GHD Design

Quakers Hill WRRF Advanced Treatment Upgrade

Landscape and Visual Impact Assessment

Sydney Water

30 May 2025

→ The Power of Commitment

Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.

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Terminology

Terminology	Definition
Impact	The effect of a project, which can be adverse or beneficial, when measured against an existing condition
Impact area	The area proposed for direct impact by the project
Impact assessment area	The wider area in addition to the impact area with potential impacts, within which project assets may move
Landscape	A holistic area comprised of its various parts including landform, vegetation, buildings, villages, towns, cities and infrastructure
Landscape character	The combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place
Landscape character unit	An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby
Magnitude	The apparent size of the project in the landscape or when viewed from a given viewpoint
Project or site boundary	An imaginary line that is established to convey the approximate extent of the works that generally includes the proposal and immediate surrounding areas
Reduced level	A height above (or below) a nominated datum
Sensitivity	The capacity of a landscape or viewpoint to absorb the impacts from a proposed land use change and/or built form
Study area	The area surrounding the project including land that has the potential to be indirectly impacted by the project
The guideline	*Guideline for landscape character and visual impact assessment - Environmental impact assessment practice note EIA-N04 - Version 2.3* (Transport for NSW, 2023)
The project	The construction and operation of the Quakers Hill WRRF Advanced Treatment Upgrade
View	The sight of a landscape or scene
Viewpoint	A location within the public or private domain with a potential view of the project
Viewshed	The area within which the proposal can be seen at eye level above ground. Its extent will usually be defined by a combination of landform, vegetation and built elements
Visibility	The state or fact of being visible or seen
Visual impact	The impact on views from private and public places. It is determined by considering the visual magnitude and sensitivity
Visual receiver	Individuals and/or groups of people who have the potential to be affected by views of or towards the project
Zone of theoretical visibility	As related to viewshed, a map showing areas of land within which a development is theoretically visible

Abbreviations

Abbreviations	Definitions
AWTP	Advanced Water Treatment Plant
BTF	Biotrickling Filter
CEMP	Construction Environmental Management Plan
CIP	Clean in place
ENM	Excavated Natural Material
GIS	Geographic Information System
HDD	Horizontal Directional Drilling
HV	High Voltage
IDAL	Intermittently Decanted Aerated Lagoons
km	Kilometre
LCU	Landscape Character Unit
LVIA	Landscape and Visual Impact Assessment
LEP	Local Environment Plan
LGA	Local Government Area
LSPS	Local Strategic Planning Statement
MBR	Membrane Bioreactor
m	Metre
ML	Megalitres
OCF	Odour Control Facility
NSOOS	Northern Suburbs Ocean Outfall Sewer
PCT	Plant Community Type
PRW	Purified Recycled Water
REF	Review of Environmental Factors
VP	Viewpoint
WAS	Waste Activated Sludge
WRRF	Water Resource Recovery Facility
ZTV	Zone of Theoretical Visibility

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Executive Summary

Project Overview

Sydney Water is upgrading the Quakers Hill Water Resource Recovery Facility (WRRF) to:

– support population and industrial growth by increasing treatment capacity from 28 ML/day to 48 ML/day.
– meet stricter environmental discharge limits for nutrients into the Hawkesbury-Nepean River.
– enable future production of Purified Recycled Water (PRW), though PRW is not part of this assessment.

Key components of the project include

– a new Advanced Water Treatment Plant (AWTP) with reverse osmosis and ultrafiltration
– an 8 km underground brine pipeline to discharge by-products into the existing wastewater network
– demolition of decommissioned infrastructure and restoration of affected areas.

Purpose of the Report

This Landscape and Visual Impact Assessment (LVIA) supports the Review of Environmental Factors (REF) for the project. It evaluates potential impacts on landscape character and visual amenity during construction and operation and recommends mitigation measures.

Key Findings

Landscape Character Assessment

Three Landscape Character Units (LCUs) were identified:

– LCU1 – Low Density Residential
– LCU2 – Parklands and Reserves
– LCU3 – Industrial

Construction Impacts: Rated as Moderate for LCU1 and LCU2 due to temporary disruption, vegetation removal, and construction compounds. LCU3 was rated Moderate-Low.

Operational Impacts: Generally Moderate-Low or Negligible, with LCU3 rated Negligible due to compatibility with existing industrial character.

Visual Impact Assessment

Construction Phase: Most significant impacts, especially near residential areas and parks. Four viewpoints (e.g., Billy Goat Hill Reserve) were rated High or High-Moderate.

Operational Phase: Impacts were generally Low or Negligible, except:

– VP04 (Billy Goat Hill Reserve): High due to the new 12 m barometric loop
– VP12 (Melrose Avenue): Moderate due to removal of an earth mound exposing views of the WRRF.

Cumulative Impacts

No significant cumulative impacts identified.

Mitigation Measures

Key recommendations include:

– Temporary screening around construction sites
– Restoration of disturbed areas to pre-existing or improved conditions
– Minimising vegetation removal and protecting existing trees
– Visual integration of the barometric loop through design and community engagement
– Managing lighting to reduce night-time visual impacts.

1. Introduction

1.1 The project

Upgrades to Sydney Water's Quakers Hill Water Resource Recovery Facility (WRRF) are required by 2028 to:

- service industry growth and housing policies as current treatment capacity at the plant of 38 ML/day is expected to be exceeded in late 2028
- meet Environment Protection Licence limits that require reduced nutrient loads to the Hawkesbury-Nepean River (Sackville 2 zone)
- provide high quality water treatment that enables a future Purified Recycled Water (PRW) scheme and its introduction into Prospect Reservoir.

The project is located in the Blacktown Local Government Area (LGA), in largely urbanised areas with a mix of residential, industrial, and recreational land uses, refer Figure 1.1.

The key features of the project and study area are shown in Figure 4.1 and include:

- secondary treatment process upgrade from the current 28 ML/day to 48 ML/day
- a new advanced treatment plant, including reverse osmosis, ultrafiltration and stabilisation
- a range of ancillary infrastructure such as new buildings, tanks, pipes, services and chemical storage
- demolition and restoration of previously decommissioned structures
- new brine pipeline to transfer the brine generated as a by-product of the reverse osmosis process into the existing wastewater network. The pipeline would:
    - have flow capacity of up to 12.5 ML/day
    - be about 8 km long and about 500 mm diameter
    - be installed largely along shared paths, public parkland, and road corridors
    - be mostly underground and built using open trench and trenchless methods
    - be connected into Sydney Water's existing Northern Suburbs Ocean Outfall Sewer (NSOOS).

The advanced treatment plant is required to treat the wastewater to meet more stringent nutrient limits. However, it would also produce high quality water that could be further treated to produce PRW.

Sydney Water is preparing a Review of Environmental Factors (REF) for the project. This report has been prepared to support that REF. PRW is not part of the scope of this assessment. Sydney Water is separately assessing the potential introduction of PRW in an Environmental Impact Statement.

1.2 Purpose of this report

This Landscape and Visual Impact Assessment (LVIA) has been prepared by GHD Design as part of the REF for the project. The purpose of this report is to assess potential landscape character and visual impacts from the construction and operation of the components of the project included in the REF scope. Refer to Section 4 for a summary of the visual components of the project assessed in this LVIA.

- assesses the existing landscape and visual environment,
- assesses the landscape and visual impacts of the project, and
- provides recommendations and mitigation measures in response to these landscape and visual impacts.

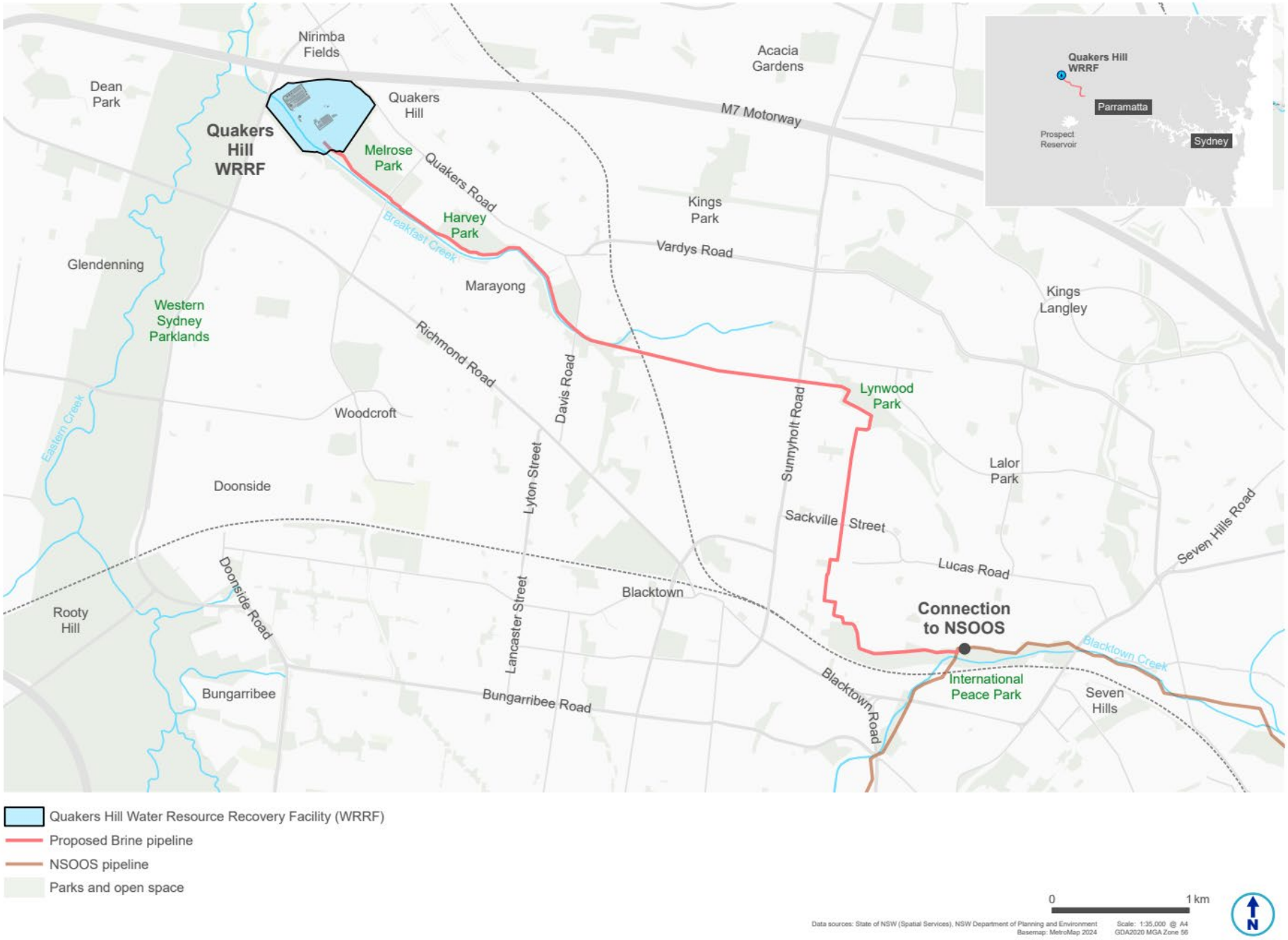

Figure 1.1 Project overview and location

1.3 Structure of this report

This report has been prepared in accordance with Transport for NSW's *Guideline for landscape character and visual impact assessment - Environmental impact assessment practice note EIA-N04* (TfNSW 2023). The following structure was developed based on the policy and detailed methodologies for each part of the assessment are included in the relevant chapters of the report, Figure 1.2:

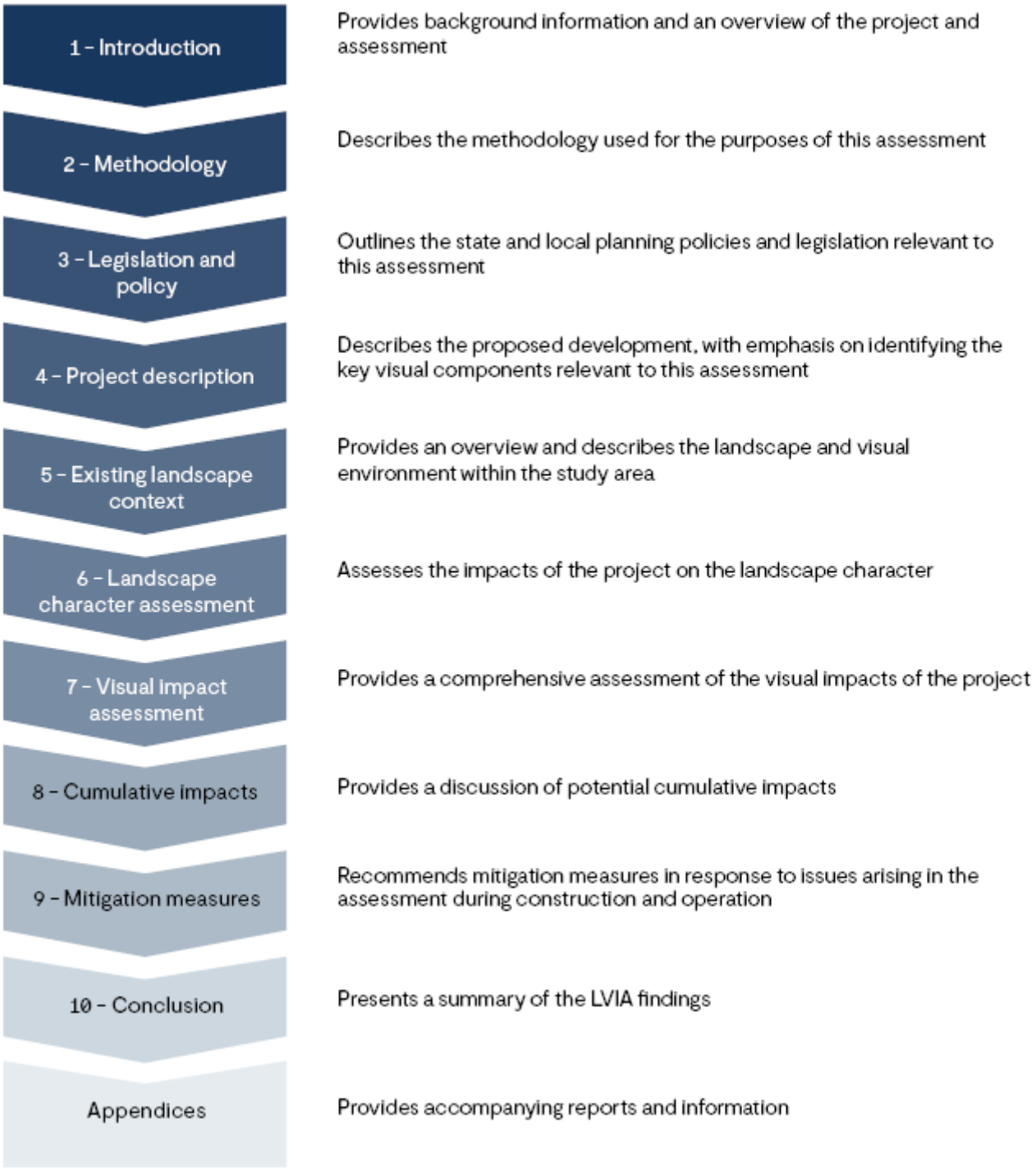

Figure 1.2 Report structure

1.4 Scope and limitations

This report has been prepared by GHD Design for Sydney Water and may only be used and relied on by Sydney Water for the purpose agreed between GHD Design and Sydney Water as set out in section 1.5 of this report.

GHD Design otherwise disclaims responsibility to any person other than Sydney Water arising in connection with this report. GHD Design also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD Design in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD Design has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD Design described in this report. GHD Design disclaims liability arising from any of the assumptions being incorrect.

1.5 Assumptions

The assessment aims to be objective and describe any changes factually. While potential changes resulting from the proposal are defined, the significance of these changes requires qualitative (subjective) judgements. This assessment's conclusion therefore combines objective measurement and professional interpretation. While this assessment aims to be objective, it is recognised that visual impact assessment can be subjective, and individuals are likely to associate different visual experiences to the study area.

2. Methodology

The following provides an overview of the Study Method utilised for undertaking the LVIA. This methodology is based on the relevant policies, frameworks and our experience in undertaking LVIAs for large infrastructure and renewable energy projects.

2.1 Landscape and visual impact guidance

This LVIA is prepared in accordance with Transport for NSW's *Guideline for landscape character and visual impact assessment - Environmental impact assessment practice note EIA-N04 - Version 2.3* (the guideline). Although this guideline has been developed for transport related projects, the methodology within it provides a consistent approach to visual impact assessments across government agencies and where the project has significant visual or landscape impacts (e.g., treatment plants, reservoirs, or pipelines in sensitive areas).

Additional information used to inform the LVIA methodology includes:

– *Guidelines for Landscape and Visual Impact Assessment, 3rd Edition* (Landscape Institute and Institute of Environmental Management & Assessment 2013).
– *Cumulative Impact Assessment Guidelines for State Significant Projects* (NSW Department of Planning and Environment 2022).

2.2 Study area

The study area is defined as the area of investigation that includes the impact area and surrounding area that may be directly or indirectly affected. The area of investigation for this LVIA comprises an approximate 250 m buffer from the impact area including the WRRF and pipeline corridors, refer also Figure 4.1 for the study area and the main project components. A 250 m buffer was chosen to encompass all the areas potentially affected by the project while ensuring other, non-relevant areas, are not unnecessarily assessed. The distance for the buffer was set in the initial desktop review based on examining satellite images and project design information to determine areas that may be impacted.

2.3 Site work

Site work for the project was undertaken by two Landscape Architects on 12 and 13 March 2025 between the hours of 9 am and 4 pm. The purpose of the field work was to:

– review the site and landscape character of the study area
– review publicly accessible locations identified in the desktop study as likely to provide views of the project, including from roads, car parks, trails and other publicly accessible areas
– confirm sensitive visual receiver locations that were identified during the desktop review, and
– take photographs from identified viewpoints and other locations for use in the LVIA.

2.4 Community consultation

Stakeholder and community engagement is a planned process of initiating and maintaining relationships with external parties who have an interest in Sydney Water's activities. Consultation would be undertaken by Sydney Water where work impacts the community in some way. This includes engaging the broader community and stakeholders during plan or strategy development or before making key decisions. Where required, mitigation proposals would be developed with relevant community and stakeholders, refer also Section 9.

2.5 Impact assessment

A qualitative based rating assessment is used in this LVIA to determine both landscape character and visual impacts. The evaluation of potential impacts for landscape character and visual impacts is based on sensitivity to change and the magnitude of change that is likely to occur, refer Table 2.1 (Transport for NSW, 2023).

Table 2.1 Landscape character and visual impact rating matrix

		Magnitude			
		High	**Moderate**	**Low**	**Negligible**
Sensitivity	**High**	High	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

2.6 Landscape character

Landscape character refers to the distinct and recognizable pattern of elements that occur consistently in a particular type of landscape. It encompasses the combination of natural and human-made features that make one landscape different from another. These features can include:

– Topography: The shape and form of the land, such as hills, valleys, and plains
– Vegetation: Types of plants and trees that are native or have been introduced to an area
– Water Features: The presence of rivers, lakes, creeks, and other types of water
– Land Use: How the land is used by humans, including agriculture, urban development, and recreation, and
– Cultural Elements: Historical sites, buildings and other elements that reflect the history and culture of an area.

2.6.1 Landscape character units and scenic quality

Understanding landscape character is important as it helps to maintain the unique qualities of different landscapes. Landscape character units (LCU) are identified and mapped as part of the landscape assessment in this LVIA. LCUs for the project are mapped on a plan, described and then assessed by evaluating the sensitivity of the landscape and the magnitude of the project's impacts on the LCU.

