Roads and Maritime Services/Sydney Airport Corporation Limited

Sydney Gateway Road Project

Environmental Impact Statement/ Preliminary Draft Major Development Plan

Chapter 13 Contamination and soils

November 2019

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This chapter provides a summary of the contamination and soils assessment. It describes existing contamination and soils within the project site, identifies potential impacts, considers whether the site is suitable for the proposed development, and provides measures to mitigate and manage the impacts identified. Further information is provided in Technical Working Paper 5 (Contamination and Soils) and Technical Working Paper 16 (Former Tempe Landfill Assessment). Further information about potential groundwater and water quality impacts as a result of contamination is provided Chapters 15 (Groundwater) and 16 (Surface water).

The SEARs relevant to contamination and soils are listed below. There are no MDP requirements specifically relevant to contamination and soils, however there is a requirement under section 91(1) of the Airports Act to assess the potential environmental impacts associated with a development (section 91(1)(h)), and to specify how those impacts may be dealt with (section 91(1)(j)).

Full copies of the SEARs and MDP requirements, and where they are addressed in this document, are provided in Appendices A and B respectively.

Reference	Requirement	Where addressed
Key issue SEARs		
12	**Contamination**	
12.1	The Proponent must assess the potential for contamination and any impacts associated with the management of contaminated soils and water resources including, but not limited to:	
	(a) a detailed assessment of the extent and nature of any contamination of the soil, groundwater and soil vapour including from activities on Tempe Tip and PFAS;	Section 13.2
	(b) an assessment of potential risks to human health and the environmental receptors in the vicinity of the site;	Sections 13.3 and 13.4
	(c) a description and appraisal of any mitigation and monitoring measures; and	Section 13.6
	(d) consideration of whether the site is suitable for the proposed development.	Section 13.4.3
12.2	Any assessment of contamination must be in accordance with relevant guidelines produced or approved under the *Contaminated Land Management Act 1997*.	Section 13.1
12.3	All reports prepared for the assessment of contamination must be prepared, or reviewed and approved, by a consultant certified under either the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme.	Technical Working Paper 5 (Contamination and Soils) was reviewed and approved by a consultant certified under the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)).

Reference	Requirement	Where addressed
12.4	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 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.	Section 13.3 Section 13.6.1
13	**Soils**	
13.1	The Proponent must verify if the proposal is on land marked as Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map or within 500 m of adjacent Class 2, 3 or 4 land that is below 5 m Australian Height Datum (AHD) and where the proposal is likely to lower the water table in this adjacent land below 1 m AHD.	Section 13.2.2
13.2	The Proponent must assess the impact of the proposal on acid sulfate soils (including the impacts of acidic runoff offsite) in accordance with the current guidelines.	Sections 13.3.3 and 13.4.4
13.3	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 proposal area.	Sections 13.2.2, 13.3.3 and 13.4.4
13.4	The Proponent must assess the impacts of the proposal on soil salinity and how it may affect groundwater resources.	Sections 13.3.3 and 13.4.4, and Chapter 15 (Groundwater)
13.5	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.	Sections 13.2.2, 13.3.3 and 13.4.4 and Chapter 16 (Surface water)

13. Contamination and soils

13.1 Assessment approach

Construction work can expose contaminated soils and groundwater in areas where previously contaminating activities or land uses have been undertaken. Exposing contaminated soils and/or groundwater can mobilise contaminants, potentially leading to environmental, health and safety risks.

There is also the potential for construction and operation of new infrastructure to expose and disturb soils or contaminate soils, surface water and groundwater if these activities are not managed appropriately. The disturbance of soil, if improperly managed, can lead to soil erosion, increase soil salinity levels, and/or cause oxidation/acid generation, all of which could affect receiving environments.

It is important that such risks are identified and planned for during project development so that they can be avoided, minimised and effectively managed through appropriate design and construction planning.

A contamination and soils assessment has been carried out for both the construction and operational stages of the project in general accordance with the framework for the assessment of site contamination outlined in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended). The assessment was reviewed and approved by an experienced practitioner certified under the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)).

An overview of the approach to the contamination and soils assessment is provided below, including the legislative and policy context and a summary of the assessment methodology.

13.1.1 Legislative and policy context to the assessment

The assessment was undertaken in accordance with the SEARs and MDP requirements (provided in Appendices A to B) and with reference to the following:

- Relevant legislation and planning instruments, including the EP&A Act, the Airports Act and associated regulations, *Contaminated Land Management Act 1997* (NSW) (CLM Act), *State Environmental Planning Policy No 55 - Remediation of Land* (SEPP 55), and the EPBC Act
- *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended)
- *PFAS National Environmental Management Plan* (Heads of EPAs Australia and New Zealand (HEPA), 2018) (the PFAS NEMP)
- *Australian Guidelines for Water Quality Monitoring and Reporting* (ANZECC/ARMCANZ, 2000) (the ANZECC guidelines)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Governments, 2018)
- *Managing asbestos in or on soil* (WorkCover NSW, 2014)
- *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2012)
- *Acid Sulfate Soils Assessment Guidelines* (Acid Sulfate Soils Management Advisory Committee (ASSMAC), 1998)
- *Managing Urban Stormwater: Soils and construction* - Volume 1 (Landcom, 2004), Volume 2B Waste landfills (DECC, 2008a) and Volume 2D, Main Road Construction (DECC, 2008b) (collectively referred to as the Blue Book)
- *Sydney Airport Master Plan 2039* (SACL, 2019a)
- *Sydney Airport Environment Strategy 2019-2024* (SACL, 2019b).

13.1.2 Methodology

Study area

The study area for the contamination assessment is the project site, as described in Chapter 2 (Location and setting). Based on a preliminary review of the contamination history across the project site, five assessment areas within the project site were defined for the contamination assessment (referred to as project areas by the assessment):

- Assessment area 1 – Former Tempe landfill
- Assessment area 2 – Sydney Airport northern lands car park
- Assessment area 3 – Land north of the rail corridor
- Assessment area 4 – Sydney Airport land along Alexandra Canal and Qantas Drive
- Assessment area 5 – Alexandra Canal.

These areas were identified as having the potential to require special management (potentially including remediation) before or during construction and/or operation. The following additional areas were also considered by the contamination assessment; however, a detailed assessment was not undertaken for these areas for the reasons detailed below:

- Rail corridor – extends from Alexandra Canal in the south to the Ikea site in the north. This area will be investigated further during detailed design.
- St Peters interchange tie-in – this portion of the project site extends beyond Canal Road to the north-east and has been assessed as part of the contamination investigations undertaken for the New M5.

These areas are shown in Figure 13.1. Desktop searches for the contamination assessment also extended a further 500 metres around the project site.

Key tasks

The assessment methodology generally followed the framework for the assessment of site contamination outlined in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended) (the NEPM). The assessment involved:

- Reviewing the following databases to identify areas of known and potential contamination:
  - NSW EPA register of contaminated sites and list of notified sites, under sections 58 and 60 of the CLM Act, for sites located within 500 metres of the project site
  - NSW EPA's environment protection licence records under section 308 of the POEO Act
  - WaterNSW database for registered groundwater bores
- Reviewing publicly available data and web-based information searches, background information relevant to the study area, survey data, and topography including:
  - Historical aerial photographs from the NSW Government Land and Property Information website
  - Australian Soil Resource Information System (maintained by the Commonwealth Scientific and Industrial Research Organisation (CSIRO))
  - *Geology of the Sydney 1:100,000 Sheet 9130* (Herbert, 1983)
  - *Soil Landscapes of the Sydney 1:100,000 Sheet map* (9130) (Chapman and Murphy, 1989)
  - NSW Soil and Land Information System
  - NSW Government acid sulfate soils risk mapping
  - Maps published by the Geological Survey of NSW, former Department of Conservation and Land Management, and Australian Soils Resource Information System

- Reviewing previous contamination assessments applicable to the project site, including those provided by Sydney Airport Corporation
- A site visit in December 2018 to compare site conditions to the conditions documented in historical reports and identify potential sources of contamination in the project site
- Reviewing intrusive investigations undertaken by Roads and Maritime between November 2018 and February 2019. These investigations included soil sampling at 66 locations and installation of 34 groundwater monitoring wells and 20 landfill gas monitoring wells throughout the project site. Sampling locations are shown in Appendix F of Technical Working Paper 5 (Contamination and Soils)
- Compiling a conceptual site model for the assessment areas to identify potential contamination sources, receptors and exposure pathways
- Identifying the potential to disturb acid sulfate soils and areas of salinity
- Assessing potential construction and operation impacts that may result from contaminated land or groundwater, including a preliminary qualitative risk assessment to identify the severity of impacts
- Assessing the potential impacts on soils
- Identifying mitigation measures to reduce or minimise identified impacts.

13.1.3 Risks identified

An environmental risk assessment was undertaken as an input to the impact assessment (see Appendix G). This involved identifying potential environmental risks during construction and operation, and rating the potential risks according to likelihood, consequence and overall level of risk, in general accordance with *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*. Contamination and soils risks with an assessed level of medium or above, identified by the environmental risk assessment, included:

- Management and disposal of leachate from the former Tempe landfill where the removal of the capping layer results in the infiltration of rainwater and the production of additional leachate that may not be managed by the existing leachate system
- Disturbance of the capping layer, leachate and gas management systems at the former Tempe landfill due to sub-surface works being undertaken in this area
- Disturbance/mobilisation of landfilled materials and contaminants at the former Tempe landfill where sub-surface works such as excavation have the potential to extend deeper than the existing capping layer
- Disturbance/mobilisation of contaminated sediments in Alexandra Canal as a result of construction in the canal or the operation of new stormwater outlets
- Interaction with potentially contaminated soils and groundwater as a result of sub-surface disturbance during construction and operation, including disturbance and potential migration/mobilisation of contaminants (such as per-and poly-fluoroalkyl substances (PFAS))
- Release of potentially contaminated groundwater where construction activities such as piling and trenching intercept groundwater and dewatering is required
- Dewatering, management and disposal or discharge of contaminated groundwater and/or managing the disposal of contaminated soils encountered during construction in areas where existing contamination is present
- Contamination of soils and groundwater due to spills or leaks of fuels, oils or other hazardous substances during construction and operation
- Direct contact and/or inhalation of contaminated soil and/or groundwater by site workers where construction and operational activities result in the exposure of existing contamination.

In some instances the design has been modified to avoid the risks noted above. This is described further in Chapter 6 (Project alternatives and options). Where the risks cannot be avoided through project design or construction planning the contamination and soils assessment included consideration of these potential risks.

