16 Contamination

This chapter assesses the potential contamination impacts associated with the M4-M5 Link project (the project). This chapter has been informed by **Appendix R** (Technical working paper: Contamination).

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued environmental assessment requirements for the project. These are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 16-1** sets outs these requirements and the associated desired performance outcomes that relate to contamination of soils, and identifies where they have been addressed in this environmental impact statement (EIS).

Table 16-1 SEARs – contamination

Desired performance outcome	SEARs	Where addressed in the EIS
13. Soils The environmental values of land, including soils, subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination.	1. The Proponent must verify the risk of acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Risk Map) within the area likely to be impacted by, the project.	The potential for acid sulfate soils to occur within the project footprint is addressed in **section 16.3.1**. Further discussion is also provided in **Chapter 15** (Soil and water quality).
	2. The Proponent must assess the impact of the project on acid sulfate soils (including impacts of acidic runoff offsite) in accordance with the current guidelines and detail the mitigation measures proposed to minimise potential impacts.	Potential impacts of acid sulfate soils is provided in **section 16.3.1**. Mitigation for acid sulfate soils is provided in **section 16.5**. Further discussion is also provided in **Chapter 15** (Soil and water quality).
	3. The Proponent must assess whether the land is likely to be contaminated and identify if remediation of the land is required, having regard to the ecological and human health risks posed by the contamination in the context of past, existing and likely (or potential) future land uses. Where assessment and/or remediation is required, the Proponent must document how the assessment and/or remediation would be undertaken in accordance with current guidelines.	Qualitative assessment of the potential contamination risks is addressed in **section 16.3** and **section 16.4**. Specific remediation actions for construction ancillary facilities are provided in **Appendix R** (Technical working paper: Contamination). Commitment to undertaking and implementing a Remediation Action Plan is provided in **section 16.5**. Human health risks are discussed in **Appendix K** (Technical working paper: Human health risk assessment).
	4. The Proponent must assess whether salinity is likely to be an issue and if so, determine the presence, extent and severity of soil salinity within the project area.	Soil salinity is discussed in **Chapter 15** (Soil and water quality).

Desired performance outcome	SEARs	Where addressed in the EIS
	5. The Proponent must assess the impacts of the project on soil salinity and how it may affect groundwater resources and hydrology.	Soil salinity is discussed in **Chapter 15** (Soil and water quality). Potential impacts on groundwater are discussed in **Chapter 19** (Groundwater).
	6. The Proponent must assess the impacts on soil and land resources (including erosion risk or hazard). Particular attention must be given to soil erosion and sediment transport consistent with the practices and principles in the current guidelines.	Impacts on soil and land resources (including erosion risk or hazard) are addressed in **Chapter 15** (Soil and water quality).
	7. The Proponent must assess the impact of any disturbance of contaminated groundwater and the tunnels should be carefully designed so as to not exacerbate mobilisation of contaminated groundwater and/or prevent contaminated groundwater flow.	Disturbance of contaminated groundwater is summarised in **section 16.3** and **section 16.4**. Potential impacts on groundwater are addressed in **Chapter 19** (Groundwater).

16.1 Assessment methodology

16.1.1 Relevant legislation and policies

The requirement to undertake an assessment of potential contamination impacts as a result of the project is underpinned by relevant NSW legislation. **Appendix R** (Technical working paper: Contamination) provides a preliminary assessment of contamination risks associated with the surface disturbance areas of the project in accordance with the following legal instruments.

Contaminated Land Management Act 1997 (NSW)

The *Contaminated Land Management Act 1997* (NSW) (CLM Act) promotes the better management of contaminated land by establishing a process for investigating and (where appropriate) remediating land that the NSW Environment Protection Authority (NSW EPA) considers to be contaminated significantly enough to require regulation under Division 2 of Part 3 of the Act.

Particular objects of the CLM Act are to:

- Set out accountabilities for managing contamination if the NSW EPA considers the contamination is significant enough to require regulation under Division 2 of Part 3 of the CLM Act
- Set out the role of the NSW EPA in the assessment of contamination and the supervision of the investigation and management of contaminated sites
- Provide for the accreditation of site auditors of contaminated land to ensure appropriate standards of auditing in the management of contaminated land
- Ensure that contaminated land is managed with regard to the principles of ecologically sustainable development.

The assessment of contaminated land and the subsequent requirement for mitigation and/or management measures for the project will be guided by the objects of the CLM Act.

Protection of the Environment Operations Act 1997 (NSW)

The *Protection of the Environment Operations Act 1997* (NSW) (POEO Act) is the key piece of environment protection legislation administered by the NSW EPA. The POEO Act enables the government to set out explicit protection of the environment policies (PEPs) and adopt more innovative approaches to reducing pollution. This chapter considers the requirements of the POEO Act in the formulation of mitigation measures to avoid or reduce potential impacts as a result of the project.

Environmentally Hazardous Chemicals Act 1985 (NSW)

The *Environmentally Hazardous Chemicals Act 1985* (NSW) (EHC Act) provides a mechanism for regulating chemicals of environmental concern throughout their entire life cycle. These requirements are set out in chemical control orders and may require a licence or prohibit certain activities. The activities may include storing, transporting or treating chemicals and/or their wastes.

The EHC Act would be relevant for activities undertaken during construction and operation of the project. The Act ensures that particular chemicals and/or chemical wastes generated as a result of the project that have a significant potential or actual impact on the environment, are adequately controlled.

State Environmental Planning Policy No. 55 – Remediation of Land

The purpose of the State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) is to establish 'best practice' for managing land contamination through the planning and development control process. The assessment uses SEPP 55 to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.

16.1.2 Relevant guidelines

The assessment for the project also considers the following key guidelines applicable to contamination identification, assessment and management:

- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (NSW EPA 2015)
- *Guidelines for the Site Auditor Scheme* (Second Edition) (NSW Department of Environment and Conservation (DEC) 2006)
- *Guidelines for the Assessment and Management of Groundwater Contamination* (DEC 2007)
- National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) 2013 (National Environment Protection Council (NEPC) 1999)
- *Environmental Guidelines: Solid Waste Landfills* Second Edition (NSW EPA 2016)
- *Guidelines for Consultants Reporting on Contaminated Sites* (NSW Office of Environment and Heritage (OEH) 2011)
- *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA 2012)
- *National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines* (Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000)
- *Acid Sulfate Soils Assessment Guidelines,* Acid Sulfate Soils Management Advisory Committee ((ASSMAC) 1998).

16.1.3 Study area

The study area for the contamination assessment is the same as the project footprint, which comprises the location of all operational infrastructure and areas where construction activities would occur. Particular emphasis has been given to those areas where historical land use activities have impacted soil, sediment and groundwater and which would require remediation and/or management during the construction and operation of the project.

The study area for the contamination assessment has been assessed in two parts:

- An assessment of the surface components of the project (construction and operational activities)
- An assessment of the project tunnel alignment to identify potential sources of groundwater contamination.

For further information on the construction and operational components of the project, refer to **Chapter 6** (Construction work) and **Chapter 5** (Project description) respectively.

The twelve construction ancillary facilities and surrounding areas assessed for contamination are listed below. To assist in informing the development of a construction methodology that would manage constructability constraints and the need for construction to occur in a safe and efficient manner, while minimising impacts on local communities, the environment, and users of the surrounding road and other transport networks, two possible combinations of construction ancillary facilities at Haberfield and Ashfield have been assessed in this EIS. The construction ancillary facilities that comprise these options have been grouped together in this EIS and are denoted by the suffix a (for Option A) or b (for Option B).

- Construction ancillary facilities at Haberfield (Option A), comprising:
  - Wattle Street civil and tunnel site (C1a)
  - Haberfield civil and tunnel site (C2a)
  - Northcote Street civil site (C3a)
- Construction ancillary facilities at Ashfield and Haberfield (Option B), comprising:
  - Parramatta Road West civil and tunnel site (C1b)
  - Haberfield civil site (C2b)
  - Parramatta Road East civil site (C3b)
- Darley Road civil and tunnel site (C4)
- Rozelle civil and tunnel site (C5)
- The Crescent civil site (C6)
- Victoria Road civil site (C7)
- Iron Cove Link civil site (C8)
- Pyrmont Bridge Road tunnel site (C9)
- Campbell Road civil and tunnel site (C10).

The project tunnel alignment was assessed in order to identify potential sources of groundwater contamination. The tunnel alignment was split into the following sections for ease of interpretation:

- Haberfield to Annandale and Rozelle: Parramatta Road at Haberfield to Whites Creek at Annandale
- Rozelle to Iron Cove and Balmain: City West Link at Annandale to Wellington Street and Theodore Street at Balmain
- Annandale to Camperdown: Whites Creek at Annandale to Bishopgate Lane at Camperdown
- Camperdown to Newtown: Bishopgate Lane at Camperdown to Lord Street at Newtown
- Newtown to St Peters: Lord Street at Newtown to Mary Street at St Peters.

16.1.4 Methodology

The method adopted for the contamination assessment consisted of:

- A review of relevant data and background information including, but not limited to, previous contamination assessments, land titles, council records, NSW EPA records and Universal Business Directories Pty Ltd (UBD) business directories historical records to evaluate whether historical land uses were likely to have caused contamination of soil and groundwater
- A preliminary assessment of the nature and location of infrastructure, hazardous materials and other features located within the study area, both current and historical
- A review of available published geological and hydrogeological information for the construction ancillary facilities and study area
- A search of the NSW Government's groundwater bore database for groundwater bores within a one kilometre radius of the study area and review of available groundwater monitoring results for the project
- A search of the NSW EPA list of contaminated sites within 500 metres of the study area
- A review of selected historical images (including aerial photographs) and survey maps for the study area, which may provide an indication of historically contaminating land uses
- Completion of site inspections to assist with the identification of potential on and off-site sources of contamination and to understand the general condition of the construction ancillary facilities and construction sites and surrounding area
- Assessment of intrusive investigations completed within the project footprint and previous reports prepared to identify the areas and contaminants of concern
- An assessment of potential construction and operational impacts that may result from contaminated land or water (including a preliminary qualitative risk assessment (see below))
- Identification of mitigation measures to reduce or minimise the effects of potential impacts.