Scenic quality is also a general consideration and refers to the visual appeal and aesthetic value of a landscape. It is determined by evaluating various elements that contribute to the overall beauty and character of the area. Scenic quality is subjective and can vary based on individual perceptions and cultural values.

2.6.2 Sensitivity

Sensitivity refers to the value placed on a landscape and how sensitive the landscape is to the proposed change. The sensitivity of the landscape character type is rated based on the inherent capability of the area to absorb changes from the project.

2.6.3 Magnitude

Magnitude refers to the physical scale of the project and is assessed based on the following factors:

– Size and scale including:
    – the extent of existing landscape elements that may be lost and the contribution of that element to the character of the landscape

  - the extent to which the project becomes a minor or major element in the landscape and its dominance in the visual catchment
  - the extent to which the project changes the key characteristics of the landscape that are critical to its distinctive character.
- Geographical area – the area of the landscape over that the effects would be experienced having regard to the nature and scale of the project's effects. The area could vary from the immediate setting of the site to larger scales where the project may influence several landscape character units.
- Duration and reversibility of the effects on the landscape.

2.6.4 Landscape character impact assessment

Sensitivity and magnitude ratings are used in this LVIA to determine potential impacts on landscape character and the criteria for establishing impact assessment ratings are summarised in Tables 2.2 and 2.3. The rating criteria is based on GHD's interpretation of the *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute and Institute of Environmental Management & Assessment, 2013).

Each LCU is given a sensitivity and magnitude rating (High, Moderate, Low or Negligible) based on these criteria that are then used to determine the overall landscape character impact. Table 2.1 is then used to determine the overall landscape character impact.

Table 2.2 Sensitivity criteria – landscape character

Rating	Criteria
High	Landscape character is considered to have high qualities, such as state or nationally recognised features. The existing character of the setting would be highly sensitive to the proposed change. The type of development proposed could have a detrimental effect on the landscape character, condition or value. Mitigation measures are unlikely to reduce the impacts of any change(s).
Moderate	Landscape character is considered to contain moderate qualities, such as locally recognised features, that would have moderate impacts on sensitive receivers. The existing character of the setting would be moderately sensitive to the proposed change. Any change caused by the proposed development would be unlikely to have a significant adverse effect on the landscape character or value that could not be mitigated.
Low	Landscape character is considered of a low quality, with few if any recognised features, and a low number of receivers with minimal sensitivity. The existing character of the setting would be low sensitivity to the proposed nature of change. Change caused by the development is unlikely to have an adverse effect on the landscape character. Mitigation measures would be able to mitigate adverse effects.
Negligible	Landscape character lacks distinctive local features and is generally considered of a poor quality. Development of this type is unlikely to have an adverse effect on the urban landscape character. Mitigation measures would not be required as they would have no impact.

Table 2.3 Magnitude criteria – landscape character

Rating	Criteria
High	A substantial/obvious change to the landscape character due to total loss of, or change to, elements, features or characteristics of the landscape. Would cause a landscape to be permanently changed and its quality diminished.
Moderate	Discernible changes in the landscape character due to partial loss of, or change to elements, features or characteristics of the landscape, however, has potential to be partly mitigated. The change would be out of scale with the landscape character, and at odds with the local pattern and landform and would leave an adverse impact on the landscape character.
Low	Minor loss or alteration to one or more key landscape character elements, features or characteristics, or the introduction of components that may be new but may not be uncharacteristic within the existing landscape character.
Negligible	Almost imperceptible or no change in the landscape character as there is little or no loss of/or change to the elements, features or characteristics of the landscape.

2.7 Visual impact assessment

The LVIA also considers the potential visual impacts of the project. While landscape character assessment focuses on understanding and documenting the character of the landscape, visual impact assessment is concerned with assessing the visual effects of specific projects on that landscape and aims to understand how changes in the landscape will be perceived by people. Both landscape character and visual impact assessments utilise the same matrix (Table 2.1) to determine an overall rating however, the definitions for sensitivity and magnitude are different relating to each respective assessment.

The level of effects on a view depends on factors such as the extent of visibility, degree of obstruction of existing features, degree of contrast with the existing view, angle of view, duration of view, and distance from the project. Steps undertaken to assess visual impacts include:

- Identification and mapping viewpoint locations through viewshed mapping
- Assessment of visual impacts comprising assigning ratings for:
    - **Sensitivity** of identified visual receivers to the proposed change based on:
        - importance of the view, its existing scenic qualities and the presence of other existing human-made elements in the view
        - type of visual receiver and their likely interest in the view
        - scenic quality of a view including the scenic, cultural or aesthetic value of a landscape.
    - **Magnitude** of visual impact based on:
        - nature, scale and duration of the change that is expected to occur
        - loss, change or addition of any feature in the field of view of the receiver, including an assessment of the level to which the change contrasts with the existing view or expected view of the landscape
- Combining sensitivity and magnitude to obtain an overall level of significance of the visual impacts in relation to the existing view**.** Tables 2.4 and 2.5 include the criteria values utilised to establish a rating for sensitivity and magnitude.

Table 2.4 Sensitivity criteria - visual

Rating	Criteria
High	Occupiers of residential properties, at home or going to or from, with long viewing periods, within close proximity to the project; Communities that place value upon the urban landscape and enjoyment of views of their setting.
Moderate	Outdoor workers who have a key focus on their work who may also have intermittent views of the project; Viewers at schools, or similar, when outdoor play and recreation areas are located within close proximity but viewing periods are limited; Occupiers of residential properties with long viewing periods, at a distance from or screened from the project.
Low	Road users in motor vehicles, trains or on transport routes that are passing through or adjacent to the project and therefore have short term views; Viewers indoor at their place of work, schools or similar.
Negligible	Viewers from locations where there is screening by vegetation or structures where only occasional screened views are available and viewing times are short; Road users in motor vehicles, trains or on transport routes that are passing through/adjacent to the project and have partially screened views and short viewing times.

Table 2.5 Magnitude criteria - visual

Rating	Criteria
High	A substantial/obvious change to the existing view due to total loss of, or change to, elements, features or characteristics of the view. Would cause a view to be permanently changed and its quality diminished.
Moderate	Discernible changes in the existing view due to partial loss of, or change to elements, features or characteristics of the view, however, has potential to be partly mitigated. The change would be out of scale with the existing view and would leave an adverse impact on the view.
Low	Minor loss or alteration to one or more key view elements, features or characteristics, or the introduction of components that may be visible but may not be uncharacteristic within the existing view.
Negligible	Almost imperceptible or no change in the view as there is little or no loss of/or change to the elements, features or characteristics of the view.

2.7.1 Visibility and viewpoints

A visual baseline assessment including viewshed mapping, a site visit and a desktop review of the visual catchment is undertaken to establish viewpoints within the study area to be assessed for visual impacts. These viewpoints typically include residential dwellings, public buildings, public spaces, heritage items, and businesses.

Viewshed mapping is utilised to understand a project's visibility on the surrounding area. A Zone of theoretical visibility (ZTV) map is prepared to help understand a project's visibility utilising terrain modelling and GIS software to show areas from where a project may be visible.

2.8 Duration of impact

Landscape and visual impacts can be temporary or more permanent in nature. Duration of impact is used in this assessment for landscape and visual impacts associated with the construction and operation phases of the project. The following terms provide an indication of how the terms temporary and permanent are defined within the LVIA:

– Temporary – generally defined as those that do not result in permanent changes to the landscape or environment. However, if the impact duration exceeds one year, it may still be considered temporary if the area can recover to its pre-project condition or better within a specified timeframe after the project ends
– Permanent – refer to changes to the landscape or visual environment that are irreversible and will persist indefinitely.
– Short viewing time – characteristics include brief exposure (typically only lasting seconds or minutes), transient views often associated with moving viewers, such as those traveling in vehicles, walking, or cycling resulting in a limited impact
– Long viewing time – Extended exposure (often hours or more) typically associated with viewers who are stationary or spend significant time in one location, such as residents, workers, or visitors at a particular site usually resulting in greater impacts.

3. Legislation and policy

3.1 State and regional planning policies

Two NSW Government planning policies were identified that have relevance to the LVIA, they include;

– *A Metropolis of Three Cities – Greater Sydney Region Plan*
– *Our Greater Sydney 2056 – Central City District Plan*

3.1.1 A Metropolis of Three Cities – Greater Sydney Region Plan

The *Greater Sydney Region Plan* (Greater Sydney Commission, 2018) includes a vision to manage Greater Sydney's growth and enhance its status as one of the world's most liveable cities (Greater Sydney Commission, 2018). The project is located within Blacktown City Council and is towards the western region of the Central River City an area identified as future development.

The *Greater Sydney Region Plan* is relevant to this LVIA for several reasons:

– **Integrated Planning**: The plan aims to align land use, transport, and infrastructure planning to create three interconnected cities within Greater Sydney. This integrated approach ensures that landscape and visual impacts are considered in the broader context of urban development and infrastructure projects.
– **Urban Design and Public Spaces**: The plan emphasizes the creation of great places that bring people together and celebrate the unique character of different areas. This focus on urban design and public spaces directly influences how landscape and visual impacts are assessed and managed.
– **Community and Cultural Values**: The plan recognises the importance of community and cultural values in shaping the landscape. LVIAs should take these values into account to ensure that developments respect and enhance the character and visual appeal of the area.
– **Mitigation and Enhancement**: The plan encourages the implementation of mitigation measures to reduce adverse impacts on the landscape and visual environment. This aligns with the LVIA process, that seeks to identify and address potential impacts through careful planning and design.

Objective 28, "*Scenic and cultural landscapes are protected*" from the *Greater Sydney Region Plan,* is also relevant to this LVIA. This objective specifically refers to the protection of scenic values associated with rivers and creeks within the Central River City. By incorporating the principles and objectives of the *Greater Sydney Region Plan*, the LVIA can help ensure that development projects contribute positively to the region's overall character and visual quality.

3.1.2 Our Greater Sydney 2056 – Central City District Plan

The *Central City District Plan* outlines planning priorities for the Sydney metropolitan area including the study area. The design of the project should address planning priorities as it will help to contribute positively to the project area's overall character and visual quality. Table 3.1 includes the planning priorities from the District Plan relevant to this LVIA.

Table 3.1 Our Greater Sydney 2056 relevant planning priorities

Planning priority	Relevance to LVIA
Planning priority C13 Protecting and improving the health and enjoyment of the District's waterways	Recreational, scenic and environmental values associated with the project, should be considered in this LVIA to ensure they contribute positively to the landscape's visual quality and ecological health.
Planning priority C15 Protecting and enhancing bushland, biodiversity and scenic and cultural landscapes	Landscapes in the project study area contribute to the identity and international profile of Greater Sydney and the Blacktown City region. Protection of visual amenity and landscape values should be considered in this LVIA.
Planning priority C16 Increasing urban tree canopy cover and delivering Green Grid connections	This priority focuses on enhancing green infrastructure and connectivity. The LVIA should consider the impact of developments on tree canopy cover and green grid connections.

3.2 Local government

3.2.1 Blacktown City Council Local Strategic Planning Statement

Blacktown City Council Local Strategic Planning Statement (LSPS) sets out a 20-year vision for the future of the Blacktown City LGA. The project is located within the Blacktown LGA and the key local planning priority set out in Table 3.2 below is relevant to consider.

Table 3.2 Blacktown City Council LSPS planning priorities

Planning Priority	Relevance to LVIA
Local Planning Priority 13: Protecting and enhancing bushland, biodiversity and scenic and cultural landscapes	The LVIA should consider the impacts of the project on protection of the natural environment within the Blacktown City LGA noting that Sydney Water are the determining authority so can override this requirement.

3.2.2 Blacktown City Council Local Environmental Plan (LEP) 2015

The project is located within the Blacktown City Local Government Area (LGA) and should consider the policies in the Blacktown City Local Environmental Plan (LEP) 2015. Landscape and visual impact assessments can help ensure that developments within the Blacktown LGA are visually appealing and respectful of the area's unique character and heritage. The key objectives of the LEP relevant to this LVIA are summarised in Table 3.3.

Table 3.3 Blacktown LEP relevant objectives

Objective	Relevance to LVIA
Schedule 5 Environmental heritage and **Part 5 Miscellaneous provisions** **5.10 Heritage Conservation** (1) to identify, conserve and promote Blacktown City's environmental heritage and significance.	The objectives of this clause are; (a) to conserve the environmental heritage of Blacktown, (b) to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views, (c) to conserve archaeological sites, (d) to conserve Aboriginal objects and Aboriginal places of heritage significance. Although this objective requires development consent, Sydney Water are the determining authority so can override this requirement.

Objective	Relevance to LVIA
Part 5 Miscellaneous provisions **5.23 Public Bushland**	The objective of this clause is to protect and ensure the ecological viability of bushland, including rehabilitated areas in urban areas. The protection of native flora should be considered in this LVIA. Although this objective requires development consent, Sydney Water are the determining authority so can override this requirement.

3.3 Related development

Sydney Water is seeking separate approval for a PRW scheme, including a PRW Treatment Plant at Quakers Hill WRRF. That project (Securing our water supply – Quakers Hill to Prospect) is State significant infrastructure (SSI). Sydney Water is preparing an Environmental Impact Statement (EIS) to be submitted to the Department of Planning, Housing and Infrastructure for public exhibition in late 2025. GHD are preparing a LVIA in support of the EIS.

4. Project design

4.1 Existing infrastructure modifications

Modification of existing infrastructure at the Quakers Hill WRRF is required to facilitate construction and operation of the proposal's other components. This includes modifications to the following existing assets:

- Modifications to existing infrastructure at Quakers Hill WRRF including:
  - secondary wastewater treatment process upgrade to increase treatment capacity of the WRRF and provide suitable feedwater for the new Advanced Water Treatment Plant (AWTP)
  - AWTP with associated interconnecting pipes, valves and isolation points to treat wastewater to a high quality to achieve EPL compliance
- Brine pipeline with associated valves, chambers, barometric loop and maintenance access points to transport brine to the existing wastewater reticulation system

The location and layout of the main project components are shown in Figure 4.1 with more detailed descriptions of individual components provided later in this section. The project design is ongoing and is subject to change as it is further developed. This LVIA is based on the reference design of the main visual components of the project at the time of preparing the assessment.

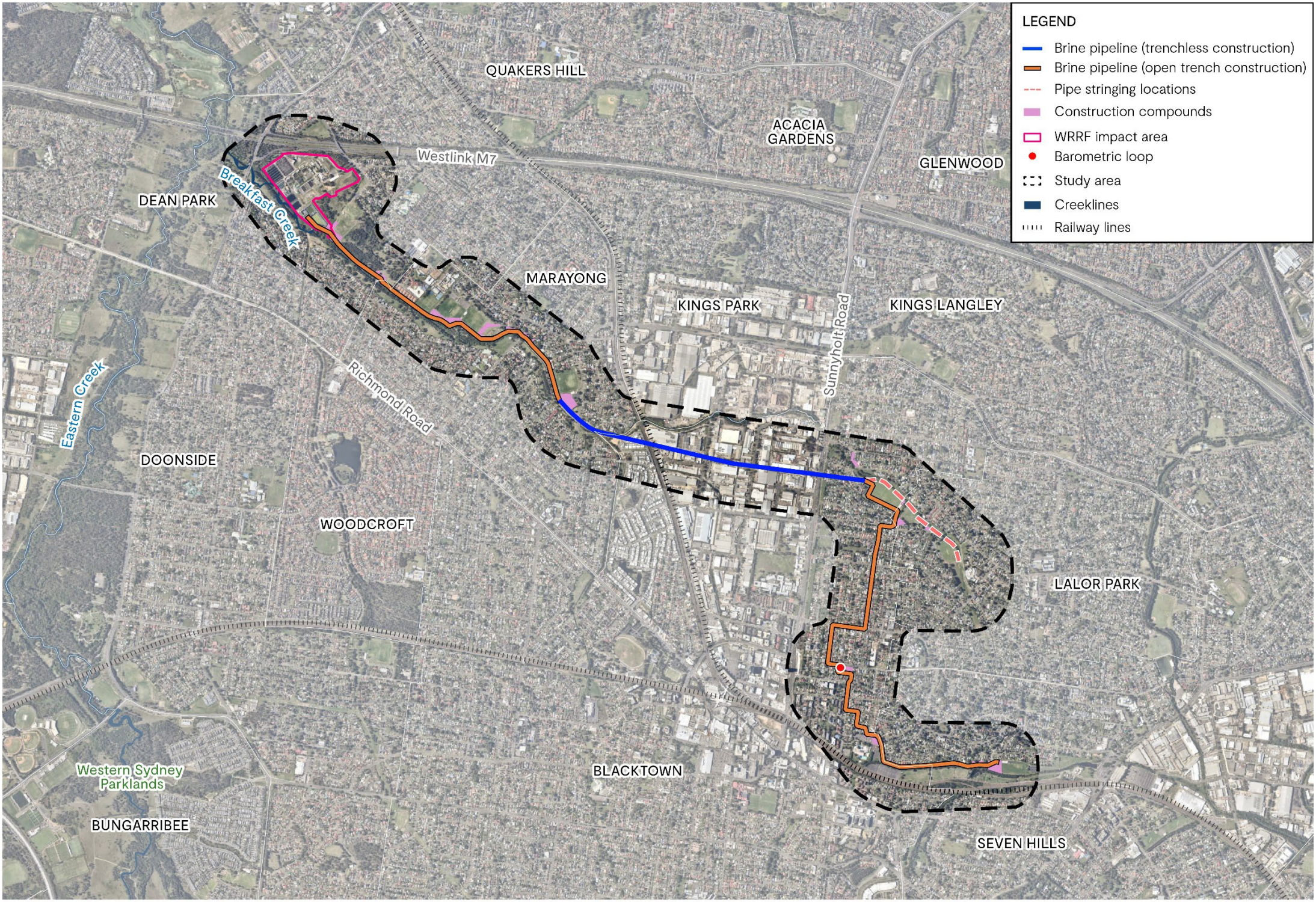

Figure 4.1 Project design

4.2 WRRF

Modification of existing infrastructure at the Quakers Hill WRRF is required to facilitate construction and operation of the project's other components, refer Figure 4.2 (Source: Sydney Water). This includes modifications to the following existing assets:

- Primary treatment plant
- Clearwater basin
- Brine tanks
- Brine pumps
- Activated granular sludge polymer system
- Coagulant bulk storage
- Hypochlorite bulk storage
- Site services (reclaimed effluent supply, compressed air system, fire water etc.)
- High voltage (HV) power supply
- Supervisory Control and Data Acquisition system
- Switchboards.

The type of modification required depends on the asset. Types of modification include retrofitting of connections, cut-ins, reuse or demolition, or the addition of structures. The scope of the required modifications will be developed and refined as the design of the proposal progresses and confirmed at detailed design.

Modifications would also involve the demolition and infilling of two previously decommissioned Intermittently Decanted Aerated Lagoons (IDALs), which currently occupy the proposed location of the AWTP.