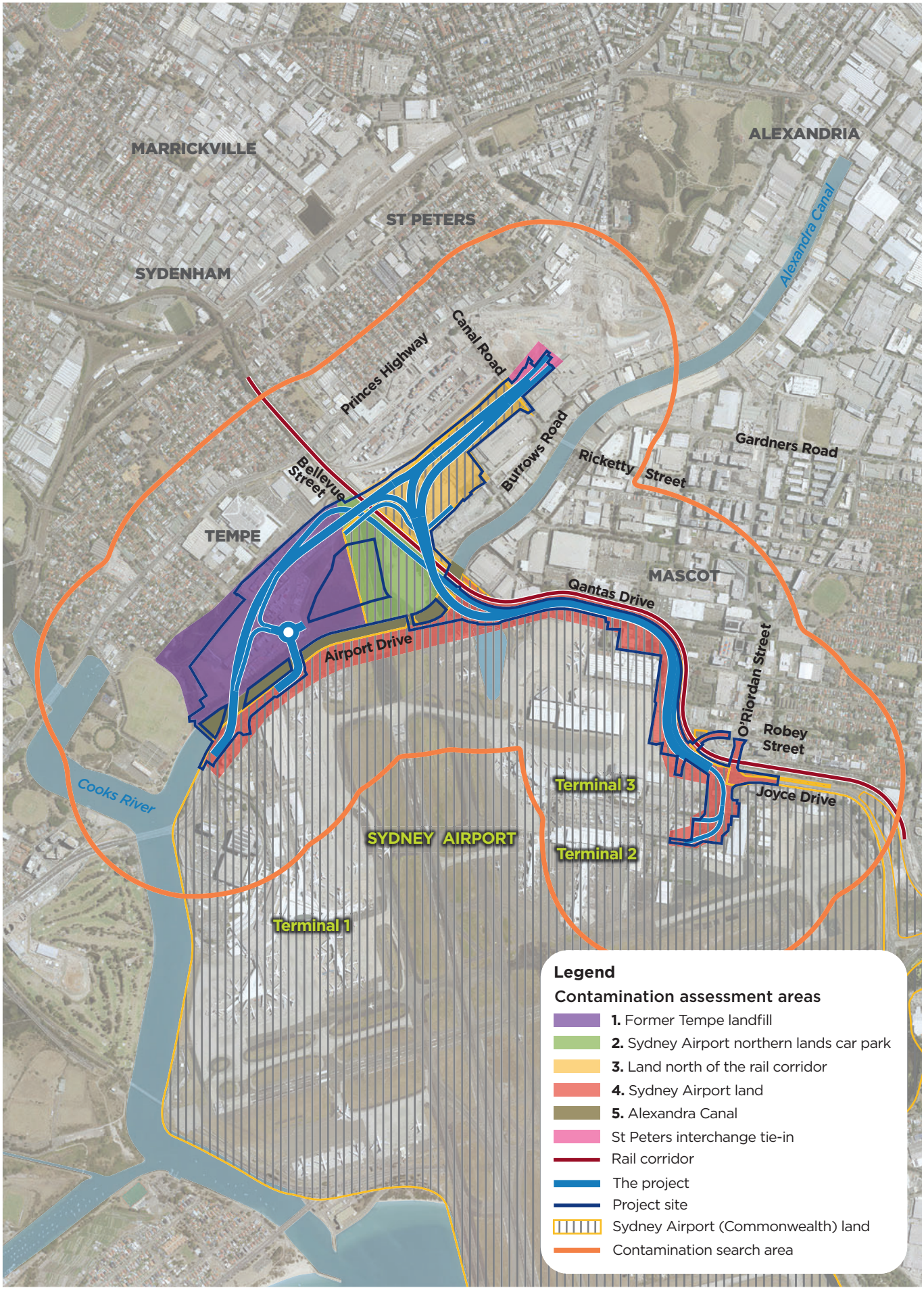


Figure 13.1 **Contamination assessment areas**

13.2 Existing environment

13.2.1 Topography and geology

The project site is relatively flat and low-lying, with gentle undulations. The topography generally slopes gently upwards from zero metres Australian Height Datum in the south, west and north-west of the project site, to elevations of 30 to 40 metres Australian Height Datum in the north-east, east and south-east. Areas of higher elevations are also present across the former Tempe landfill.

A band of Ashfield Shale underlies a series of low crests running north-east to south-west, parallel to the western part of the project site. Ashfield shale comprises black to dark grey shale and laminate. Minor occurrences of Hawkesbury Sandstone are also mapped to the west of the Cooks River. These geological units are overlain by Quaternary sediments, which infilled drowned river valleys that were incised into the bedrock. These sediments, referred to locally as the Botany Sands, are composed of predominantly unconsolidated to semi-unconsolidated permeable sands interspersed with lenses and layers of peat, peaty sands, silts and clays (low permeability).

Reclamation and stabilisation of Sydney Airport land altered the original southern drainage channel networks of Alexandra Canal and Cooks River, which were diverted around the airport. Other influences on landform include drainage and reclamation of the original swamps, estuaries and wetlands that surrounded Botany Bay, landfill activities, and extensive cut/fill works.

Most of the project site is mapped as ‘disturbed terrain’, which extends across Sydney Airport land, the lower reaches of the Cooks River, Alexandra Canal, Mascot, and into Tempe and St Peters. Disturbed terrain is described as areas extensively disturbed by human activity, including complete disturbance, removal or burial of original soils.

Introduced fill, including dredged estuarine sand and mud, demolition rubble, industrial and household waste, is also found within the project site.

13.2.2 Soils

Soil types

Soil landscapes within the project site predominantly consist of disturbed terrain, with the exception of the north-western extent of the project site, which is underlain by the residual Blacktown soil landscape and the aeolian Tuggerah soil landscape. The key characteristics of these soil landscapes are listed in Table 13.1.

Table 13.1 Soil landscapes

Soil landscape	Characteristics	Erosion/mass movement potential
Disturbed terrain	Original soil materials have been removed, greatly disturbed or buried, and landfill, including soil, rock, building and waste materials, may have been added.	The erosion potential of this soil landscape depends on the nature of the disturbed soil or fill. Could result in mass movement hazard, soil impermeability and poor drainage. Source of sedimentation and groundwater contamination.
Blacktown (residual landscape)	Shallow to moderately deep (less than one metre deep) red and brown podzolic soils. Occurs on gently undulating rises on Wianamatta Group shales and Hawkesbury shale.	Soils are moderately reactive, highly plastic with poor drainage. No appreciable erosion occurs in this unit. The land surface above this soil landscape within the project site is generally paved.
Tuggerah (Aeolian landscape)	Deep (greater than two metres) podzols on dunes and podzol/humus intergrades on swales. Occurs on gently rolling coastal dune fields.	Limitations include extreme wind erosion hazard, non-cohesive and highly permeable soil, very low soil fertility, localised flooding, and permanently high water tables.

Soil salinity

Salinity has the potential to damage foundations of infrastructure, make soils unsuitable for re-use as fill, and may affect landscaping. Saline soil and water has the potential to damage concrete and metal structures, including bridge piers and foundations.

Most of the project site is classified as having low salinity potential. The following areas (shown on Figure 13.2) are classified as having high salinity potential:

- An area in the Sydney Airport northern lands car park (assessment area 2), immediately north of Alexandra Canal
- An area north of the rail corridor (assessment area 3), to the west of the St Peters interchange.

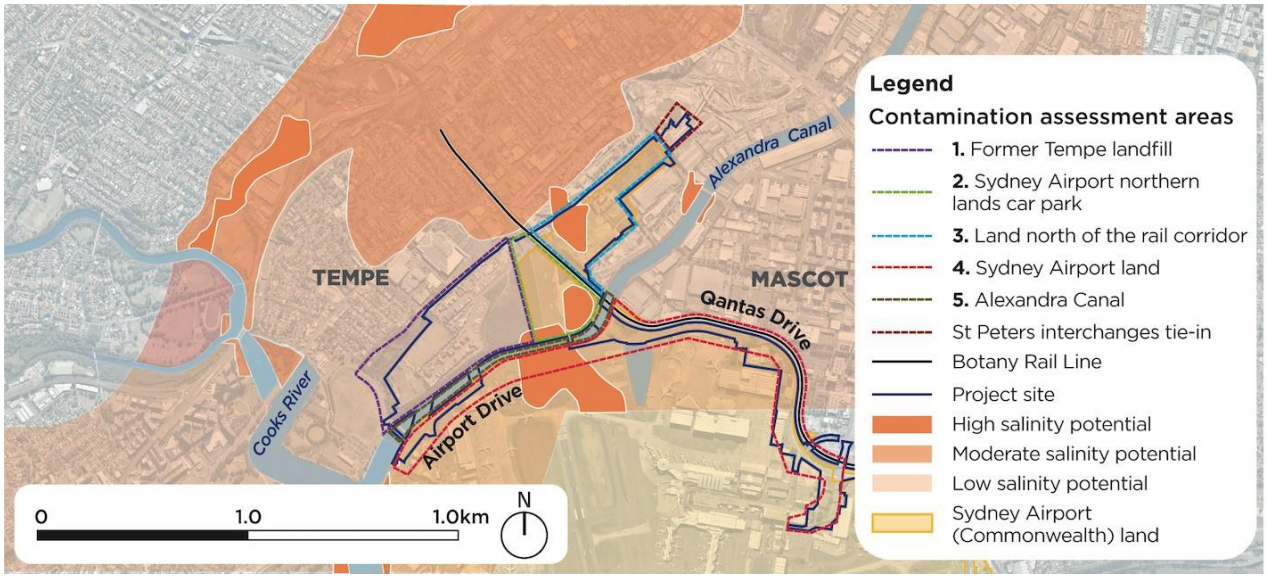


Figure 13.2 Salinity potential

Acid sulfate soils

Acid sulfate soils and potential acid sulfate soils are naturally occurring soils containing iron sulfides. On exposure to air, iron sulfides oxidise and create sulfuric acid. This increase in acidity can result in the mobilisation of aluminium, iron and manganese from the soils.

The CSIRO Australian Soil Resource Information System indicates that there is a low probability of acid sulfate soils within most of the project site, except for Alexandra Canal and low lying areas surrounding the canal, which are mapped as potentially containing acid sulfate soils.

Table 13.2 lists acid sulfate risk classifications for land within and in the vicinity of the project site. The risk classifications are based on the NSW Government acid sulfate soil risk mapping. Acid sulfate soil risk mapping is shown on Figure 13.3.

Table 13.2 Acid sulfate soil classifications

Location	Acid sulfate soil class	Work that would potentially expose acid sulfate soils
Alexandra Canal	1	Any work below natural ground
Former Tempe landfill (assessment area 1), Sydney Airport northern lands car park (assessment area 2), land north of the rail corridor (assessment area 3) and Sydney Airport land (assessment area 4)	2	Work beyond the natural ground surface and work by which the water table is likely to be lowered
St Peters interchange north of Canal Road	3	Work beyond one metre below natural ground surface and work by which the water table is likely to be lowered one metre below natural ground surface
Joyce Drive, east of the intersection with O'Riordan Street	4	Work more than two metres below the natural ground surface and work by which the water table is likely to be lowered by more than two metres below natural ground surface.

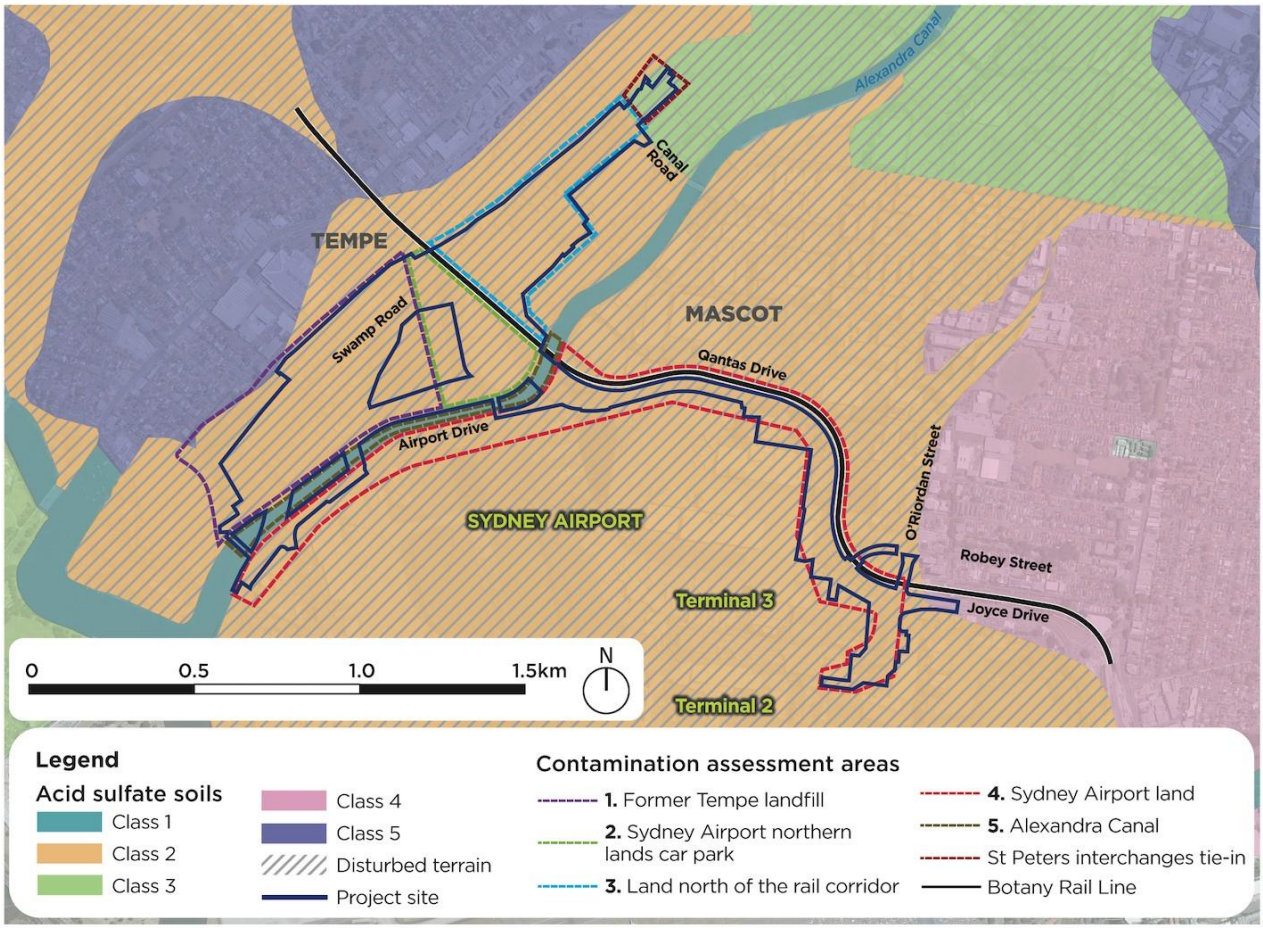


Figure 13.3 Acid sulfate soils risk mapping

13.2.3 Surface water

The project site is located in the Botany Bay catchment area, which includes two river catchments – the Cooks River catchment and the Georges River catchment.

