship of the two factors of visual sensitivity and the magnitude of visual change together determine the likely effect on the existing key viewpoints as described in **Section 2.2.3**.

2.2.3 Defining 'Magnitude of visual change' and 'overall level of effect'

'Magnitude of visual change' (for both visual amenity and key viewpoints)

For the purposes of consistency, terminology adapted from the Landscape Institute and the Institute of Environmental Management and Assessment (2002) *Guidelines for Landscape and Visual Impact Assessment* has been used to define the magnitude of visual change:

- *None or Negligible – No, or only a very small part of the proposal is discernible and/or is at such a distance that it is scarcely appreciated. Consequently, it would have very little effect on the scene.*
- *Minor – The proposal constitutes only a minor component of the wider view, which might be missed by the casual observer or receptor. Awareness of the proposal would not have a marked negative effect on the overall quality of the scene.*
- *Moderate – The proposal may form a visible and recognisable new element within the overall scene that affects and changes its overall character in a negative way.*
- *Severe – The proposal forms a significant and immediately apparent part of the scene that affects and changes its overall character in a negative way.*
- *Devastating– The proposal becomes the dominant feature of the scene to which other elements become subordinate, and significantly affects and changes the character in a negative way.*

'Overall level of effect' (for both visual amenity and key viewpoints)

Table 2.1 illustrates the general relationship of the two factors of visual sensitivity and the magnitude of visual change, that together are used to determine the likely impact on the existing visual amenity and key viewpoints.

For example, although a severe magnitude of visual change may be identified, the level of impact will differ depending on whether there was a 'high visual sensitivity' (such as if the visual amenity was high and the site seen by a high number of viewers) or alternatively whether the visual sensitivity was 'moderate' (such as if the visual amenity was high to moderate and site seen by a moderate number of viewers). Under those two scenarios, the impact to visual amenity would be determined to be respectively 'severe' or 'moderate' as shown in **Table 2.1**.

The table is used to provide a general understanding of the level of impact, with further commentary then included to describe any predicted impacts. Where relevant the effect of time is also considered, such as in the short term (construction and before any installed landscape works mature) and longer term (when installed landscape works have matured).

Table 2-1: Matrix illustrating relationship between 'visual sensitivity' and 'magnitude of visual change'						
Potential effect level		Magnitude of visual change				
		Devastating	Severe	Moderate	Minor	None or negligible
Visual sensitivity	Very high	Devastating impact	Devastating impact	Severe impact	Moderate impact	Minor or negligible impact
	High	Devastating impact	Severe impact	Moderate impact	Moderate impact	Negligible impact
	Moderate	Severe impact	Moderate impact	Moderate impact	Minor impact	Negligible impact
	Low	Moderate impact	Moderate impact	Minor impact	Negligible impact	Negligible impact

2.3 Identifying if additional mitigation required

Additional mitigation is generally recommended in the following instances:

- to improve the overall visual amenity where such changes are feasible
- where there is an impact of moderate or greater on any particular assessed key viewpoint.

3. Visual environment

3.1 Site location

The proposal site comprises the following:

- substation site at corner of Lindfield Ave and Strickland Ave, Lindfield
- site for installation of aerial earth wires, generally between Killara Station to the north and Russell Avenue, Lindfield in the south
- site for the realignment of the existing 33 kV and 11 kV overhead wiring (OHW), to a new combined services route (CSR) - generally between power pole 57 (to the south of Lindfield Station near Russell Avenue, Lindfield) and power pole 49 (to the north of the Clanville Road overbridge).

The proposal site is illustrated in **Figure 3.1a** and **3.1b**.

3.2 Context

3.2.1 Context of the substation site

The substation site is within the main urban area of the northern suburbs of Sydney. The dominant surrounding land use is residential closest to the site, fringed further to the north by the Lindfield Railway station and associated Lindfield shopping area. Traversing this part of Lindfield from north to south are two transport corridors: the North Shore Railway and the Pacific Highway.

The substation site location and context of the general area are shown in **Figure 3.2**. The substation site is near a rectangular, vacant portion of the railway corridor that is elevated several metres above the level of the railway lines. It is currently covered mostly with grass and weeds, with some native plant species. There is a wire-mesh security fence along the eastern side of the corridor.

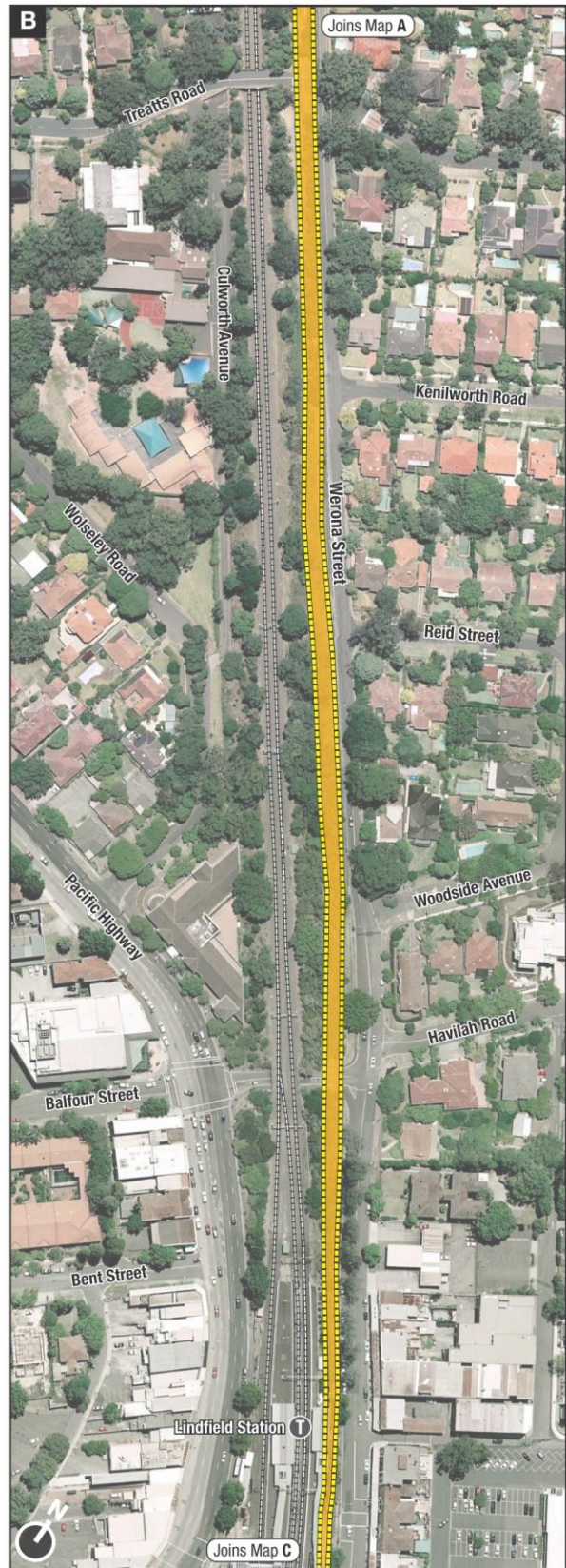
The broader landform slopes gently from the Pacific Highway, west of the railway corridor down, towards Lindfield Avenue alongside the site, and continues falling towards Middle Harbour some three kilometres (km) to the east.