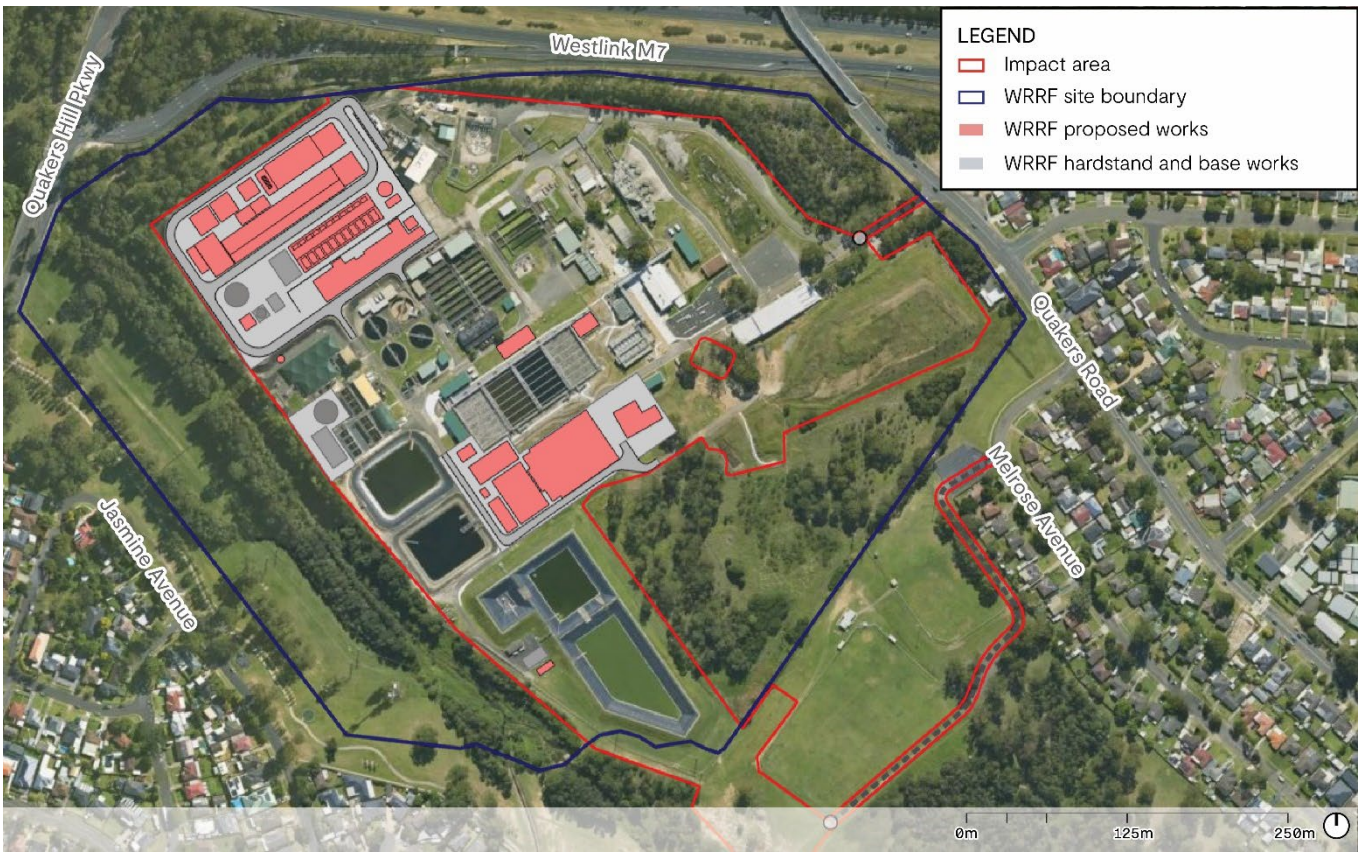

Figure 4.2 WRRF site layout

4.2.1 Secondary wastewater treatment

The secondary wastewater treatment plant would be located near the middle of the existing Quakers Hill WRRF site on vacant land adjacent to existing infrastructure. This location minimises interactions with buried services and surrounding existing processes. Secondary wastewater treatment plant components are described in Table 4.1.

Most components of the secondary wastewater treatment plant are process units and will be located outside. The largest of these will be the bioreactor, standing about 58 metres long, 70 metres wide and 6 metres high. The highest component will be the odour control discharge stack at about 14 metres. The switch room and blower room will be housed in a combined, multi-storey building with dimensions of 12 m wide, 24 m long and 12 m high.

A range of other ancillary infrastructure will also be required, such as connecting pipelines, safety equipment, HV electricity cables, utility conduits, site lighting and internal roads.

Table 4.1 Components of secondary wastewater treatment plant

Wastewater treatment component	Key design details
Membrane bioreactor (MBR) process unit	The MBR would comprise a concrete water retaining structure about 6 metres high, 29 metres long and 26 metres wide.
MBR and bioreactors switch room and Blower room building	Multi-storey building measuring 12m wide, 24m long and 12m high housing the MBR and bioreactors switch room.
MBR pre-screens process unit	An outside process unit raised on a plinth for the fine screening of feed water to the bioreactor. This process unit would be about 8.5 metres high, 20 metres long and 25 metres wide located immediately east of the Bioreactor.
Odour control facility (OCF), including stack	The OCF would consist of an 8-metre-long concrete slab at ground level supporting 2 fans, 4 fibreglass tanks for either biotrickling filter (BTF) or activated carbon odour treatment technologies, and a discharge stack. The 2 larger BTF tanks would be about 14 metres high and 3.4 metres in diameter. The smaller activated carbon polishing tanks would be about 3 metres in diameter. The stack would be about 14 metres high and <1 metre in diameter and is located approximately 100 m north of the Bioreactor.

4.2.2 Advanced water treatment

The proposed AWTP would be in the northwest portion of the existing Quakers Hill WRRF site, within an area currently occupied by two disused IDALs. The tallest component of the AWTP will be the flow splitter tank at about 14 metres high. Component infrastructure of the AWTP is described in Table 4.2.

Table 4.2 Components of the AWTP

Wastewater treatment component	Key design details
Ultrafiltration feed tank	Raised tank on a plinth providing intermediate storage of water to be pumped to the ultrafiltration membranes via the ultrafiltration feed pumps. The tank would be about 10 metres high and 10 metres in diameter and positioned near the northern edge of the AWTP.
Ultrafiltration building	A metal-clad building housing 6 ultrafiltration trains. The structure would be about 5.5 metres high, 45 metres long and 25 metres wide and positioned near the northern edge of the AWTP.
Reverse osmosis feed tank	2 raised 1,500 cubic metre tanks set on a plinth for storage of water received from the ultrafiltration process, to be pumped to the reverse osmosis trains via the low-pressure and high-pressure reverse osmosis pumps. These

	tanks would be located north of the reverse osmosis building and stand about 12 metres high and 16 metres in diameter and positioned near the northwest corner of the AWTP.
Reverse osmosis building	A large metal-clad building about 12 metres high, 118 metres long and 22 metres wide to house the reverse osmosis trains, low pressure pumps, cartridge filters and high-pressure pumps. Located towards the centre of the AWTP.
Reverse osmosis permeate tank	A 1,000 cubic metre tank on a plinth south of the reverse osmosis building for storage of permeate from the reverse osmosis process. The tank would be about 12 metres high and 12 metres in diameter.
Reverse osmosis CIP unit	This structure would house the CIP system and CIP chemicals required for the reverse osmosis equipment. The round unit would be located east of the reverse osmosis building on a separate slab and stand about 8 metres high and 3 metres wide and located in the eastern area of the AWTP.
Enhanced treatment building and system	The enhanced treatment building houses the enhanced treatment system and would stand about 12 metres high, 68 metres long and 25 metres wide located towards the centre of the AWTP.
Chemical dosing area building housing lime and CO_2 system	An open wall, covered structure at ground level, housing the chemical dosing equipment. The structure would stand about 9 metres high, 120 metres long and 25 metres wide
AWTP and PRW switch room	A tilt slab / brick building housing switch room and other electrical equipment required for the control and operation of the AWTP and sized to accommodate future planned PRW plant on the site. The structure would stand about 6 metres high, 25 metres long and 25 metres wide and located to the western end of the AWTP.
Brine storage tanks	Some modifications may be required to the existing brine storage tanks to ensure adequate storage for brine produced by the project. For example, this may include slightly increasing the height of the earthen walls or covering them.

Up to 7 buildings could be built to house process units that require controlled conditions to operate. Of those, five will be large structures including:

– Chemical dosing area building
– Reverse osmosis building
– Enhanced treatment building
– Ultrafiltration building
– Switch room building

4.3 Brine pipeline

The project's brine pipeline would be linear infrastructure about 7.7 km long located underground between the Quakers Hill WRRF in the west and the International Peace Park (Seven Hills) in the east, where it would connect into the NSOOS. The diameter of the proposed pipeline is about 500 mm, providing a 38 ML/day flow capacity.

The route of the brine pipeline follows the alignment of Breakfast Creek from Quakers Hill WRRF to Marayong Park. From there, the pipeline alignment continues east under a railway and the Kings Park Industrial Estate and Blacktown Distribution Centre to Lynwood Park, before tracking south along public road corridors and shared paths to the Blacktown Aquatic Centre car park. The alignment then generally follows a shared path eastwards to connect with the NSOOS at the International Peace Park in Seven Hills. Most of the brine pipeline is within the suburb of Blacktown except for about 90 metres of pipeline at Lynwood Park, which extends into the Lalor Park suburb.

The brine pipeline is predominantly within public land, either along shared paths or along public roads. The central section of the brine pipeline will be constructed entirely underground using trenchless construction techniques.

This includes tunnelling under multiple private lots associated with residential and commercial properties, most likely using horizontal directional drilling (HDD). The launch and receival pits for these drilling activities and where the brine pipeline nears the surface are within public spaces or a cul-de-sac within the industrial park.

Ancillary infrastructure required for the brine pipeline includes (but is not limited to):

– about 19 air valves
– about 17 scour valves and/or chambers
– about 3 isolation valves
– up to 8 maintenance access points (based on an assumption of one access point per 1 km of pipe)
– a barometric loop at Billy Goat Hill Reserve, rising about 12 m above ground.

4.4 Barometric loop

Billy Goat Hill Reserve represents the highest point along the brine pipeline alignment on public land (i.e. not within private property). Changes in pressure associated with the change in gradient of the pipeline at this location means a barometric loop would be required. The concept design is based on a 12 m height and a 2.5 m diameter with a chainmesh security fencing surrounding on a concrete slab at the base.

4.5 Construction – wastewater treatment infrastructure

The sequence of construction of the wastewater treatment components of the project will generally involve:

– Site establishment and early works
– Preliminary civil works
– Main civil works
– Main structural works
– Main mechanical and electrical works (where relevant)
– Commissioning
– Restoration
– Demobilisation

4.5.1 Site establishment and early works

Before main construction works can begin for the wastewater treatment infrastructure, the following activities are required to establish the site:

– Site surveys to locate buried services and utilities
– Set up of site access and traffic management controls
– Setting out the site and construction compounds (including boundary marking)
– Installing safety barriers, as well as erosion and sediment controls including sediment basins
– Minor vegetation clearance, in pre-approved areas
– Stripping and stockpiling of topsoil for reuse in restoration
– Minor earthworks associated with ground levelling.

Exact activities required would be site-specific and may differ slightly between the secondary wastewater treatment upgrades and the AWTP. Site establishment and early works activities would be manual or involve the use of minimal plant and equipment to prepare the site for the main construction activities, as described below.

4.5.2 Access and traffic management

Access to the operational Quakers Hill WRRF site is already established from Quakers Road. An electric gate on the access road from the public road is set back about 90 m from Quakers Road. The existing internal road

network within the Quakers Hill WRRF site is proposed to be extended to border the secondary wastewater treatment plant on three sides and encompass the AWTP to facilitate construction and operation activities.

Existing amenities and car parking on the Quakers Hill WRRF site will be available to the construction workforce for amenity breaks and car parking respectively. An overflow car park may be required to accommodate workers' vehicles at busy periods during the construction program. If this overflow is needed, Sydney Water propose to temporarily use an existing council carpark off Melrose Avenue in Quakers Hill and would consult with Blacktown Council during detailed design about this option. This location has been used as overflow parking for a previous upgrade project at Quakers Hill WRRF.

4.5.3 Construction compounds

Construction compounds are designated areas for use by contractors to facilitate construction activities and would be required throughout the construction phase at multiple locations along the brine pipeline. These areas would be used to store equipment and materials and provide site office facilities and parking for construction workers but may also be used as muster points and include amenities for workers. Sheds may be installed at some construction compounds to house construction equipment and materials.

Locations identified for construction compounds are mostly in grassed areas which are easily accessible from public roads. Compounds are required at the HDD launch and receival pits to accommodate the construction equipment for drilling activities. HDD construction methods also require long areas to string out the pipeline prior to it being pulled through the tunnel.

Different types of compounds would be required for different lengths of time during construction (about 24 months). In general, main and satellite compounds would be required for the entire construction duration, and smaller HDD compounds and laydown compounds would be required for about 1 to 6 months, refer Table 4.3.

Up to 20 locations for construction compounds have been identified at intervals along the brine pipeline alignment. Sydney Water may not need all compounds that are proposed, or alternative locations may be required. Taking a conservative approach, 20 construction compound locations have been included within the scope of the project to provide optionality for the pipeline delivery contractor(s).

The secondary wastewater treatment upgrades and AWTP will have construction compounds located within the existing WRRF site. Both construction compounds have been located near to the respective construction footprint and sized according to the expected needs of the delivery contractor and with consideration of the existing constraints. The exact location and size of construction compounds for the proposal will be confirmed by the respective delivery contractor during detailed design and approved by Sydney Water's Project Manager.

Construction compounds will be established before construction of the main civil works on each component of the proposal starts.

Table 4.3 Overview of construction compound types

Compound type	Key activities and description	Duration
Main	Large compounds that would be active for the entire construction of the proposal and would include: – Temporary buildings such as offices and meeting rooms, amenities and first aid facilities – Stockpiling and sorting of waste material prior to disposal or reuse – Storage of site equipment, including bunded storage for any chemicals such as fuel.	Entire 24-month construction period of the proposal
Satellite	Smaller compounds that would be active for the entire construction of the proposal. They would have similar activities to main compounds.	Entire 24-month construction period of the proposal

HDD	Only identified for HDD launch and receival pits where an increased construction presence will be required. Accommodate activities associated with drilling such as the drill rig, spoil management and pipe placement. Only required during HDD activities	Duration of the tunnelling work they are supporting, typically 1 – 6 months
Laydown	Small, transient compounds located at brine pipeline trenching construction sites. These would only be required for short periods of time and would move along the pipeline alignment as trenching progresses.	About 4 – 8 weeks

4.5.4 Safety and environmental controls

Measures to ensure the safety of people on the site will be implemented, including the installation of safety barriers and fencing around the construction areas. Contractors will ensure appropriate controls are in place for storing chemicals on site and that response equipment and procedures are available and accessible in the event of an emergency or environmental incident.

Control measures to minimise erosion of soils and runoff of sediment from site will be implemented during site establishment. This would include creating detention basins or re-use of existing basins to allow sediment entrained in stormwater runoff from site to settle out.

4.5.5 Vegetation clearance

Vegetation within the impact area which has been identified and approved for removal would be cleared. While most native vegetation on the site has been avoided, the delivery contractor will consider whether there is further opportunities to minimise vegetation clearance within the impact area. The method of vegetation removal is expected to be mechanical, with the use of handheld equipment to remove above-ground vegetation and small excavators to remove tree roots and below-ground vegetation.

4.5.6 Stockpiling of material and site restoration

Topsoil and excavated natural material (ENM) from site establishment activities (and main construction works) will be separated and stored separately within the construction footprint during construction activities. Once construction of the proposal is complete the stockpiled ENM and topsoil would be used as infill and to restore the site to a safe and aesthetic condition, as well as to aid any landscaping and revegetation of the site.

4.5.7 Post construction

Restoration and demobilisation

The working areas of the construction site will be returned to the pre-construction condition. If confirmed to be of suitable quality, the ENM, VENM and topsoil removed at the start of construction and stockpiled on site will be used in site restoration:

– dismantling the site, cleaning up and restoring areas
– removing waste materials, machinery and excess materials
– removing environmental controls, contractor site sheds, temporary fencing and safety barriers
– fixing any defects during the liability period.

All construction plant, equipment, waste and personnel not required for the operation of proposal will be removed from site.

4.6 Construction – brine pipeline

The sequence of construction of the brine pipeline will generally follow the same steps as those identified for the wastewater treatment infrastructure. However, the methodology for constructing the brine pipeline differs in that the location of the construction footprint will be dynamic, likely occurring in several locations at one time, moving progressively along the pipeline alignment, with each location likely to be in a different phase at any one time.

The delivery contractor(s) will install the brine pipeline using 2 construction methods. The method selected for certain sections of pipeline has been informed by a review of engineering and environmental constraints. About 5.1 km of the overall brine pipeline will be constructed using an open-cut trench method. About 2.6 km of pipeline between Marayong Park and Lynwood Park would be installed using a trenchless technique (expected to be horizontal directional drilling (HDD)).

To reduce construction program and for procurement reasons, several work fronts may be established along the length of the brine pipeline. It is likely that one work front would construct the open-cut trench sections of pipeline, while the other would construct the HDD sections of pipeline.

4.6.1 Site establishment and early works

Aspects relating to carrying out site surveys, implementing safety and environmental controls, clearing vegetation and stockpiling material for site restoration as part of site establishment would be consistent with that described for the wastewater treatment infrastructure. Given the dynamic location of the work front, the differences in access and traffic management and construction compounds are outlined in the following sections. Materials associated with construction of the brine pipeline will be delivered to construction compounds.

Construction compounds

Up to 24 locations for construction compounds have been identified at intervals along the brine pipeline alignment. Not all these locations are expected to be used for construction compounds. However, 24 options have been considered within the REF to provide flexibility for the pipeline delivery contractor(s).

Access and traffic management

The construction footprint of the brine pipeline would move along the pipeline alignment over the construction program. Access to the brine pipeline construction front would be from nearby public roads. Suitable traffic management controls will be implemented to ensure the safety of road users. Materials associated with construction of the brine pipeline will be delivered to construction compounds.

4.6.2 Main civil works

The main civil work activities associated with both brine pipeline construction methods are described in this section.

Open trench method

Prefabricated pipe would be laid in a trench about 1-1.5 metres underground. The following steps are expected to occur:

– In grassy areas, excavators will first strip the grass and topsoil from the site of the trench and store these separately for use in restoration. Where the pipeline alignment interacts with existing hardstand areas (i.e. roads) or filled land, pneumatic drilling, concrete cutting or jackhammering may be required to break the solid surface.
– Subsoil will be excavated and temporarily stockpiled within the construction corridor.
– A trench with depth sufficient to accommodate the prefabricated section of pipe, would be dug.

It is anticipated that several work fronts will construct sections of the brine pipeline simultaneously, with each section being in a different phase at any one time. Each work front will work progressively along the designated section of pipeline. Restoration of the impacted area is expected to be completed following backfill of the trench. The exact process will be fully defined by the delivery contractor during detailed design.

Image 4.1 shows a typical open trench excavation for pipeline construction and the use of shore boxes which are used for deep excavation and narrow construction corridors such as in a roadway. Image 4.2 shows open trenching with a benched trench when a wider construction corridor is required. Images provided by Sydney Water.

Image 4.1 Trenched pipeline construction within road

Image 4.2 Trenched pipeline construction with benching

Trenchless (HDD) method

The following steps are expected:

- Contractors responsible for the HDD work front would mobilise at construction compounds C5 to C15. A launch and receival pit will be established at the start and end of the planned HDD route.
- Lengths of pipe to be installed by an HDD construction method will be 'strung' out on the ground along the alignment of the brine pipeline and connected together and pressure tested.
- An HDD rig would be set up and calibrated at the launch pits.
- The drill head would be activated and begin drilling along the pre-defined path. Spoil arising from the drill will be stockpiled within the construction compound areas.
- Once drilling between launch and retrieval pits is complete, the pipe-string would be pulled through the hole that has been drilled.
- Stockpiled spoil would be managed depending on the type of material. If deemed excavated natural material (ENM) or virgin excavated natural material (VENM), this may be reused on site. If not suitable for reuse, the spoil would be removed from site by a licensed waste carrier to a licensed waste management facility.
- The HDD rig would be demobilised and removed from site, along with all other plant, equipment, materials and waste associated with HDD activities.