To assess the potential construction and operational impacts for the project, a preliminary qualitative risk assessment was undertaken based on the review of information.

The risk assessment follows the standard source, receptor, pathway methodology, where potential receptors have been defined as:

- Project construction workers and visitors
- Surrounding land users such as the general public and nearby residents and commercial workers
- Receiving water bodies
- Intrusive maintenance workers
- Future site users of final land use such as commercial, open space or residential
- Ecological receptors.

To identify the risk rating, a preliminary qualitative contamination risk assessment matrix in **Table 16-2** was used.

Table 16-2 Preliminary qualitative risk assessment matrix

Consequence	Likelihood of soil or groundwater contamination to be present				
	Very unlikely to be present and limited in extent	Potentially present and limited in extent	Potentially present and widespread	Most likely present and widespread	Known to be present and widespread
No or unlikely exposure pathway*	Low	Low	Low	Medium	Medium
Exposure pathway likely to be present*	Low	Medium	Medium	High	High
Exposure pathway present*	Medium	Medium	High	High	High

Note:

* Without implementation of appropriate controls or remediation as recommended in **section 16.5.**

A full explanation of the risk assessment methodology is detailed in **Appendix R** (Technical working paper: Contamination).

16.2 Existing environment

The following section identifies the site history, land use and any previous investigations carried out in the study area. For further information on soils and geology, including identifying the risk of acid sulfate soils across the site, refer to **Chapter 15** (Soil and water quality). For further information on hydrogeology, refer to **Chapter 19** (Groundwater). Contaminants of potential concern for each area is summarised in **section 16.2.14**.

16.2.1 Wattle Street civil and tunnel site (C1a)

Site description and surrounding land use

The Wattle Street civil and tunnel site at Haberfield is within the project footprint of the Wattle Street (City West Link) interchange construction zone for the M4 East project. The site would be located in an area comprising former residential properties, demolished as part of the M4 East project. The site is currently being used as a construction ancillary facility for the M4 East project.

The site slopes to the northeast and southwest and is surrounded by the land uses described in **Table 16-3**.

Table 16-3 Surrounding land use – Wattle Street civil and tunnel site (C1a) at Haberfield

Direction	Description of surrounding land use and proximity to the site
North	• Wattle Street, low density residential properties • Reg Coady Reserve (120 metres topographically down-gradient) (northeast) • Dobroyd Canal (Iron Cove Creek) (250 metres down-gradient)
South	• Low density residential properties
East	• Ramsay Street followed by low density residential properties (down-gradient)
West	• M4 East construction ancillary facilities and commercial/industrial properties along Parramatta Road

Site history

Key findings relevant to the Wattle Street civil and tunnel site (prior to the construction of the M4 East project) include:

- Historical aerial photographs from between 1930 and 2014 showed that low density residential properties were located within and surrounding the site
- A car sales yard was located 130 metres topographically down-gradient and southwest of the site (225-227 Parramatta Road), which was a former laundry/dry cleaner from 1919 to 1982
- A car service centre was located 125 metres topographically down-gradient and southwest of the site (235-237 Parramatta Road)
- A search of the NSW EPA records of notices and list of NSW contaminated sites identified no sites within 500 metres of the project.

Limited investigations were undertaken to inform the M4 East EIS (GHD 2015). Subsequent to M4 East project approval, soil and groundwater investigations were undertaken at the site (Ramboll Environ 2016a) to inform contamination management measures. Asbestos was the primary contaminant of concern identified.

Further detail on the site history and previous investigations for the Wattle Street civil and tunnel site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.2 Haberfield civil and tunnel site (C2a)

Site description and surrounding land use

The Haberfield civil and tunnel site would be located in an area comprising former residential and commercial properties, demolished as part of the M4 East project. The site is currently being utilised as a construction ancillary facility for the M4 East project.

The Haberfield civil and tunnel site slopes to the southwest and is surrounded by the land uses described in **Table 16-4**.

Table 16-4 Surrounding land use – Haberfield civil and tunnel site (C2a) at Haberfield

Direction	Description of surrounding land use and proximity to the site
North	• Construction ancillary facilities used by the M4 East project and residential properties • Dobroyd Canal (Iron Cove Creek) 400 metres to the north
South	• Walker Avenue, a gym and mixed residential and commercial land use
East	• Residential properties (adjacent and up-gradient)
West	• Parramatta Road, Bunnings Warehouse, The Infants Home preschool and Long day care centre

Site history

Key findings relevant to the Haberfield civil and tunnel site (prior to the construction of the M4 East project) include:

- Historical aerial photographs from between 1930 and 2015 showed that low density residential properties were located within and surrounding the site
- From 1968, a number of car dealerships were located in the area along with a laundry proprietor and dry cleaners.

With the exception of limited investigations undertaken to inform the M4 East EIS (GHD 2015), no soil or groundwater investigations are known to have been completed within the Haberfield civil and tunnel site.

Further detail on the site history for the Haberfield civil and tunnel site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.3 Northcote Street civil site (C3a)

Site description and surrounding land use

The Northcote Street civil site at Haberfield would be located in an area comprising former residential and commercial properties, demolished as part of the M4 East project. The site is currently being utilised as a construction ancillary facility for the M4 East project.

The site slopes to the west is surrounded by the land uses described in **Table 16-5**.

Table 16-5 Surrounding land use – Northcote Street civil site (C3a) at Haberfield

Direction	Description of surrounding land use and proximity to the site
North	• Wolseley Street • Muirs Prestige Smash Repairs (20 metres north and across gradient) • Speedway Service Station (35 metres north and across gradient) • Automotive Hospital (80 metres north and across gradient) • Platinum Car Wash Café (former petrol station) (100 metres north and across gradient) • Little VIPs Childcare Centre (100 metres north and across gradient) • Dobroyd Canal (Iron Cove Creek) (195 metres north)
South	• Wattle Street • Haberfield civil and tunnel site (C2a) • Residential properties (45 metres across gradient) • Bunnings warehouse (45 metres down-gradient)
East	• Residential properties (adjacent and up-gradient)
West	• Parramatta Road • Various retail shops and fast food restaurants (20 metres down-gradient) • Residential properties (70 metres down-gradient)

Site history

Key findings relevant to the Northcote Street civil site include (prior to the construction of the M4 East project):

- Historical aerial photographs from between 1930 and 2016 showed that low density residential properties were located within and surrounding the site
- Industrial activities included the presence of a service station that was subsequently used as a garden shop from 1980 until 2016. Truck and car dealerships were also prominent along with associated workshops.

With the exception of limited investigations undertaken to inform the M4 East EIS (GHD 2015), no soil or groundwater investigations are known to have been completed within the Northcote Street civil site.

Further detail on the site history for the Northcote Street civil site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.4 Parramatta Road West civil and tunnel site (C1b)

Site description and surrounding land use

The Parramatta Road West civil and tunnel site would be located on land currently utilised for commercial purposes (including a car dealership and associated maintenance facilities). The Parramatta Road West civil and tunnel site drains north towards Dobroyd Canal (Iron Cove Creek) and is surrounded by land uses listed in **Table 16-6**.

Table 16-6 Surrounding land use – Parramatta Road West civil and tunnel site (C1b) at Ashfield

Direction	Description of surrounding land use and proximity to the site
North	• Great Western Highway/Parramatta Road • Alt Street • Northern portion of the C3b site (currently Muirs Kia Sales) 201–203 Parramatta Road, Ashfield • Further north is residential and commercial/industrial land use and Walker Avenue
South	• Bland Street • Vacant sites (202-204 and 220 Parramatta Road, Ashfield) formerly Brescia Furniture Showroom (destroyed by fire) and 192 Parramatta Road Ashfield formerly car sales yard (Sydney GPS Motors) currently occupied by the M4 East for construction purposes (M4 East Parramatta Road civil site C10) • Low to medium density residential along Bland Street and Chandos Street
East	• Parramatta Road East civil site (C3b) – currently Muirs Holden and Muirs Kia Sales • Low density residential housing on Bland and Alt Streets
West	• Low to high density residential housing on Bland Street and Alt Street • Chaya's Family Day Care on Alt Street (about 50 metres west of the site)

Site history

Key findings relevant to the Parramatta Road West civil and tunnel site include:

- Aerial photographs showed that the site and surrounds comprised of predominantly residential land use throughout the 1930s to 1960s. From the 1970s, commercial development increased along Parramatta Road
- The site appears to have been used as a car sales yard since the 1970's and owned by various commercial/industrial businesses from the 1930s to 1960s
- A former mechanical workshop has been identified around 20 metres north of the site.

Previous soil and groundwater sampling works have been carried out (GHD 2015) which indicated some exceedances of contaminant concentrations above the ASC NEPM health investigation levels and groundwater investigation levels.

Further detail on the site history and previous sampling results for the Parramatta Road West civil and tunnel site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.5 Haberfield civil site (C2b)

The Haberfield civil site is an alternative design to the Haberfield civil and tunnel site (C2a). This civil site (C2b) would not be used to support tunnelling. The location of the Haberfield civil site (C2b) would be the same as the Haberfield civil and tunnel site (C2a), however it would require less land at the surface. Therefore, information relevant to the site description and site history remain the same as those discussed in **section 16.2.2**.