Immediate surrounding land uses

The immediate boundaries of the site are: the local two-lane roadway of Lindfield Avenue to the east; the railway corridor to the west and north; and the railway bridge along Strickland Avenue to the south.

On the opposite side of Lindfield Avenue, and extending down both sides of Strickland Avenue to the south-east, is low density, detached housing, dominated by Federation-style, brick houses on quite large blocks. The Clanville heritage conservation area (HCA) covers part of this area.

Across the railway corridor, west of the site, are a number of older-style three storey residential flat buildings (RFBs) that front the Pacific Highway and have the rear of the buildings orientated east towards the railway corridor and subject site. On the opposite, southern, side of Strickland Avenue is another older-style three storey RFB which fronts Strickland Avenue.



- Train station
- North Shore Rail Line
- Electrical works site area
- Proposal boundary

0 100m

Figure 3.1a: Proposal site (north)



- Train station
- North Shore Rail Line
- Electrical works site area
- Proposal boundary

0 100m

Figure 3.1a: Proposal site (north)

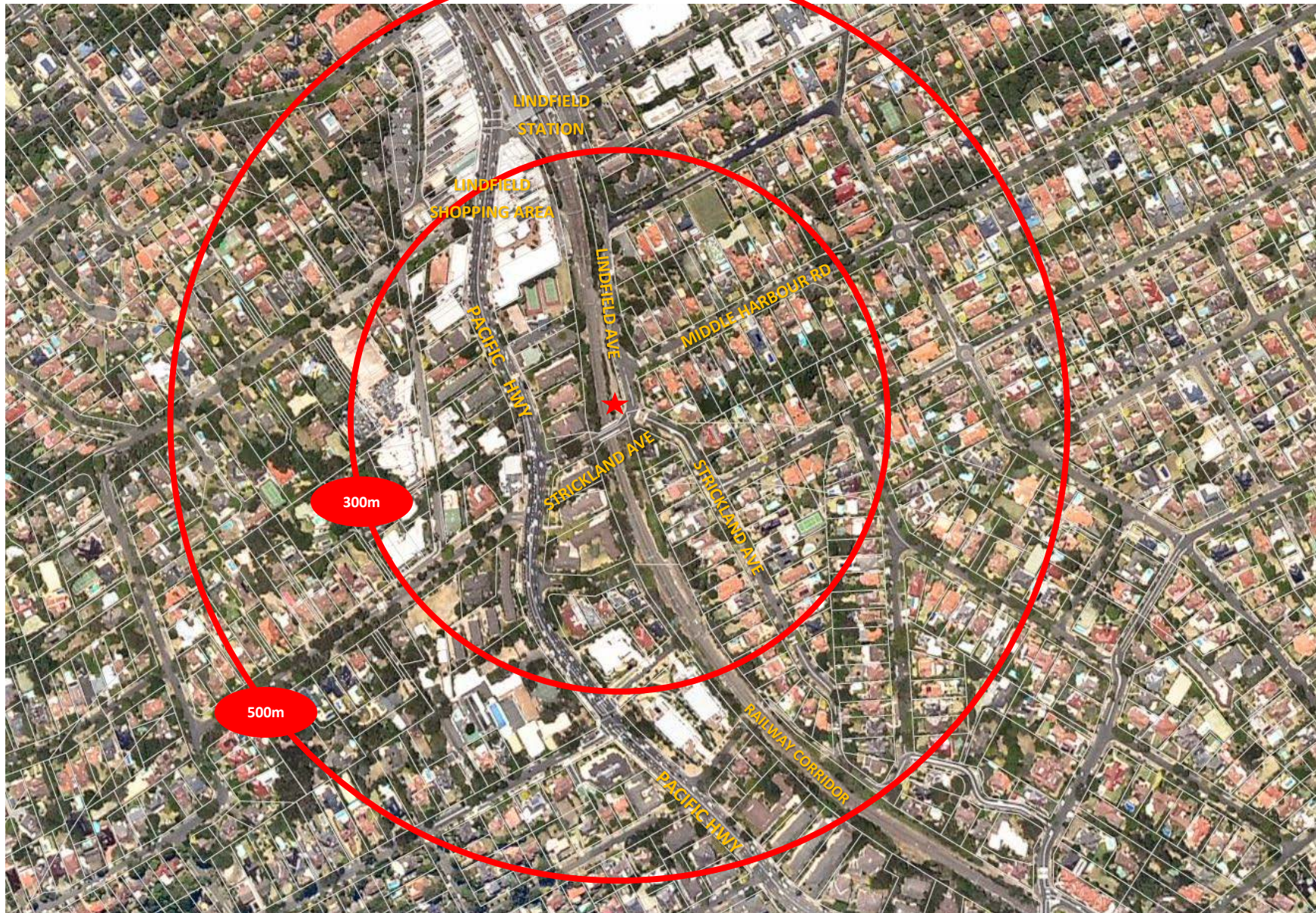


- Train station
- North Shore Rail Line
- Proposal boundary
- Electrical works site area
- Main substation works site

- Sydney Trains power pole number

0 100m

Figure 3.1: Proposal site (south)



0m 200m



★ SITE LOCATION

FIGURE 3.2: SITE LOCATION AND CONTEXT

Heritage

According to the Proposal's heritage report (Artefact Heritage, 2014), the 'Clanville' heritage conservation area (HCA) is located to the south of the proposed Lindfield Substation site. As a result, some visual constraints in terms of the HCA were identified, although overall the potential negative impact of the proposal on the HCA is considered minor.

The report states that: *The HCA has high aesthetic significance as a cohesive early twentieth century and Interwar development and for the high proportion of quality houses.*

The report makes the following recommendations which have been taken into account regarding potential visual impact of the proposal on the Clanville HCA:

- care should be taken to make the substation building as unobtrusive as possible by measures such as dark colours used for the roofing and walls
- the lower the substation is in the landscape, the less visual impact it would have on the HCA, and the surrounding Lindfield area.
- consider introducing screening vegetation along the southern boundary of the proposed substation site at the completion of works.

These recommendations have been taken into account as part of the site mitigation as discussed in **Section 6.0**.

Vegetation

The substation site consists of an access track and heavily degraded, cleared vegetation and regrowth native vegetation. It currently contains some native plant species, however, is dominated by a variety of weed and introduced plant species. The majority of the existing vegetation community resembles Sydney Turpentine Ironbark Forest without a canopy and high disturbance from edge effects and weed invasion. The existing vegetation has little value in terms of visual amenity.