A simple illustration of a typical HDD activity is provided in Figure 4.3 (source: Sydney Water).

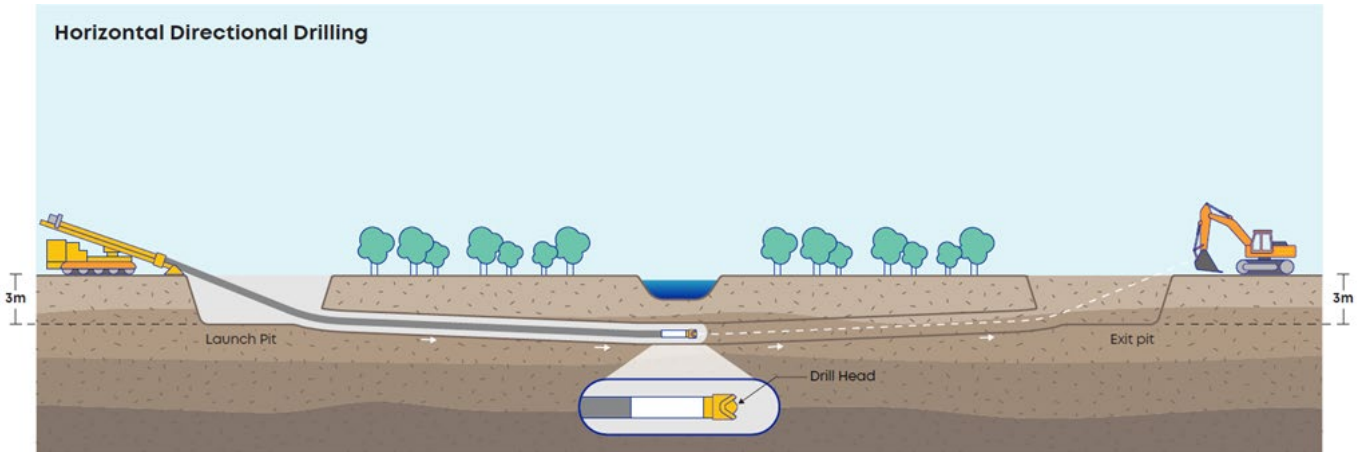

Figure 4.3 Illustration of HDD trenchless construction technique

4.7 Construction program

Sydney Water is targeting 2027 to start construction of the proposal. Early civil works for the demolition of the IDALS may start within 2026, subject to securing the necessary approvals. Table 4.3 shows the expected start and anticipated duration of works for each proposal component.

Table 4.4 Expected start and duration of construction for each component

Proposal component	Expected start	Duration
Existing infrastructure modifications and secondary wastewater treatment upgrades	Early 2027	About 15 months
Advanced water treatment plant	Mid-2027	About 18 months
Brine pipeline	Early 2027	About 24 months

Work hours

Work and deliveries will typically be scheduled and carried out during standard daytime hours of:

– 7am to 6pm, Monday to Friday
– 8am to 1pm, Saturdays.

At this stage, minimal night works are planned. However, some work outside standard daytime hours may be required for:

– Truck deliveries
– Trenchless construction techniques, including HDD activities
– Activities requiring continuous work, e.g. concrete pours, commissioning and performance testing
– Excavations (trenching) and pipe installation in busy public roads
– Connections within the operational WRRF to operating assets
– Works requiring low flows in the wastewater network, e.g. connections and cut-ins.

Sydney Water's Project Manager can approve work outside of standard daytime hours.

Vehicle movements

Construction traffic related to the proposal would be generated by activities including:

– worker crews – crews undertaking tunnelling and open trenching along the pipeline alignment
– light vehicles accessing site compounds, including the secondary wastewater treatment upgrades and AWTP construction site at Quakers Hill WRRF
– heavy vehicles accessing site compounds, including the secondary wastewater treatment upgrades and AWTP construction site, to deliver construction materials and equipment to remove waste.

Table 4.4 provides the estimated peak traffic movements for light vehicles and heavy vehicles during construction.

Table 4.5 Indicative construction traffic generated by the proposal

Location	Likely route	Estimate peak daily vehicle movements
AWTP works site at Quakers Hill WRRF	Quakers Road	100 light vehicles 78 heavy vehicles
Brine pipeline	Western section: M7 Motorway, Quakers Hill Parkway and Quakers Road Central section: M7 Motorway, Sunnyholt Road and Vardys Road Eastern section: M7 Motorway and Sunnyholt Road	50 light vehicles 8 heavy vehicles

Car parking

Car parking spaces are available within the existing Quakers Hill WRRF site for worker's vehicles during construction. However, at peak construction periods the number of personal vehicles associated with the workforce may exceed the number of onsite parking spaces. To address the potential shortage of parking spaces within the Quakers Hill WRRF site, an existing car park at Melrose Avenue (east of the WRRF) is proposed as temporary overflow parking. The existing car park at Melrose Avenue will provide about 27 additional parking spaces.

5. Existing landscape context

5.1 Regional

The project is in the Greater Western Sydney region of metropolitan Sydney an area that is diverse and rapidly growing with many key features including economic, culture, education, employment, historic and natural beauty.

Regional landscape features of the area include national parks (including parts of the Blue Mountains), waterways such as Eastern Creek, and significant open spaces such as the Western Sydney Parklands located west of the project. These natural features offer residents and visitors a range of recreational activities and scenic landscapes.

5.2 Local

Quakers Hill is located approximately 30 km north-west of Sydney's central business district. The project crosses several suburbs from the north-west to the south-east including Quakers Hill, Marayong, Lalor Park and Blacktown, refer Figure 5.1.

The developed nature of the study area means that it is supported by a primary and secondary road network. Main arterial routes near the WRRF include the Westlink M7 motorway, Richmond Road and Sunnyholt Road.

Other waterways, public spaces and industrial facilities within the study area include:

– Breakfast Creek
– Melrose Park
– Harvey Park
– Graham Whitehouse fields
– Marayong Park
– Kings Park / Blacktown industrial area,
– Lynwood Park,
– Billy Goat Hill Reserve, and
– International Peace Park.

The WRRF is set within a predominantly suburban residential landscape with the Westlink M7 motorway located directly to the north. Melrose Park is a recreational park located to the south-east and includes running and walking trails and sports fields. The project is also bounded by Breakfast Creek, running east to west along the south-west boundary of the WRRF. A shared user path runs alongside the creek in some areas and the creek is inaccessible in other parts, joining with Eastern Creek to the north.

Harvey Park and Graham Whitehouse Fields are suburban parks with sporting fields and other active and passive recreation opportunities such as walking and cycling paths and play areas. The Kings Park / Blacktown industrial area is a large, industrial precinct with a range of commercial and warehouse operations such as storage facilities and other support services.

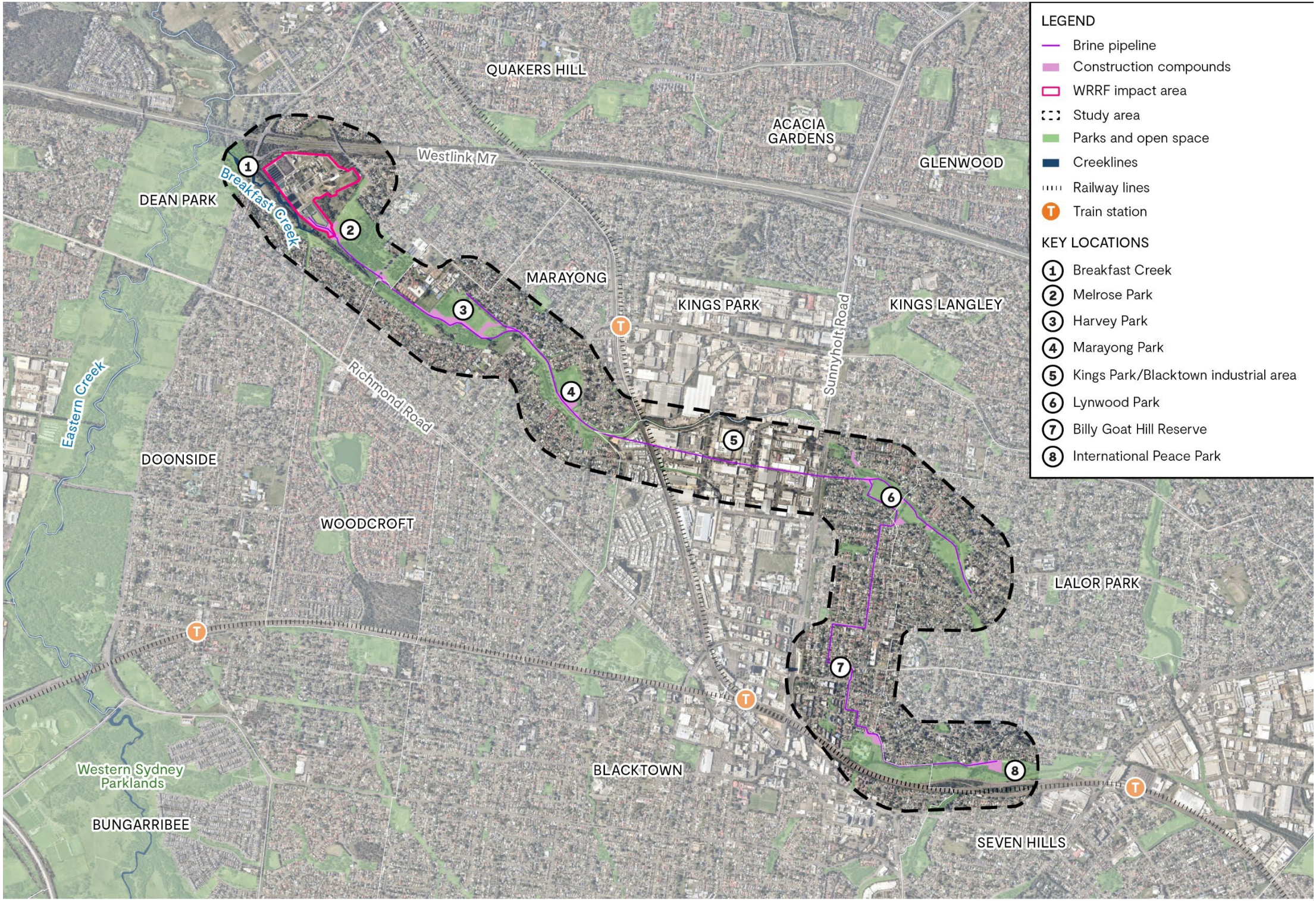

Figure 5.1 Local context

5.3 Topography and hydrology

The study area is generally flat with only minor level changes from end-to-end. Elevations range from RL 25 m in the north-west near the WRRF to the highest point of 75 m in the south-east of the study area. Low points are associated with the waterbodies such as Breakfast Creek (RL 30 m) near the WRRF, refer Figure 5.2. The lowest and highest points are located at opposite ends of the study area approximately 4 km apart, resulting in subtle level changes across the study area.

Breakfast Creek is an urban watercourse that borders the south-western edge of the WRRF and continues east through the study area to the Kings Park/Blacktown industrial area. The creek originates in Lalor Park and flows generally north-west, joining with other creeks before merging with Eastern Creek in Quakers Hill. The creek is approximately 7 km long and is part of the Hawkesbury-Nepean catchment.

The WRRF is located towards the north of the study area inside Quakers Hill. The relatively flat land has an elevation of RL 30 m nearby Melrose Park. The topography, combined with existing structures and vegetation in the residential area, generally limits visibility of the WRRF from nearby visual receivers.

Higher elevations within the study area can be found to the south in the areas between Blacktown and Lalor Park. The highest elevations are generally associated with the industrial and commercial land at the south-eastern extent of the study area.

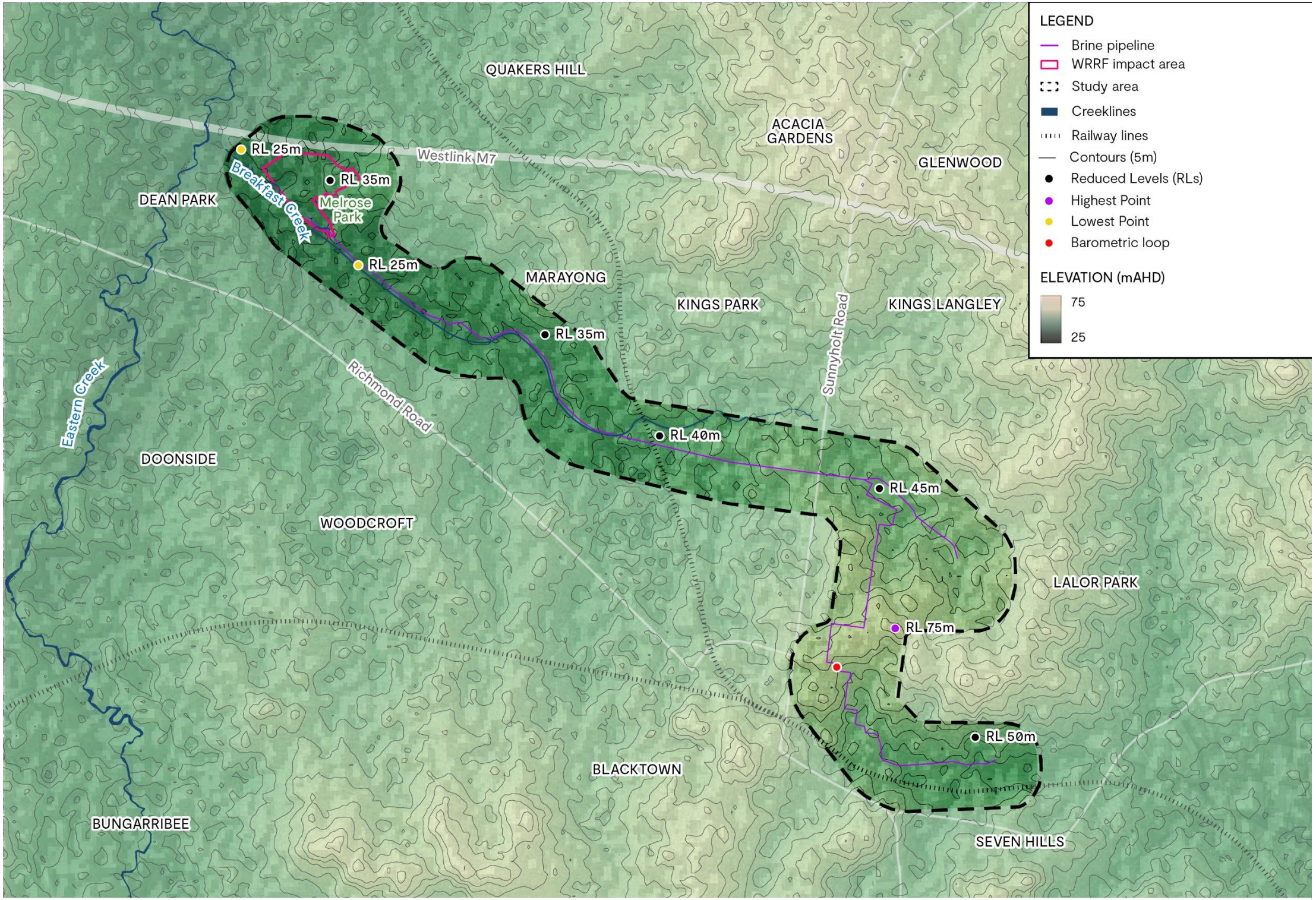

Figure 5.2 Topography and hydrology

5.4 Vegetation communities

Much of the study area comprises a highly modified landscape due to urban development. Areas of remnant vegetation are generally concentrated around drainage lines, public open space such as Breakfast Creek, refer Figure 5.3.

The natural vegetation formations identified within the study area include Forested Wetlands and Grassy Woodlands. Forested Wetlands are generally located along drainage corridors and creeklines such as Breakfast Creek. It is also worth noting that many of these urban communities include invasive exotic weed species.

Forested Wetlands community is an ecosystem characterized by the presence of trees and periodic inundation by floodwaters and are typically found along riverine corridors and floodplains (Office of Environment and Heritage, 2024). The wetlands are dominated by sclerophyllous trees such as eucalypts, tea-trees, paperbarks, and she-oaks and the understorey is composed of plants adapted to wet conditions including grasses, sedges, and rushes that thrive in the nutrient-rich, periodically flooded soils.

Grassy Woodland community in Western Sydney is an example of Cumberland Plain Woodland. This ecosystem is characterised by an open canopy of eucalypt trees, such as Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*Eucalyptus tereticornis*), with a diverse ground layer of native grasses and herbs (Office of Environment and Heritage, 2024). The Grassy Woodland is scattered throughout the study area with a large community located within Melrose Park.

The remainder of the study area is typified by suburban streetscape trees and grass, parks and residential gardens and partially to highly cleared industrial and commercial landscapes. Existing vegetation around the Quakers Hill WRRF provide screening of existing infrastructure associated with these locations.

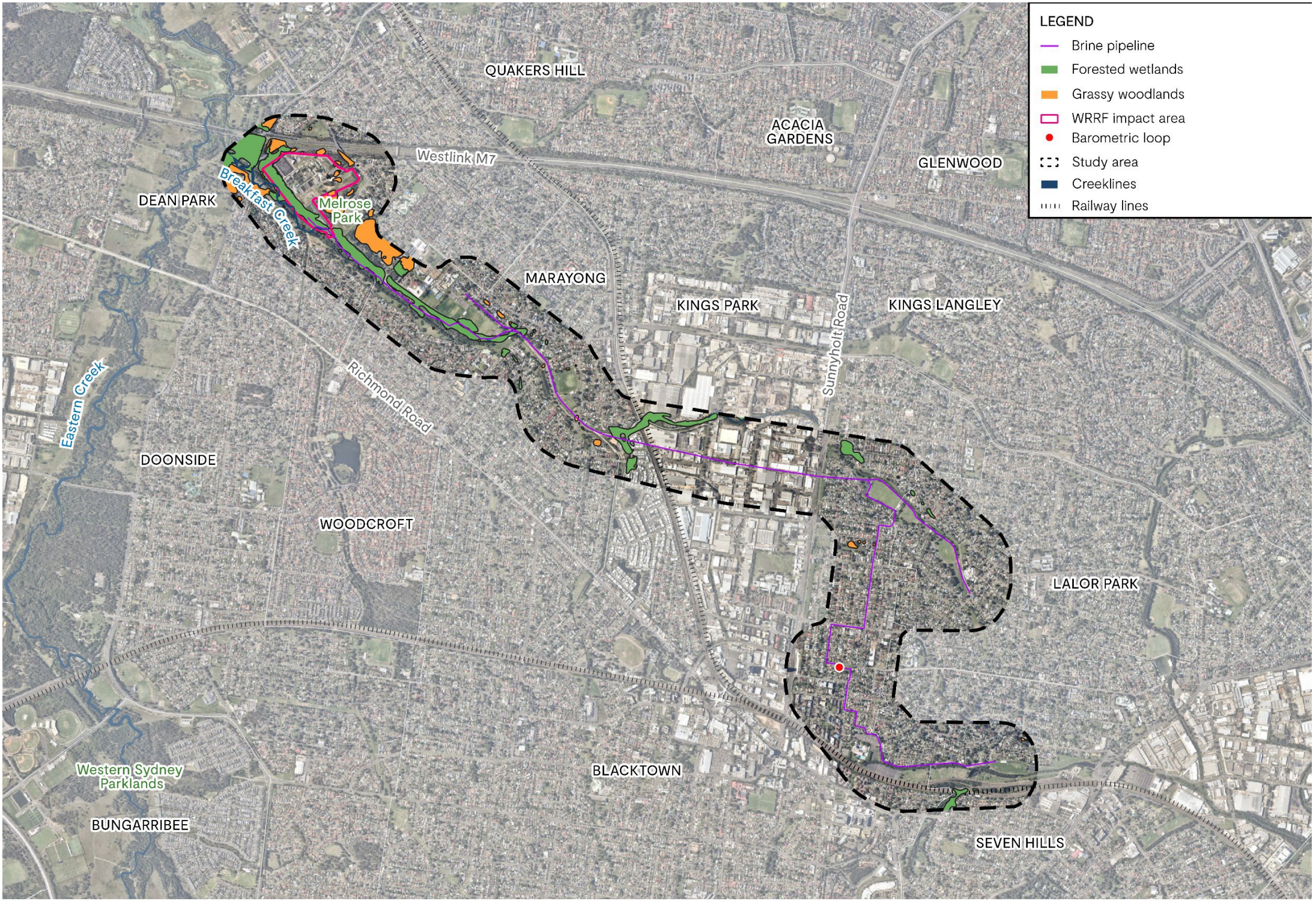

Figure 5.3 Vegetation communities

5.5 Land use and built form

The study area comprises a combination of different land uses owing to the scale of the project and its location in a major metropolitan and residential area in Western Sydney, refer Figure 5.4. Based on NSW Landuse data from the Department of Climate Change, Energy, the Environment and Water (2023), the land within the study area is broadly categorised into various land uses;

– Waste Treatment and Disposal
– Services
– Residential
– Nature Conservation

Wastewater treatment and disposal

The Quakers Hill WRRF is a wastewater treatment facility and is part of the Waste Treatment and Disposal land use classification.