Surface water features near and within the project site include Alexandra Canal, Tempe Wetlands, Mill Stream and Botany Bay to the south-east. Constructed ponds, which are known as the northern ponds,

are located on Sydney Airport land and discharge to Alexandra Canal. Most of the project site drains to Alexandra Canal with a small portion of Sydney Airport land draining to Mill Stream.

Further information on surface water features and hydrology is provided in Chapter 16 (Surface water).

13.2.4 Hydrogeology

There are two main groundwater systems beneath the site – a deeper groundwater system associated with the Triassic aged, fractured/porous Hawkesbury Sandstone, and a shallow, highly permeable system within the Quaternary aged marine sands, referred to as the Botany Sands aquifer. The project is likely to intersect the Botany Sands aquifer.

The Botany Sands aquifer extends north and east from Botany Bay to Surry Hills and Centennial Park. The flow directions within the aquifer are generally controlled by topography. Groundwater flows south and south-west from the recharge areas located at higher elevations north-east of the Botany Basin, towards rivers and other tributaries, and into Botany Bay.

The Botany Sands aquifer has a relatively shallow water table and is readily recharged by rainfall. The level of groundwater under Sydney Airport is an average of three metres below the ground surface. However, the level can often be less than one to two metres below the ground surface, with the level varying in relation to recharge from rainfall and evaporation. The Botany Sands aquifer is highly vulnerable to contamination due to the permeability of the sands and shallow depth of the aquifer. Historical industrial land uses in the area have included chemical manufacturing, fuel storage, tanneries, metal electroplaters, service stations, landfills, dry cleaners and wool scorers. These industries have resulted in the potential and known occurrence of a wide range of pollutants in groundwater.

Due to the extent of known contamination, and to ensure that public health is not put at risk, the NSW Government has placed controls on the extraction and use of groundwater in some areas. The project site is located in the Botany Groundwater Management Area 2 (see Figure 13.4). In this area, domestic bore water use is prohibited and the extraction of groundwater for industrial and irrigation purposes is restricted unless water is proven to be suitable for use.

Further information on groundwater is provided in Chapter 15 (Groundwater).

13.2.5 Areas of contamination concern

This section provides an overview of the areas of contamination concern located in each of the assessment areas considered by the contamination assessment, identified as an outcome of the desktop review of existing information and data. It includes contaminated sites located within 500 metres of the project site (shown on Figure 13.4) that have been notified under section 60 of the CLM Act or otherwise reported to the NSW EPA. It also describes other areas of concern with respect to contamination (also shown on Figure 13.4). There are no public contaminated site registers for Commonwealth-owned land, including Sydney Airport land.

Key previous and existing land uses are described for each area. Further information on land use and properties in the project site is provided in Chapter 19 (Land use and property).

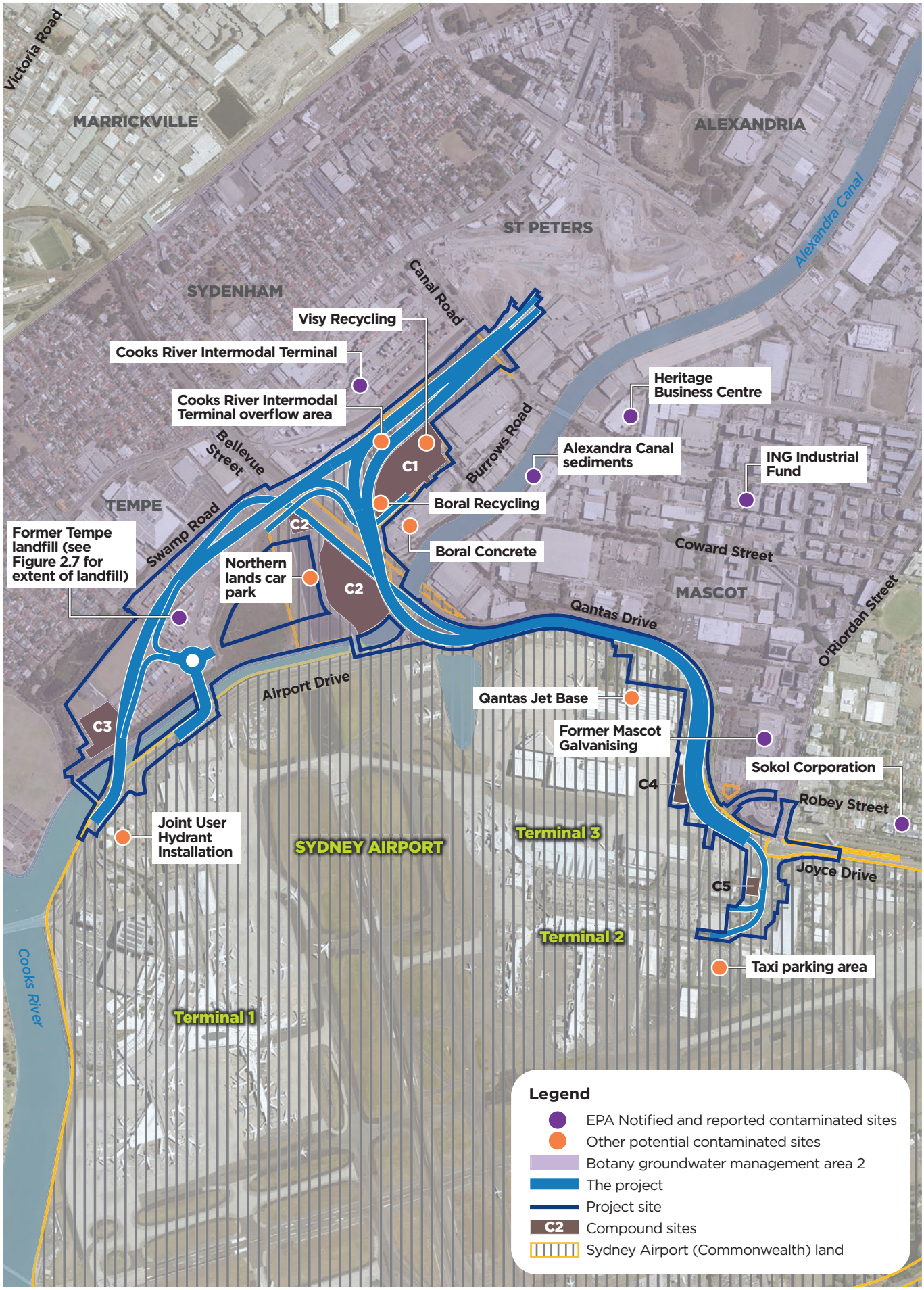


Figure 13.4 **Contaminated sites**

Former Tempe landfill (assessment area 1)

Land use

This area incorporates a portion of the former Tempe landfill, which was used as a council operated landfill between 1910 and the mid-1970s. During this period the landfill received a wide range of waste, including general domestic waste, liquid waste, industrial waste and hazardous waste (referred to as stage 1 fill). Part of the site was used as a scrapyard once landfill operations ceased.

In 2000, Marrickville Council was issued an environment protection licence (number 6665) for filling activities, which included acceptance of green waste, minor quantities of putrescible waste, demolition waste from road works and building maintenance, and council clean-up waste (referred to as stage 2 fill). This environment protection licence was surrendered in 2004, subject to surrender conditions amended in 2006. These conditions included regular monitoring of existing gas monitoring wells and of gas accumulation in commercial buildings, certain residential buildings, and utility trenches.

Current uses of this area include recreation/open space (uses within the Tempe Lands) and industrial (Tyne Container Services).

Desktop search results

A search of the NSW EPA's contaminated land record and of the NSW EPA's record of notices identified the former Tempe landfill (notified/reported to the NSW EPA as the former Tempe Tip) as a site that is currently regulated under the CLM Act and declared as a remediation site. In July 2000, the NSW EPA declared the former Tempe landfill a remediation site under section 21 of the CLM Act as a result of leachate migrating off-site towards Alexandra Canal. The leachate was found to be mainly affected by metals and ammonia. The remediation order issued to the former Marrickville Council required that a remediation action plan (RAP) be prepared to address the contaminant migration into Alexandra Canal.

Marrickville Council subsequently entered into a voluntary remediation proposal, which was approved by the NSW EPA in 2014. The voluntary remediation proposal requires that the water quality of Alexandra Canal is not adversely impacted by leachate originating from the former landfill site. It also included requirements to install infrastructure at the former landfill site to mitigate environmental risk.

A bentonite cut-off barrier wall was constructed in 2004 along the southern, eastern and western boundaries of the landfill to prevent leachate migrating into Alexandra Canal. A leachate collection and treatment system was also installed to treat leachate before discharge to wastewater via a trade waste agreement with Sydney Water.

Between 2004 and 2006, the surface of the former landfill was regraded and capped to minimise water infiltration and provide enhanced protection to people and the environment. The composition and thickness of the cap varies across the site. It generally comprises inert waste (concrete, sandstone, etc) and virgin excavated natural material overlain by either bitumen/asphalt or topsoil and turf/vegetation.

Between 2005 and 2009, landfill gas monitoring was carried out in accordance with conditions required under the environment protection licence surrender notice. The monitoring results indicated that off-site landfill gas migration was occurring through the north-western site boundary. A passive interception and venting trench was installed along the impacted boundary to address this issue. The trench extends into Ikea's site.

An environmental management plan (EMP) was developed for the Tempe Lands in 2006 to implement controls on future development and provide for maintenance works to manage residual contamination.

A Site Audit Statement was prepared in 2009 that documents the completeness of the voluntary remediation agreement and certifies the suitability of the area for various land uses, subject to the implementation of the EMP.

Potential contamination

Table 13.3 provides an overview of potential contamination sources and contaminants of concern within this area, including results of previous and recent site investigations.

Table 13.3 Overview of potential contamination within the former Tempe landfill (assessment area 1)

Potential source of contamination	Contaminants of potential concern[1]	Outcomes of site investigations
■ Landfilling of the site during operation as a landfill ■ Current container storage activity in a portion of the site ■ Historic weed and insect control on vacant areas	■ Total recoverable hydrocarbons (TRH) ■ Polycyclic aromatic hydrocarbons (PAHs) ■ Asbestos containing materials ■ Heavy metals ■ Phenols ■ Polychlorinated biphenyls (PCBs) ■ PFAS ■ Pesticides (organochlorine and organophosphorus pesticides) ■ Volatile organic compounds ■ Semi volatile organic compounds ■ Nutrients (in groundwater) ■ Landfill gas (carbon monoxide, carbon dioxide, hydrogen sulfide and methane)	**Soil** ■ Elevated concentrations of contaminants were encountered across the site at varying depths ■ Hotspots of TRH, PAHs and heavy metals in fill materials were found to exceed relevant criteria ■ Low levels of PFAS compounds were detected in most soil samples tested. All PFAS concentrations were below the PFAS NEMP health criteria for recreational users and commercial workers ■ Potential asbestos containing materials were identified **Groundwater** ■ Concentrations of ammonia and heavy metals exceeded assessment criteria ■ Low levels of hydrocarbons and PFAS were reported **Other** ■ Landfill gas concentrations recorded across the assessment area ■ The maximum gas screening value recorded within the site falls into 'characteristic gas situation 2' low risk conditions (NSW EPA, 2012) ■ High concentrations of methane and carbon dioxide were detected

Note: 1. Contaminants of potential concern are based on previous and current activities undertaken in the assessment area.

Sydney Airport northern lands car park (assessment area 2)

Land use

This area has been used for commercial/industrial uses since 1930. A bulk fuel storage depot operated at the site from 1930 until between 1950 and 1970.

Currently, the area is mainly used for parking by Sydney Airport staff. A small strip of vegetation is located between Alexandra Canal and the car park. The car park is fully sealed with asphalt.

Desktop search results

No sites listed on NSW EPA's contaminated land record or NSW EPA's record of notices are located within this area.