16.2.6 Parramatta Road East civil site (C3b)

Site description and surrounding area

The Parramatta Road East civil site would be located within an area currently comprising commercial properties, including a car dealership and associated maintenance facilities. The Parramatta Road East civil site drains north towards Dobroyd Canal (Iron Cove Creek) and is surrounded by land listed in **Table 16-7**.

Table 16-7 Surrounding land use – Parramatta Road East civil site (C3b) at Haberfield

Direction	Description of surrounding land use and proximity to the site
North	• Alt Street and Walker Avenue • Former laundry/dry cleaner on corner of Walker Avenue and Parramatta Road • Further north is residential and commercial/industrial land use (including car sales yard and Wattle Street
South	• Great Western Highway/Parramatta Road • Bland Street • Juvenile Justice – Yasmar training facility located between Bland Street and Chandos Street on Parramatta Road • Vacant sites (202–204 and 220 Parramatta Road Ashfield formerly Brescia Furniture Showroom (destroyed by fire) and 192 Parramatta Road Ashfield formerly car sales yard (Sydney GPS Motors) currently occupied by the M4 East for construction purposes (M4 East Parramatta Road civil site C10) and low to medium density residential Low to medium density residential along Bland and Chandos Streets
East	• Low density residential housing on Bland and Alt Streets • Haberfield Public school on the corner of Bland Street and Denman Avenue
West	• Great Western Highway/Parramatta Road • Parramatta Road West civil and tunnel site (C1b) currently Muirs Holden Automotive servicing and sales and NSW Roads and Maritime Services (Roads and Maritime) land various commercial leases on corner of Bland Street and Parramatta Road • Low to high density residential housing on Bland and Alt Streets • Chaya's Family Day Care on Alt Street (about 50 metres west of the C1b site)

Site history

Key findings relevant to the Parramatta Road East civil site include:

- Previous use of the site includes a newsagency, television repairs and sales business, and ownership by Rennon Motors Pty Ltd
- As part of the previous investigations for the M4 East project in 2014, two of the boreholes that were drilled are on the boundary of the site.

Previous soil and groundwater sampling works have been carried out (GHD 2015) which indicated some exceedances of contaminant concentrations above groundwater investigation levels.

Further detail on the site history and previous sampling results for the Parramatta Road East civil and tunnel site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.7 Darley Road civil and tunnel site (C4)

Site description and surrounding land use

The Darley Road civil and tunnel site would be located on land owned by RailCorp – Transport for NSW. This land comprises a two storey vacant brick building with a fibre cement roof which has been renovated and now used as a commercial retail outlet. The western portion of the land is paved with bitumen and is used as a carpark servicing the retail outlet. The eastern portion of the site consists of a paved and landscaped area.

The land is bound to the north by the Leichhardt North light rail stop and line, to the south by Darley Road and Canal Road to the west.

The Darley Road civil and tunnel site slopes to the west and is surrounded by the land uses listed in **Table 16-8**.

Table 16-8 Surrounding land use – Darley Road civil and tunnel site (C4) at Leichhardt

Direction	Description of surrounding land use and proximity to the site
North	• Sydney Light Rail line and Leichhardt North light rail stop • City West Link followed by low to medium density residential properties
South	• Darley Road followed by low to medium density residential properties • An industrial building which operates as an antiques business fronting Darley Road • Monzo petrol station 100 metres southeast along Norton Street
East	• Norton Street followed by low to medium density residential properties and some commercial/industrial properties along Norton Street
West	• Charles Street and light rail corridor followed by Blackmore Park • Hawthorne Canal 300 metres west of C4 adjacent to Blackmore Park and Canal Road

Site history

Key findings relevant to the Darley Road civil and tunnel site include:

- Based on historical aerial photographs, the land was mostly cleared and vacant with one small building near the centre-north part of the land prior to 1950
- Industrial activities included a concrete facility and steel guttering production as well as additional light industry uses, including a bakery and vehicle storage
- Underground storage tanks (USTs) were also present, but understood to have been decommissioned.

Previous site investigations have been carried out (Environmental Investigation Services 2002 and HLA-Envirosciences Pty Ltd 2007) and results were all lower than the current ASC NEPM health investigation levels and health screening levels for commercial/industrial land use.

Further detail on the site history and previous sampling results for the Darley Road civil and tunnel site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.8 Rozelle civil and tunnel site (C5)

Site description and surrounding area

The Rozelle civil and tunnel site would be located within the Rozelle Rail Yards at Lilyfield and Rozelle and encompasses an area of about 13.5 hectares.

Existing railway tracks, rail related infrastructure, buildings, surface wastes/stockpiles and noxious weeds are being removed from part of the Rozelle Rail Yards site at Rozelle as part of site management works, which were assessed separately in the Rozelle Rail Yards site management works review of environmental factors (REF) (Roads and Maritime 2016). The site management works will be completed prior to construction of the project commencing.

The Rozelle civil and tunnel site drains to Rozelle Bay and is surrounded by land uses as detailed in **Table 16-9**.

Table 16-9 Surrounding land use – Rozelle civil and tunnel site (C5) at Rozelle

Direction	Description of surrounding land use and proximity to the site
North	• Low to medium density residential properties • Lilyfield Road • Easton Park
South	• City West Link • Whites Creek followed by Brenan Street and then low to medium density residential properties • James Craig Road, commercial and industrial wharves, Maritime NSW, and Australian Superyacht Services Sydney • Rozelle Bay
East	• Victoria Road bridge followed by the former White Bay Power Station
West	• Construction site for the CBD and South East Light Rail Rozelle maintenance depot • Low to high density residential properties (topographically up-gradient to the southwest and northwest)

Site history

Key findings relevant to the Rozelle civil and tunnel site include:

- Prior to 1900 the eastern third of the site was part of Rozelle Bay, which was reclaimed to build the Rozelle Rail Yards. From 1914 to 1930s the land was acquired by The Commissioner for Railways, which became the Public Transport Commission of New South Wales (1970s) and then State Rail Authority of New South Wales (1980s). The railyards were transferred to Sydney Harbour Foreshore Authority in 2000 (which was absorbed into Government Property NSW in 2015)
- Various industries operated in the Rozelle Rail Yards including panel beaters, petroleum companies, logistics, boat and seafood businesses
- Historical aerial photographs showed City West Link was formerly part of the Rozelle Rail Yards until between 1982 and 1991.

Several previous investigations have been carried out at the site, including fill, natural soil and groundwater samples collected as part of a site investigation undertaken by AECOM in 2016. Results include some ASC NEPM health investigation levels and ecological investigation levels being exceeded for some contaminants. Additional contamination investigations were carried out to inform management measures for the Rozelle Rail Yards site management works REF.

Further detail on the site history and sampling results for the Rozelle civil and tunnel site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.9 The Crescent civil site (C6)

Site description and surrounding area

The Crescent civil site at Annandale is currently vacant. The site was previously used for boat, plant and machinery storage and maintenance. The site is currently owned by Roads and Maritime and encompasses an area of around 6,620 square metres. The site is used to access commercially leased jetties. Rozelle Bay is a tidal harbour embayment located immediately adjacent. Rozelle Bay has been substantially modified by land reclamation activities and receives urban runoff from the suburbs of Rozelle, Lilyfield, Annandale and Forest Lodge.

The Crescent civil site at Annandale is anticipated to drain in an easterly direction towards Rozelle Bay, which is located immediately adjacent to and east of the site and is surrounded by land uses detailed in **Table 16-10**.

Table 16-10 Surrounding land use – The Crescent civil site (C6) at Annandale

Direction	Description of surrounding land use and proximity to the site
North	• Parkland, pedestrian and cyclist corridors which collectively form part of road verge above Whites Creek and Easton Park drainage into Rozelle Bay immediately east of the intersection of The Crescent and City West Link • Rozelle Rail Yards
South	• The Crescent and intersection with Johnston Street and Petersham TAFE College Annandale Campus. Above the intersection of these roadways is the Inner West Light Rail line • Federal Park adjacent to Rozelle Bay • Medium and low density residential properties
East	• Rozelle Bay, jetties, pontoons and marina
West	• The Crescent, residential land use further west, Buruwan Park adjacent to Whites Creek running west to east parallel to City West Link • Above Buruwan Park the Rozelle Bay light rail stop, tracks and associated infrastructure

Site history

It is understood that the site has been previously used for marine storage and maintenance purposes. The site history prior to that is unknown, however there is potential that the area has been filled and was previously part of Rozelle Bay. The Rozelle Rail Yards Site Management Works REF (Roads and Maritime 2016) noted that historic reports indicate Rozelle Bay is one of the most heavily polluted areas of Sydney Harbour.

Previous samples at the site (Jacobs (2015b)) have been undertaken and indicate that soil and groundwater is likely to be contaminated.

AECOM carried out soil and sediment investigation at the site in 2017 with some samples exceeding the human health United States Environmental Protection Agency residential regional screening levels and ASC NEPM ecological screening levels. Further detail on site history and sampling results at The Crescent civil site at Annandale is provided at **Appendix R** (Technical working paper: Contamination).

16.2.10 Victoria Road civil site (C7)

Site description and surrounding area

The Victoria Road civil site would be located in an area currently comprising residential and commercial properties at Rozelle. The site slopes to the east and southeast and is surrounded by the land uses listed in **Table 16-11**.

Table 16-11 Surrounding land use – Victoria Road civil site (C7) at Rozelle

Direction	Description of surrounding land use and proximity to the site
North	• Quirk Street and Victoria Road, with medium density residential properties to the northwest and commercial retail outlets about 100 metres to the north • Rosebud Cottage Child Care Centre about 75 metres topographically up-gradient
South	• Lilyfield Road followed by medium density residential properties and then the Rozelle Rail Yards, City West Link and then Rozelle Bay wharves • Rozelle Bay about 300 metres to the south
East	• Victoria Road, White Bay Power Station, Glebe Container Terminal and White Bay
West	• Medium and low density residential properties

Site history

Previous industrial uses included a service station and non-descript commercial buildings. No soil or groundwater investigations are known to have been completed within the Victoria Road civil site.