Services

Services comprise a mix of commercial and industrial land uses including light and heavy industry, business parks, manufacturing and services. These areas are interspersed amongst residential land uses throughout the study area including the Kings Park / Blacktown industrial area**.**

Residential

The largest portion of the study area comprises a mix of residential land uses located on both the western and eastern extents of the study area. The WRRF is located adjacent to areas of residential land use and the pipeline is located through pockets of residential areas.

Nature Conservation

The study area features an area of open parkland space and nature conservation north-west of the WRRF, associated with Breakfast Creek.

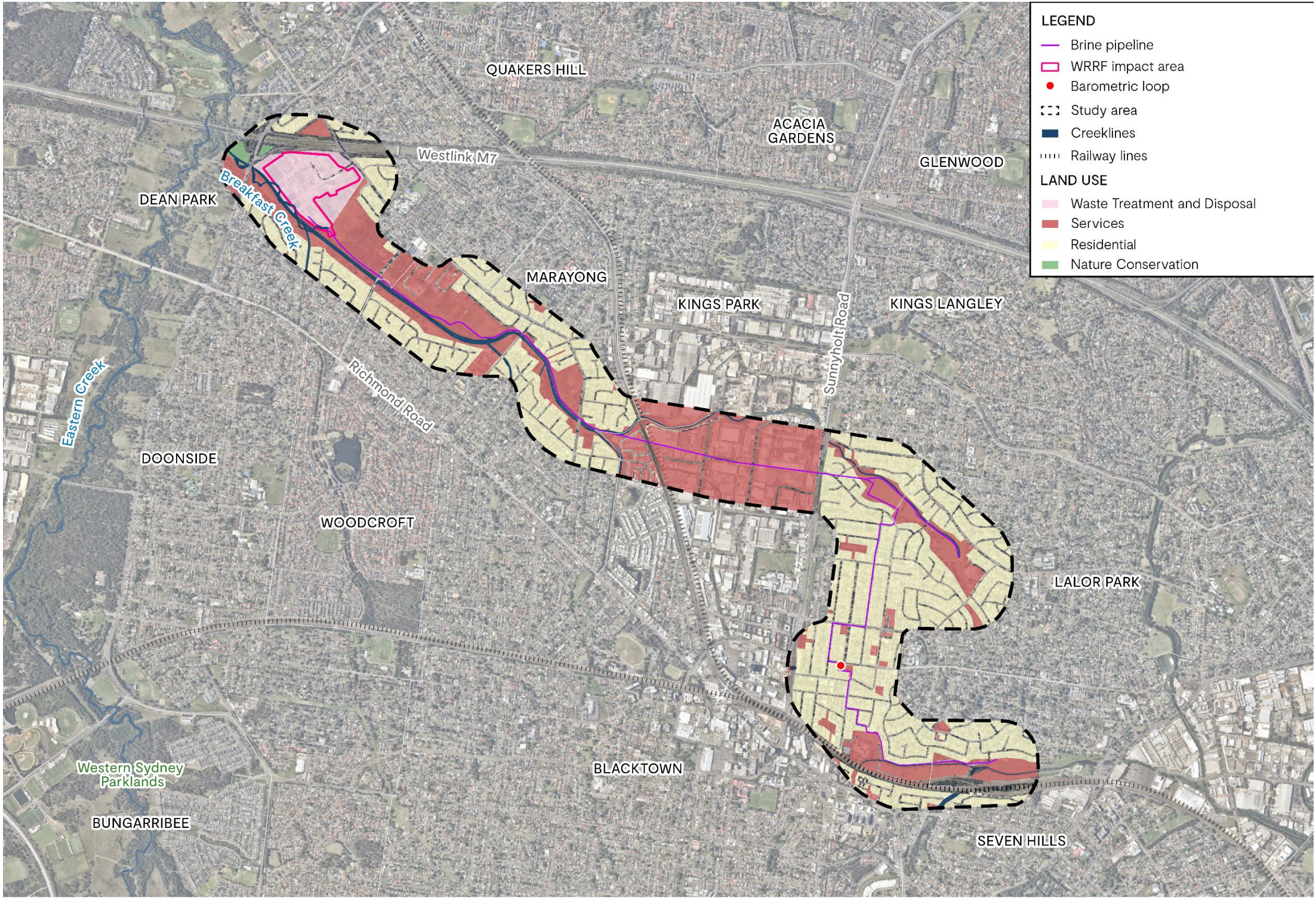

Figure 5.4 Land use

5.6 Heritage and Indigenous cultural values

5.6.1 Indigenous heritage

The Blacktown Local Government Area (LGA) is the traditional land of the Dharug people. The Dharug people have lived in the region for thousands of years, with their traditional lands stretching from the coast to the Blue Mountains and south to the Nepean River. The LGA includes sites such as open campsites, artefact scatters, and modified trees. Archaeological surveys across the Cumberland Plain, including Blacktown, have uncovered tangible evidence of Dharug cultural activity such as stone tools, art sites, shell middens, and scarred trees (Blacktown City Council, 2024).

5.6.2 Non-indigenous heritage

Local heritage listed items are located in the study area, refer Figure 5.5 and Table 5.1. Six of these are heritage listed homesteads in the south-eastern portion of the study area. The Polish Memorial Church (I34) is located south-east of the WRRF.

Table 5.1 Heritage listed items

Listing number	Listing title	Description
I34	Blacktown Local Environmental Plan 2015	The Polish Memorial Church
I18	Blacktown Local Environmental Plan 2015	4 Wallace Street, Blacktown
I17	Blacktown Local Environmental Plan 2015	5 Sarsfield Street, Blacktown
I16	Blacktown Local Environmental Plan 2015	2 Sarsfield Street, Blacktown
I12	Blacktown Local Environmental Plan 2015	11 Harold Street, Blacktown
I3	Blacktown Local Environmental Plan 2015	47 Clifton Street, Blacktown
I2	Blacktown Local Environmental Plan 2015	41 Clifton Street, Blacktown
4570286	Heritage Act - s.170 NSW State agency heritage register	Northern Suburbs Ocean Outfall Sewer (NSOOS) located at the eastern end of the brine pipeline

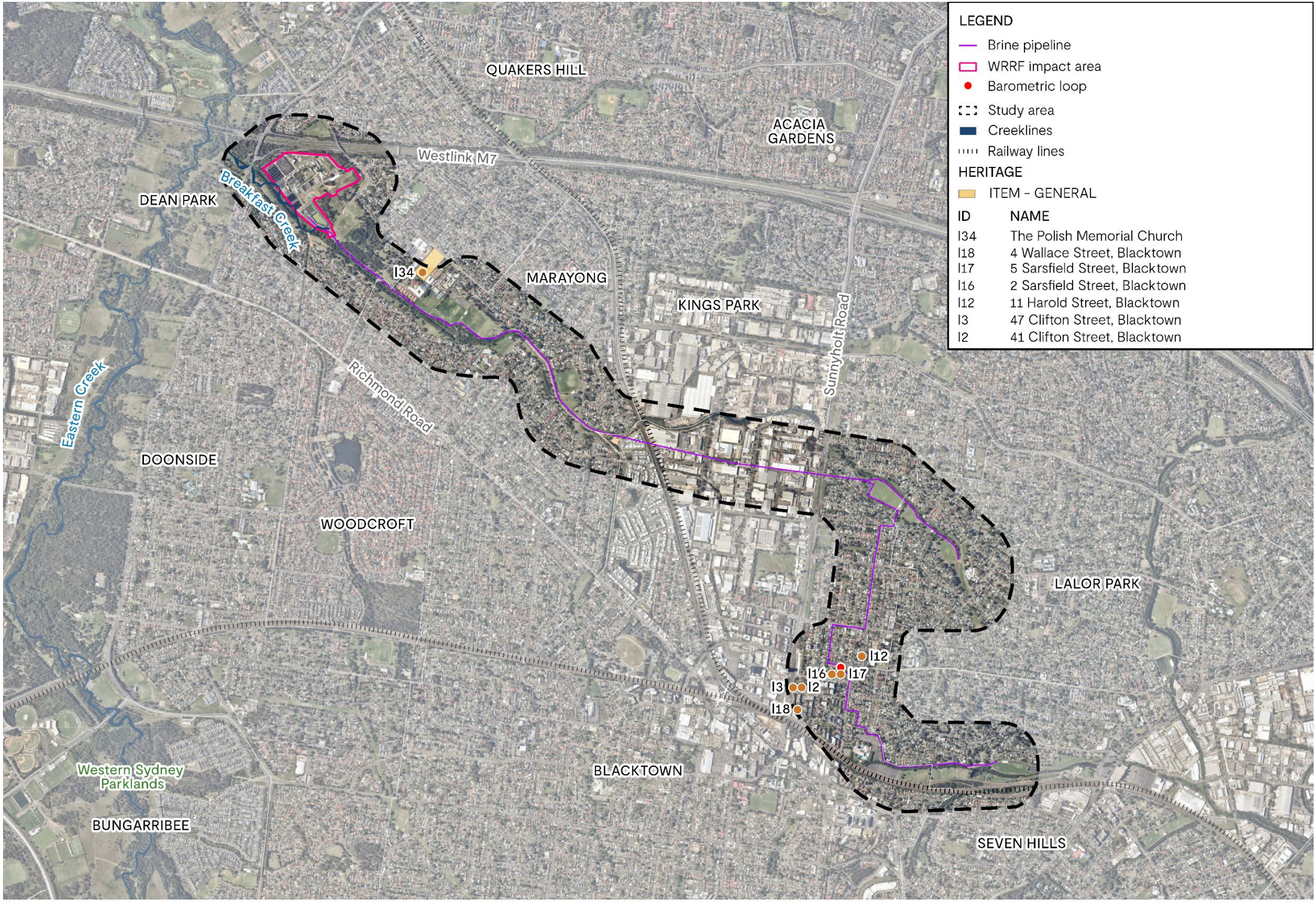

Figure 5.5 Non-Indigenous heritage

5.7 Landscape character

Three distinct LCUs were identified in the study area based on the built, natural and cultural features of the landscape identified in the analysis of the existing environment, refer Figure 5.6.

The following LCUs are described in this section and the construction and operation impacts are then assessed in section 6.

– **LCU1** – Low density residential
– **LCU2** – Parklands and reserves
– **LCU3** – Industrial

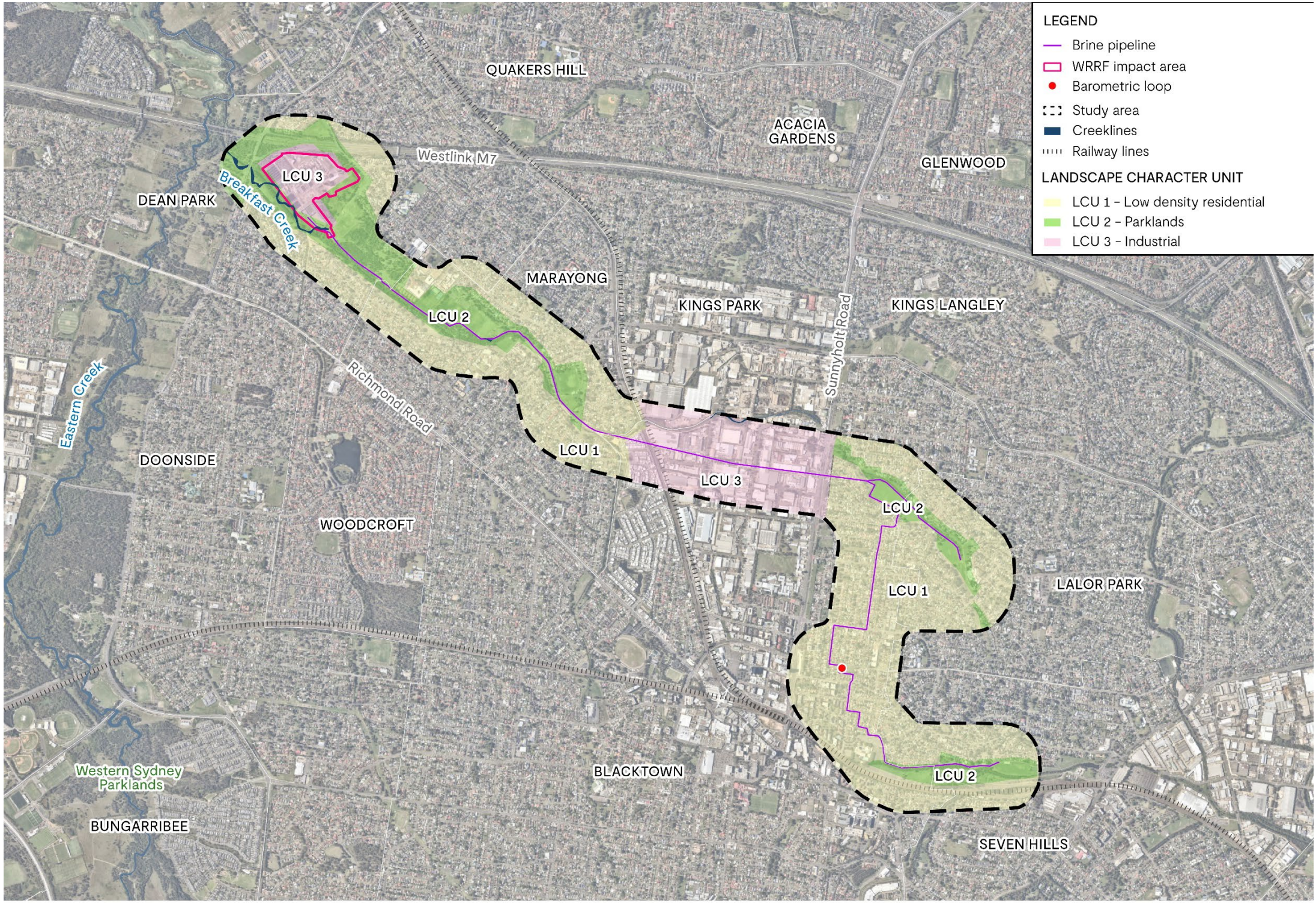

Figure 5.6 Landscape character units

5.7.1 LCU1 – Low density residential

LCU1 includes low density suburban development located throughout the eastern and western extents of the study area such as in Quakers Hill, Marayong, Blacktown, and Seven Hills, refer also Section 5.5 Land uses. Defining characteristics include residential dwellings and private gardens, low apartment blocks, local parks and gardens, refer Table 5.2 and character images below.

Table 5.2 LCU1 existing characteristics

Landform	– LCU1 comprises flat land towards the north of the study area and gently undulating more contoured land towards a ridgeline in the south
Vegetation	– Formal and informal plantings of grass and trees on street verges with native or exotic species – Native and exotic vegetation on private properties including private gardens and streetscapes with trees and grass planting – Small parks with associated groups of trees and vegetation and open grass areas
Hydrology	– Surface flows to underground piped drainage networks via kerb and gutter – Local creeks and swales
Land use	– Suburban areas with residential dwellings, streets and recreation areas – Schools and other institutional facilities such as St Andrews Primary School and Quakers Hill Public School – Services such as childcare and home-based businesses
Infrastructure/Built form	– Predominately one and two storey residential development such as single family dwellings and 2-3 storey apartment blocks, occasionally higher density to 6 stories – Suburban parks, gardens and open spaces, some with recreation facilities, including playgrounds, pathways and amenities buildings – Sealed roads, driveways, concrete kerb and gutter drainage systems – A mixture of property boundary treatments include picket, wire mesh, Colourbond fencing or open boundaries – Primary and secondary streets as part of the urban road network – T1 and T5 rail services – Overhead powerlines and other utilities such as power poles and streetlights

LCU1 character images

5.7.2 LCU2 – Parklands

LCU3 comprises open, linear parklands with sports reserves, recreational open spaces, playgrounds, wetlands and waterways including Breakfast Creek as well as other recreational facilities, refer Table 5.4, character images below and Section 5.5 Land uses.

Table 5.3 LCU2 existing characteristics

Landform	– The LCU comprises a mix of both, open flat and gently sloping land.
Vegetation	– Large, open, mown, grassed areas fringed by remnant bushland – Riparian vegetation along Breakfast Creek particularly towards the southern edge of Melrose Park where it adjoins the WRRF – Native and exotic species trees planted singularly or in groups for shade and aesthetics
Hydrology	– Creeks and other small urban drainage systems such as swales, channels and culverts – Breakfast Creek is classified as a third-order creek as based on the Strahler Stream Order system – Periodic flooding in lower-lying parts of the LCU
Land use	– Sports and recreational uses including netball and soccer as well as personal training exercise groups. – Walking, cycling, playgrounds and other community activities – Softball and netball grounds at International Peace Park – Nature conservation areas and bushland reserves – Commercial scale recreational facilities such as the Blacktown Aquatic Centre
Infrastructure/Built form	– Parks and recreation related infrastructure include amenities blocks, playgrounds, shelters, clubhouses and storage facilities – Blacktown Aquatic Centre and ancillary infrastructure – Street infrastructure includes sealed roads, carparks, footpaths and cycleways – Primary and secondary street systems as part of the urban road network – Overhead powerlines and other existing utilities – Open style fencing such as Monowills that define boundaries and for safety

LCU2 character images

5.7.3 LCU3 – Industrial

LCU2 comprises industrial and commercial developments predominately in the Kings Park and Blacktown areas, refer also Section 5.5 Land uses. The highly urban, industrial LCU includes large warehouse buildings with associated security fencing and open carparks, refer Table 5.3 and character images below.