3.2.2 Other affected sites

There are two other sites affected by the proposed works:

- site for installation of aerial earth wires, generally between Killara Station to the north and Russell Avenue, Lindfield in the south
- site for the realignment of the existing 33 kV and 11 kV overhead wiring (OHW), to a new combined services route (CSR) - generally between power pole 57 (to the south of Lindfield Station near Russell Avenue, Lindfield) and power pole 49 (to the north of the Clanville Road overbridge).

These two areas are in a similar urban environment to that of the substation site, with the affected linear corridor being predominantly a residential area flanked by housing to the east and the railway corridor to the west. Overall the visual amenity is moderate and consistent with that of the general surrounding area which is often referred to as Sydney's leafy northern suburbs.

3.3 Substation site's visual environment

Visual amenity

The site's visual amenity reflects its location as part of an urban railway corridor. The vacant and generally untended nature of the site means that the site itself and railway corridor have a low visual amenity, however, the surrounding residential area of Lindfield exhibits an attractive and moderate visual amenity, which is comparable with other nearby suburbs in the northern parts of Sydney.



PHOTOGRAPH 2.1: VIEW OF SUBSTATION SITE LOOKING NORTH



PHOTOGRAPH 2.2: VIEW OF SUBSTATION SITE FROM CORNER OF STRICKLAND AVENUE AND LINDFIELD AVENUE

Visibility

The current visibility of the site is relatively limited when considered that it is within an urban setting, with views towards the site quite limited due to intervening buildings, vegetation and the configuration of the landform.

Photographs 2.1 and **2.2** show images of the substation site's typical existing landscape.

The main residential views to the site are from those houses on the opposite side of Lindfield Avenue, the RFB on the western side of the railway corridor and the RFB on the opposite side of Strickland Avenue. Some views are also possible from the houses on the upper parts of Strickland Avenue near where it meets Lindfield Avenue, with views reducing further south-east along Strickland Avenue where it falls away. Public views are possible from Lindfield Avenue, Strickland Avenue, the railway overbridge and from within the railway corridor.

A detailed analysis of the visibility of the proposed substation and potential visual impact is contained in **Section 5.0**.

4. Project description

4.1 Project overview

Some project plans are provided in **Appendix A**, with more in the main report (i.e. the Review of Environmental Factors). The key components of the proposed substation that would result in visual changes would be:

- construction and operation of a new traction power substation at Lindfield in order to continue to power the Sydney Trains network (in particular the North Shore Line). Components of the substation would generally include:
 - ▶ construction of two new rectifier transformers
 - ▶ installation of switchgear room
 - ▶ installation of the rectifier and reactor unit(s)
 - ▶ office and associated facilities
 - ▶ earthworks and construction of a retaining wall on the western side of the substation site, adjacent to the rail line.
- construction of a new driveway access to the substation site from Lindfield Avenue and a paved surface area to provide for car parking for approximately four vehicles within the proposed substation compound
- security and permanent maintenance lighting within and external to the building
- landscaping and vegetation surrounding the proposed substation building, generally to the east and south of the substation
- realignment of the existing 33 kilovolt (kV) and 11 kV overhead wiring (OHW), to a new combined services route (CSR), generally between power pole 57 (to the south of Lindfield Station near the intersection with Russell Avenue) and power pole 49 (to the north of the Clanville Road overbridge)
- relocation and installation of signalling and communication cables to the substation to connect with existing cables along the North Shore Line
- installation of feeder and return cabling to the OHW system on the North Shore Line
- relocation of street lighting and power routes to provide access to the substation for construction and maintenance (including future replacement of substation equipment)
- installation of an aerial earth wire to the top of the existing (Sydney Trains) poles, generally between Russell Avenue, Lindfield and Killara Station.

4.2 Substation building

The architectural design of the substation building is intended to limit the impact of the building in the residential neighbourhood, to reduce its perceived scale and to provide a landscaped edge treatment between the building and the adjoining street. The landform/contours of the substation site have been used to reduce the overall height of

the building by locating the tallest elements to the south, where they sit below natural ground level.

The proposed substation building would consist of an aboveground structure, located within the rail corridor between the North Shore Line up-track and Lindfield Avenue at the intersection with Strickland Avenue. The substation building would occupy most of the substation site and would be approximately 40 metres by 10 metres in size. Additional hardstand and driveway areas would be located towards the northern end of this site to allow for vehicle access and car parking spaces for approximately four vehicles. The building would be single storey (with a cable subfloor) with a height of approximately six metres.

The building would be architecturally designed and generally be constructed from concrete panels, with a metal clad roof and would be rectangular in shape. The exterior of the building would be designed to minimise visual intrusion to the surrounding area. A range of metal louvers and roller shutters would also be required within the building façade to provide both access to, and ventilation for, the building. The final building materials and finishes for the proposed substation building would be determined during the detailed design phase of the proposal.

As part of the construction of the substation site, a retaining wall approximately three metres in height would be constructed along the western boundary of the substation site between the substation and the up-track of the North Shore Line. This wall would run for the entire length of the substation site.

Access to the substation site would be via a relocated driveway along Lindfield Avenue, approximately 20 metres to the north of its intersection with Middle Harbour Road.

4.3 Vegetation removal

Construction of the proposed substation and associated cabling at Lindfield would require the removal of up to approximately 0.94 hectares of native vegetation being a combination of Blue Gum High Forest and Sydney Turpentine Ironbark Forest scrubby regrowth. Up to approximately 2.31 hectares of habitat will be removed which is of low to moderate condition and may provide some marginal foraging habitat for several threatened species of birds and bats.

4.4 Lighting

Lighting within and external to the building would consist of security and permanent maintenance lighting. The security lighting would automatically switch on in low light conditions to provide minimal light for safe access and security. Maintenance lighting would only be used while works are being undertaken at the substation. External security lighting would be installed in a manner which minimises light spill to areas beyond the substation site boundary.

4.5 Security fencing

Security fencing would be installed around the substation and would be compliant with current Sydney Trains standards for substation fencing. This would include generally three metre high palisade/security fencing on all sides of the substation site. Additional security mesh would be installed on top of the retaining wall on the western perimeter of the substation where it faces the rail line.

4.6 Drainage works

Following excavation of the substation site, new stormwater drainage would be installed around the perimeter of the substation site, generally prior to the construction of the main civil and buildings works on the substation site. The proposed stormwater drainage works seen above ground would be:

- a new concrete lined cess drain along the western side of the substation site (to the west of the proposed retaining wall)
- longitudinal pipes along the length of the substation site, connected by a series of stormwater inlet and junction pits
- an on-site detention (OSD) tank towards the northern end of the substation site to collect surface flows from within the site
- a stormwater quality improvement device connected to the OSD tank to allow for stormwater quality improvement of collected water prior to discharging off-site
- general kerb and guttering surrounding the hardstand areas of the substation site, including a grated drain at the substation site driveway entrance point.

4.7 Utilities

High voltage line realignment

There would be a realignment of the aboveground electricity feeder lines for approximately 950 metres of lines between pole power poles P57 and P49. The redundant aerial 33kV and 11 kV feeder lines would be removed as part of the proposal.