The area is impacted by its former use for commercial/industrial activities as well as the historical migration of landfill gas from the adjoining former Tempe landfill. Sydney Airport has undertaken staged investigation and remediation of the site, to render the site suitable for its use as a car park.

Remediation works were undertaken in the western portion of the assessment area in 2015. These works involved removing contaminated soil, followed by installing a gas venting system and capping layer. The capping layer comprises the sealed surface, underlain by clean fill and a geotextile marker layer.

Remediation works were undertaken in the centre of the assessment area in 2016. These works involved capping to address soil contamination in fill material, including the presence of asbestos containing

materials. The capping layer consists of a geotextile marker layer overlain with clean fill to a maximum of 0.8 metres deep.

Remediation works within the eastern section of the assessment area are still pending.

The assessment area is managed by Sydney Airport Corporation in accordance with a long-term EMP prepared in January 2017, which documents the procedures to be followed during any future works in this area. The EMP requires ongoing inspections in the centre of the area to monitor erosion of the cap and the presence of landfill gas. For the western portion of the assessment area, this EMP has been superseded by another EMP that documents the requirements for maintaining the gas venting system.

Potential contamination

Table 13.4 provides an overview of potential contamination sources and contaminants of concern within this area, including results of previous and recent site investigations.

Table 13.4 Overview of potential contamination within the Sydney Airport northern lands car park (assessment area 2)

Potential source of contamination	Contaminants of potential concern[1]	Outcomes of site investigations
■ Historic bulk fuel storage ■ Historic general commercial/industrial activity ■ Historic uncontrolled site filling ■ Potential firefighting activity (firefighting foam) ■ Adjacent landfill activities (former Tempe landfill)	■ TRH ■ PAHs ■ Heavy metals ■ Asbestos ■ Phenols ■ Nutrients (including ammonia) ■ Landfill gas ■ PFAS	**Soil** ■ Asbestos identified within fill material across the area (bonded asbestos containing materials and asbestos fines/fibrous asbestos) ■ Hotspots of TRH, PAHs and lead in fill material exceeded criteria in Schedule 2 of the Airports (Environment Protection) Regulations 1997 **Groundwater** ■ Ammonia, phosphate and heavy metals exceeded assessment criteria ■ PFAS detected in groundwater. Concentrations reported in one monitoring well location exceeded NEMP ecological (95 per cent protection) criteria **Other** ■ Landfill gas including methane concentrations recorded ■ The maximum gas screening value recorded falls into 'characteristic gas situation 3' moderate risk conditions (NSW EPA, 2012)

Note: 1. Contaminants of potential concern are based on previous and current activities undertaken in the assessment area.

Land north of the rail corridor (assessment area 3)

Land use

This area has had an extensive industrial history and has been filled with uncontrolled fill. Buildings adjacent to the south of the area were built as wool stores and contained asbestos containing material and potentially other hazardous building materials. The buildings were damaged by a large gas explosion in 1990.

This assessment area is currently occupied by commercial/industrial tenants including Cooks River Intermodal Terminal, Boral Recycling and Visy Paper. The leased Cooks River Intermodal Terminal overflow area within the centre of the assessment area is occupied by stored shipping containers and driveways with large unsealed areas. A vacant, vegetated area located immediately east of Canal Road appears to have been artificially raised using fill.

Desktop search results

A search of the NSW EPA's contaminated land record and record of notices identified the 'Cooks River Rail Terminal' (the Cooks River Intermodal Terminal) as a contaminated site notified to the NSW EPA. This listing refers to the land used to operate the Cooks River Intermodal Terminal, a portion of which is located at the northern edge of this assessment area. This site has a documented history of industrial use since 1947.

A search of the NSW EPA's record of facilities licensed under the POEO Act identified the Boral Recycling and Visy Recycling sites within the project site as holding current environment protection licences, despite being located on Sydney Airport land.

The search also identified the Heritage Business Centre within 500 metres of this area (see Figure 13.4). These sites do not require regulation under the CLM Act, therefore it is assumed that the EPA has not identified significant contamination migrating off-site at levels that could pose a risk to human health or the environment.

Potential contamination

Previous investigations within Lot 2 in DP802342 (the southern portion of assessment area 3) reported elevated concentrations of PAHs and heavy fraction petroleum hydrocarbons. Potential free tar and fragments of asbestos containing materials were also observed.

Table 13.5 provides an overview of potential contamination sources and contaminants of concern within this area, including results of previous and recent site investigations.

Table 13.5 Overview of potential contamination within land north of the rail corridor (assessment area 3)

Potential sources of contamination	Contaminants of potential concern[1]	Outcomes of site investigations
■ Historic general commercial/industrial activity ■ Historic uncontrolled site filling ■ Asbestos containing materials in soil from previous buildings ■ PCBs in soil ■ Current freight storage activity.	■ TRH ■ PAHs ■ Heavy metals ■ Asbestos ■ Phenols ■ PCBs ■ PFAS ■ Pesticides	**Soil** ■ Hotspots of TRH, PAHs, benzene, toluene, ethylbenzene and xylenes (BTEX), heavy metals and asbestos detected in fill above assessment criteria ■ PCBs identified in one location ■ PFAS concentrations reported above the NEPM ecological criteria (discrete areas only) ■ Seepage of tar-like material was observed in one location in the south-west portion of the area **Groundwater** ■ Ammonia, phosphate, heavy metals and PFAS concentrations in groundwater exceeded assessment criteria. On-site and off-site sources may have contributed to groundwater contamination ■ A previous well had TRH above groundwater criteria but was removed in 2012.

Note: 1. Contaminants of potential concern are based on previous and current activities undertaken in the assessment area.

Sydney Airport land along Alexandra Canal and Qantas Drive (assessment area 4)

Land use

This area has historically been used as an aerodrome since 1919. The assessment area is currently used for Sydney Airport operations and road transport (Airport Drive, Qantas Drive and Joyce Drive). The Jet Base and Qantas Flight Training Centre is located within the north-eastern corner of the assessment area (adjacent to Qantas Drive). The base includes a number of buildings and structures that would be removed as part of the project (see Chapter 8 (Construction)).

The northern ponds are located west of the Jet Base. The ponds, which provide flood mitigation and a spill control function for the airport, discharges to Alexandra Canal.

Joint User Hydrant Installation (JUHI) (a Sydney Airport tenant) operates a bulk fuel storage terminal adjacent to Airport Drive on Sydney Airport land.

Desktop search results

Two sites listed on NSW EPA's contaminated land record are located within 500 metres of this area (ING Industrial Fund and Former Mascot Galvanising – see Figure 13.4). Contamination on the Former Mascot Galvanising site is currently regulated under the CLM Act and this site is also listed on NSW EPA's record of notices.

Potential contamination

There are a number of known contaminated groundwater plumes located in land within Qantas's lease areas within Sydney Airport, including the Jet Base. Site investigations identified a number of contaminants in the soil and/or groundwater, including hydrocarbons, PAHs, PFAS and heavy metals.

The JUHI site is impacted by hydrocarbons that are managed under a RAP. Remediation activities have included removing liquid hydrocarbons where possible and regular groundwater monitoring of the hydrocarbon plume.

Table 13.6 provides an overview of potential contamination sources and contaminants of concern within this area, including results of previous and recent site investigations.

Table 13.6 Overview of potential contamination within Sydney Airport land (assessment area 4)

Potential sources of contamination	Contaminants of potential concern[1]	Outcomes of site investigations
■ Historic uncontrolled site filling ■ Historic general and Sydney Airport commercial/industrial activity ■ Fuel storage and firefighting training ■ Jet Base ■ Taxi parking area light non-aqueous phase liquid plume (down-hydraulic gradient)	■ TRH ■ PAHs ■ Heavy metals ■ Asbestos ■ Phenols ■ PCBs ■ Volatile halogenated compounds ■ PFAS	**Soil** ■ No significant soil contamination identified ■ PAHs hotspot directly beneath project site ■ TRH, BTEX, PAHs, heavy metals and asbestos detected in fill material within adjacent airport areas **Groundwater** ■ Concentrations of heavy metals directly beneath project site exceeded the assessment criteria. Groundwater contamination likely attributed to background concentrations or off-site sources ■ TRH, chlorinated solvents, PAHs, ammonia, sulphide and heavy metals found in down-hydraulic gradient airport areas exceeded groundwater criteria (as per Schedule 2 of the Airports (Environment Protection) Regulations 1997) ■ Light non-aqueous phase liquid was recorded in six of the monitoring wells gauged, at thicknesses ranging between 0.1 m and more than 0.5 m, in down-hydraulic gradient locations ■ PFAS exceeded NEPM criteria within the project site

Note: 1. Contaminants of potential concern are based on previous and current activities undertaken in the assessment area.

Alexandra Canal (assessment area 5)

Desktop search results

A search of the NSW EPA's contaminated land record and of the NSW EPA's record of notices identified that Alexandra Canal is listed on both databases and has been declared a remediation site as a result of contamination of bed sediments from historical industrial activities in the local area.

Due to the type and levels of contaminants, the NSW EPA determined that the bed sediments have the potential to present a significant risk of harm to human health and the environment if disturbed. The NSW EPA consequently issued Sydney Water with a remediation order (number 23004) under the CLM Act to regulate sediment disturbance.

Potential contamination

Contaminants of concern that have previously been identified in Alexandra Canal sediments include:

- pH
- Petroleum hydrocarbons
- PAHs
- PCBs
- Pesticides
- Asbestos
- Metals
- Speciated nitrogen
- Organotin compounds
- PFAS.

Investigations undertaken for the assessment identified:

- Concentrations of metals, TPH, PAHs, PCBs and pesticides in sediment exceeding the ecological criteria
- Asbestos detected in 13 of the sediment samples collected
- PFAS compounds detected, however concentrations were below the NEMP criteria
- Organotin compounds detected – organotin waste materials are subject to a chemical control order under Part 3, Division 5 of the *Environmentally Hazardous Chemicals Act 1985* (NSW).

Surface water quality investigations undertaken for the project (see Chapter 16 (Surface water)) identified:

- Samples obtained from Alexandra Canal frequently exceeded ANZECC guidelines default trigger values for total nitrogen, total phosphorus, aluminium, iron, manganese, mercury, zinc and ammonia
- PFAS compounds, including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), were detected in samples obtained from Alexandra Canal
- PFAS was detected in samples taken from up-stream sampling points
- Concentrations of PFAS were below the nominated criteria.

13.2.6 Summary of contaminated areas and existing soils on Sydney Airport (Commonwealth) land

Contaminated areas

The following assessment areas considered by the assessment are located on Sydney Airport land:

- Sydney Airport northern lands car park (assessment area 2)
- Land north of the rail corridor, with the exception of the northern and southern extents (assessment area 3)
- Sydney Airport land along Alexandra Canal and Qantas Drive (assessment area 4).

Soil and groundwater impacted with contaminants above health and/or environmental criteria is present in these areas. Detectable concentrations of PFAS in soil and groundwater, including concentrations above the NEMP criteria, have been reported across all of these areas.

Additional contamination issues identified include:

- Landfill gas recorded in Sydney Airport northern lands car park
- Fill material, including asbestos containing materials and other contaminants, across the Sydney Airport northern lands car park has been subject to ongoing remediation
- Light non-aqueous phase liquid identified in groundwater beneath the Jet Base, down-gradient of the project site.

Soils

Soils on Sydney Airport land are mapped as ‘disturbed terrain’. Reclamation and stabilisation in the area has altered the original topography of the site and drainage patterns.

Areas mapped as having high salinity potential are shown on Figure 13.2 and include the following areas on Sydney Airport land:

- In Sydney Airport northern lands car park (assessment area 2), immediately north of Alexandra Canal
- In land north of the rail corridor (assessment area 3), to the west of the St Peters interchange.

13.3 Assessment of construction impacts

13.3.1 Potential to encounter contamination

There is potential for contamination to be encountered across the project site. If inadequately managed, disturbance of contaminated areas has the potential to:

- Mobilise contaminants, affecting nearby soils, surface water and groundwater
- Increase the migration of contaminants into surrounding areas via leaching, overland flow and/or subsurface flow (water and/or vapour) or dust, with the potential to impact on receiving environments, such as Alexandra Canal, and the surrounding community
- Increase the risk of exposure to contaminants (direct contact and/or inhalation) by site workers, visitors and the local community.