Table 5.4 LCU3 existing characteristics

Landform	– LCU2 comprises of primarily flat land with minimal topographical relief
Vegetation	– Mostly cleared with limited vegetation and trees, occasional boundary planting – Grassed along streetscapes, street tree planting
Hydrology	– Urban surface flows across hard surfaces to concrete kerbs and gutters and roadside drainage
Land use	– Industrial facilities and warehousing – Wastewater treatment and disposal facilities – Commercial buildings as part of business parks with associated car parking
Infrastructure/Built form	– Heavy industrial facilities with associated ancillary infrastructure – Relatively large scale, wastewater treatment facilities including tanks, buildings, digesters, open bodies of wastewater, access roads, car parking areas security fencing and associated ancillary infrastructure – Typically, two to three storey warehouse style industrial buildings and facilities with plain facades, signage, security lighting and awnings – Sealed road network including large, open carparks and footpaths – Overhead powerlines and street lighting and signs – Security fencing

LCU3 character images

6. Landscape character assessment

6.1 LCU1 - Low density residential

Table 6.1 LCU1 impact assessment

Anticipated change	**Construction -** Open trenching is expected for pipeline construction with the use of heavy machinery for excavation, soil stockpiling, fencing and pipeline storage through existing streets. **Operation -** Minimal change is anticipated as the pipeline would be located underground. There is some potential for permanent loss of tree and vegetation where it cannot be replaced although it is anticipated to be relatively minor. Ancillary, above-ground pipeline elements such as permanent maintenance holes and air valves that will be located along the pipeline (locations to be determined in future design stages). The barometric loop and security fence in Billy Goat Hill Reserve.
Sensitivity	**Moderate** The LCU is a modified, suburban landscape with established, existing residential development with visual receivers in dwellings.
Magnitude	**Construction - Moderate** Discernible changes to the LCU during construction would occur from excavation for open trenching, soil stockpiling, fencing and machinery required for construction of the brine pipeline along residential streets Changes are temporary and progressive lasting from a few months up to about one year Construction compounds would be used to deliver and temporarily store construction equipment in the areas of Billy Goat Hill Reserve and the Blacktown Aquatic Centre and may have associated vegetation removal where compounds would be installed Construction would involve traffic access management such as control blocking and potentially full use of roads and footpaths **Operation - Low** – The impacts are based on assumed tree removal in the southern, residential area and the barometric loop. Otherwise there are relatively few changes anticipated that would impact the LCU and impacted areas would generally be reinstated to a similar character. – Permanent above-ground components of the pipeline include maintenance holes and air valves, however these are very small features and would have minimal impacts on the overall landscape character.
Impact rating	**Construction - Moderate** **Operation – Moderate-Low**

6.2 LCU2 – Parklands

Table 6.2 LCU2 impact assessment

Anticipated change	**Construction –** Site establishment and early works such as establishment of construction compounds, installing safety barriers, erosion and sediment controls, sediment basins, minor vegetation clearance, stripping and stockpiling of topsoil for reuse in restoration and ground levelling Public access and vehicle traffic management measures and the potential for temporary use of an existing council carpark off Melrose Avenue in Quakers Hill Open trenching is expected for pipeline construction including the use of heavy machinery for excavation, soil stockpiling, fencing and pipeline stringing and storage through existing parkland open spaces. There is potential for removal of trees and existing vegetation. **Operation -** Minimal change as the pipeline would be located underground with some potential for permanent loss of tree and vegetation where it cannot be replaced. Maintenance holes and air valves are permanent, above-ground features that will be located along the pipeline (locations to be determined in future design stages).
Sensitivity	**Moderate**

	Higher values are typically associated with parkland areas as they provide visual amenity in urban areas particularly when located within or near residential areas.
Magnitude	**Construction - Moderate** – Potential impacts on existing vegetation and causing temporary visual disruption to open spaces from open trenching for the brine pipeline and/or pipe stringing at Melrose, Harvey and International Peace Parks. Excavation and use of launch/receival pits at Lynwood and Marayong Parks. Construction activities would be temporary and progressively implemented but lasting generally from a few months up to about two years. **Operation - Low** – The brine pipeline would be located entirely underground except where it enters the barometric loop. Where open trenching occurs, the brine pipeline alignment has been designed to avoid impacts with existing trees however some removal is assumed to be required where unavoidable. Otherwise, the landscape where impacted, is assumed to generally be reinstated to a similar character including replanting where possible. – Permanent above-ground components of the pipeline include maintenance holes and air valves, however these are very small features and would have minimal impacts on the overall landscape character.
Impact rating	**Construction - Moderate**
	Operation – Moderate-Low

6.3 LCU3 - Industrial

Table 6.3 LCU3 impact assessment

Anticipated change	**Construction –** Temporary discernible changes within the WRRF would occur from excavation, stockpiling and machinery required for construction particularly at the WRRF as part of the AWTP and secondary wastewater treatment upgrade construction. Industrial area changes involve excavation for the intermediate shaft, traffic control, and potential temporary loss of access to roads or footpaths. **Operation -** Construction within the WRRF of the project components otherwise no change to the LCU outside of the WRRF.
Sensitivity	**Low** The LCU is a highly modified, synthetic, landscape with heavy industrial facilities, large warehouse and commercial buildings, manufacturing facilities and limited vegetation. The LCU is considered to have a low scenic and landscape quality due to its modified, urban character.
Magnitude	**Construction - Moderate** Construction required in the WRRF would be within the context of other large-scale infrastructure and confined to Gate Road in the industrial area. Works in the WRRF would potentially take up to two years to complete whereas those in the Kings Park Industrial Estate would be of a shorter duration lasting from a few months potentially up to about two years. **Operation - Negligible** Works would continue to reinforce the industrial character of the WRRF and the Kings Park Industrial Estate through further industrial infrastructure development.
Impact rating	**Construction – Moderate-Low**
	Operation - Negligible

6.4 LCU impact assessment summary

Table 6.4 LCU assessment summary table

Landscape character zone	Sensitivity	Magnitude	Overall LCU assessment rating
LCU1 - Construction	Moderate	Moderate	**Moderate**
LCU1 - Operation		Low	**Moderate-Low**
LCU2 - Construction	Moderate	Moderate	**Moderate**
LCU2 - Operation		Low	**Moderate-Low**
LCU3 - Construction	Low	Moderate	**Moderate-Low**
LCU3 - Operation		Negligible	**Negligible**

7. Visual impact assessment

7.1 Viewpoints

Fourteen (14) viewpoints (VPs) were identified for assessment within the study area that have potential views of the various visual components of the project, refer Figure 7.1. These viewpoints are representative of private and public receivers with potential views during either construction and/or operation. We note that the assessments are based on unmitigated impacts and that the ratings could potentially be reduced further. Mitigation measures are included in Section 9.

Viewpoints were selected to represent private and public receivers with potential views during either construction and/or operation. All selected viewpoints were publicly accessible and safe for assessors to visit. Selecting viewpoints in this LVIA involved considering several key factors to ensure a comprehensive and accurate assessment. The following were the key factors:

– Viewpoints were selected from locations where people live, as residents are often highly sensitive to changes in their visual environment
– Parks, recreational areas, and other public spaces where people spend time and enjoy the landscape are deemed important
– Major roads, railways, and footpaths are included to assess the views of travellers and commuters

The viewpoint assessments include the following:

– VP01 – International Peace Park
– VP02 – Blacktown netball courts pathway
– VP03 – Winifred Crescent
– VP04 – Billy Goat Hill Reserve
– VP05 – Mort Street
– VP06 – Lynwood Park
– VP07 – Gate Road
– VP08 – Marayong Park
– VP09 – Breakfast Road
– VP10 – Harvey Park
– VP11 – Falmouth Road
– VP12 – Melrose Avenue
– VP13 – M7 cycleway
– VP14 – Jasmine Avenue

7.2 Visibility

To assist with determining visibility, a ZTV map was generated for the project based on the main visible components of the project at operation including the following:

– Tallest structure (AWTP flow splitter tank and OCU Discharge Stack) in the WRRF at 14 m high
– Barometric Loop at 12 m high

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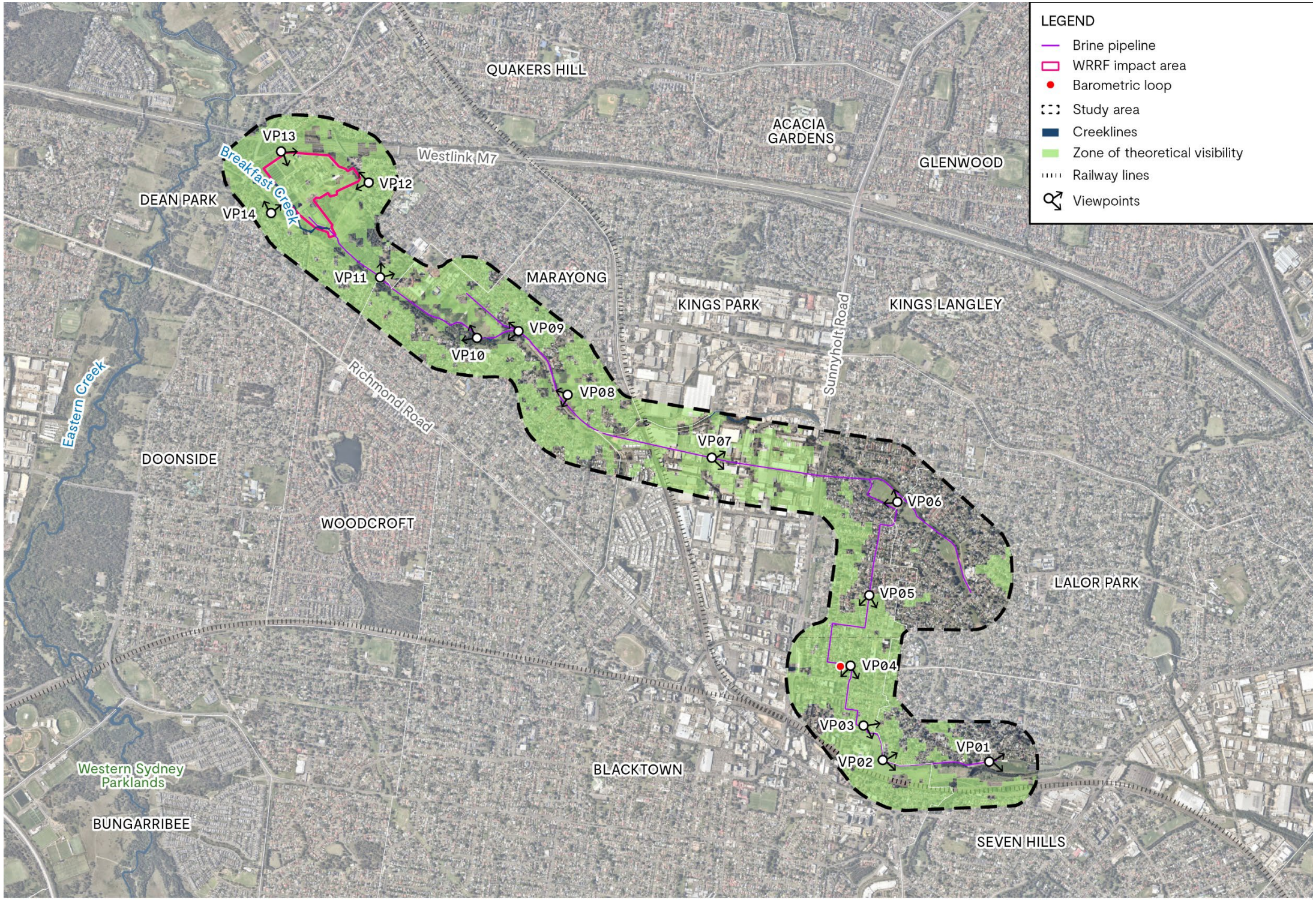


Figure 7.1 Zone of theoretical visibility and viewpoints

7.2.1 VP01 – International Peace Park

Table 7.1 VP01 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°46'22"S 150°55'37"E** View looking east from International Peace Park near Jean Street.
Description of existing view	The location was selected as it represents publicly accessible, open space areas within International Peace Park. The view comprises a large, open, lawn playing field bounded on both sides by chainwire fencing. A continuous row of trees and vegetation frames the southern edge behind the fence while the northern boundary includes a two-storey private dwelling and garden with Banana trees and a colorbond privacy fence. A footpath on the northern edge of the lawn connects the foreground with an amenities block located in the centre rear of the view.
Anticipated change to view	**Construction** The construction compound occupies the entire playing field with the open trench for the pipeline within it extending along the footpath towards the amenities block. Larger areas of excavation would be required for connecting the brine pipeline to the NSOOS. **Operation** There are few expected to the view during operation once the landscape is reinstated apart from a relatively small amount of vegetation removal.
Sensitivity	**High** – Two-storey dwellings with windows overlook the park and impact area. Residential visual receivers have high sensitivity due to potentially long viewing times – Visual receivers include pedestrians, cyclists and park users. Receivers are temporary park users with generally short viewing times.
Magnitude	**Construction – Moderate** – The compound occupies a large area with open trenching works, refer Figure 7.2. This rating assumes that only a small amount of vegetation requires removal and that the anticipated construction duration is temporary taking about six months to a year to complete. **Operation – Negligible** – It is assumed that the landscape around the sports fields including footpath, would be returned to a similar condition after construction.
Overall rating	**Construction – High-Moderate**
	Operation - Negligible

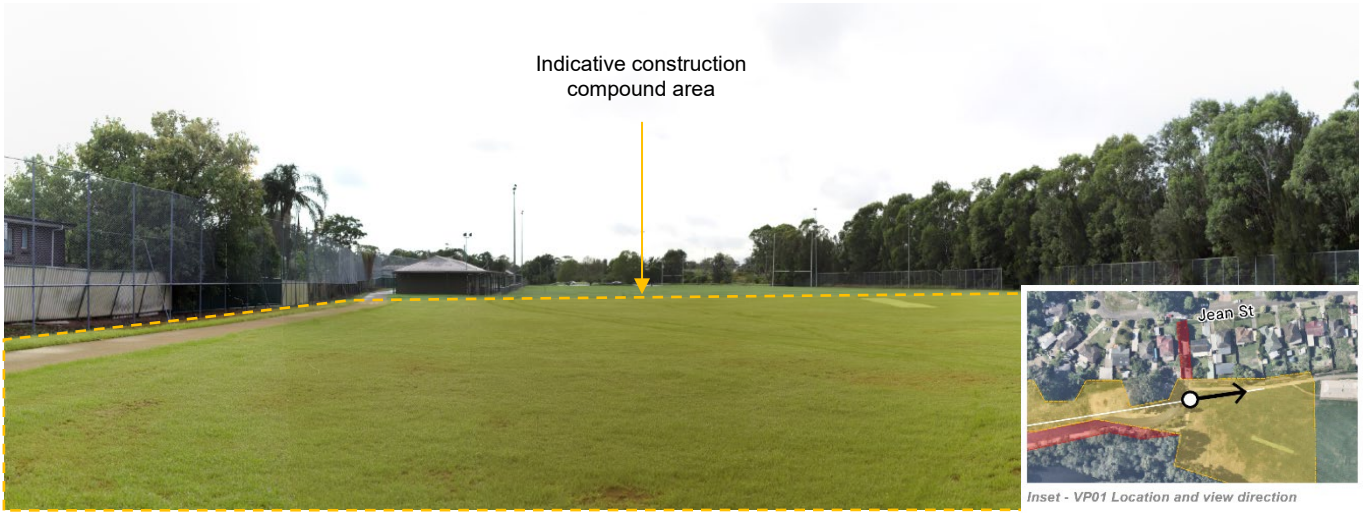


Figure 7.2 VP01 – View east from International Peace Park showing construction compound area

7.2.2 VP02 – Blacktown netball courts pathway

Table 7.2 VP02 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°46'21"S 150°55'08"E** VP02 is a view east of the pathway from Blacktown Netball Courts, north of Cumberland Nepean Softball Grounds. It represents public views from pedestrian pathways.
Description of existing view	The location was selected as it represents views from a publicly accessible pathway that accesses the BCNA Netball Courts. The view is along a public path that provides access to the Blacktown netball courts from the local area. Monowills safety handrails frame the path either side in the foreground while a continuous line of residential colorbond fences follow the edge of the footpath. The fences and private garden plantings frame the view along with the bushland on the opposite side of the path.
Anticipated change to view	**Construction** Temporary changes to the view would occur for construction of the brine pipeline and associated trenching activities. There is likely to be vegetation and tree removal required in the bushland area creating a more open view. **Operation** The change is to a more open view corridor in the short term from assumed vegetation removal however the extent of change would be dependent on the amount of vegetation removal and the successful reestablishment of most of the low-level landscape.
Sensitivity	**Low** – Visual receivers include pedestrians and cyclists generally with short viewing times and their attention focused on the path.
Magnitude	**Construction – Moderate** – During construction, discernible changes are anticipated with open trenching works, tree and vegetation removal, refer Figure 7.3. The footpath would be closed during construction in this area as the pipeline is progressively constructed over a few months to potentially a year. **Operation – Low** – The magnitude impact rating assumes that the landscape around the sportsfields would be reinstated in the long term.
Overall rating	**Construction – Moderate-Low**
	Operation - Low

Figure 7.3 VP02 – View east on the footpath near the Blacktown Netball Courts showing impact area

7.2.3 VP03 – Winifred Crescent

Table 7.3 VP03 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°46'13"S 150°55'03"E** VP03 is a public view southeast from Winifred Crescent. It represents private, residential views from adjacent houses, as well as public views from the street.
Description of existing view	VP03 location is selected as it is in a residential area where visual impacts may be greater due to views from dwellings. The view is a suburban street with a small, open grassed park area and a Monowills handrail delineating the street verge and a footpath. A relatively narrow road and one storey dwellings are the primary visual elements with other smaller, urban elements such as, signs, picket style and colourbond fencing contributing to the suburban scale.
Anticipated change to view	**Construction** Temporary changes to the view would occur for construction of the pipeline in the street and the reserve involving open trenching, excavation machinery, site fencing, stockpiling and construction traffic. **Operation** There are few if any changes anticipated to the view during operation assuming the landscape is generally reinstated to the existing including footpath and road.
Sensitivity	**High** – Visual receivers include pedestrians, cyclists and road users in motor vehicles. Receivers generally have short viewing times with their attention focused on the road. – Residential dwellings have high sensitivity due to potentially long viewing times.
Magnitude	**Construction – High** – During construction, discernible changes are anticipated with open trenching works, fencing, construction machinery and vehicles in proximity to dwellings, refer Figure 7.4. **Operation – Negligible** – Changes would be temporary over an approximate six month period but it is expected that the landscape could be reinstated to a similar or better condition.
Overall rating	**Construction - High**
	Operation - Negligible

Figure 7.4 VP03 – View south-east on Winifred Crescent showing construction compound location

7.2.4 VP04 – Billy Goat Hill Reserve

Table 7.4 VP04 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°46'00"S 150°55'00"E** VP04 is a view south-west from Billy Goat Hill reserve, adjacent to Cardiff Street. It represents public views of the nearby parkland area and residential streetscape.
Description of existing view	The viewpoint was chosen as it represents public views near a large, open grassed reserve The view comprises the open lawn area of the reserve surrounded by residential development and associated private garden planting. A Monowills rail separates the reserve area from the street verge where a kiosk and continuous row of power poles with overhead wires are located. A small play area with select trees and shrubs are visible contributing to visual activity in the middle ground.
Anticipated change to view	**Construction** Changes to the view would occur for construction of the pipeline through a relatively large area of the reserve with the construction of open trenching, excavation machinery, fencing, stockpiling and construction traffic. A large area of the reserve would be utilised as a compound therefore the playground would not be accessible, the grassed areas would be impacted and trees in the reserve would be removed. Signs, including a small plinth, would need to be temporarily relocated where impacted. **Operation** The barometric loop is a new tall, vertical, cylindrical, steel tube and although it is set back from the street, its industrial character visually contrasts sharply with the residential context. The 12 m height of the barometric loop is comparable to a power pole located nearby along Cardiff Street or similar to a four storey building. The base of the tube would be 2.5 m diameter with hard stand (concrete) area and a chainwire security fence and gate to prevent unauthorised access. The top of the fence may require additional safety wire.
Sensitivity	**High** – Visual receivers include views from the street such as pedestrians, cyclists and vehicles considered to be Low sensitivity due to have short viewing times. Reserve and playground users also with short viewing times. – There are visual receivers in dwellings with high sensitivity from potentially long viewing times in proximity of the reserve along Cardiff Street.
Magnitude	**Construction – High** – Considerable areas of the reserve are used for the construction apart from the playground which would become inaccessible, refer Figure 7.5. Approximately up to half of the street, associated verge and a corner of the reserve would be impacted by construction for a period of six months to a year. **Operation – High** – The barometric loop is a tall, new and visually incongruous, vertical structure. The remainder of the reserve grassed areas, signs and pipe rail safety barrier are assumed to be reinstated once complete, refer Figure 7.6.
Overall rating	**Construction - High**
	Operation - High