Aerial earth wire

A new aerial earth wire would be installed between Killara Station in the north and existing power pole P57 (near the intersection with Russell Avenue) to the south. The installation of the aerial earth wire would be undertaken through the placement of a new metal shaft to the top of the existing 33kV and 11kV power poles. The aerial earth wire would then be attached to the new structure.

Where it is deemed that an existing power pole is in a poor condition, a new pole would be installed in a similar location (within approximately one to two metres of the existing pole) and all existing wires relocated to the new pole.

Other utilities

The proposal would likely require some additional utility diversions, including the following relatively minor visual changes:

- The Ausgrid low voltage overhead power lines in Lindfield Avenue adjacent to the substation site would also require relocation to avoid clashes with cranes during construction and future maintenance operations. Three poles would be removed and replaced with underground conduits located in the roadway.
- The Ausgrid street lighting supply aerial cable in Lindfield Avenue would be relocated to the eastern side of Lindfield Avenue. The location of the new street lighting would be revised during detailed design to maintain appropriate lighting levels.
- Foxtel/Telstra cables have also been identified as aerial cables on the Ausgrid poles which are to be removed. These cables would be relocated as part of the overall relocation of cabling from these poles.

- Optus aerial cables are mounted on the Ausgrid poles which are required to be removed. These cables would be relocated as part of the overall relocation of cabling from these poles.

4.8 Construction activities

Construction activities would include:

- cut and fill to establish a level area for the site facilities and temporary storage areas
- construction hoarding/noise walls
- trenching to install site services (power, water, sewer).

Site facilities such as offices, crib rooms and ablutions would likely be prefabricated huts (ATCO or similar).

Minor enabling works are expected to be undertaken in late 2014. Service relocation will commence in mid-2015 with construction of the substation expected to commence in early 2016 (subject to Transport for NSW's determination of the Review of Environmental Factors (REF)) with testing and commissioning anticipated in August 2017. The substation site is expected to be handed over to Sydney Trains in late 2017.

4.9 Landscaping

New landscaping would be provided around the perimeter of the substation site following the completion of the main building works to assist with screening of the new substation structure (refer to **Figure 5.2** and **Figure 5.3** for an indicative illustration of the proposed landscaping).

5. Visual impact assessment

This assessment focusses on two main types of visual impact:

- effect on visual amenity
- effect on surrounding viewpoints.

The methodology for the visual impact assessment, and the terminology used, has been described previously in **Section 2.0**.

The main potential for visual impact relates to the substation, namely the building, fencing, driveway and compound area. These changes are addressed under the overall banner of 'substation' as described below (**Sections 5.1** and **5.2**).

Other visual changes with potential impact, such as those related to the relocation of street lighting and power routes and installation of an aerial earth wire to the top of the existing (Sydney Trains) poles, generally between Russell Avenue, Lindfield and Killara Station are assessed in **Section 5.4**.

5.1 Impact to visual amenity of the area due to substation

Step 1: Determine visual amenity

The visual amenity of the site and general surroundings was described previously as moderate (refer **Section 3.3**).

Step 2: Determine the visual sensitivity of the amenity

The site has a moderate visibility, reflecting its location both along a rail corridor and at the corner of a busy local road that connects the area of Lindfield that is east of the railway line with the Pacific Highway to the west.

The combination of visual amenity and visibility mean that the visual sensitivity of the site of the proposed substation can be described as moderate.

Step 3: Determine 'magnitude of visual change'

The magnitude of visual change at the site would be relatively small when considering the following:

- the substation is within an existing rail corridor that is currently vacant
- a minimal amount of vegetation would be removed
- the site of the building would be excavated so that the building sits as low as possible when viewed from outside the rail corridor
- the building would be of high quality materials and coloured in recessive, dark colours to minimise visual contrast with the surrounding area and blend with the new vegetation
- landscape planting would be established along the Lindfield Avenue and Strickland Avenue boundaries to partially screen the substation
- there are no street trees affected by the proposal (assuming none are affected by the relocation of any street lights or power poles, with those locations yet to be determined).

Overall, the magnitude of visual change has been assessed as being minor, which is

defined as: "The proposal constitutes only a minor component of the wider view, which might be missed by the casual observer or receptor. Awareness of the proposal would not have a marked negative effect on the overall quality of the scene."

Step 4: Assess overall effect on visual amenity

The general relationship of the two factors of visual sensitivity and the magnitude of visual change together determine the likely effect on the existing visual amenity.

Based on a visual sensitivity of moderate, and a magnitude of visual change of minor, overall there would be a minor effect on the visual amenity of the site and surrounding area.

5.2 Visual impact of substation on surrounding key viewpoints

Step 1: Identify key viewpoints

The locations of the key viewpoints and the two photomontages illustrating the likely look of the proposed substation, are indicated in **Figure 5.1**.

Due to the quite limited area from where the substation would be visible, and its relatively small scale the visual impact assessment of key viewpoints has focussed on those affected viewpoints within 300m, as beyond that distance any visual changes would represent a negligible change.

Seven key viewpoints have been identified (refer **Figure 5.1**):

1. View from Lindfield Avenue (roadway and footpath users)
2. View from Lindfield Avenue (residential properties)
3. View from Strickland Avenue and Clanville HCA
4. View from railway overbridge
5. View from residential flat buildings (RFBs) to west
6. View from rail corridor
7. View from Middle Harbour Road.

The remaining steps for the assessment of key viewpoints, as described previously in the methodology are:

- Step 2: Determine visual sensitivity of key viewpoints
- Step 3: Determine 'magnitude of visual change'
- Step 4: Assess overall effect of key viewpoints.

For each of the viewpoints these steps have been undertaken.

5.2.1 Viewpoint 1 - View from Lindfield Avenue (roadway and footpath users)

Visual sensitivity of viewpoint

Lindfield Avenue is along the immediate eastern boundary of the site, with a concrete public footpath on the closest road verge. The relatively high use of Lindfield Avenue, and its proximity to the site, means that the visual sensitivity of the viewpoint is high.

'Magnitude of visual change'

Current views are of the rail corridor where site is located are of the boundary security fence with existing vegetation seen through the fence along the rail corridor.

Insert Figure 5-1

The substation building would occupy the majority of the outer boundary of the site along Lindfield Avenue. The building would extend some 3m above the level of the road verge, and between the building and the footpath there would be some landscape planting which would partially screen the building.

At each end of the building there would be a black palisade security fence through which views across the outer compound areas would be possible. A predicted view of the substation from Lindfield Avenue is shown in **Figure 5.2** (photomontage location A). The magnitude of visual change of the proposal is assessed as being minor.

Overall effect on viewpoint

Based on a visual sensitivity of high, and a magnitude of visual change of minor, the overall level of effect is assessed as being a moderate impact to this viewpoint.