Further detail on the site history for the Victoria Road civil site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.11 Iron Cove Link civil site (C8)

Site description and surrounding area

The Iron Cove civil site would be located along the southern side of Victoria Road at Rozelle, in an area currently comprising residential, commercial and industrial properties, road corridor and open space. The surrounding land use is summarised in **Table 16-12**.

Table 16-12 Surrounding land use – Iron Cove Link civil site (C8) at Rozelle

Direction	Description of surrounding land use and proximity to the site
North	• Bridgewater Park and residential apartments located directly to the north down-gradient • United 24 Service Station, Andrew Lyall Car Dealership and Caltex Service Station, VRS prestige (mechanics) and a substation are located directly adjacent up-gradient of the site • Iron Cove Bridge located immediately north down-gradient of the site
South	• 7 Eleven Service Station is located adjacent up-gradient • Low density residential properties are located adjacent up-gradient
East	• Rozelle Primary School is located about 200 metres topographically up-gradient • Further east are Rozelle shops and low to medium density residential
West	• King George Park is adjacent and topographically down-gradient

Direction	Description of surrounding land use and proximity to the site
	• Iron Cove (Parramatta River) located 50 metres and topographically down-gradient

Site history

Key findings relevant to the Iron Cove civil site include:

- The former Balmain Power Station was located directly north and adjacent to the site and was previously regulated by the NSW EPA due to the presence of a range of contaminants including PCBs and asbestos. The NSW EPA notices were revoked in August 1997 following remediation of the site
- Previous industrial uses included timber merchants, carpenters, motor garages, petrol stations, metal founders, laundries and copper and vat maker businesses
- Residential properties have also been in the area since at least 1930.

No contamination investigations are known to have been completed within the Iron Cove civil and construction site.

Further detail on the site history for the Iron Cove civil site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.12 Pyrmont Bridge Road tunnel site (C9)

Site description and surrounding area

The Pyrmont Bridge Road tunnel site is located at Annandale in an area currently comprising various commercial properties. The site slopes to the northwest and is surrounded by the land uses listed in **Table 16-13**.

Table 16-13 Surrounding land use – Pyrmont Bridge Road tunnel site (C9) at Annandale

Direction	Description of surrounding land use and proximity to the site
North	• Pyrmont Bridge Road, followed by commercial/industrial and residential properties (topographically down-gradient) and then Johnstons Creek 150 metres northwest and about 280 metres north
South	• Parramatta Road followed by the Bridge Road School and commercial and medium to high density residential properties • Alfred's Dry Cleaning located about 315 metres topographically up-gradient • Johnstons Creek is also located about 150 metres northwest up-gradient
East	• Booth Street followed by commercial and medium to high density residential properties • Grace Dry Cleaning and Laundry located about 95 metres topographically up-gradient • BP Connect Camperdown service station located about 270 metres topographically up-gradient
West	• Camperdown Service Centre located about 50 metres topographically down-gradient • James Squires Brewery located adjacent and topographically down-gradient • 7 Eleven service station located about 65 metres topographically down-gradient

Site history

Key findings relevant to the Pyrmont Bridge Road tunnel site include:

- A number of industrial and commercial business have been present at the site since around 1948
- Previous industrial uses included earth moving equipment manufacturers, motor car/truck dealers and storage facilities, electrical suppliers, blacksmiths and welders, spring manufacturers, textile manufacturers, annunciators and electroplaters.

No soil or groundwater investigations are known to have been completed within the Pyrmont Bridge Road tunnel site. Further detail on the site history for the Pyrmont Bridge Road tunnel site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.13 Campbell Road civil and tunnel site (C10)

Site description and surrounding area

The Campbell Road civil and tunnel site is located at St Peters, on land currently being used as a construction site for the New M5 project. This land would be handed over to the project when it is no longer needed for New M5 construction. The site slopes to the southeast and is surrounded by the land uses listed in **Table 16-14**.

Table 16-14 Surrounding land use – Campbell Road civil and tunnel site (C10) at St Peters

Direction	Description of surrounding land use and proximity to the site
North	• Medium to high density residential properties • Commercial properties including Barbara's Prestige Smash Repairs and Australian Refined Alloys • Campbell Road • Sydney Park
South	• Former Alexandria Landfill/St Peters interchange construction site (part of the New M5 project)
East	• Commercial/industrial properties including Real Foods, former smash repairs and taxi base, and former Sims Metal Management scrap metal depot
West	• Former Alexandria Landfill/St Peters interchange construction site (part of the New M5 project) • Retail and warehouse commercial businesses • Princes Highway • Medium to high density residential properties

Site history

Key findings relevant to the Campbell Road civil and tunnel site include:

- The site was a mixture of unknown commercial/industrial land use and agricultural land use prior to 1908. From 1908 to 1962, there was the Ralford pit quarry and brick works
- The City of Sydney Council operated a solid waste 'inert/non-putrescible' landfill (Alexandria Landfill) within the former quarry from 1988 until 2002 when the landfill was purchased and operated by Dial-A-Dump Industries in 2015
- At the St Peters interchange construction site, the property was occupied by market gardens prior to 1923. After 1923 the brick works infrastructure (buildings, furnaces and chimneys) was constructed on the site. The brick works was demolished in 1970 and then the property was used

for storing crushed sandstone. The crushed sandstone stockpile (known as Bradshaw Mountain) was unused and became vegetated after 2004

- At the Holland Street lot, the property was previously occupied by a fishing line manufacture from 1926 to 1947, laminated timber veneer manufacturers until 1970, a storage company until 1995, Brambles Australia Ltd until 1999 and then Glenridge Holdings
- Other uses at the site include a bakery, workshops, warehouses and various commercial businesses.

Previous investigations for the New M5 project encompass the Campbell Road civil and tunnel site, which indicated some contaminant concentrations exceeded the ASC NEPM health investigation levels and ecological investigation levels.

Further detail on the site history and previous sampling results for the Campbell Road civil and tunnel site is provided in **Appendix R** (Technical working paper: Contamination).

16.2.14 Contaminants of potential concern

The contaminants of potential concern for each area are summarised in **Table 16-15**. Further detail is provided at **Appendix R** (Technical working paper: Contamination).

Table 16-15 Contaminants of potential concern

Area	Description	Contaminants of potential concern
Wattle Street civil and tunnel site (C1a)	• Demolition of former buildings (potentially containing asbestos or lead paint) • Use of the site as a construction ancillary facility for the M4 East project and associated potential for leaks and spills • Use of plant and machinery and excavation activities. However, the site would be returned generally to pre-construction condition before being handed over to M4-M5 Link construction contractor	• Lead • Asbestos • Metals • Polycyclic aromatic hydrocarbons (PAHs) • Hydrocarbons
Haberfield civil and tunnel site (C2a) and Haberfield civil site (C2b)	• Demolition of former buildings (potentially containing asbestos or lead paint) • Small scale mechanical workshops and laundry may have been operational within the property, which may have historically stored and handled oils, fuels and solvents	• Total recoverable hydrocarbons (TRH) • Benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN) • PAHs • Volatile organic compounds (VOCs) • Lead • Asbestos • Metals

Area	Description	Contaminants of potential concern
Northcote Street civil site (C3a)	• Use of the site as a construction ancillary facility as part of the M4 East project. Demolition activities, tunnelling and use of plant and machinery and excavation activities. However, the site would be returned generally to pre-construction condition before being handed over to M4-M5 Link construction contractor • Previous mechanical workshops and petrol station on the site may have stored and handled oils, fuels and solvents and the former underground petroleum storage system including USTs and pipelines may still be in situ, which has a risk of historical leaks	• TRH • BTEX • PAHs • VOCs • Lead • Asbestos
Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b)	• Demolition of former buildings (potentially containing asbestos or lead paint) • Surrounding areas may have been filled using potentially contaminated sources • Previous mechanical workshops and petrol station on the site may have stored and handled oils, fuels and solvents and the former underground petroleum storage system including USTs and pipelines may still be in situ, which has a risk of historical leaks	• Metals • TRH • BTEX • PAHs • VOCs • Lead • Asbestos • Polychlorinated biphenyls (PCBs) • Organochlorine Pesticides (OCPs) • Organophosphate Pesticides (OPPs)
Darley Road civil and tunnel site (C4)	• A decommissioned UST is to the west of the site, which may have localised petroleum contamination • Fill from unknown sources is present on the site, which may contain potentially contaminated sources • The Sydney Buses Leichhardt Depot and manufacturing sites are located up-gradient	• Metals • PAHs • TRH • Asbestos • Semi Volatile Organic Hydrocarbons (SVOCs)
Rozelle civil and tunnel site (C5)	• Fill on site contains elevated concentrations of contaminants above applicable human health and ecological criteria. Asbestos was also identified in fill in several locations • Previous uses as timber yard, rail yard and manufacturing • Acid sulfate soil risk identified • The Crescent civil site (C6)	• Metals • TRH • PAH • Asbestos • Acid sulfate soils • OCPs