Figure 7.5 VP04 – Existing view

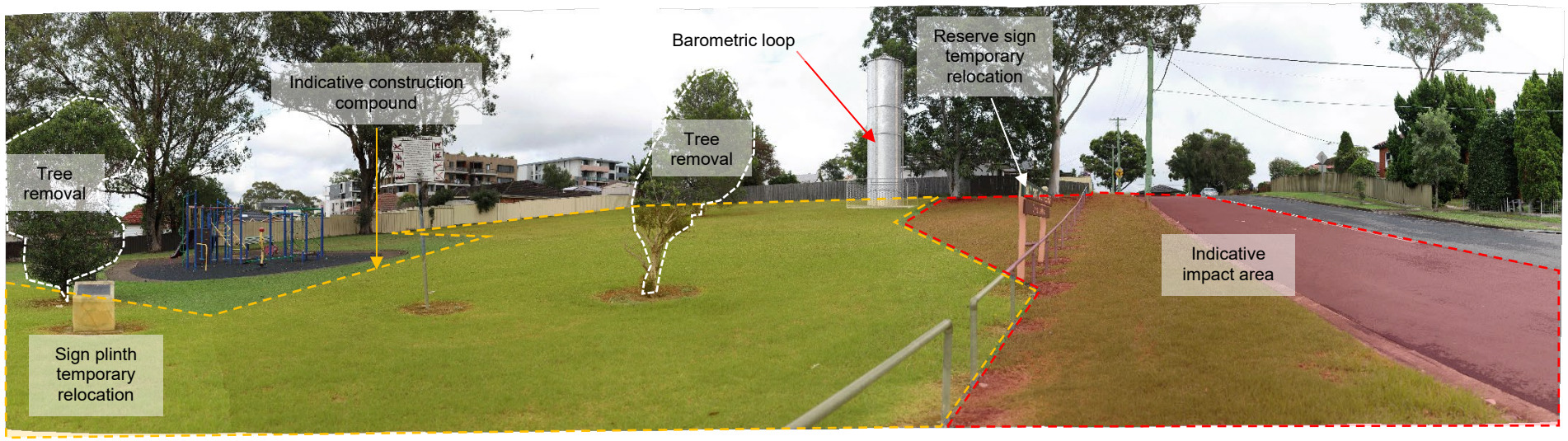


Figure 7.6 VP04 – Artist's impression of barometric loop

7.2.5 VP05 – Mort Street

Table 7.5 VP05 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°45'44"S 150°55'06"E** View south from Mort Street, approximately 100 m north of Sackville Street. It represents private, residential views from adjacent houses and public views from the street.
Description of existing view	The viewpoint was chosen to represent views from a typical suburban street where there is higher visual sensitivity from dwellings. The view comprises a suburban street with one and two-storey brick or weatherboard dwellings, low front fences, private gardens consisting of grass, shrub and tree planting and driveway connections to the street. Power poles and overhead power lines are prominent visual elements in the view. The verge is grassed with occasional small tree planting and a footpath along the eastern side.
Anticipated change to view	**Construction** Excavation works could occur for construction of the pipeline in the street and verge areas to the private residential boundaries and likely involve open trenching, machinery, fencing, stockpiling and construction traffic. **Operation** Minimal change once the street and verge are reinstated.
Sensitivity	**High** – Visual receivers include pedestrians, cyclists and road users in vehicles and generally have short viewing times – Residential dwellings with sensitive visual receivers and views to the street.
Magnitude	**Construction – Moderate** – Approximately up to half of the street reserve would temporarily be impacted for a period of three to six months through excavation for trenching, fencing and partial or full street closures, refer Figure 7.7. **Operation – Negligible** – Changes are temporary and it is expected that the landscape would be returned to its previous condition after construction.
Overall rating	**Construction – High-Moderate**
	Operation - Negligible

Figure 7.7 VP05 – View south on Mort Street showing impact area

7.2.6 VP06 – Lynwood Park

Table 7.6 VP06 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°45'24"S 150°55'14"E** View north-west towards Lynwood Park from the clubhouse/amenities block and carparking area. The viewpoint represents a public view of open greenspace and public community areas.
Description of existing view	The viewpoint location was chosen as it represents public views of a typical large, open grassed reserve The view is of a flat, open, grassed sports field. The field is framed by existing fencing, drainage swales, vegetation and one or two-storey residential dwellings. Other elements in the view include flood lighting and power poles along the periphery of the sports fields.
Anticipated change to view	**Construction** The brine pipeline is located along the south-west side of the field and pipe stringing will occur along the opposite side of the field. A launch/retrieval shaft for trenchless construction is located at the far end of the field. Construction activities visible within VP06 include the use of heavy machinery, excavation, fencing, pipe stringing and stockpiling. Tree removal may be required on the edges of the field pending final location of the pipeline. **Operation** Minimal anticipated changes to the overall view during operation.
Sensitivity	**Low** – Visual receivers are park users that typically visit for relatively short periods of time, typically up to several hours at a time for the duration of sports game or recreational activities. – The park is a typical suburban sports park with no particularly discernible visual features that would increase the sensitivity rating.
Magnitude	**Construction – Moderate** – Ground level construction is visible on both sides of the field along the entire length however is not the focus of the view, refer Figure 7.8. Changes are temporary and anticipated to last anywhere from six months to a year. **Operation – Negligible** – The rating assumes that the landscape would generally be reinstated after construction along the edges of the park. Vegetation removal, if not reinstated, would constitute a relatively small portion of the overall view.
Overall rating	**Construction – Moderate-Low**
	Operation – Negligible

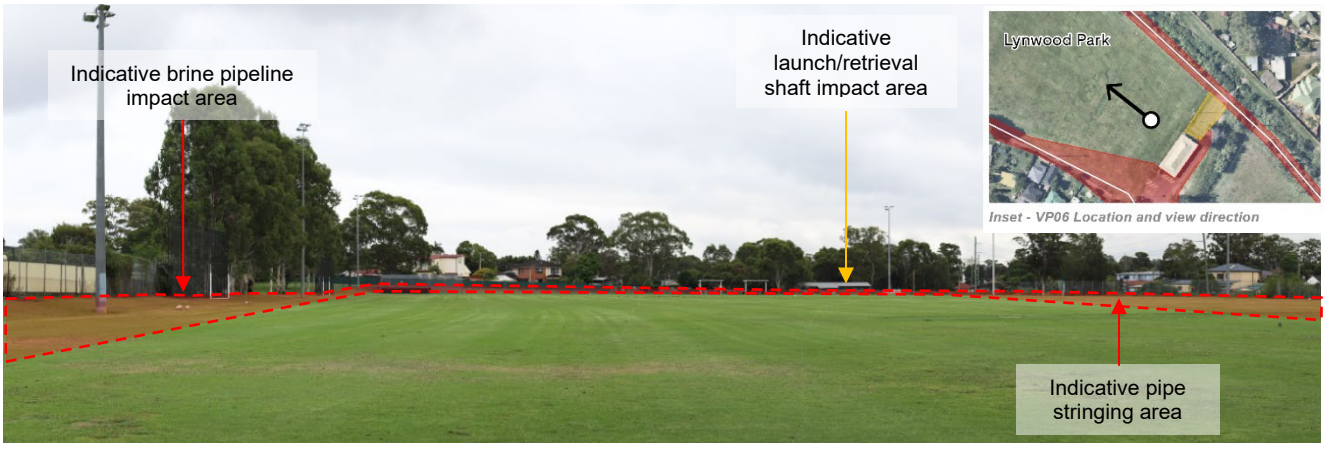


Figure 7.8 VP06 – View north-west towards construction and pipe stringing locations at Lynwood Park

7.2.7 VP07 – Gate Road

Table 7.7 VP07 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°45'13"S 150°54'25"E** View is east from Gate Road in an industrial zone. It represents a public view of the street.
Description of existing view	The viewpoint location was chosen to assess impacts along Gate Road in the Kings Park Estate Industrial area. The view is of a relatively wide street lined with trees on the northern edge, footpaths along both grassed verge areas and private vehicle parking along both sides of the street and a large car park within the Caddy Storage lot to the north. Large, industrial warehouse buildings frame the view. The buildings have extended awnings, windowless facades and security fencing along the boundary. Vegetation is also visible within properties.
Anticipated change to view	**Construction** Changes to the view would occur for construction including excavation for the Brine pipeline access points, intermediate shaft and partial road closures at the compound sites. The launch/receival shaft is located nearby and ancillary equipment such as the drill rig, generator, etc. may be present within the viewpoint. **Operation** There are negligible changes to the view during operation as it is assumed that the street would be reinstated to a similar condition.
Sensitivity	**Low** – Visual receivers include pedestrians and road users in vehicles. Receivers generally have short viewing times with their attention focused on the road. – Temporary views are also from of a warehousing car park area.
Magnitude	**Construction – Moderate** – The construction compound areas occupy a relatively large area of the road and verge for pipe laydown areas, refer Figure 7.9. Presence of the launch/receival shaft and ancillary equipment. – Impacts are temporary but potentially lasting for up to about one to two years. **Operation – Negligible** – Changes are temporary with the street and verge landscape returned to its previous condition after construction.
Overall rating	**Construction – Moderate-Low**
	Operation - Negligible

Figure 7.9 VP07 – View east on Gate Road showing construction compounds

7.2.8 VP08 – Marayong Park

Table 7.8 VP08 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°44'59"S 150°53'47"E** VP08 is a view looking west towards Marayong Park. It represents a public view of open greenspace and public community areas.
Description of existing view	VP08 was selected as it represents typical views from within a public open reserve area where construction would potentially occupy large areas. The view is of a flat, open, grassed field towards a fenced, pedestrian bridge on top of a mound as it crosses over the Breakfast Creek channel in the middle ground of the view. A mass of trees and remnant bushland provide a solid backdrop to the view. Other elements include chainwire and pipe fencing that delineate sports fields and bench seats.
Anticipated change to view	**Construction** Construction compound and associated fencing is prominent in the view with pipe trenching towards the north and in the background The pipeline continues through the compound area where there would potentially be excavation works and soil stockpiling. **Operation** The grassed landscape areas disturbed by construction would be reinstated resulting in a view similar to the existing assuming no tree removal is required.
Sensitivity	**Low** – Visual receivers are park and sports field users that typically visit for relatively short periods of time, typically up to several hours at a time for the duration of sports game or recreational activities. – This area of the park is relatively degraded with worn turf and signs of erosion.
Magnitude	**Construction – Moderate** – Large compound areas and restricted access to the park for a period lasting from six months to a year. Pipeline excavation area north of the footbridge, refer Figure 7.10. **Operation - Negligible** – The rating assumes that existing trees are retained and that the grassed areas are reinstated to an equal to or better than existing standard.
Overall rating	**Construction – Moderate-Low**
	Operation - Negligible

Figure .7.10 Marayong Park looking west

7.2.9 VP09 – Breakfast Road

Table 7.9 VP09 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°44'44"S 150°53'35"E** VP09 is a view west from Breakfast Road near Breakfast Creek and represents public views of open space.
Description of existing view	The view is from a footpath with the park constituting the main component of the view. VP09 was selected as it represents typical views from within a public open reserve area where construction works would potentially occupy large areas. The park comprises scattered trees in open lawn areas, trees and vegetation in groups. A sports field is visible in the background along with park lighting poles and low, open barrier fencing.
Anticipated change to view	**Construction** The construction compound and the pipe stringing and pipeline excavation are prominent visual elements in the view as well as fencing and construction vehicles. **Operation** The view returns to the existing condition as grass, paving and landscape areas are reinstated.
Sensitivity	**Low** – Visual receivers include park users that typically stay for a short duration.
Magnitude	**Construction - Moderate** – The compound combined with excavation works and construction vehicles are prominent elements in the view, refer Figure 7.11. Restricted public access in this area but vegetation is generally retained. **Operation - Negligible** – The landscape would generally be reinstated where removed or disturbed by construction.
Overall rating	**Construction – Moderate-Low**
	Operation - Negligible

Figure 7.11 VP09 – Breakfast Road looking west towards impact areas and compounds

7.2.10 VP10 – Harvey Park

Table 7.10 VP10 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°44'46"S 150°53'23"E** VP10 is a view to the west from Harvey Park from a pedestrian path adjacent Breakfast Creek representing public views from the park.
Description of existing view	The view is of a park footpath as it bends around a corner out of view behind existing trees and an open park sportsfield area with flood lighting and amenities building towards the background of the view. The viewpoint location was chosen as construction areas would potentially occupy large, open space recreation areas
Anticipated change to view	**Construction** The pipeline excavation area comprising fencing, machinery and soil stockpiles and the site compound are visible. Access to this viewpoint would likely be restricted during construction. **Operation** The path and the grassed areas are reinstated to a similar condition as existing.
Sensitivity	**Low** – Visual receivers are pedestrians and cyclists utilising the path and/or sporting fields.
Magnitude	**Construction - Moderate** – Visual changes are from ground level construction compound and pipe stringing over a relatively large area however assumes that vegetation is retained, refer Figure 7.12. Public access would be restricted along the southern edge of the playing fields however the changes would be temporary lasting one to two years. **Operation - Negligible** – Any changes to the view are temporary and the landscape, including the pathway and grassed areas are reinstated.
Overall rating	**Construction – Moderate-Low**
	Operation – Negligible

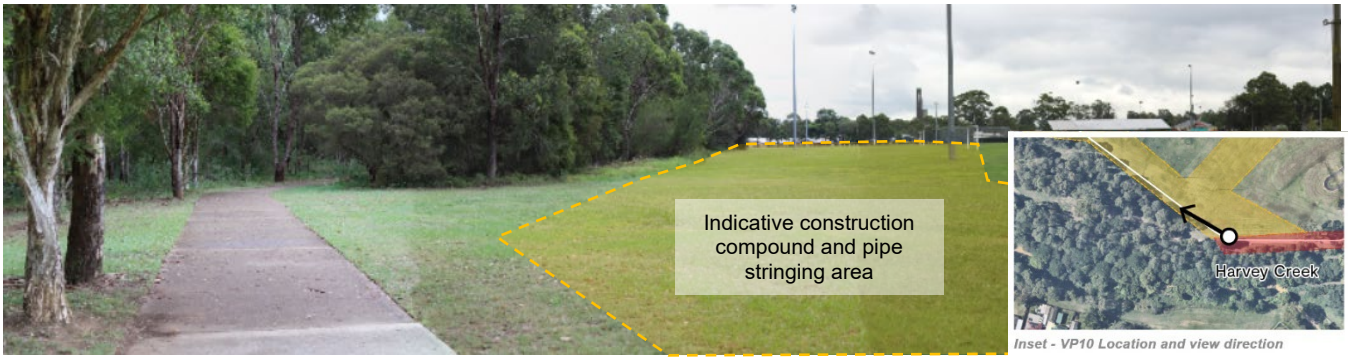


Figure 7.12 VP10 – View west in Harvey Park showing construction compounds and pipe stringing areas

7.2.11 VP11 – Falmouth Road

Table 7.11 VP11 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°45'37"S 150°52'50"E** VP11 is a street view north from Falmouth Road at the eastern end of Melrose Park where the road crosses Breakfast Creek.
Description of existing view	The viewpoint was selected as it represents a location where there may be views of large areas of construction on both sides of Falmouth Road. The viewpoint is looking north up Falmouth Road at a pedestrian crossing point that connects the east and west areas of two park spaces. The road is a dual lane carriageway with concrete islands and a central median with safety rails to assist with crossing the road. A low, pipe rail barrier delineates the road verge from the park areas where there are footpaths, street lighting and trees in grass. The middle ground of the view is filled with mature tree canopy and ground level vegetation that channels view further up the road.
Anticipated change to view	**Construction** Works associated with the open, trenching and excavation of the pipeline and construction compounds on both sides of the road would be visible. **Operation** The view would be similar once the landscape is reinstated pending vegetation removal.
Sensitivity	**Low** – Visual receivers are users of Falmouth Road including pedestrians, cyclists and road users in motor vehicles. Receivers generally would have short viewing times with their attention focused on the road. – Residential properties are located approximately 130 m east of the view, however existing trees would screen views of the impact area from these properties.
Magnitude	**Construction - Moderate** – Impacts to the road from construction works and site compounds are visible on both sides of the road, refer Figure 7.13. Some vegetation removal may be required in the compound areas with park access restricted in these areas. Changes would be temporary lasting about six months up to two years. **Operation – Low** – Grass and pathways are reinstated with potentially only a small amount of permanent vegetation removal.
Overall rating	**Construction – Moderate-Low**
	Operation - Low

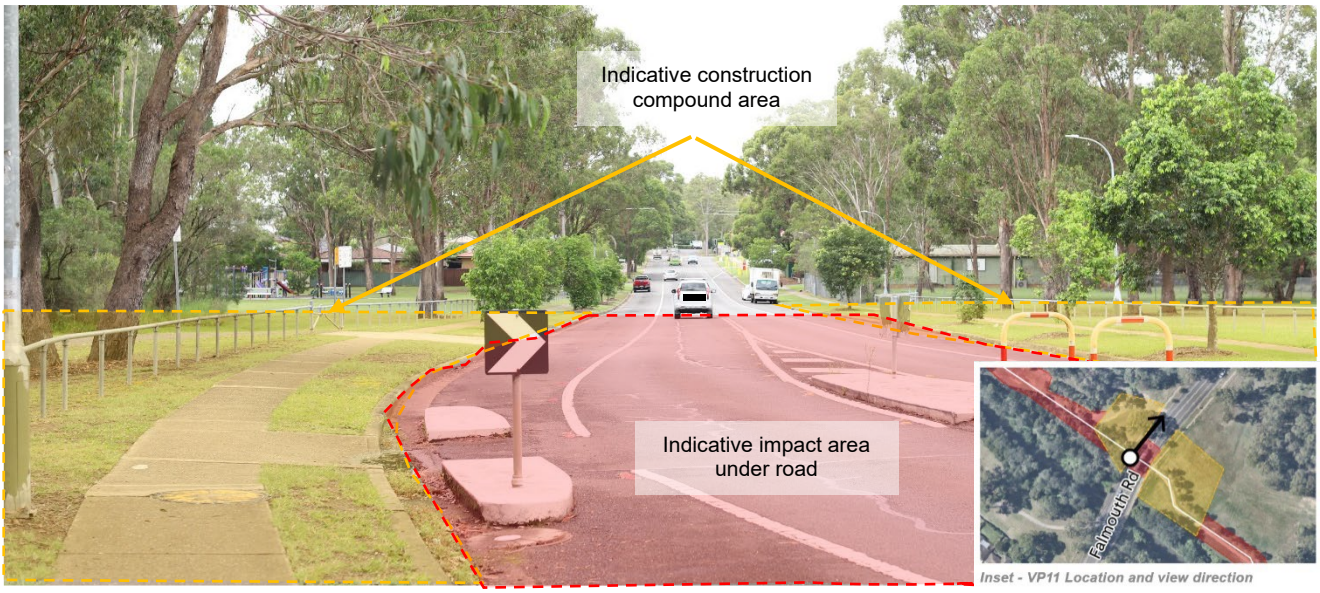
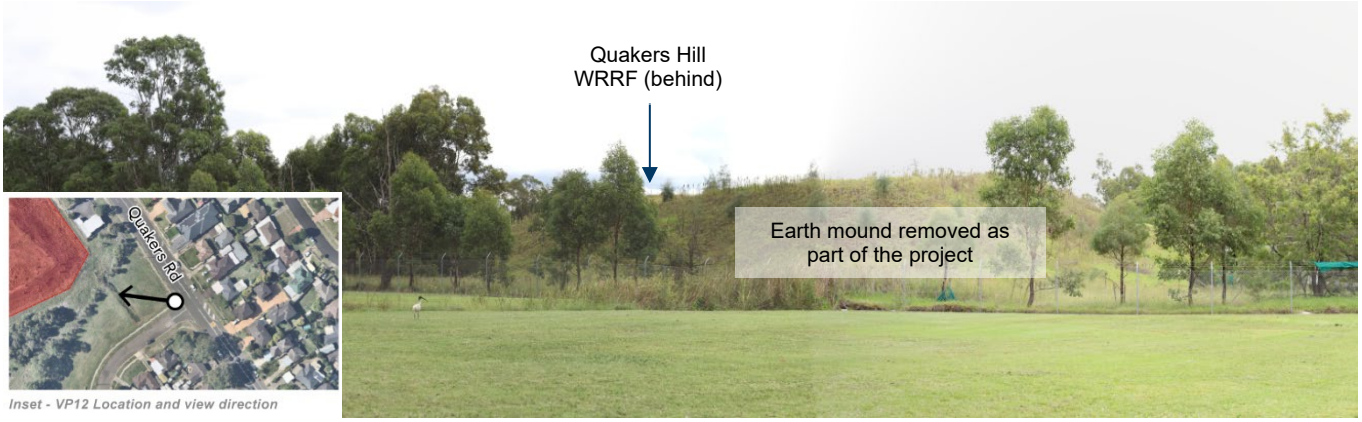