FIGURE 5.2: PHOTOMONTAGE A - PREDICTED VIEW OF SUBSTATION FROM LINDFIELD AVENUE

5.2.2 Viewpoint 2 - View from Lindfield Avenue (residential properties)

Visual sensitivity of viewpoint

The closest residential properties are on the opposite side of Lindfield Avenue, some 20m away. The private nature of these viewpoints, and their proximity, means that the visual sensitivity of the viewpoint is moderate.

'Magnitude of visual change'

Views would be of side, and in some cases part of the roof, of the building extending some 3m above the level of the road verge. The side view of the building would be visually broken-up by landscape planting which would partially screen the building. At each end of the building there would be a black palisade security fence through which views across the outer compound areas would be possible.

The magnitude of visual change of the proposal is assessed as being minor.

Overall effect on viewpoint

Based on a visual sensitivity of moderate, and a magnitude of visual change of minor, the overall level of effect is assessed as being a minor impact to this viewpoint.

5.2.3 Viewpoint 3 - View from Strickland Avenue and Clanville HCA

Visual sensitivity of viewpoint

The closest residential properties on Strickland Avenue are approximately 25m away. There are also public viewpoints along Strickland Avenue and the associated part of the Clanville heritage conservation area (HCA). Taking into account the HCA and the relatively high traffic on Strickland Avenue, overall the visual sensitivity of these areas is considered high.

'Magnitude of visual change'

The landform along Strickland Avenue falls away from the site of the substation, meaning that many views from Strickland Avenue and the Clanville HCA would be from a lower point looking slightly upslope. The effect of the landform means that as a viewer moves further down Strickland Avenue the more that the lower part of substation building would be blocked from view.

From the nearest viewpoint on Strickland Avenue, that is at the corner of Lindfield Avenue, the majority of the substation would be seen (refer **Figure 5.2**, photomontage location B). From this viewpoint the side view of the building would be visually broken-up by landscape planting which would partially screen the building. The magnitude of visual change of the proposal is assessed as being minor on this viewpoint.



FIGURE 5.3: PHOTOMONTAGE B - PREDICTED VIEW OF SUBSTATION FROM CORNER OF STRICKLAND & LINDFIELD AVENUES

Overall effect on viewpoint

Based on a visual sensitivity of high, and a magnitude of visual change of minor, the overall level of effect is assessed as being moderate impact to this viewpoint.

5.2.4 Viewpoint 4 - View from View from railway overbridge

Visual sensitivity of viewpoint

The railway overbridge is along the immediate southern boundary of the site, where views of the substation would be seen.

The public nature of this viewpoint, and its close proximity, lead to a visual sensitivity of this viewpoint of high.

'Magnitude of visual change'

Views would be of the southern end and the side facing the railway corridor when on the bridge. Footpath users would have the longest views, with roadway users experiencing more of a glimpse when travelling over the bridge. As the railway bridge is somewhat higher than the site views would be mostly of the upper part of the building and roof.

The magnitude of visual change of the proposal is assessed as being minor to this viewpoint.

Overall effect on viewpoint

Based on a visual sensitivity of high, and a magnitude of visual change of minor, the overall level of effect is assessed as being moderate impact to this viewpoint.

5.2.5 Viewpoint 5 - View from residential flat buildings to west

Visual sensitivity of viewpoint

There are two residential flat buildings (RFBs) on the western side close to the site, one on either side of Strickland Avenue. The private nature of these viewpoints, and their proximity, means that the visual sensitivity of the viewpoints are moderate. **Photographs 5.1** and **5.2** show the nearest sides of these buildings and the intervening vegetation.

'Magnitude of visual change'

Views would be available from the eastern side of number 239 Pacific Highway (north side of Strickland Avenue), and the eastern end and northern side of number 235-237 Pacific Highway (south side of Strickland Avenue), with the extent of views depending on where the unit of the viewer is located. Both buildings have balconies which would allow views towards the site, with more elevated views as one moves higher. Current views are of the partially vacant site and the mostly shrubby vegetation along the edges.

From the eastern side units of number 239 Pacific Highway, the railway side of the new substation would be seen with the security fence in the foreground where there are gaps in the existing vegetation. However, the substantial vegetation within this property alongside the rail corridor means that most views would be prevented or filtered. Any such views would be of the substation building some 3m above the ground, with views of the roof from the higher units.



PHOTOGRAPH 5.1: RFB TO IMMEDIATE WEST OF SUBSTATION SITE SHOWING BALCONIES & EXISTING HEAVY SCREENING (239 PACIFIC HIGHWAY)



PHOTOGRAPH 5.2: RFB TO IMMEDIATE ON SOUTHERN SIDE OF STRICKLAND AVENUE (235-237 PACIFIC HIGHWAY)

Views from 235-237 Pacific Highway would be more obscure due to the increased distance and some intervening vegetation between the RFB and the site, both within the property itself and along the railway corridor. There would be no views from ground floor units, yet from some of the upper units on the eastern end and northern side have the potential for some views of the railway side of the building and southern end of the site, with landscape planting providing partial screening. The magnitude of visual change of the proposal on both of these viewpoints is assessed as being minor.

Overall effect on viewpoint

Based on a visual sensitivity of moderate, and a magnitude of visual change of minor, the overall level of effect is assessed as being a minor impact to these viewpoints.

5.2.6 Viewpoint 6 - View from rail corridor

Visual sensitivity of viewpoint

This is a public viewpoint in very close proximity, however, its location within the rail corridor itself, and the very transient nature of any views to rail users mean that it is considered to have a visual sensitivity of minor.

'Magnitude of visual change'

Frequent users of this part of the railway would likely notice some level of visual change associated with the substation, most notably during the construction phase when the activity may draw attention to viewers. However, the lower level of the railway line means that any such views would be generally hidden from viewers on the lower carriage levels, with those on the top level having a quick glimpse of the site as the train passes.

The magnitude of visual change of the proposal is assessed as being minor to this viewpoint.