The risk of disturbing or encountering contaminated material during construction varies depending on the extent and type of contamination and the work undertaken. A preliminary contamination risk evaluation (considering the potential for risks without implementation of appropriate controls or remediation) was undertaken to understand the potential risk of the identified areas of contamination concern. The risk

evaluation was undertaken by assessing identified areas of contamination concern based on the likelihood of:

- Encountering contamination
- The exposure pathway for human and/or ecological receptors (demonstrated by the conceptual models provided by Figure 13.5 to Figure 13.8, which show the ways that contamination may be encountered).

The following risk categories were assigned:

- Low – impact can be managed by implementing standard construction management practices in accordance with relevant guidelines
- Medium – contamination specific management plans and controls are required
- High – engineered controls and/or environmental/health monitoring are required.

Table 13.7 summarises the findings of the preliminary contamination risk evaluation, providing impacts that would occur during works across all assessment areas, and additional impacts that are specific to assessment areas. It is noted that the following areas are not considered to have additional impacts beyond those mentioned for all areas:

- Land north of the rail corridor (assessment area 3)
- Rail corridor
- St Peters interchange tie-in.

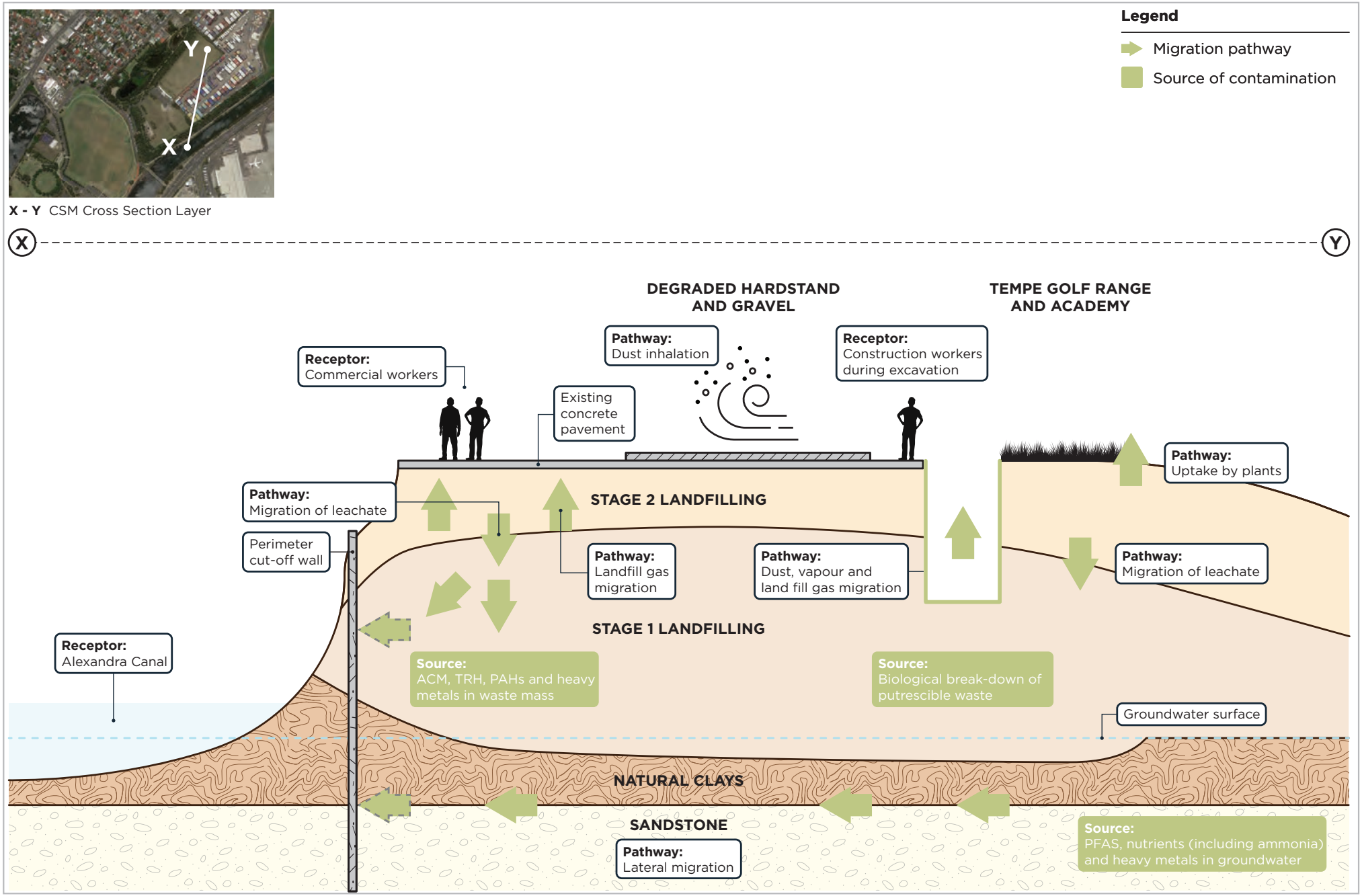


Figure 13.5 **Conceptual site model – former Tempe landfill**

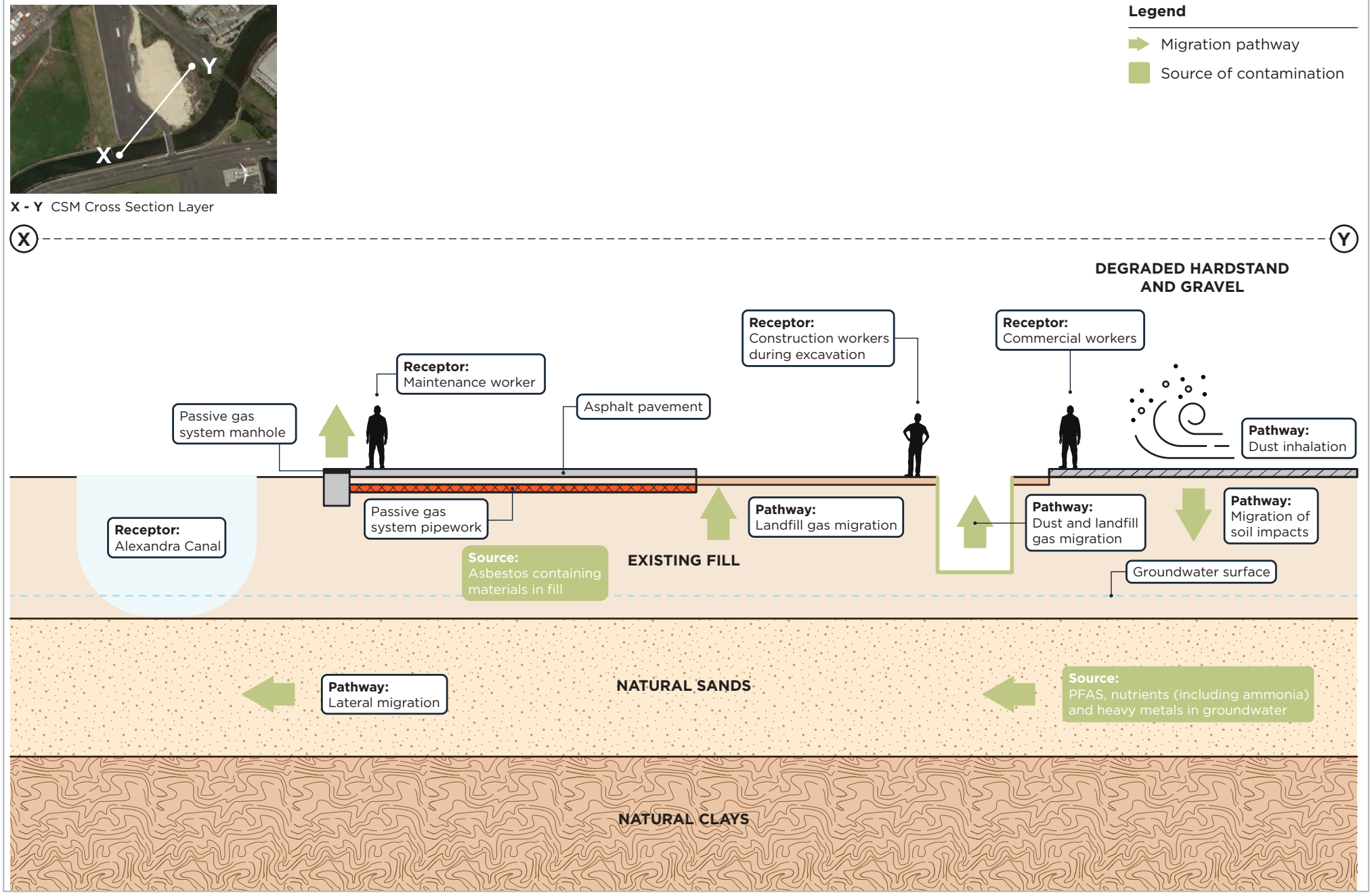


Figure 13.6 **Conceptual site model – Sydney Airport northern lands car park**

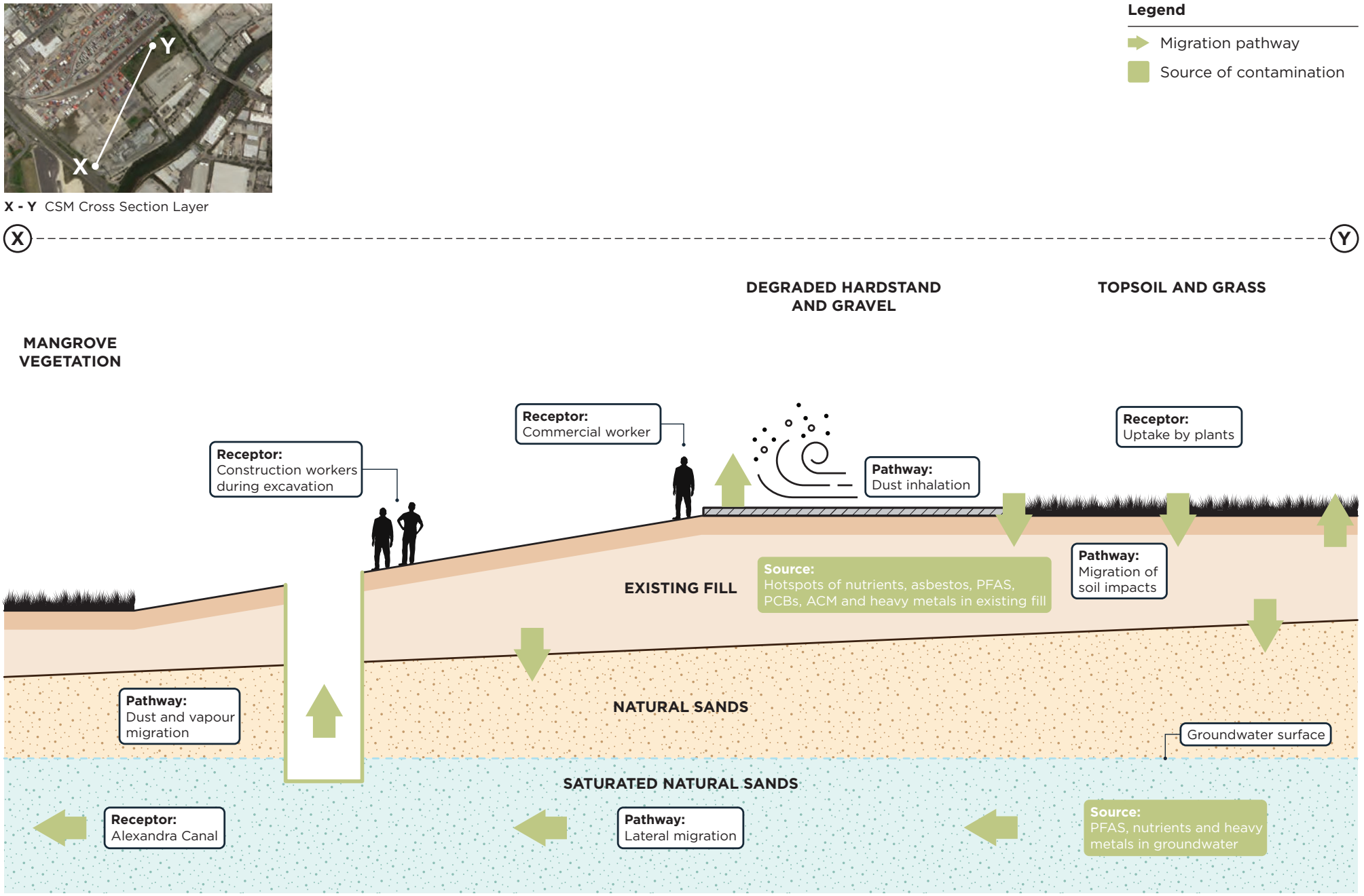
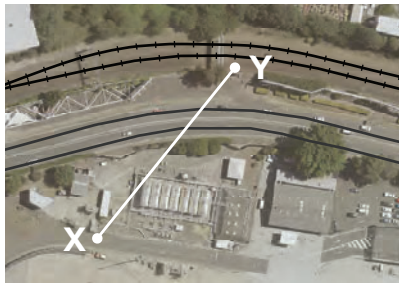