Area	Description	Contaminants of potential concern
The Crescent civil site (C6)	• Imported fill of unknown origin • Elevated concentrations of contaminants above ecological criteria • Acid sulfate soil risk identified • Potential for up-gradient contaminants to be mobilised via sediment and stormwater following into Whites Creek and Easton Park drain into Rozelle Bay • Previous uses of the Rozelle civil and tunnel site (C5) nearby • Boat maintenance activities within Rozelle Bay	• Asbestos • PFAS – PFOS and PFHxS • Metals • PAHs • Phathalates • Acid sulfate soils • Tributyltin • SVOCs • VOCs • TRH • BTEXN
Victoria Road civil site (C7)	• Previous underground petroleum storage system located on site, which has a risk of historical leaks • Demolition of former buildings (potentially containing asbestos or lead paint)	• TRH • BTEXN • PAHs • Lead • Asbestos
Iron Cove Link civil site (C8)	• Demolition of former buildings (potentially containing asbestos or lead paint) • Imported fill from an unknown origin • Previous mechanical workshops and petrol station on the site may have stored and handled oils, fuels and solvents and the former underground petroleum storage system including has a risk of historical leaks • Acid sulfate soil risk identified	• Metals • TRH • BTEX • PAHs • OCPs • PCBs • Asbestos • VOCs • SVOCs
Pyrmont Bridge Road tunnel site (C9)	• Previous mechanical workshops on the site may have stored and handled oils, fuels and solvents	• Metals • TRH • BTEXN • PAHs • VOCs • Asbestos • PCBs
Campbell Road civil and tunnel site (C10)	• Former solid waste landfill and recycling facility • Imported fill from an unknown origin • Unknown former commercial/industrial purposes	• Landfill gases (from adjacent landfill) • Metals

Area	Description	Contaminants of potential concern
	• Demolition of former buildings (potentially containing asbestos or lead paint)	• PAHs • Asbestos • Metals • TRH • SVOCs • VOCs • BTEXN

16.2.15 Tunnel alignment – Haberfield to Annandale and Rozelle

Current and former potentially contaminating land uses

Current and former potentially contaminating land uses identified within 300 metres of the tunnel alignment include petroleum storage and workshops, former 5th Ordnance Leichhardt Depot, former public works depot, former petrol station, former steel manufacturers, boiler makers, plastic manufactures, former metal engineering, electroplating, non-metal founding, timber supplies and panel beaters and the former Cumberland brick pit filled.

Notified and regulated sites

Sites notified to the NSW EPA under section 60 of the CLM Act or formerly regulated by the NSW EPA under the CLM Act and within 300 metres of the tunnel alignment are listed in **Table 16-6**.

Table 16-16 Contaminated sites notified to or regulated by the NSW EPA – Haberfield to Annandale and Rozelle

Property	Status	Proximity to alignment
Bus Depot (Area E) Corner of Balmain Road and City West Link, Leichhardt	Reported to the NSW EPA under section 60 of the CLM Act. Currently under assessment by the NSW EPA.	300 metres north of the alignment
RailCorp Leichhardt 7 Darley Road, Leichhardt	Reported to the NSW EPA under section 60 of the CLM Act. NSW EPA assessed the site as not requiring regulation under the CLM Act.	150 metres north of the alignment

Licensed sites

Sites licensed under the POEO Act and within 300 metres of the tunnel alignment are listed in **Table 16-17**.

Table 16-17 POEO Register – Haberfield to Annandale and Rozelle

Property	Licence number	Proximity to alignment
M4 East Homebush Bay Drive to Parramatta Road, Burwood	Environment Protection Licence (EPL) 20734	Adjacent
Sydney Trains (Railcorp) Network, Railway	EPL 12208	Above alignment

Groundwater quality

Groundwater monitoring was undertaken as part of the combined geotechnical and contamination investigations for the M4-M5 Link project. Samples were collected and analysed for metals (arsenic, cadmium, chromium, copper, nickel, lead, mercury and zinc), TRH, VOCs and SVOCs. Exceedances of two analytes (zinc and nickel) were discovered in two of the boreholes. The results are summarised in **Appendix R** (Technical working paper: Contamination) and **Appendix T** (Technical working paper: Groundwater).

16.2.16 Tunnel alignment - Rozelle to Iron Cove and Balmain

Current and former potentially contaminating land uses

Current and former potentially contaminating land uses identified within 300 metres of the tunnel alignment include petroleum storage, dry cleaners, and various manufacturing and metal foundries.

Notified and regulated sites

Sites notified to the NSW EPA under section 60 of the CLM Act or formerly regulated by the NSW EPA under the CLM Act and within 300 metres of the tunnel alignment are listed in **Table 16-18**.

Table 16-18 Contaminated sites notified to or regulated by the NSW EPA – Rozelle to Iron Cove and Balmain

Property	Status	Proximity to alignment
White Bay Power Station Rozelle	Reported to the NSW EPA under section 60 of the CLM Act. NSW EPA assessed the site as not requiring regulation under the CLM Act.	70 metres north and topographically down-gradient of the alignment
Balmain Power Station Terry Street, Rozelle	Formerly regulated by the NSW EPA due to a range of contaminants including PCBs and asbestos. The NSW EPA notices were revoked in August 1997 following remediation of the site.	80 metres north and topographically down-gradient of the alignment
Former Chemplex Factory 35 Terry Street, Rozelle	Formerly regulated by the NSW EPA due to metals and organic compounds. The notices were revoked in 1997.	300 metres north and topographically down-gradient of the alignment
Caltex service station 121 Victoria Road, Rozelle	Currently under assessment by the NSW EPA after being notified under section 60 of the CLM Act.	Immediately adjacent to the alignment
7 Eleven service station, 178–180 Victoria Road, Rozelle	Currently under assessment by the NSW EPA after being notified under section 60 of the CLM Act.	Immediately adjacent to the alignment

Licensed sites

There were no sites licensed under the POEO Act within 300 metres of the tunnel alignment. Licenses in the broader area include boat construction and maintenance activities around Rozelle Bay and White Bay, and construction activities associated with the CBD and South East Light Rail project to the west of the Rozelle Rail Yards.

Groundwater quality

Groundwater monitoring was undertaken as part of the combined geotechnical and contamination investigations for the M4-M5 Link project. Samples were collected and analysed for metals (arsenic, cadmium, chromium, copper, nickel, lead, mercury and zinc), TRH, VOCs and SVOCs. Only one borehole recorded an exceedance relating to arsenic. The results are summarised in **Appendix R** (Technical working paper: Contamination).

16.2.17 Tunnel alignment - Annandale to Camperdown

Current and former potentially contaminating land uses

Current and former potentially contaminating land uses identified within 300 metres of the tunnel alignment include petroleum storage, uncontrolled filling in a former clay pit, dry cleaning and various historical manufacturing sites.

Notified and regulated sites

Sites notified to the NSW EPA under section 60 of the CLM Act or formerly regulated by the NSW EPA under the CLM Act and within 300 metres of the tunnel alignment are listed in **Table 16-19**.

Table 16-19 Contaminated sites notified to or regulated by the NSW EPA – Annandale to Camperdown

Property	Status	Proximity to alignment
O'Dea Reserve Salisbury Lane, Camperdown	Formerly regulated under the CLM Act due to PAHs, lead and TPH from uncontrolled backfilling of a former clay-pit with a range of materials.	Directly above the alignment
Mobil service station 198 Parramatta Road, Annandale	Reported to the NSW EPA under section 60 of the CLM Act. Currently under assessment by the NSW EPA.	220 metres east and up topographic gradient of the alignment

Licensed sites

No sites licensed under the POEO Act were within 300 metres of the tunnel alignment.

Groundwater quality

Although deep groundwater monitoring wells have been installed within the vicinity of the Camperdown to Annandale section of the tunnel alignment, they are understood to have been screened between 40 and 50 metres below ground level and are not considered likely to detect any shallow groundwater contamination.

16.2.18 Tunnel alignment – Camperdown to Newtown

Current and former potentially contaminating land uses

Current and former potentially contaminating land uses identified within 300 metres of the tunnel alignment include dry cleaning, petroleum storage, workshops and manufacturing. Further detail on the current potentially contaminating land uses is provided in **Appendix R** (Technical working paper: Contamination).

Notified and regulated sites

Sites notified to the NSW EPA under section 60 of the CLM Act or formerly regulated by the NSW EPA under the CLM Act and within 300 metres of the tunnel alignment are listed in **Table 16-20**.

Table 16-20 Contaminated sites notified or regulated by the NSW EPA – Camperdown to Newtown

Property	Status	Proximity to alignment
Caltex service station 26 Enmore Road, Newtown	Reported to the NSW EPA under section 60 of the CLM Act. Currently under assessment by the NSW EPA.	Directly adjacent (west side) and above the alignment

Licensed sites

No sites licensed under the POEO Act are within 300 metres of the tunnel alignment.

Groundwater quality

Although deep groundwater monitoring wells have been installed within the vicinity of the Camperdown to Newtown section of the tunnel alignment, they are understood to have been screened between 40 and 50 metres below ground level and are not considered likely to detect any shallow groundwater contamination.

16.2.19 Tunnel alignment – Newtown to St Peters

Current potentially contaminating land uses

Current and former potentially contaminating land uses identified within 300 metres of the tunnel alignment between Newtown and St Peters include petroleum storage, dry cleaning (now closed), potentially workshops and manufacturing, a former landfill, paint manufacturing and uncontrolled filling.

Further detail on the current potentially contaminating land uses is provided in **Appendix R** (Technical working paper: Contamination).

Notified and regulated sites

Sites notified to the NSW EPA under section 60 of the CLM Act or formerly regulated by the NSW EPA under the CLM Act and within 300 metres of the tunnel alignment are listed in **Table 16-21**.