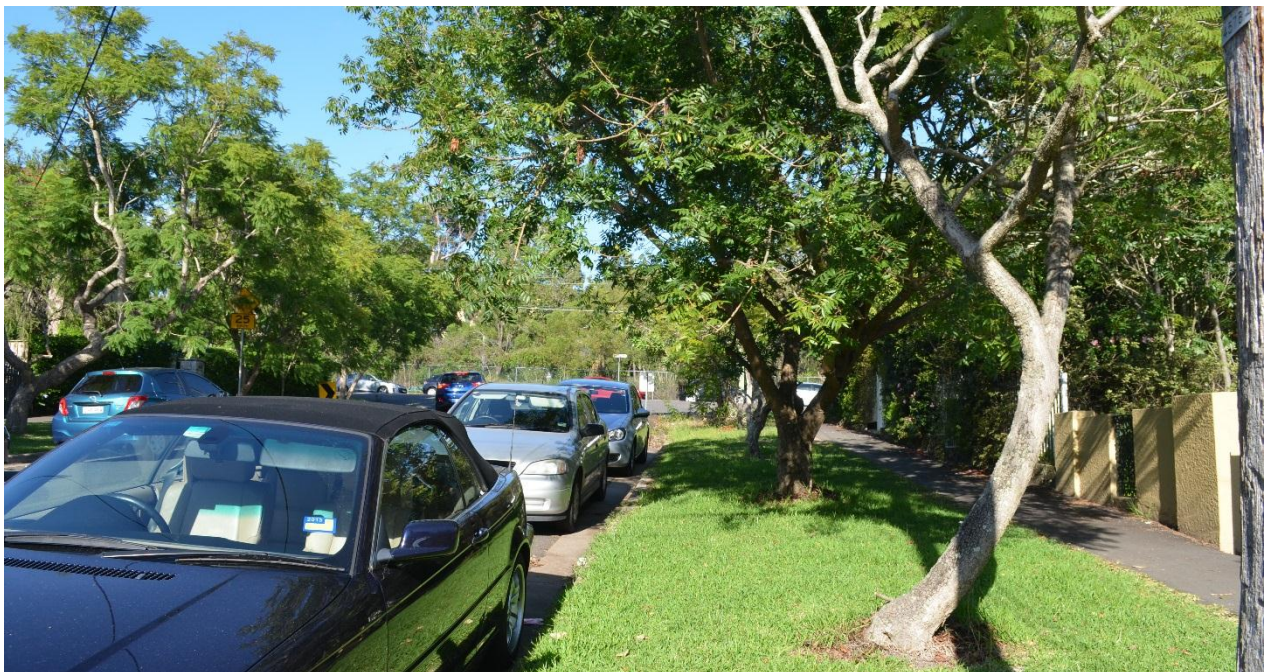
Overall effect of key viewpoints

Based on a visual sensitivity of low, and a magnitude of visual change of minor, the overall level of effect is assessed as being negligible impact to this viewpoint.

5.2.7 Viewpoint 7 - View from Middle Harbour Road

Visual sensitivity of viewpoint

Middle Harbour Road is a local road that connects down to Middle Harbour and has relatively low traffic volumes. The visual sensitivity of the viewpoint is moderate.



PHOTOGRAPH 5.3: EXISTING VIEW TOWARDS SUBSTATION SITE FROM MIDDLE HARBOUR ROAD

Views would be of side of the building when approaching along Middle Harbour Road (refer to **Photograph 5.3** for current view). The quite steep slope on the road means that the building would be seen against the skyline. The initial removal of vegetation would be visually obvious as the vegetation forms the terminating view currently along this part of the road. The proposed landscape planting would partially screen the building over time. The magnitude of visual change of the proposal is assessed as being moderate as the substation building would be quite obvious in the viewpoint, particularly before the proposed landscape works mature.

Overall effect on viewpoint

Based on a visual sensitivity of moderate, and a magnitude of visual change of moderate, the overall level of effect is assessed as being a moderate impact to this viewpoint.

5.2.8 Other viewpoints

There are other viewpoints from where the substation would be visible that have not been assessed in detail as these were not considered to be of sufficient concern, particularly when considering the highest level of assessed visual impact for the closest viewpoints has been assessed as moderate.

Such other viewpoints include the residential flat buildings on the western side of the railway corridor further to the north of Strickland Avenue. There would be no more than a minor impact to these or any other nearby viewpoints.

5.3 Other potential visual impacts during operation

Other visual changes with potential impact are related to the:

- realignment of the existing 33 kilovolt (kV) and 11 kV overhead wiring (OHW), to a new combined services route (CSR), generally between power pole 57 (to the south of Lindfield Station and power pole 49 (to the north of the Clanville Road overbridge)
- installation of an aerial earth wire to the top of the existing power poles generally between Russell Avenue, Lindfield and Killara Station.

In general, the visual impact of the second element would be that the current OHW which are aboveground would be moved to ground level, which would be seen only from passing trains) or be underground. Therefore there would overall be a beneficial visual impact. For the installation of the aerial earth wires, a single wire would be added to the top of existing power poles that already have wires in place, and therefore there would be a negligible visual impact.

5.4 Construction impacts

There would be some additional, short term impacts during the construction phase due in particular to:

- necessary temporary security fencing
- the presence of construction machinery and materials storage
- clearing and removal of existing vegetation.

These visual changes would be of a short term, temporary nature and limited to a relatively small area, and therefore would be considered to have a minor impact.

6. Recommended mitigation measures

6.1 Summary of overall impact assessment

As stated previously, mitigation is generally recommended in the following instances:

- to improve the overall visual amenity where such changes are feasible
- where there is an impact of moderate or greater on any particular assessed key viewpoint.

Visual amenity of general area

The assessed level of impact to the general visual amenity of the surrounding area as a result of the proposed substation or associated works is minor (refer **Section 5.1**), however, it is recommended that to ensure that such a level of impact is achieved, the following recommendations are made:

- ensure landscape screening is adequate and of high quality
- ensure the substation building and security fence have a high quality finish and materials.

Key viewpoints to substation

Table 6.1 summaries the assessed level of impact of the seven key identified viewpoints to the substation site. Of the seven viewpoints, three have been assessed as having an impact level of minor, and four with a level of moderate.

For the viewpoints where a moderate impact level has been identified further mitigation measures have been recommended in **Table 6.1**.

Table 6.1: Summary of assessed key viewpoints		
Viewpoint	Assessed level of impact	Recommended mitigation
1. Lindfield Avenue (roadway & footpath users)	moderate	Ensure landscape screening is adequate & high quality finishes
2. Lindfield Avenue (residential properties)	minor	No further mitigation required
3. Strickland Avenue and Clanville HCA	moderate	Ensure landscape screening is adequate & high quality finishes
4. Railway overbridge	moderate	Ensure landscape screening is adequate & high quality finishes
5. Residential flat buildings to west	minor	No further mitigation required
6. Rail corridor	minor	No further mitigation required
7. Middle Harbour Road	moderate	Ensure landscape screening is adequate

Other visual changes

There would be an overall beneficial visual impact as a result of a proposed reduction in overhead wiring between power pole 57 (to the south of Lindfield Station and power pole 49 (to the north of the Clanville Road overbridge) and a negligible visual impact associated with the proposed installation of the aerial earth wires.

No other visual impacts of note are anticipated, assuming that no street trees are affected by the relocation of any street lights or power poles, with those locations yet to be determined.

6.2 Recommended mitigation measures

Mitigation measures to minimise potential visual impacts during construction and operation have been recommended and are outlined below.

Construction phase

Recommended mitigation during construction to mitigate any construction impacts in terms of visual impact include:

- ensure any security fencing includes screening of the site from views from the outer boundary and if possible is not of a garish or light colour (if permitted)
- minimise the storage of materials and construction machinery as far as possible
- maintain site in an orderly and tidy fashion.