Figure 13.7 **Conceptual site model – Land north of the rail corridor**



X - Y CSM Cross Section Layer

Legend

- Migration pathway
- Source of contamination

X Y

QANTAS JET BASE

LANDSCAPED VEGETATION

BOTANY RAIL LINE

Receptor: Commercial workers

Above ground fuel tanks

Receptor: Construction workers during excavation

Existing concrete pavement

Existing Road Pavement

Source: PFAS

Source: Fuel spillage

Source: Hotspots of heavy metals and PAHs in existing fill

EXISTING FILL

Pathway: Vapour migration

Pathway: Dust and vapour migration

Pathway: Migration of soil impacts

Groundwater surface

Source: Light non-aqueous phase liquid

Source: Dissolved TRH and PFAS

Pathway: Migration via underground utilities

Source: Hotspots of asbestos containing material, heavy metals and PAHs in fill

NATURAL SANDS

2km

Receptor: Cooks River

Pathway: Lateral migration

NATURAL CLAYS

Figure 13.8 **Conceptual site model – Sydney Airport land**

Table 13.7 Preliminary contamination risk evaluation (without implementation of controls or remediation)

Assessment area	Construction activity	Potential impact	Risk rating	Mitigation required
All areas	Excavation and ground disturbance activities that would be undertaken across the project site, including but not limited to: ■ Vegetation removal ■ Construction compound establishment ■ Vehicle movements on unsealed surfaces ■ Installing drainage systems and utilities ■ Excavation for retaining walls and embankments ■ Piling for bridge piers ■ Temporary spoil stockpiling ■ Cut for final pavement levels.	Due to the presence of shallow contaminated groundwater, extraction of groundwater during excavation could result in contamination of the receiving surface water environment if any extracted groundwater is not treated adequately prior to discharge to surface water or stormwater.	High	Treatment and monitoring of groundwater would be undertaken prior to discharge. A dewatering management strategy would be developed to confirm the appropriate management approaches to minimise any impacts associated with dewatering (see Chapter 15 (Groundwater)).
		There is the potential for construction workers to either ingest or have contact with contaminated groundwater during excavation activities.	Low	Potential impacts would be mitigated by implementing standard construction safety measures, including the use of personal protective equipment.
		Due to the presence of contaminated soil, the disturbance of soils could result in erosion and contaminated and sediment laden run-off discharging to surface water or stormwater.	Medium	A Construction Soil and Water Management Plan would be prepared (in accordance with the Blue Book) and implemented as part of the CEMP to manage potential impacts associated with erosion and runoff (see section 13.6).
		The disturbance of contaminated soil could result in site workers and the community being exposed to dust containing contaminants, including airborne asbestos fibres, which exceed occupational health levels for inhalation.	Medium	A Construction Air Quality Management Plan would be prepared and implemented to mitigate potential dust and airborne fibres (see Chapter 12 (Air quality)). This would include a requirement for monitoring in accordance with work health and safety requirements.
		The movement of equipment, vehicles and personnel from unsealed areas containing soil contamination to ‘clean’ areas, either within the project site (eg compounds, areas without exposed soil contamination) or outside the project site could result in cross contamination. This could affect workers, via direct contact/ingestion, or the increased potential for contaminated sediment laden run-off.	Low	This would be managed by implementing standard environmental management measures as detailed in the Construction Soil and Water Management Plan, including street sweeping of tracked sediment and the provision of vehicle wash down areas.

Assessment area	Construction activity	Potential impact	Risk rating	Mitigation required
Former Tempe landfill (assessment area 1)	Excavation and ground disturbance activities across the assessment area including but not limited to: ■ Excavation which would remove parts of the capping layer ■ Excavation through the construction waste fill layer ■ Emplacement of excavated material into emplacement mounds. ■ Movement of plant and equipment ■ Construction compound establishment and operation ■ Piling for bridge piers near Alexandra Canal ■ Installing drainage systems and utilities.	There is the potential for increased rainfall infiltration when the landfill cap is removed during excavation. This could result in additional leachate volumes, which may exceed current leachate management system capacity.	Medium	The EMP requires that approval is sought from a site auditor where there is a proposed change in land use from those outlined in the EMP or where removal of capping is significant. A RAP would be prepared to define how the landfill cap would be reinstated during construction (see section 13.6).
		The exposure of landfill material during excavation and construction of the emplacement mounds could result in increased potential for contaminated sediment laden run-off discharging to surface water or stormwater, particularly during rainfall events	Medium	A Construction Soil and Water Management Plan would be prepared and implemented as part of the CEMP to manage potential impacts associated with erosion and runoff (see section 13.6).
		Odours and landfill gas could be generated during works at the former landfill site, which could result in health and amenity impacts on workers and the surrounding community.	Medium	A Construction Air Quality Management Plan would be prepared and implemented to mitigate potential landfill gas and odour issues during construction (see Chapter 12).
		The weight from the emplacement mounds and other construction materials (including plant, equipment and construction compounds) has the potential to result in stability and settlement issues such as the movement or collapse of landfill material which could also result in the creation of fissures which release landfill gas and/or odour.	High	A settlement and slope stability analysis would be undertaken to ensure that the mounds and other construction material do not impact landfill stability. There may be a need to provide engineering controls where the placement of compounds, plant and/or equipment has the potential to impact stability (see section 13.6).
		Ground disturbance activities have the potential to damage the existing gas collection systems along the north-western boundary.	Low	The presence of the gas collection systems would be identified on site plans and avoided as far as possible (see section 13.6).
		Ground disturbance activities could damage the leachate collection system (eg sumps and pipes) and change established leachate flow paths. Piling to support piers for the Terminal 1 connection bridge and the freight terminal bridge would be installed close to the existing bentonite cut-off wall. As the wall forms part of the leachate containment system, any potential impact to its	High	Detailed design would seek to avoid interactions with the bentonite cut-off wall. The vertical and horizontal location of the wall near the proposed bridge support structures would be established during detailed design, and a suitable buffer area established. Any works close to the wall would consider the existing leachate collection system (including

Assessment area	Construction activity	Potential impact	Risk rating	Mitigation required
		integrity could result in leachate entering Alexandra Canal. Piling would be undertaken very close to where the bentonite cut-off wall is located (the exact location/depth of the wall is still to be confirmed).		sumps and pumping equipment) and the stability of the canal bank. The RAP for this area will describe measures to protect the landfill management infrastructure during construction, or reinstate the infrastructure such that it continues to operate effectively after construction is finished (see section 13.6).
		Disturbance of the landfill cap and establishment of enclosed or confined places above the former landfill, including trenches for utilities and drainage, could result in the accumulation of gases creating an explosive atmosphere. This could also result in the depletion of oxygen levels inside compound buildings and trenches.	High	The cap would be reinstated and other controls would be provided to mitigate this risk, including ongoing monitoring during works (see section 13.6). Reinstatement of the cap would be outlined in the RAP for this area (see section 13.6). Measures to mitigate impacts associated with the accumulation of landfill gas would be included in the Construction Air Quality Management Plan (see Chapter 12).
Sydney Airport northern lands car park (assessment area 2)	Excavation and ground disturbance activities that would be undertaken across the project site, including but not limited to: ■ Installation of drainage and utilities ■ Temporary spoil stockpiling ■ Cut for final pavement levels ■ Piling for the Qantas Drive and terminal link bridges ■ Construction compound establishment and operation	Nuisance odours and landfill gas could be generated during disturbance of the existing cap, which could affect worker and community health and amenity.	Medium	A Construction Air Quality Management Plan would be prepared and implemented to mitigate potential landfill gas and odour issues during construction (see Chapter 12).
		Ground disturbance activities have the potential to damage the existing gas collection system.	High	The gas venting system would be protected and/or relocated prior to works commencing. This would be undertaken in accordance with the EMP that applies to the area (see section 13.6).
		Disturbance of the cap and establishment of enclosed or confined places, including trenches for utilities and drainage, could result in the accumulation of gases creating an explosive atmosphere. This could also result in the depletion of oxygen levels inside compound buildings and trenches.	High	The cap would be reinstated and other controls would be provided to mitigate this risk, including ongoing monitoring during works. The cap would be reinstated in accordance with the EMP that applies to this area. Measures to mitigate impacts associated with the accumulation of landfill gas would be included in the Construction Air Quality Management Plan (see Chapter 12).

Assessment area	Construction activity	Potential impact	Risk rating	Mitigation required
Sydney Airport land (assessment area 4)	Drainage and utilities works	The presence of groundwater with light non-aqueous phase liquid and volatile contaminants reported in wells down-gradient of the project site could mean that there is the potential for volatile soils and groundwater to exist beneath this assessment area. This could result in the accumulation of volatile contaminants (from soil and/or groundwater) in confined space work areas.	Medium	Limited soil and groundwater assessment has been undertaken in this area. Further assessment would be undertaken to discount this potential risk (see section 13.6).
Alexandra Canal (assessment area 5)	Construction of stormwater outlets	Coffer dams would be used to construct stormwater outlets in Alexandra Canal and minimise sediment disturbance and mobilisation. The installing and removing the coffer dams, however, could disturb and mobilise contaminated sediments within the bed of the canal, which could affect water quality and aquatic ecosystems.	High	To limit the mobilisation of contaminated sediments, physical controls (such as silt curtains) would be put in place when installing and removing the coffer dams. This is discussed further in the section below the table.

Potential disturbance of contaminated sediments in Alexandra Canal

The project has been designed to minimise the disturbance of the Alexandra Canal bed sediments. Structural supports and foundations associated with the bridge crossings have been located outside of the canal walls.

The proposed stormwater system would connect into Alexandra Canal. The outlets would be constructed by first constructing coffer dams around the outlet locations. The water inside the coffer dam would then be removed so that the stormwater outlets could then be constructed without further sediment disturbance.

Installing and removing the coffer dams has the potential to disturb sediments within the bed of the canal and cause localised sediment plumes. Due to the contaminated nature of the sediments mobilisation of contaminated sediments would have the potential to affect water quality within the canal. However, these effects would be mitigated by using silt curtains, which would be installed around the coffer dams during installation and removal.

In accordance with the requirements of the remediation order for Alexandra Canal, and due to the presence of contaminated sediments, a management plan would be prepared for all works proposed within the canal (see section 13.6).

Potential water quality impacts associated with disturbing contaminated sediments within Alexandra Canal are discussed further in Chapter 16 (Surface water).

13.3.2 Potential to generate site contamination

If inadequately managed, construction activities have the potential to result in the contamination of soil due to:

- Accidental spills and leaks of fuel, oils, and other potentially contaminating substances, from plant and equipment or mishandling of dangerous goods stored on site
- Inadequate handling of contaminated materials and excavated waste
- Mobilisation of contaminants during demolition of structures, including buildings and services, which contain potentially contaminating substances such as asbestos and leaded paint.

The potential contamination of surface soils due to the above activities could affect groundwater through leaching, and/or surface water due to mobilisation of contaminated run-off. Additionally, there is the potential for the mobilisation of contaminated surface water during works on the stormwater pipe that connects the northern ponds, which could affect water quality in Alexandra Canal.

These potential impacts would be mitigated by implementing the mitigation measures provided in section 13.6. Hazardous materials surveys would be undertaken prior to the stripping and demolition of any buildings and structures. Hazardous materials would be removed and disposed of in accordance with relevant legislation, codes of practice, and Australian Standards. Mitigation measures are provided in Chapter 23 (Health, safety and hazards) to minimise the potential impacts of transport and handling dangerous goods and hazardous materials.

To avoid potential cross-contamination of soils, the reuse of materials for fill or other purposes would be subject to testing in accordance with the relevant guidelines prior to their use. Where materials are deemed unsuitable for reuse, or where there is a surplus of reusable material (eg fill), this would be managed in accordance with the management hierarchy and measures provided in Chapter 24 (Waste management).

13.3.3 Soil impacts

Soil erosion and sediment transport

Construction would temporarily expose the natural ground surface and sub-surface through the removal of vegetation, general excavation and soil disturbance, and the removal of hardstand surfaces including roads and footpaths.