Table 16-21 Contaminated sites notified to or regulated by the NSW EPA – Newtown to St Peters

Property	Status	Proximity to alignment
BP Express service station 2 Princes Highway, St Peters	Reported to the NSW EPA under section 60 of the CLM Act. Currently under assessment by the NSW EPA.	80 metres east and across topographic gradient of the alignment
Former Tidyburn Facility 53 Barwon Park Road, St Peters	Formerly regulated under the CLM Act. Concentrations of naphthalene were present in groundwater on the site at concentrations above the relevant trigger values for the protection of aquatic ecosystems. TPHs were also present in groundwater at elevated concentrations. A Site Audit Statement (SAS) and Site Audit Report (SAR) were prepared certifying that the site was suitable for residential land use with minimal opportunity for soil access, including units. The site has been redeveloped into a high density residential apartment building with basement car park.	Immediately east and across topographic gradient of the alignment
Camdenville Park May Street, St Peters	Reported to the NSW EPA under section 60 of the CLM Act. NSW EPA assessed the site as not requiring regulation under the CLM Act.	25 metres west and up topographic gradient of the alignment

Licensed sites

Sites licensed under the POEO Act and within 300 metres of the tunnel alignment are listed in **Table 16-22**.

Table 16-22 POEO Register – St Peters to Newtown

Property	Licence number	Proximity to alignment
Metropolitan Demolitions And Recycling 396 Princes Highway, St Peters	EPL 11483	300 metres south and down topographic gradient of the alignment
CPB Contractors Pty Ltd New M5 St Peters interchange (former Alexandria Landfill)	EPL 4627	Above and adjacent to alignment

Groundwater quality

Groundwater monitoring was undertaken for the New M5 project around the St Peters interchange and additional monitoring wells were monitored as part of the combined geotechnical and contamination investigations for the M4-M5 Link project. The results are summarised in **Appendix R** (Technical working paper: Contamination) and show that the relevant trigger levels were exceeded across the majority of contaminants tested.

16.3 Assessment of potential construction impacts

The project has the potential to generate contamination during construction and operation, including the potential to disturb existing contaminated lands at surface works locations.

16.3.1 Construction ancillary facilities

The assessment of impacts for surface works during construction is presented in **Table 16-23**. Site layouts showing construction work areas are shown in **Chapter 6** (Construction work).

Table 16-23 Risk assessment for potential construction impacts

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
Wattle Street civil and tunnel site (C1a) at Haberfield	• Stockpiling within cut-and-cover structure • Excavations and tunnelling for ramps using roadheaders • Minor civil and finishing (pavement and line-marking) works	The demolition of former buildings and use of lead paint which may have resulted in localised areas of asbestos containing material (ACM) and lead paint flakes in soil. If present and not appropriately controlled, there is potential for: • Inhalation and/or ingestion risk to site workers of hazardous building materials via dust • Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds • Accidental leaks and spills from the use of the site as a construction ancillary site. The site would be demobilised and earthworks carried out by the M4 East contractor to provide finished levels that are consistent with the original ground surface before being handed over to the M4-M5 Link contractor.	Very unlikely and limited in extent	Exposure pathway likely to be present	Low
Haberfield civil and tunnel site (C2a) at Haberfield	• Minor civil construction and shallow excavation associated with the substation • Demolition activities and use of plant and machinery • Use of existing M4 East facilities (currently under construction)	Historical land uses of former dry cleaners, workshops associated with former car dealerships and mechanics may have caused soil and groundwater contamination at the western end of the site. Isolated soil contamination may be present from demolition or construction of former buildings and use of lead paint which may have resulted in localised areas of ACM and lead paint flakes in surface soil. If present and not appropriately controlled, there is potential for: • Accidental leaks and spills from the use of the site as a construction ancillary site • Demolition activities to mobilise contaminants. The site would be demobilised and earthworks	Very unlikely and limited in extent	Exposure pathway likely to be present	Low

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
		carried out by the M4 East contractor to provide finished levels that are consistent with the original ground surface before being handed over to the M4-M5 Link contractor.			
Northcote Street civil site (C3a) at Haberfield	• Use of existing M4 East facilities (currently under construction) • Demolition activities and use of plant and machinery	Historical land uses within the site may have caused soil and potentially groundwater contamination (potential former petrol station and workshops). If present and not appropriately controlled, there is potential for: • Accidental leaks and spills from the use of the site as a construction ancillary site • Demolition activities to mobilise contaminants. The site would be demobilised and earthworks carried out by the M4 East contractor to provide finished levels that are consistent with the original ground surface before being handed over to the M4-M5 Link contractor.	Very unlikely and limited in extent	Exposure pathway likely to be present	Low
Parramatta Road West civil and tunnel site (C1b) at Ashfield	• Demolition of existing buildings and structures • Utility works • Establishment of site offices, amenities and temporary infrastructure • Laydown and storage of materials • Delivery of materials, plant and equipment • Construction of an acoustic shed • Construction of a temporary	Historical and current land uses including car servicing, potential USTs, former dry cleaner, workshops associated with former car dealerships and mechanics may have resulted in soil and groundwater contamination. Soil contaminations (PAHs) have also been previously identified to the east of the site (GHD 2015). If present and not appropriately controlled, there is potential for: • Demolition activities to mobilise contaminants (ACM and lead paint) • Inhalation and/or ingestion risk to site workers from hazardous building materials and PAHs in excavated soil via dust • Cross contamination associated with the incorrect handling or disposal of	Potentially present and widespread	Exposure pathway likely to be present	Medium

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
	access tunnel • Tunnel excavation, stockpiling of excavated material and spoil haulage • Mechanical installation and fitout of the tunnels • Finishing works • Demobilisation	spoil/unexpected finds • Accidental leaks and spills from the use of the site as a construction ancillary site.			
Haberfield civil site (C2b) at Haberfield	• Establishment of site offices, amenities and temporary infrastructure • Delivery, laydown and storage of materials • Civil works • Landscaping • Demobilisation	Historical land uses of potential former dry cleaners and workshops associated with former car dealerships and mechanics at the western end of the site may have caused soil and groundwater contamination. The remainder of the site was historically residential therefore no other outstanding areas of concern were identified. Isolated soil contamination may be present from demolition or construction of former buildings and use of lead paint which may have resulted in localised areas of ACM and lead paint flakes in surface soil. Demolition activities, use of plant and machinery and excavation activities are proposed which could result in: • Inhalation and/or ingestion risk to site workers from hazardous building materials (if present) and PAHs in surface soil via dust • Accidental leaks and spills from the use of the site as a construction ancillary site. The site would be demobilised and earthworks carried out to provide finished levels that are consistent with the original ground surface before	Very unlikely and limited in extent	Exposure pathway likely to be present	Low

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
		being handed over to the M4-M5 Link contractor.			
Parramatta Road East civil site (C3b) at Haberfield	• Demolition of existing structures • Establishment of site offices, amenities and temporary infrastructure including temporary noise barriers • Utility works • Establishment of site offices and workforce amenities • Civil works • Landscaping • Demobilisation	Historical and current land uses for car servicing, USTs, former dry cleaner, workshops associated with former car dealerships and mechanics may have caused soil and groundwater contamination. Isolated soil contamination may be present from demolition or construction of former buildings and use of lead paint which may have resulted in localised areas of ACM and lead paint flakes in surface soil. Soil contaminations (PAHs) have also been previously identified to the east of the site (GHD 2015). Demolition activities, use of plant and machinery and excavation activities are proposed which could result in: If present and not appropriately controlled, there is potential for: • Inhalation and/or ingestion risk to site workers from hazardous building materials (if present) and PAHs in surface soil via dust • Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds • Accidental leaks and spills from the use of the site as a construction ancillary site.	Known to be present	Exposure pathway potentially present	Medium
Darley Road civil and tunnel site (C4) at Leichhardt	• Demolition and UST decommissioning • Excavation for the temporary access tunnel • Stockpiling	Previous soil investigations identified fill material with slightly elevated metals and PAHs, although the site is still suitable for ongoing commercial/industrial land use. A UST has also been decommissioned. If present and not appropriately controlled, there is potential for: • Direct contact, inhalation and ingestion risk to	Known to be present and widespread	Exposure pathway potentially present	Medium

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
	• Road works • Construction of permanent operational infrastructure	site workers from contaminated soil or hazardous building materials via dust • Discharge of contaminated surface water to the stormwater system and ultimately Hawthorne Canal and Iron Cove • Incorrect handling or disposal of spoil • Disturbance of actual or potential acid sulfate soils at the western end of the site which could impact local soil and water quality.			
Rozelle civil and tunnel site (C5) at Rozelle	• Demolition of structures, including buildings • Excavations for tunnel portals and cut and cover tunnels • Road construction • Stockpiling in acoustic sheds • Construction of temporary and permanent infrastructure • Tunnelling (for ventilation/road construction) • Utility works • Drainage infrastructure including upgraded culvert to Rozelle Bay	Previous soil investigations identified metals (lead, arsenic, cadmium and zinc), asbestos, petroleum sourced Light Non-Aqueous Phase Liquid (LNAPL) and PAHs exceeding the land use criteria for open space and commercial/industrial. Potential construction impacts include: • Impacts on site workers and the local community through contact with contaminants and asbestos released during demolition and ground disturbance works • Exposure of underlying ground surface following removal of vegetation, ballast stockpile and excavated spoil resulting in the potential mobilisation of contamination that may be present within the site • Impacts as a result of sediment basins interacting with groundwater on the site resulting in dewatering and potential contamination of groundwater • Contamination resulting from potential leaks and spills from equipment and plant • Erosion and off-site transport of sediment and	Known to be and widespread	Exposure pathway likely to be present	High