Figure 7.13 VP11 – Falmouth Road looking north towards construction and compound areas

7.2.12 VP12 – Melrose Avenue

Table 7.12 VP12 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°44'17"S 150°52'30"E** The view is west towards Melrose Park from the intersection of Melrose Avenue and Quakers Road. The view is towards the east across Melrose Avenue towards Melrose Park and the WRRF and it represents views from private, residential one-storey dwellings and from the street. The view is towards the east from Melrose Avenue towards Melrose Park and the WRRF representing views from private, residential one-storey dwellings and from the street.
Description of existing view	The viewpoint was chosen as it represents views from dwellings and suburban streets across open parkland areas towards the WRRF. The view is open across Melrose Park towards a small, sparsely vegetated hill occupying the centre of the view with a chainwire security fence, tall grasses and relatively small trees demarcating the eastern extent of the WRRF land. Trees and vegetation become larger and denser to the south (left) and north (right) providing screening of the WRRF.
Anticipated change to view	**Construction** Visibility of construction work would be partially obscured by the trees in the foreground and at approximately 500 m therefore unlikely to be visible from this distance. The earth mound in the middle ground will be removed during construction. **Operation** The removal of the earth mound in the foreground of the view will open views of the WRRF to the west. An ancillary building and existing trees located immediately west of the mound would likely occupy the view after removal.
Sensitivity	**High** – Residential visual receivers are located within proximity to the WRRF however views are generally screened by existing topography and vegetation. Residential visual receivers in dwellings have potentially long viewing times. – The existing view is a relatively typical view of park open space without any key features.
Magnitude	**Construction - Low** – Vegetation and removal of the earth mound using large excavation machinery such as backhoes, bulldozers and dump trucks, hoarding or safety fencing along the boundary. **Operation - Low** – Views of the existing WRRF are likely possible due to the removal of the earth mound in the foreground. Existing trees to the east and west of the mound would likely screen some views of the facility beyond.
Overall rating	**Construction – Moderate**
	Operation – Moderate



VP12 – View east from Melrose Avenue towards Quakers Hill WRRF

7.2.13 VP13 – M7 cycleway

Table 7.13 VP13 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°44'03"S 150°52'33"E** VP13 represents views east from the M7 Cycleway, near where it crosses under the Westlink M7 Motorway.
Description of existing view	The viewpoint was selected as it is a publicly accessible path in proximity of the WRRF. The view includes the cycleway as it emerges from under the M7 Motorway underpass and turns south. A continuous, tall, solid, panel wall and a row of trees screen views of the WRRF facility located behind. The M7 Motorway embankment, planted with trees and grasses, is visible on the opposite side of the cycleway. Other elements include cycleway signage, lighting and a rail safety barrier in the foreground.
Anticipated change to view	**Construction** The construction works are located behind the existing WRRF wall and row of trees and is not likely to be visible. **Operation** There are no anticipated changes to the view during operation as the new elements within the WRRF would be screened by the existing wall and tree planting.
Sensitivity	**Low** – Visual receivers include cyclists and generally would have short viewing times as they travel along the cycleway. – The location is a modified, urban environment with a generally low scenic value.
Magnitude	**Construction - Negligible** – Construction works are not visible and existing trees within the WRRF site are retained. **Operation - Negligible** – Few if any discernible visible changes to the existing views at this location.
Overall rating	**Construction - Negligible**
	Operation - Negligible

Inset - VP13 Location and view direction

VP13 – View east from M7 Cycleway towards Quakers Hill WRRF

7.2.14 VP14 – Jasmine Avenue

Table 7.14 VP14 visual impact assessment

Viewpoint type and location	**Photo GPS location: 33°44'17"S 150°52'30"E** VP14 is a view towards the north from Jasmine Avenue facing Breakfast Creek and the WRRF, located approximately 50 m to the north. It represents public views from parkland and open space.
Description of existing view	The viewpoint was selected to represent views from a large, contiguous parkland. The view is from an existing, linear, park recreation path across an open lawn area planted with trees. The view terminates at Breakfast Creek in the middle ground of the view from dense vegetation and trees. There is also utility poles, overhead wires, pits and light poles in the view.
Anticipated change to view	**Construction** No change as the construction work is screened by existing vegetation. **Operation** There are no anticipated changes to the view during operation as the WRRF is screened by existing vegetation.
Sensitivity	**Low** – Visual receivers are those accessing the park along the path. As the path is a recreation path link, view times would be short. – The park is well-planted, with tree cover and maintained therefore has some scenic aspects although there are no distinguishing landscape features.
Magnitude	**Construction - Negligible** – Construction of the WRRF is not visible from this viewpoint. **Operation - Negligible** – There are no visible changes from this viewpoint.
Overall rating	**Construction - Negligible**
	Operation - Negligible

Inset - VP14 Location and view direction

VP14 – View north from Jasmine Avenue towards Quakers Hill WRRF

7.3 Summary of visual impacts

Table 7.15 provides a summary of the assessment of visual receptors. As highlighted in the table, the overall visual impact rating ranges from **High-Moderate** to **Negligible**.

Table 7.15 Detailed visual impact assessment summary

Viewpoint	Sensitivity	Magnitude	Overall LCU assessment rating
VP01 - Construction	High	Moderate	**High-Moderate**
VP01 - Operation		Negligible	**Negligible**
VP02 - Construction	Low	Moderate	**Moderate-Low**
VP02 - Operation		Low	**Low**
VP03 - Construction	High	High	**High**
VP03 - Operation		Negligible	**Negligible**
VP04 - Construction	High	High	**High**
VP04 - Operation		High	**High**
VP05 - Construction	High	Moderate	**High-Moderate**
VP05 - Operation		Negligible	**Negligible**
VP06 - Construction	Low	Moderate	**Moderate-Low**
VP06 - Operation		Negligible	**Negligible**
VP07 - Construction	Low	Moderate	**Moderate-Low**
VP07 - Operation		Negligible	**Negligible**
VP08 - Construction	Low	Moderate	**Moderate-Low**
VP08 - Operation		Negligible	**Negligible**
VP09 - Construction	Low	Moderate	**Moderate-Low**
VP09 - Operation		Negligible	**Negligible**
VP10 - Construction	Low	Moderate	**Moderate-Low**
VP10 - Operation		Negligible	**Negligible**
VP11 - Construction	Low	Moderate	**Moderate-Low**
VP11 - Operation		Low	**Low**
VP12 - Construction	High	Low	**Moderate**
VP12 - Operation		Low	**Moderate**
VP13 - Construction	Low	Negligible	**Negligible**
VP13 - Operation		Negligible	**Negligible**
VP14 - Construction	Low	Negligible	**Negligible**
VP14 - Operation		Negligible	**Negligible**

7.4 Night lighting

The lighting design has not yet been confirmed therefore a thorough assessment is not possible at this time however lighting may be required as part of the construction and/or operation for the project.

7.4.1 Construction

Construction work hours are expected to be between 7 am and 7 pm, generally during daylight hours. However, some out of hours work may be required during construction and potentially require the use of “daymakers” (portable construction lighting for night works). Details of times and locations of night works would be provided in later design stages. Lighting will potentially be required for night works such as drilling or open trenching across regional roads. Some impacts may occur where construction is located near residential dwellings.

7.4.2 Operation

Operational lighting would likely only be required for the WRRF. The light sources would potentially be limited to low-level lighting for security, night time maintenance and emergency purposes. The WRRF is an existing facility and lighting impacts would likely be similar at operation to the existing lighting at the site.

Adverse visual impacts could be mitigated by incorporating the following principles:

– only use lighting for areas when required
– switch off lighting when not required
– keep lights close to the ground and / or directed downwards
– use the lowest intensity required for the job
– ensure lights are not directed at reflective surfaces
– use non-reflective dark coloured surfaces to reduce reflection of lighting
– use light shield fittings to avoid light spill
– direct light away from residential properties, if possible.

8. Cumulative impacts

Large-scale infrastructure projects have the potential to alter the perception of the overall landscape character and visual amenity within a region as new developments become part of the landscape. Cumulative landscape and visual impacts result from further changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it) or actions that occurred in the past, present or are likely to occur in the foreseeable future (Landscape Institute et al, 2008).

Cumulative impact assessments have a range of dimensions to consider:

– Impact of the project when combined with impacts from all other existing developments and the existing landscape character of the area.
– Impact of the project in the context of potential for other future infrastructure developments on a local and regional scale.
– Impact of developments which are ancillary to or associated with the project.

It is important to evaluate whether or not the impact of other projects within the area would change the character by becoming the dominant visual element thereby transforming the discernment of the overall character.

As part of the cumulative impact assessment review, a search of the NSW Government major projects portal was conducted in May 2025. There were found to be no State Significant projects either in the application process or approved. This is likely due to the zoning for low density residential and industrial designations being the predominant land uses in the study area.

As noted previously, the project includes very limited visible operational infrastructure the two main elements being the visually screened WRRF modifications and the barometric loop located in a suburban residential area. It is concluded therefore that the project would have negligible cumulative impacts both on individual receivers and nil impacts on the broader landscape.

Securing our Water Supply - Quakers Hill to Prospect

A separate application is currently being prepared for the Securing our Water Supply - Quakers Hill to Prospect upgrade. The project also involves relatively minor upgrading of the WRRF facility infrastructure and new pipeline extending south from the WRRF eventually connecting to the Prospect Reservoir.

In terms of cumulative impacts, there is a small overlap of the operational infrastructure at the WRRF and where the pipelines converge at the southeast corner however considering there are no visible components from this project at this location, no cumulative impacts are anticipated.

Removal of an earth mound at the easternmost extent of the WRRF, as part of the REF, would potentially allow new views of the WRRF facility from visual receivers to the east. The combination of development for both the EIS and REF would therefore create relatively small cumulative impacts on local receivers in the immediate areas to the east should they not be screened by new vegetation noting also that the majority of the cumulative impacts would be from the EIS upgrade works of the facility.

8.1 Assessment of identified viewpoints

This LVIA has identified that impacts are being driven by construction related works and that the WRRF would have negligible impacts on the surrounding areas due to it being visually isolated by surrounding physical factors such as trees, walls and landform.

The remaining visible element outside of the WRRF, the barometric loop, is a relatively small, discreet, physical object within the overall landscape with limited visibility to the immediately surrounding area. Therefore, apart from the barometric loop, the overall project would not be visible with other proposed development and would not contribute to cumulative landscape character or visual impacts on the identified viewpoints.

8.2 Broader landscape

It is important to consider whether the project has the potential to alter the perception of landscape character in the study area and in the wider regional context. The project is located within a predominately suburban, metropolitan context and relatively small, linear parkland areas. Development within the WRRF boundary increases the industrial nature of the facility itself but for the reasons provided in 8.1, would have nil impact on broader area both in terms of landscape character and visual amenity.

9. Mitigation measures

Table 9.1 lists the mitigation measures to manage potential impacts to landscape character and visual impacts identified in Sections 6 and 7. Mitigation measures should be discussed and developed in consultation with Sydney Water and any identified potentially affected landowners and stakeholders.

Table 9.1 Landscape and visual impact mitigation and management measures

Reference	Impact	Mitigation measure	Project stage
LCV01	Visual impact of construction works, including the construction of the brine pipeline	Consider the installation of temporary screening measures, and/or alternative solutions, around construction sites and compounds to minimise the visual impacts on sensitive receivers. Temporary screens should be considered near viewpoints where Moderate-Low or higher sensitivity ratings are identified.	Construction
LCV02	Restore work sites to pre-existing conditions or better	Develop and implement landscape plans for construction sites requiring restoration. Plans should include: – Removing all equipment and materials from the site. – Repair/replace pavements with new. – Replace street trees, vegetation and turf removed during construction wherever possible or consider other opportunities to reduce impacts on landscape character and visual amenity of streets.	Design, Construction and Operation
LCV03	Vegetation removal	Minimise vegetation clearance and disturbance, where possible including impacts to trees and riparian zones.	Design and Construction
LCV04	Tree protection	Protect trees in accordance with the requirements of *Australian Standard 4970-2009* for the Protection of Trees on Development Sites. Do not damage tree roots unless absolutely necessary and engage a qualified arborist where roots >50mm are impacted within the Tree Protection Zone.	Construction
LCV05	Visual impact of the Barometric loop on the public and private receivers	Visually integrate the Barometric loop into the open reserve at Billy Goat Hill Reserve. Engage with the community to understand their preference(s) for a community led solution. Potential treatments to mitigate visual impacts may include: – Implementing screen planting including trees along the road corridor or adjacent the Barometric loop – Use a light-coloured non-reflective finish – Consider the use of public art as part of the Barometric loop design to improve visual amenity and interest	Design and Construction
LCV06	Construction Environmental Management Plan (CEMP)	Prepare a Construction Environmental Management Plan (CEMP) addressing the requirements of this assessment. The CEMP should record the locations where adverse construction visual impacts have been identified for mitigation and any associated measures that must be put in place to address these impacts. The CEMP must be readily available on site and include a site plan which shows: – go/no go areas (heritage/AHIP zones professionally surveyed. Mark the boundary with highly visible non-ground-disturbing and 'environmental protection zone' signs) and boundaries of the work area/disturbance corridor (or use EIA terminology) including locations of lay-down and storage areas for materials and equipment – location of environmental controls (such as erosion and sediment controls, fences or other measures to protect vegetation or fauna, spill kits) – location and full extent of any vegetation disturbance. The CEMP will identify appropriate delineation. Delineate approved disturbance boundary before construction.	Construction

Reference	Impact	Mitigation measure	Project stage
LCV07	Stockpile Management Plan (SMP)	Include a Stockpile Management Plan (SMP) as part of the SWMP to adequately manage any visual impacts from proposed temporary and permanent stockpiles. This will include detail on: – exact location of stockpiles – minimising stockpile size – height, slopes and batters – erosion and sediment control – restoration. The Stockpile Management Plan will be approved by the Sydney Water Project Manager in consultation with the Environmental Representative and Contamination and Hazardous Materials team.	Construction
LCV08	Biodiversity Offset	Offset residual impacts to native vegetation and trees in accordance with the Biodiversity Offset Guideline	Design and Construction
LCV09	Lighting	Direct artificial light away from sensitive receivers where possible (ie sensitive environmental areas such as Breakfast Creek). Proposed lighting must be designed in accordance with Australian Standards AS/NZS 4282:2019 Control of the Obtrusive Effects of Outdoor Lighting, and any recommendations from other environmental assessments, for example an ecological assessment.	Design, Construction and Operation

10. Conclusion

GHD has completed a landscape and visual impact assessment to determine the landscape and visual impacts for the project. A summary of the key findings for the landscape character and visual impact assessments are included below.

10.1 Summary of landscape character assessment

The landscape character assessment identified a total of three (3) LCUs within the study area, LCU1 – Low density, LCU2 - Parklands and LCU3 - Industrial. All LCUs had either **Moderate** or **Moderate-Low** impact ratings for construction. These ratings were due to Moderate sensitivities of the LCUs and/or Moderate or Low magnitude ratings from vegetation removal, construction compounds and pipe stringing expected as required from the brine pipeline. It was noted that construction impacts are temporary with a potentially short duration lasting anywhere from a few months potentially up to two years.

LCU1 and LCU2 were assessed as a **Moderate-Low** impact ratings generally because of anticipated permanent vegetation removal. LCU3 received a **Negligible** operational impact rating due to lack of visible infrastructure and the project being congruous with the existing LCU character. Impact ratings could potentially be reduced through the successful implementation of the identified mitigation measures.

10.2 Summary of visual impact assessment

A total of fourteen (14) representative viewpoints were identified for a qualitative assessment within the study area. The viewpoints were established based on a desktop review and confirmed as part of the site work. Assessments were undertaken of both construction and operational infrastructure based on the current 50% design stage from a range of public and private visual receiver types.

Overall, it was found that the project's most significant impacts were construction related. The higher rating impacts were driven by sensitive visual receivers in proximity to the (sometimes large) areas for construction compounds and the associated activities, such as traffic management, excavation and vegetation removal, as related to the implementation of the brine pipeline.

Impacts from the operational stage are based on un-mitigated views and are, for the most part, limited to two locations. At VP04, (Billy Goat Hill Reserve) a new 12 m high by 2.5 m wide barometric loop would be visible to nearby dwellings and local streets resulting in a **High** visual impact rating. VP12 (Melrose Avenue) resulted in a **Moderate** rating where removal of a large earth mound would open views towards the WRRF. Otherwise, it was determined that lack of visibility of the WRRF from the surrounding areas resulted in **Negligible** or **Low** operational visual impacts apart for the remaining viewpoints.

Construction

Four (4) viewpoints were assessed as being **High-Moderate** or **High** impacts due to High sensitivity ratings from residential receivers in proximity to construction works and potential tree removal. The viewpoints are all located in the southern study area with VP04 (Billy Goat Hill Reserve) receiving a **High** rating owing to a combination of construction works for the construction of the barometric loop in the reserve and adjacent roadworks. VP

Seven (7) viewpoints were assessed as **Moderate-Low** ratings from Moderate magnitude ratings where large areas of construction impact from excavation of the pipeline and site compounds are co-located. VP12 received the only **Moderate** impact rating from a High sensitivity rating and works relating to removal of an earth mound.

Negligible ratings were assessed for the remaining three (3) viewpoints from Negligible magnitude construction and operation ratings near the WRRF.

Operation

Thirteen (13) viewpoints were assessed as either **Low** or **Negligible** due to **Negligible** magnitude ratings from the expected reinstatement of the landscape to current conditions and from little to no remaining visible infrastructure. Implementation of the identified mitigation measures for impact ratings assessed as Moderate or higher should be further considered as they can potentially reduce visual impact ratings.

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