Excavation and ground disturbance activities would expose and disturb soils, which if not managed adequately, could result in:

- Erosion of exposed soil and stockpiled materials
- Exposure of soil containing sulfidic material to oxygen, resulting in the production and mobilisation of sulfuric acid
- Increases in salinity levels in soil
- Potential for localised changes to landform such as earth embankments and cut or fill areas which could impact local hydrology
- Dust generation resulting in air quality impacts
- Mobilisation of contaminated sediments and contamination of surface water runoff, with resultant potential for environmental and human health impacts.

The potential for dust impacts is considered in Chapter 12 (Air quality). The potential for soil erosion impacts would be minimised by implementing a Construction Soil and Water Management Plan that would be prepared in accordance with the Blue Book, as described in section 13.6.

Acid sulfate soils

The exposure of acid sulfate soils to oxygen during disturbance can lead to the generation of sulfuric acid. The subsequent acidic leachate can then lead to mobilisation of heavy metals such as aluminium and iron into water bodies. Drainage from acid sulfate soils may affect water quality and can impact aquatic organisms.

Acid sulfate soils may be encountered during piling for bridge piers, excavation for stormwater drainage, utility works and outfall connections to Alexandra Canal. Additionally, dewatering for road construction could result in localised drawdown of the groundwater table which could temporarily expose potential acid sulfate soils to air.

Further investigations would be undertaken within areas of medium and high acid sulfate soil potential during detailed design. Due to the disturbed nature of the project site, all excavated soil for the project would be subject to the provisions of an acid sulfate soil management plan developed in accordance with the *Acid Sulfate Soils Assessment Guidelines* (ASSMAC, 1998). Once acid sulfate soils have been treated, depending on the results of testing, they could either be reused on site, or disposed of at an appropriate facility.

Salinity

The project would involve excavation and piling within areas of high salinity potential for the construction of the Terminal 1 connection, St Peters interchange connection, Qantas Drive upgrade and for the terminal links. High salinity soil can reduce or preclude vegetation growth and produce aggressive soil conditions, which may be detrimental to concrete and steel. Impacts may also occur as a result of the erosion and off-site transport of saline sediments, resulting in impacts on the receiving environment. However, given that receiving waters within the study area are saline, the potential for impacts to water quality due to off-site migration of saline sediments is considered to be negligible.

The potential for any impacts due to the presence of saline soils is considered to be low. Any potential impacts would be temporary and managed by implementing standard erosion and sediment control measures. Soils associated with areas of high salinity potential would be considered during detailed design and mitigation measures developed and implemented as appropriate to minimise impacts associated with salinity.

13.3.4 Summary of impacts on Sydney Airport (Commonwealth) land

Contamination

Construction has the potential to disturb known areas of contamination located on Sydney Airport land in the following areas:

- Sydney Airport northern lands car park (assessment area 2)
- Land north of the rail corridor (assessment area 3)
- Sydney Airport land along Alexandra Canal and Qantas Drive (assessment area 4).

In summary, construction would have the potential for the following impacts on Sydney Airport land:

- Damage the existing remediation system (cap and landfill gas collection system) within the Sydney Airport northern lands car park
- Mobilise contaminants from existing contaminated areas, impacting nearby soils, surface water and groundwater
- Increase the migration of contaminants into surrounding areas via leaching, overland flow and/or subsurface flow or dust
- Increase the risk of exposure to contaminants (direct contact and/or inhalation) by site workers, visitors and the local community.

Other potential impacts would be managed by implementing the measures provided in section 13.6.

Soils

Potential impacts to soils on Sydney Airport land would include:

- Exposure of acid sulfate soils on land mapped as class 2 and 3 risk during excavations more than 1.5 metres deep, piling for piers and bridge abutments, and trenches for service upgrade/relocation
- Disturbance of soils in areas mapped as having high salinity potential resulting in the potential erosion and off-site transport of saline soils.

These impacts are expected to be manageable with the application of the measures described in section 13.6.

Following implementation of the mitigation measures for contamination and soils, the potential impacts on Commonwealth land are not considered to be significant.

13.3.5 Need for remediation

Construction has the potential to impact the contaminant management infrastructure and systems that are currently in place in the following assessment areas:

- Former Tempe landfill (assessment area 1) – the landfill cap, cut-off wall and leachate management system
- Sydney Airport northern lands car park (assessment area 2) – the remediation cap and passive gas venting system.

Where the project has the potential to damage and/or remove these existing systems or impact on their effectiveness, the controls and protocols outlined in the existing EMPs would need to be implemented. The EMP may require a RAP to be prepared where potential disturbance is deemed to be significant and approved by a site auditor (for works on land subject to the EP&A Act) or by Sydney Airport Corporation and endorsed by the Airport Environment Officer (for works on Sydney Airport land).

The RAP(s) would describe how the existing systems would be managed during construction, or how these systems would be reinstated, such that they continue to operate effectively after construction is finished.

Given the presence of soil contamination across the project site, the RAP(s) would also need to consider clean-up and/or remediation strategies to be implemented to ensure the project site is suitable for the proposed development (ie operation of road infrastructure). This includes ensuring that the existing contamination within the project site does not pose an ongoing risk to maintenance workers and/or the environment. In accordance with the hierarchy of preferred remediation strategies in the *Contaminated Land Management Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2017b) these strategies could include (in order of preference):

- On-site treatment of soil to destroy the contaminant or reduce the associated hazard to an acceptable level
- Off-site treatment of the soil to destroy the contaminant or reduce the associated hazard to an acceptable level, after which the soil is returned to site
- Consolidation and isolation of the contaminated soil on site by containment with a properly designed barrier
- Removal of contaminated material to an approved site or facility, followed by replacement with clean fill (as required).

Given the presence of asbestos in soil in the former Tempe landfill, Sydney Airport northern lands car park and land north of the rail corridor, for which there are no appropriate on or off-site treatment methods, the preferred remediation strategy would be consolidation and isolation on site using an appropriately constructed barrier to prevent exposure. This may include using the final road pavement and installation of additional capping, where required.

Where remediation is required, it would be undertaken in general accordance with the following:

- The RAP(s) would be prepared during detailed design by a suitably qualified environmental consultant, as defined in Schedule B9 of the NEPM
- For remediation of land subject to the EP&A Act - the RAP(s) would be approved by a site auditor accredited under the site auditor scheme under the CLM Act
- For remediation of Sydney Airport land – the RAP(s) would be approved by Sydney Airport Corporation and endorsed by the Airport Environment Officer. If Sydney Airport Corporation and/or the Airport Environment Officer consider that a site assessor is required, the site assessor would be nominated by the Secretary (as defined by Regulation 6.10 of the Airports (Environment Protection) Regulations 1997) and would endorse the RAP(s)
- The implementation of the RAP(s) would be validated by a suitably qualified environmental consultant, who would document the validation in a validation report that would be reviewed by a site auditor (for land subject to the EP&A Act) or reviewed by Sydney Airport Corporation and the Airport Environment Officer (for Sydney Airport land)
- The requirements for ongoing monitoring and maintenance of the reinstated systems as well as any new structures constructed to manage existing contamination would be documented in an EMP (or multiple EMPs) that would be prepared for the project site
- Following preparation and approval of the EMP(s) the site auditor would prepare a Site Audit Statement confirming the suitability of the project site for the proposed development (for land subject to the EP&A Act) or the Sydney Airport Environment Officer would confirm the objectives of remediation have been met (for Sydney Airport land).

While there is contaminated groundwater across the project site, this has been assessed to be an existing issue that would not be worsened by the project, provided the mitigation measures in section 13.6 are implemented. This would not preclude use of the site for the project. Therefore, remediation of groundwater is not considered necessary. Further information about groundwater is provided in Chapter 15 (Groundwater).

13.4 Assessment of operation impacts

13.4.1 Potential to encounter contamination

Day-to-day operation of the project would not expose site users (including road users, users of future open space and airport staff in Sydney Airport land), to potentially contaminated soil (or groundwater) if remediation is undertaken as described in section 13.3.5. Additionally, it is expected that remediation and encapsulation of the project site would take into consideration any potential maintenance activities, such that where sub-surface maintenance works are required these would not extend beyond the capping and marker layer.

There is the potential for landfill gas in the former Tempe landfill and Sydney Airport northern lands car park to accumulate in confined spaces (such as utilities) that would need to be accessed by maintenance workers. Additionally, the presence of piles for the bridges and other sub-surface infrastructure could result in the creation of new preferential pathways for the landfill gas to escape. The RAP(s) prepared for these assessment areas would need to consider this potential risk. This would include providing new gas collection and venting systems within the former Tempe landfill and Sydney Airport northern lands car park and/or reinstating the existing remediation systems in these areas. Where remediation does not remove the potential for existing exposure pathways to be realised the EMP(s) would identify the risk and associated mitigation measures for future maintenance activities.

There is the potential for landfill settlement to occur in the former Tempe landfill following placement of the proposed emplacement mound(s) and completion of the road work due to the additional weight of this infrastructure. Settlement could cause fissures or breaches in the capping layer, which could increase infiltration of surface water. Fissures could also cause preferential pathways for landfill gas emissions. Settlement and slope stability analysis would be undertaken to inform the design of the emplacement mounds and capping layer.

The emplacement mound(s) could also change surface water flows across the former landfill, which could result in scouring and erosion of the capping layer. The design of the capping layer would need to be integrated with the design of surface water drainage to mitigate potential impacts on the integrity of the landfill.

Modelling undertaken as part of the surface water assessment determined that there is the potential for sediments close to three new stormwater outlets within Alexandra Canal to be temporarily mobilised during a one per cent annual exceedance probability flood event. However, it is likely that contaminated bed sediments would be mobilised during a flood of this same magnitude. Energy dissipaters would be installed at these three locations to minimise sediment mobilisation. This is discussed further in Chapter 16 (Surface water). The design and construction of the stormwater outlets would be undertaken in accordance with the requirements of the remediation order, and in consultation with Sydney Water.

13.4.2 Potential to generate contamination

Operation has the potential to contaminate soil and groundwater from leaks and spills of fuel, oils and other hazardous materials during maintenance activities. However, the potential is considered to be low, given the likely scale and duration of maintenance activities.

This potential impact would be minimised by implementing procedures to handle dangerous goods and hazardous materials and manage spills similar to those used for other Roads and Maritime road infrastructure.

13.4.3 Suitability of the site for the development

A summary of the works that would be required within each contamination assessment area to ensure the project site's suitability for the proposed development (ie operation of road infrastructure), is provided in Table 13.8.

Further information regarding the remediation requirements for the project site and the general remediation process that would be followed to ensure site suitability is provided in section 13.3.5.

Table 13.8 Suitability of site for development with reference to assessment areas

Assessment area	RAP required/site suitability
Former Tempe landfill (assessment area 1)	The EMP for this area requires that approval is sought from a site auditor where there is a proposed change in land use from those outlined in the EMP or where removal of capping is significant. A RAP is required to document the reinstatement of the existing remediation systems, where impacted, the design and implementation of the emplacement mounds, and the final road pavement and additional capping design. Current known contamination status does not impede suitability of the site for the proposed development.
Sydney Airport northern lands (assessment area 2)	Where the project has the potential to damage and/or remove existing systems or impact on their effectiveness, the controls and protocols outlined in the existing EMP would need to be implemented. The EMP may require a RAP to be prepared where potential disturbance is deemed to be significant and approved by a site auditor (for works on land subject to the EP&A Act) or approved by Sydney Airports Corporation end endorsed by the Airport Environment Officer (for works on Sydney Airport land). A new EMP is required, or the existing EMP revised, to document long term maintenance and monitoring requirements in the assessment area. Current known contamination status does not impede suitability of the site for the proposed development (subject to remediation and management under the existing EMP).
Land north of the rail corridor (assessment area 3)	Additional soil sampling is required to inform construction due to limited soil characterisation across the area. A RAP is required to document the design and implementation of the final road pavement and additional capping. An EMP is required to document long term maintenance and monitoring requirements in the assessment area. Current known contamination status does not impede suitability of the site for the proposed development (subject to remediation and management under a RAP and EMP).
Sydney Airport land (assessment area 4)	Additional assessment and groundwater monitoring is required adjacent to the airport boundary, to delineate the extent of groundwater impacts associated with the Jet Base, and assess the potential for down-gradient groundwater contamination to be disturbed during construction dewatering. A RAP is required to document the design and implementation of the final road pavement and additional capping. An EMP is required to document long term maintenance and monitoring requirements in the assessment area. Current known contamination status does not impede suitability of the site for the proposed development (subject to remediation and management under a RAP and EMP). The project would not impede remediation of existing groundwater contamination beneath the Jet Base.
Alexandra Canal (assessment area 5)	In accordance with the requirements of the remediation order for Alexandra Canal a strategy is required to document how the disturbance and migration of contaminated sediments would be minimised during construction.
Rail corridor	No changes of land use proposed.
St Peters interchange tie-in	The conditions of approval for the New M5 project requires preparation of a soil contamination report, and where remediation is required, the report must be accompanied by a site audit statement prepared by an accredited site auditor. The completion of the above would need to be verified prior to construction commencing.