Operation

The following mitigation measures should be considered further as part of the detailed design of the proposed substation:

- the site of the substation building should be excavated so that the building sits as low as possible when viewed from outside the rail corridor
- the substation building would be of high quality materials and coloured in recessive, dark colours to minimise visual contrast with the surrounding area and blend with the new vegetation
- landscape planting would be established along the Lindfield Avenue and Strickland Avenue boundaries to partially screen the substation
- the substation security fence would have a high quality design and finish, being a black, palisade fence.

The substation site attributes and recommended mitigation measures would substantially contribute to reducing the potential visual impact of the proposal on both the general visual amenity of the immediate area and the impact to key viewpoints. Further mitigation in terms of materials and finishes and landscape design are also recommended below.

Materials and finishes

To ensure high quality materials and finishes are achieved on the substation building and fencing, the proposed materials and finishes to be used should be clarified as part of the detailed design. Any outside attachments to the buildings, such as services, air conditioning units or vents should also be of a similar high quality and positioned to be as unobtrusive as possible, and screened as necessary.

Landscape design

One of the most positive visual mitigation measures is the proposed landscape planting that would partially screen the outer sides of the substation building from views from surrounding areas. Future landscape planting is expected to be finalised during detailed design. It is recommended that this planting have the following attributes:

- ensure partial screening occurs whilst still considering aspects such as personal safety for users of the adjacent footpaths and not creating concealment opportunities or the potential for planting to encroach onto the footpath
- use of trees and shrubs ranging up to two metres when near the footpath
- local native plants should be selected as far as practical
- planting densities of lower storey plants should be a minimal of one per square metre to assist in the management of weeds
- all landscape planting should be in fully prepared, mulched planting beds, and at least half of the pot sizes planted should be of 200mm size or greater, and trees planted at 10 litre pot sizes as a minimum.

7. Conclusion

The current project design and site attributes have contributed to reducing the potential visual impact, including:

- The substation site is within an existing rail corridor and is currently vacant
- a minimal amount of vegetation would be removed, with that vegetation of low visual and ecological importance
- the substation site landform is such that it allows for a low building height
- there are no street trees affected by the proposal (assuming none are affected by the relocation of any street lights or power poles, with those locations yet to be determined)
- the site of the substation building would be excavated so that the building sits as low as possible when viewed from outside the rail corridor
- the substation building would be of high quality materials and coloured in recessive, dark colours to minimise visual contrast with the surrounding area and blend with the new vegetation
- landscape planting would be established along the Lindfield Avenue and Strickland Avenue boundaries to partially screen the substation
- the security fence would have a high quality design and finish, being a black, palisade fence.

Although there would be a minor effect on the visual amenity of the surrounding area, it is considered that this change is overall not a negative one, yet merely a transformation of a currently vacant part of the rail corridor to a relatively small-scale substation facility.

Of the key viewpoints to the substation assessed, none were assessed as having a visual impact considered greater than moderate which is considered a reasonable outcome.

There would be an overall beneficial visual impact as a result of a proposed reduction in overhead wiring between power pole 57 (to the south of Lindfield Station near the intersection with Russell Avenue, Lindfield) and power pole 49 (to the north of the Clanville Road overbridge) near the intersection with Russell Avenue, Lindfield) and a negligible or no visual impact associated with the proposed installation of the aerial earth wires. No other visual impacts of note are anticipated.

Some further mitigation in terms of materials and finishes and landscape design have been recommended to improve the overall visual amenity of the substation site and its surrounds.