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
		contamination via overland flow and stormwater runoff, affecting the water quality of Easton Park drain, Whites Creek and Rozelle Bay • Direct contact, inhalation and ingestion risk to site workers from contaminated soil or hazardous building materials via dust • Discharge of contaminated surface water and extracted groundwater to the stormwater system and ultimately Rozelle Bay • Disturbance of actual or potential acid sulfate soils at the western end of the site which could impact local soil and water quality.			
The Crescent civil site (C6) at Annandale	• Site establishment • Utility works • Temporary stockpiling • Road works, including construction of a new road bridge over Whites Creek • Widening and improvement works along Whites Creek • Construction of the culvert below City West Link (Easton Park drain) • Construction and dewatering of coffer dam(s) in Rozelle Bay • Finishing works • Excavating, filling and grading	Previous investigations have indicated soil, sediment and groundwater contamination associated with historical filling and more recent industrial/commercial maritime operation. There is an existing management plan to manage identified contamination on part of the site. Potential construction impacts include: • Impacts on site workers and the local community through contact with contaminants and asbestos released during demolition and ground disturbance works • Exposure of underlying ground surface during excavation resulting in the potential mobilisation of contamination • Contamination resulting from potential leaks and spills from equipment and plant • Erosion and off-site transport of sediment and contamination via overland flow and stormwater runoff, affecting the water quality of	Known to be present and widespread	Exposure pathway likely to be present	High

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
	of disturbed areas • Landscaping and construction of pedestrian and cyclist paths and bridges.	Whites Creek and Rozelle Bay • Adverse impacts on the environment as a result of the inappropriate management of waste generated by construction activities • Direct contact, inhalation and ingestion risk to site workers from contaminated soil or hazardous building materials via dust • Adverse impacts on ecological receptors from the discharge of contaminated surface water and sediment to Rozelle Bay • Adverse impacts on ecological receptors from the mobilisation of disturbed contaminated sediment within Rozelle Bay • Cross contamination from the incorrect handling of contaminated soil, fill, sediment, groundwater and surface water • Accidental spills and leaks from equipment and plant used during construction • Disturbance of actual or potential acid sulfate soils at the western end of the site which could impact local soil and water quality.			
Victoria Road civil site (C7) at Rozelle	• Demolition of existing buildings • Establishment of site sheds, laydown areas and/or site offices.	There are historical land uses within and surrounding the site which may have caused soil and potentially groundwater contamination. Further intrusive investigations would be required to assess the risk posed during construction. There is potential for inhalation and ingestion risk to site workers from contaminated soil or hazardous building materials via dust, and the potential for leaks or spills from equipment and plant used during construction.	Very unlikely and limited in extent	Exposure pathway likely to be present	Low

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
Iron Cove Link civil site (C8) at Rozelle	• Demolition • Bulk excavations for tunnel portals and cut-and-cover tunnels • Soft ground tunnelling • Road construction works • Construction of permanent operational infrastructure • Construction works for the bioretention facility and formalised car park at Manning Street • Utility works • Landscaping	There are historical land uses within and surrounding the site which may have caused soil and potentially groundwater contamination. Further intrusive investigations would be required to assess the risk posed during construction of areas of potential concern. Potential construction impacts include: • Direct contact, inhalation and ingestion risk to site workers from contaminated soil or hazardous building materials via dust • Discharge of contaminated surface water to the stormwater system and ultimately Iron Cove • Disturbance of actual or potential acid sulfate soils at the northeast corner of the site and within the area of the proposed bioretention facility located within King George Park, adjacent to Manning Street at Rozelle • Potential for leaks or spills from equipment and plant used during construction.	Potentially present and widespread	Exposure pathway likely to be present	Medium
Pyrmont Bridge Road tunnel site (C9) at Annandale	• Demolition • Excavation for the temporary access tunnel • Minor road works	There are historical land uses within and surrounding the site which may have caused soil and potentially groundwater contamination. Further intrusive investigations would be required to assess the risk posed during construction. Potential construction impacts include: • Direct contact, inhalation and ingestion risk to site workers from contaminated soil or hazardous building materials via dust • Discharge of contaminated surface water to the stormwater system and ultimately Johnstons Creek, which discharges to Rozelle Bay.	Potentially present and widespread	Exposure likely to be present	Medium

Area	Construction works	Potential contamination impacts	Likelihood of contamination	Consequence	Risk[1]
Campbell Road civil and tunnel site (C10) at St Peters	• Road works • Tunnelling and associated excavation and stockpiling • Excavation for temporary access tunnel to provide construction access to mainline • Construction of cut and cover structures • Construction of permanent operational infrastructure	There are known soil and groundwater contamination and landfill gas and leachate at the site. The remediation and management of the site is being undertaken as part of the construction of the St Peters interchange for the New M5 project. During excavation activities, there is potential for the following impacts: • Inhalation and/or exposure risk from landfill gases for site workers and surrounding land users • Direct contact, inhalation and ingestion risk to site workers or surrounding human receptors from leachate, landfill refuse and contaminated soil by dust • Discharge of contaminated surface water and groundwater/leachate to Alexandria Canal • Disturbance of actual or potential acid sulfate soils which could impact local soil and water quality • Potential for leaks or spills from equipment and plant used during construction.	Known to be present and widespread	Exposure pathway likely to be present	High

Note:

1 **Table 16-2** outlines the preliminary qualitative contamination risk assessment matrix that the risk level is based on.

16.3.2 Tunnelling

A review of potential contamination sources along the tunnel alignment identified the presence of potential, current and former contamination sources. These are summarised in **Appendix R** (Technical working paper: Contamination).

During tunnel construction, groundwater would be extracted from the tunnelling process, which would subsequently require disposal. The extracted water would be either:

- Treated onsite and then discharged to stormwater under an EPL or to sewer under a trade waste agreement
- Transported to a liquid waste facility.

Potential impacts on receiving water bodies associated with the construction of new drainage outlets and drainage infrastructure adjustments and upgrades could occur at the following locations:

- Rozelle Bay
- Iron Cove
- Whites Creek
- Easton Park drain
- Receiving waters of Sydney Harbour.

Potential pre-mitigation impacts on workers could include exposure to extracted contaminated groundwater from either direct contact or inhalation of vapours, or vapours encountered during tunnelling.

There is potential for shallow tunnelling, such as near portals, temporary access tunnels or cut-and-cover tunnels, to encounter groundwater that is impacted from contamination from sources such as petrol stations with dissolved and undissolved petroleum hydrocarbon plumes or other industrial sources. The identified highest risk locations are considered to be:

- Parramatta Road, Annandale: The temporary access tunnel connecting the mainline tunnel to the Pyrmont Bridge Road tunnel site (C9) passes directly south of the 7 Eleven service station that is presently under assessment by the NSW EPA under section 60 of the CLM Act. The temporary access tunnel may be relatively shallow as it passes the service station and could potentially intercept a dissolved or undissolved (ie LNAPL) petroleum plume
- Wattle Street, Haberfield: The Wattle Street entry and exit ramps are located in an area historically occupied for residential land use in the suburb of Haberfield. There is potential for ACM and lead paint to be present in surface soils
- Darley Road, Leichhardt: The temporary access tunnel to the Darley Road civil and tunnel site (C4) passes between former manufacturing businesses and former steel manufacturers and boiler makers. There is potential for metals, PAHs, TPH, asbestos, VOCs, SVOCs to be present in shallow surface soils and/or groundwater
- Parramatta Road west, Ashfield: The temporary access tunnel to the Parramatta Road West civil and tunnel site (C1b) is generally located within the northern portion of the site and traverses north along Parramatta Road. There is potential for ACM (from demolition and redevelopment works along Parramatta Road and associated filling) and PAHs to be present in shallow surface soils and/or groundwater
- Rozelle Rail Yards, Rozelle: previously identified LNAPL within the Rozelle civil and tunnel site (C5) could be impacted by dewatering for tunnelling around the Rozelle interchange and is likely to be encountered during future tunnelling/portal construction, if not remediated prior
- Victoria Road, Rozelle: The Iron Cove Link tunnel between Darling Street and Terry Street passes beneath or directly adjacent to several service stations, some of which are presently under assessment by the NSW EPA under section 60 of the CLM Act, as well as several former dry cleaners

- Campbell Road, St Peters: The tunnel portal area and temporary access tunnel within the former Alexandria Landfill at the New M5 St Peters interchange due to leachate and landfill gases. The tunnel at this section is shallow and would be exposed to landfill leachate if appropriate mitigation measures are not implemented.

With the exception of the former Alexandria Landfill (assessed as part of the New M5 project), other sections of the tunnel are at depths greater than 30 metres and therefore the likelihood of encountering plumes with high concentrations of contaminants is low given that deep contamination (greater than 30 metres below ground level) has generally not been identified along the proposed M4-M5 Link tunnel alignment. However, the extracted groundwater is likely to contain concentrations of metals and nutrients above background concentrations and low concentrations of chemical and petroleum hydrocarbon contaminants from the types of sources listed in the previous table. Notwithstanding, tunnels would be drained to construction water treatment facilities prior to discharge to receiving surface water bodies.

Dewatering during construction works may cause changes in the migration of plumes of contaminated groundwater by changing groundwater gradients and drawing the contamination towards the tunnel. This is most likely in areas where the tunnels are shallow and approaching the surface such as the temporary access tunnel at Parramatta Road, Annandale, and the Iron Cove section near and beneath Victoria Road at Rozelle. This is discussed further in **Appendix T** (Technical working paper: Groundwater).

Temporary construction water treatment plants would be located at each construction ancillary facility where tunnelling would occur, and would be designed to treat construction water and groundwater inflows encountered during construction. The level of treatment would consider the characteristics of the water requiring treatment, operational constraints or practicalities, and associated environmental impacts. The treatment would be developed in accordance with ANZECC (2000) and with consideration to the relevant NSW Water Quality Objectives as discussed in **Appendix Q** (Technical working paper: Surface water and flooding).