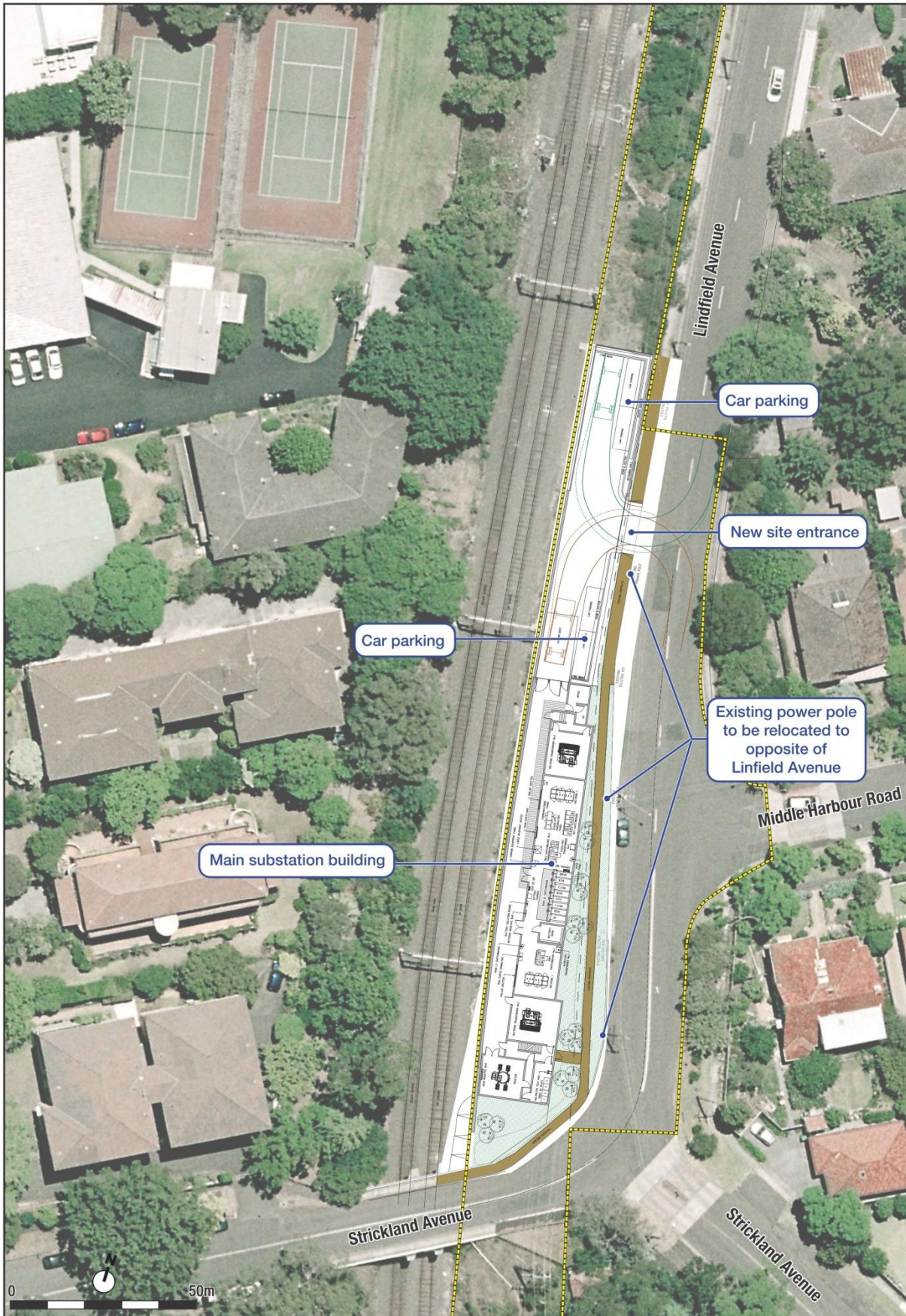
8. References

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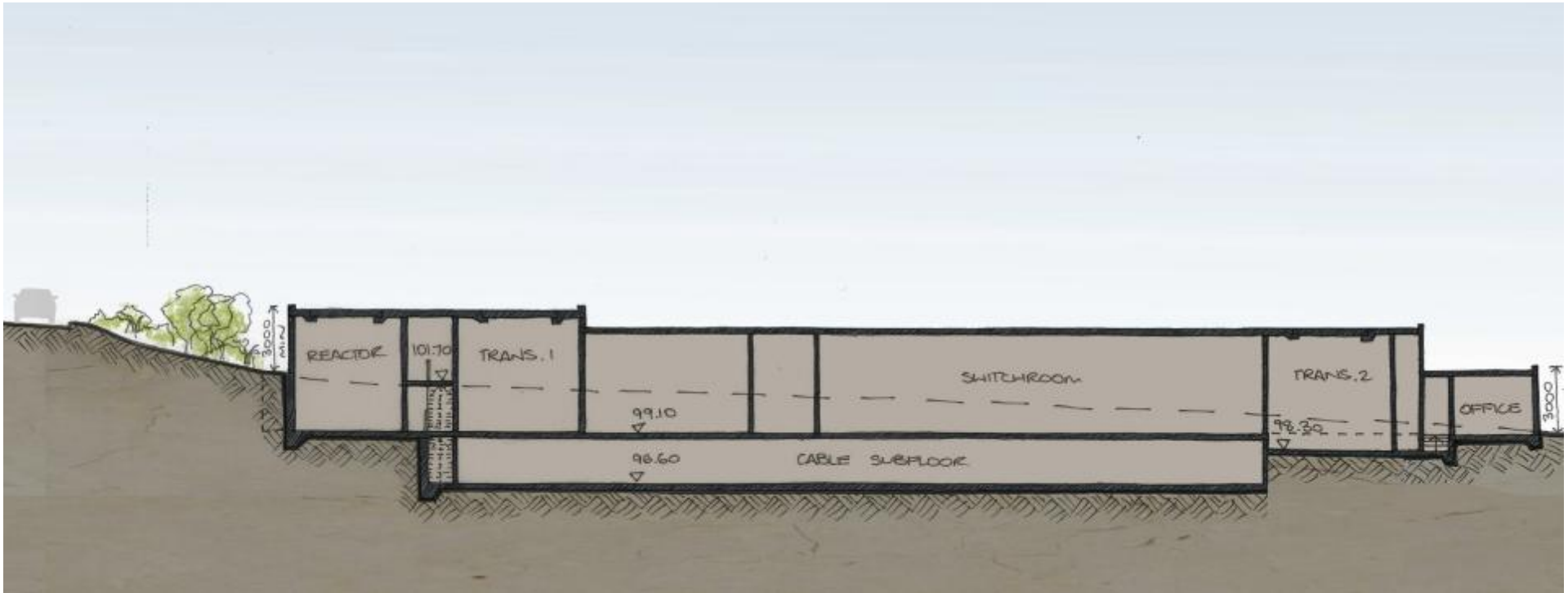
Appendix A: Project Plans



--- Proposal boundary

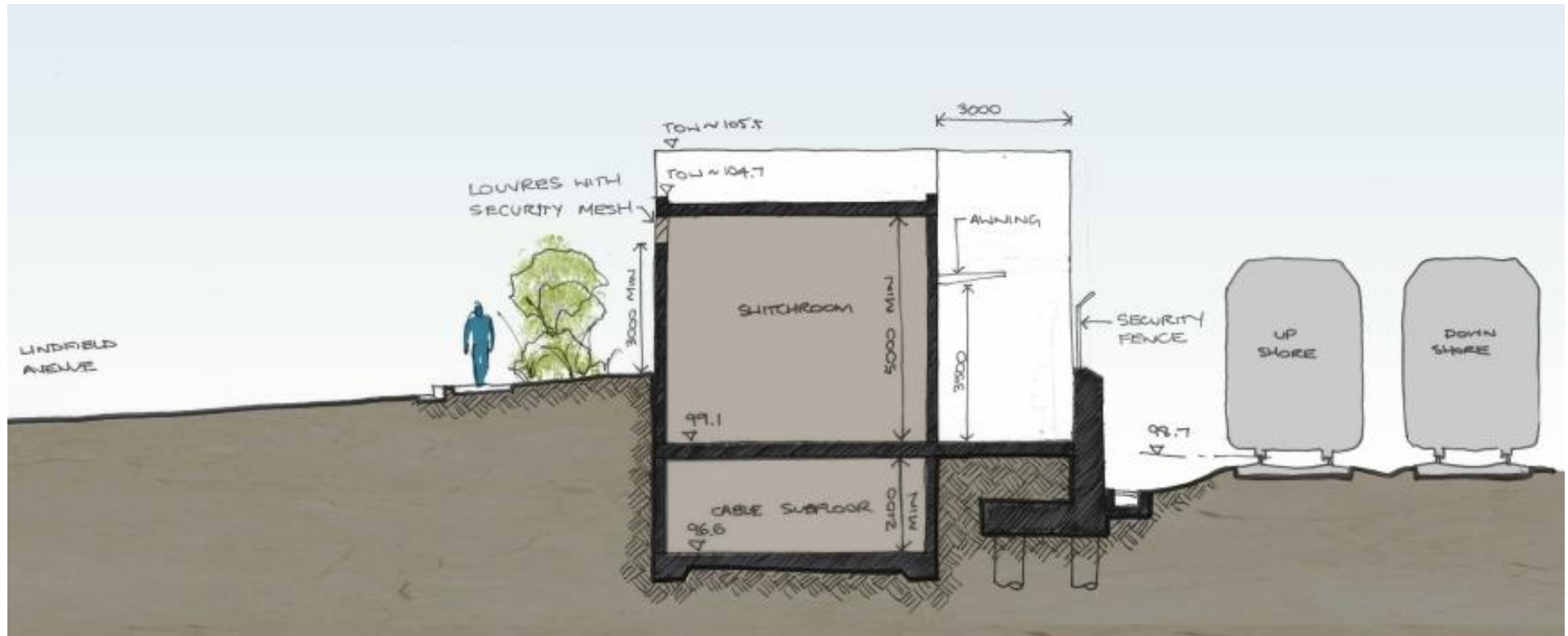
Note: Indicative only. Subject to detailed design

Indicative layout of the proposed Lindfield substation



Note: Indicative only. Subject to detailed design

Indicative elevation of the proposed Lindfield substation looking west (south to left of page)



Note: Indicative only. Subject to detailed design

Indicative elevation of the proposed Lindfield substation looking south (east to left of page)