16.4 Assessment of potential operational impacts

16.4.1 Permanent operational facilities

Potential contamination impacts associated with the presence of roads and permanent operational infrastructure is presented in **Table 16-24**. Leachate within the former Alexandria Landfill would be treated by the existing water treatment plant constructed for the New M5 project and discharged to sewer under the existing trade waste agreement with Sydney Water. Therefore, leachate within the former Alexandria Landfill does not form part of this assessment.

The Parramatta Road ventilation facility located adjacent to Parramatta Road between Wattle Street and Walker Avenue has been assessed as part of the M4 East project. The M4-M5 Link project includes the internal fit out of this structure.

The construction ancillary facilities that are not anticipated to be used for permanent operational infrastructure would be rehabilitated at the end of construction. Construction facilities that will not include new operational infrastructure are:

- Northcote Street civil site (C3a)
- Parramatta Road West civil and tunnel site (C1b)
- Parramatta Road East civil site (C3b)
- Pyrmont Bridge Road tunnel site (C9).

At the completion of M4-M5 Link construction the landscaping (where applicable) and residual land obligations as detailed in the M4 East and New M5 conditions of approval would be carried out by these respective projects. As such there are no anticipated operational impacts of these construction ancillary facilities during operation and these are not discussed further in this section.

Table 16-24 Risk assessment for potential operational impacts

Operational area	Permanent infrastructure	Potential operational impacts	Likelihood of contamination	Consequence (without implementation of appropriate controls)	Risk
Wattle Street at Haberfield	• Roadway	Accidental leaks and spills on constructed roadways from vehicles and vehicle accidents.	Very unlikely and limited in extent	Exposure pathway may be present, if leaks and spills occur	Low
Parramatta Road at Haberfield	• Parramatta Road ventilation facility	Minimal soil or groundwater contamination impacts would be expected from the operation of the ventilation facility. Sources of contamination could be from small volumes of oils, fuels, solvents and other chemicals used for operation and maintenance if not stored and handled in accordance with regulations.	Very unlikely and limited in extent	Exposure pathway may be present	Low
Darley Road at Leichhardt	• Motorway operation complex (MOC1) including a permanent water treatment facility and substation on western portion of the site	Accidental leaks and spills of water treatment chemicals from the operation of the permanent water treatment facility and discharge of inadequately treatment wastewater.	Very unlikely limited in extent	Exposure pathway may be present	Low
Rozelle Rail Yards at Rozelle	• Roads, entry and exit ramps and tunnel portals • Motorway operation complexes (MOC2 and MOC3) including: – Rozelle ventilation facility – Water treatment plant – Constructed wetland – Substations – Workshop facilities/bulky equipment store	• Accidental spills of water treatment chemicals or discharge of inadequately treatment wastewater • Minimal soil or groundwater contamination impacts from the operation of the ventilation facility, substation, workshop, water treatment facility, fire pump room and water tanks. Sources of contamination could be from small volumes of oils, fuels, solvents and other chemicals used for operation and maintenance if not stored and handled in accordance with regulations. The end land use for a large portion of the site	Potentially present and widespread, if leaks and spills occur	Exposure pathway may be present	Medium

Operational area	Permanent infrastructure	Potential operational impacts	Likelihood of contamination	Consequence (without implementation of appropriate controls)	Risk
	– Fire pump room and water tanks	would be open space. Due to the presence of existing soil and groundwater contamination from historical activities, the area would require further investigation post construction to assess operational land use suitability for recreational open space.			
The Crescent at Annandale	• Road infrastructure • Pedestrian and cyclist paths	Accidental leaks and spills on constructed roadways from vehicles and vehicle accidents.	Very unlikely and limited in extent	Exposure pathway may be present, in the event of leaks and spills	Low
Victoria Road at Rozelle	• Road infrastructure • Pedestrian and cyclist paths	Accidental leaks and spills on constructed roadways from vehicles and vehicle accidents.	Very unlikely and limited in extent	Exposure pathway may be present, in the event of leaks and spills	Low
Iron Cove Link at Rozelle	• Roads, entry and exit ramps and tunnel portals • Motorway operation complex (MOC4) including Iron Cove Link ventilation facility • Substation (land subject to landscaping)	• Accidental leaks and spills on constructed roadways from vehicles and vehicle accidents • Minimal soil or groundwater contamination from the operation of the substation and ventilation facility.	Potentially present	Exposure pathway may be present	Medium

Operational area	Permanent infrastructure	Potential operational impacts	Likelihood of contamination	Consequence (without implementation of appropriate controls)	Risk
Campbell Road at St Peters	• Roads, including dive structures, tunnel portals and entry and exit ramps • Motorway operation complex (MOC5) including Campbell Road ventilation facility • Substation • Workshop facilities/bulky equipment store	• Minimal soil or groundwater contamination from the operation of the ventilation facility, substation and workshop • Accidental leaks and spills on constructed roadways from vehicles and vehicle accidents.	Potentially present and widespread	Exposure pathway unlikely to present	Medium

16.4.2 Tunnels

During operation, groundwater seepage would need to be extracted from the tunnels, treated and discharged to receiving water bodies. As part of the tunnel design, some sections would be lined to reduce the ingress of groundwater into the tunnels.

Groundwater quality may be impacted along parts of the tunnel alignment due to overlying contamination sources impacting groundwater. An assessment of the expected groundwater seepage rates and groundwater drawdown which may have an effect on existing groundwater contamination plumes is provided in **Chapter 19** (Groundwater).

The extracted groundwater could contain concentrations of metals and nutrients above background concentrations and low concentrations of chemical and petroleum hydrocarbon contaminants. Water collected from within the tunnels would be treated to an appropriate standard to prevent environmental harm prior to discharge (refer to **Chapter 15** (Soil and water quality)). If not treated adequately, the discharge of the groundwater to receiving water bodies could contribute to poor water quality. However, the potential for this to occur is considered to be extremely low.

Tunnel drainage infrastructure would be designed to accommodate a combination of contaminated water ingress events including groundwater ingress, stormwater ingress at portals, tunnel wash-down water, fire suppressant deluge or fire main rupture and spillage of flammable and other hazardous materials. Separate sumps would be provided at tunnel sags, one to collect groundwater ingress and one to collect the other potential water sources. The two tunnel drainage streams from the mainline works would be pumped to a water treatment facility at Darley Road, Leichhardt. Potential discharge and disposal options for treated flows from the facility are discussed in **Chapter 15** (Soil and water quality).

Tunnel drainage for Rozelle would be pumped to a water treatment facility and constructed wetland at the Rozelle Rail Yards, with treated flows ultimately discharged to Rozelle Bay. Tunnel drainage from around one kilometre of the northbound and 600 metres of the southbound tunnel would be captured by the New M5 drainage system and conveyed to the New M5 operational water treatment plant at Arncliffe, which ultimately drains to the Cooks River.

An assessment of the potential impacts on the receiving bodies is provided in **Chapter 15** (Soil and water quality).

16.5 Management of impacts

The mitigation and management measures provided in **Table 16-25** would be implemented during construction and operation of the project to reduce or minimise the potential impacts created by contamination risks. These measures are expected to make the land to be used as part of the project suitable for the proposed end use. Potentially contaminated sites identified in **section 16.2.14** would be subject to further investigation, remediation and/or management. Further details on the environmental management measures are provided in **Appendix R** (Technical working paper: Contamination).

An UDLP would be prepared for the project. Areas of land not required for the construction or operation of the project but that have been identified as being subject to the UDLP would be rehabilitated and landscaped to be consistent with the UDLP. Remaining project land would be rehabilitated and returned to finished levels generally consistent with the original ground surface. The future use of remaining project land would be outlined in the Residual Land Management Plan to be prepared for the project.

Wattle Street civil and tunnel site (C1a), Haberfield civil and tunnel site (C2a) and Northcote Street civil site (C3a) would be developed in accordance with the conditions of approval for the M4 East project. The Campbell Road civil and tunnel site (C10) would be developed consistent with the conditions of approval for the New M5 project.

Table 16-25 Environmental management measures – contamination

Impact	No.	Environmental management measure	Timing
Construction			
Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material	CM01	Potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the CLM Act. This includes further investigations in areas of potential contamination identified in the project footprint. If contamination posing a risk to human or ecological receptors is identified, a Remediation Action Plan will be prepared.	Construction
	CM02	Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan (as part of the Work Health and Safety Plan) as described in **Chapter 23** (Resource use and waste minimisation).	Construction
	CM03	A hazardous materials assessment will be carried out prior to and during the demolition of buildings. Demolition works will be undertaken in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice, including the Work Health and Safety Regulation 2011 (NSW).	Construction
	CM04	The Construction Waste Management Plan for the project, prepared as described in **Chapter 23** (Resource use and waste minimisation), will include procedures for handling and storing potentially contaminated substances.	Construction
	CM05	Stockpile management procedures will be implemented to control dust, odour and cross contamination.	Construction
	CM06	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime 2013) and detailed in the CEMP. The procedure will include: • Cease work in the vicinity • Initial assessment by an appropriately qualified environmental consultant • Further assessment and management of contamination, if confirmed, in accordance with section 105 of the CLM Act.	Construction
Impacts on soil and water quality through incorrect handling of contaminated material	CM07	A Construction Soil and Water Management Plan will be prepared for the project including procedures to manage potentially contaminated stormwater runoff and acid sulfate soils, as described in **Chapter 15** (Soil and water quality).	Construction
	CM08	Measures identified in **Chapter 25** (Hazard and risk) will be implemented to appropriately store dangerous goods and reduce the potential for environmental contamination due to spills and leaks.	Construction

Impact	No.	Environmental management measure	Timing
Operation			
Accidental spills during operation	OCM09	Procedures to address spills, leaks and tunnel washing will be developed as part of an Operational Environmental Management Plan (OEMP) and implemented during operation of the project.	Operation