13.4.4 Soil impacts

Soil erosion and sediment transport

There is potential for recently disturbed soils to be susceptible to erosion, particularly during initial periods of landscaping and re-establishment of vegetation. This may occur in areas where planting is proposed, including adjacent to disturbed areas, along embankments and in the reinstatement of temporary ancillary facilities where topsoil is settling and vegetation is establishing. Temporary soil stabilisation may be required immediately following construction to prevent potential erosion, topsoil loss or soil migration. This is particularly likely to be required following severe storms. A rehabilitation strategy would be prepared to guide the approach to rehabilitation of disturbed areas, and would include requirements for ongoing monitoring following the establishment of these areas, as described in section 13.6.2.

Operation is not likely to result in any significant impacts on soils, topography or geology. The risk of soil erosion during operation would be minimal, as all areas impacted during construction would be sealed or rehabilitated and landscaped to prevent soil erosion from occurring. Maintenance activities involving ground disturbance would be undertaken in accordance with Roads and Maritime's standard operating procedures.

Operation is not expected to result in geomorphological impacts.

Soil salinity

Operation is not expected to impact the salinity levels of the project site. Maintenance activities would be unlikely to involve ground disturbance activities of sufficient magnitude to increase water infiltration resulting in erosion and off-site transport of saline sediments, particularly with the implementation of standard erosion and sediment control measures.

Salinity and potential effects on the durability of infrastructure will be considered further during detailed design.

Acid sulfate soils

Operation would not impact on acid sulfate soils. Maintenance activities would be unlikely to involve ground disturbance activities of sufficient depth to encounter acid sulfate soils.

13.4.5 Summary of impacts on Sydney Airport (Commonwealth) land

Operation would result in negligible potential impacts on Sydney Airport land based on the following:

- Ongoing maintenance and monitoring of the reinstated remediation system in Sydney Airport northern lands car park and the capping layer and final road pavement in Sydney Airport land would be undertaken in accordance with the EMP(s)
- Maintenance activities that involve ground disturbance would be undertaken in accordance with Roads and Maritime's standard operating procedures, which would limit the potential for impacts associated with soil erosion and sedimentation.

Consistency with the Sydney Airport Master Plan

The *Sydney Airport Master Plan 2039* (the Master Plan) identifies soil and land management as a key environmental issue. It recognises that due to a long history of aviation and related uses at the airport (including fuel storage and firefighting training) the airport site contains a number of areas that are subject to soil and groundwater contamination. Existing contamination issues are currently managed by implementing a contaminated sites strategy, underground storage tank strategy, and through tenant and contractor management.

By implementing the Master Plan and associated *Sydney Airport Environment Strategy 2019-2024* (the Environment Strategy), Sydney Airport Corporation plans to manage and reduce potential impacts from contaminated land and groundwater by:

- Preventing pollution from airport activities
- Preventing soil and groundwater contamination
- Managing known and suspected contaminated sites.

The five year plan for soil and land management in the Environmental Strategy includes a range of actions, of which the following are of most relevance to the project:

- Buildings and infrastructure will be planned and designed to minimise disturbance and potential impacts on soil and contaminated land where possible
- Ensure each site has a comprehensive conceptual site model
- Continue to ensure that fill material is reused and managed where appropriate in accordance with the PFAS NEMP and the Airports (Environment Protection) Regulations 1997 or disposed of in line with applicable waste classification guidelines under the NSW *Protection of the Environment Operations Act 1997*
- Where required, assess potential soil quality and contaminated land impacts and identify appropriate management measures for both the construction and operational phase of developments
- Undertake training of tenants, contractors and project managers in relation to the identification and management of soil and land contamination.

The project is consistent with these measures. In particularly, the project has been designed to avoid and/or minimise the disturbance of soils and therefore minimises the likelihood of disturbance of contaminated soils. A rigorous impact assessment process has been undertaken to ensure contamination and soils impacts are appropriately assessed and impacts minimised where practicable. Measures have been developed to ensure that soil quality and contaminated land impacts are considered during detailed design, construction planning and in the operational phase.

The key performance indicator relevant to contamination and soils for the actions outlined above is that there is a reduction (through management/remediation) of the number of contaminated sites. The project is not expected to reduce the number of contaminated sites, however it would where possible seek to minimise contamination in impacted areas and manage contamination in a way to ensure that the number of contaminated sites does not increase as a result of the project.

13.5 Cumulative impacts

Cumulative contamination and soil impacts may result from the disturbance of soils, including contaminated soil, and discharge of contaminated groundwater from other projects occurring simultaneously close to the project. This could result in the erosion and transport of soils and contaminated sediments into surface water bodies.

The EISs prepared for M4-M5 Link and New M5 included assessment of contamination and provided management measures. These projects are not expected to generate significant new contamination during construction. However, they are all likely to encounter and disturb existing contamination from past land uses that would require investigation, management and/or remediation.

The potential for cumulative impacts due to erosion and sedimentation would be managed by implementing standard erosion and sedimentation control measures. As such, it is not expected that the project would have a substantial cumulative impact on erosion and sedimentation.

Provided that projects constructed concurrently with the project are completed in accordance with the conditions of approval and any environment protection licence conditions, cumulative contamination and soils impacts are expected to be minimal.

13.6 Management of impacts

13.6.1 Approach

Approach to mitigation and management

The impact assessment has been undertaken based on the results of desktop research as well as the readily available results of intrusive site investigations. Further information on contaminants present, their concentration in soil and groundwater, and their coverage across the project site is being collected. These additional sampling results will be used to inform further actions and decisions in relation to the need for remediation of areas.

The assessment identified that if the existing contamination issues across the project site are not adequately managed during construction (including reinstating existing remediation systems), the project would have the potential to impact the receiving environment and sensitive receivers. Construction would also have the potential to expose and disturb soils which could also impact the receiving environment.

Approach to managing the key potential impacts identified

Where required, RAP(s) would be developed outlining the remediation strategies to be implemented during construction to ensure the existing site contamination does not pose an ongoing risk to maintenance workers, the community and/or the environment.

Where there are existing remediation systems in place (at the former Tempe landfill and Sydney Airport's northern lands car park), the controls and protocols outlined in the existing EMP would be implemented. The EMP may require a RAP to be prepared, which would describe how these systems would be managed during construction, or how these systems would be reinstated such that they continue to operate effectively after construction is finished. The RAP(s) would also include detailed information regarding construction of any new structures required to manage existing contamination (eg the emplacement mounds in the former Tempe landfill) so that these new structures do not pose an ongoing contamination risk.

Any maintenance activities during operation would be undertaken in accordance with the EMP(s).

A plan of management would be developed and implemented to manage work within Alexandra Canal that has the potential to disturb sediments. The management plan would address the requirements of the remediation order for the Alexandra Canal bed sediments, to prevent disturbance and dispersion of potentially contaminated sediments.

The plan would be prepared in consultation with Sydney Water and the NSW EPA.

Approach to managing other impacts

Other potential soil and contamination impacts during construction would be managed in accordance with the CEMP. The CEMP would include a Soil and Water Management Plan, which would define the processes, responsibilities and erosion and sediment control measures that would be implemented during construction (in accordance with the Blue Book). Further information on the CEMP, including requirements for the Soil and Water Management Plan, are provided in Chapter 27 (Approach to environmental management and mitigation).

Soil impacts during operation are not predicted to be significant, and therefore no specific mitigation and management measures are proposed.

Expected effectiveness

The project has minimised contamination and soil impacts as far as practicable. As described in Chapter 6, design and construction planning has included a focus on avoiding or minimising potential contamination and soil impacts. Despite this, the potential to encounter contaminated soil and groundwater during construction cannot be eliminated or avoided completely. To ensure that the potential for existing

contamination impacts are minimised, any RAP(s) and EMP(s) developed as part of the project would be reviewed and approved by a site auditor or site assessor in accordance with the CLM Act or Airports (Environment Protection) Regulations 1997.

Accredited site auditors are engaged to independently review contaminated land consultant reports to ensure the methods and interpretation of data are consistent with NSW EPA guidance. Site auditors and assessors provide increased certainty to planning authorities of the nature and extent of contamination and the suitability of a site for a specific use.

For impacts associated with soil, the erosion and sediment control measures to be implemented would be in accordance with the requirements of the Blue Book. The measures contained in the Blue Book are based on field experience and have been previously demonstrated to be effective. In general, the implementation of measures in accordance with the Blue Book would either result in a reduced potential for the impact to be realised through either the use of engineered controls (eg sediment fences, covers on stockpiles etc) or avoidance (eg not undertaking works during wet weather and minimising areas of exposed soils). Therefore, there is no reason the proposed mitigation measures should not be effective, if implemented in accordance with the Blue Book.

Audits and reporting of the effectiveness of environmental management measures employed during construction would be carried out to demonstrate compliance with management plans and other relevant approvals and would be outlined in detail in the CEMP prepared for the project.

13.6.2 List of mitigation measures

Measures that will be implemented to address potential contamination and soils impacts are listed in Table 13.9.

Measures to manage landfill gas, dust and odour impacts are provided in Chapter 12 (Air quality). Measures to manage surface water quality, potential groundwater contamination and waste, are provided in Chapters 15 (Groundwater), 16 (Surface water) and 24 (Waste management).

Table 13.9 Contamination and soils mitigation measures

Impact/issue	Ref	Mitigation measure	Timing
Investigation of data gaps and potential for unidentified asbestos containing materials	CS1	Additional soil and groundwater investigations will be undertaken to inform detailed design, construction planning, and preparation of remediation action plan(s) (RAP(s)). The investigations will include: ■ Further characterising the existing contamination status of the project site, including the potential for unidentified asbestos containing materials ■ Groundwater investigations for all assessment areas and any indirectly affected areas. ■ Soil and groundwater testing to address data gaps for land north of the rail corridor and Sydney Airport land.	Detailed design
High salinity potential	CS2	Soil salinity will be considered in the design of subsurface structures.	Detailed design
Management of contaminated sites	CS3	Where the project has the potential to affect the remediation systems in the former Tempe landfill and Sydney Airport northern lands car park, the controls and protocols outlined in the existing EMP will be implemented such that the systems continue to operate effectively during operation. A RAP (or multiple RAPs) will be prepared (as required) to describe the remediation strategy to be implemented to ensure that existing contamination does not pose a future risk to human health or the environment during operation. The RAP(s) will be prepared by a suitably qualified and experienced consultant, as defined in Schedule B9 of the *National Environment Protection (Assessment of Site Contamination) Measure 1999*.	Detailed design

Impact/issue	Ref	Mitigation measure	Timing
		The RAP(s) will be prepared and implemented in accordance with the following requirements: ■ The voluntary remediation proposal, EMP and any RAPs in place for the former Tempe landfill ■ The requirements of the existing Sydney Airport RAP and EMP (if applicable) ■ *National Environment Protection (Assessment of Site Contamination) Measure 1999* ■ Airports (Environment Protection) Regulations 1997 (for Sydney Airport land) ■ *Environmental Guidelines: Solid waste landfills* (NSW EPA, 2016a) (for reinstatement of the capping layer and/or design of the new capping layer and final road pavement at the former Tempe landfill). The RAP(s) will be: ■ Prepared in consultation with the Airport Environmental Officer and NSW EPA (as relevant) ■ For works on land subject to the EP&A Act – approved by an independent site auditor accredited under the site auditor scheme under the CLM Act ■ For works on Sydney Airport land – approved by Sydney Airport Corporation and endorsed by the Airport Environment Officer. If Sydney Airport Corporation and/or the Airport Environment Officer consider a site assessor is required, the site assessor will be nominated by the Secretary (as defined by Regulation 6.10 of the Airports (Environment Protection) Regulations 1997) and will endorse the RAP(s).	
Demolition of structures containing hazardous materials	CS4	Hazardous materials surveys will be undertaken to inform construction planning, including demolition activities and utility adjustments.	Pre-construction
Potential impacts of soil disturbance	CS5	A Construction Soil and Water Management Plan will be prepared as part of the CEMP and implemented during construction. The plan will detail processes, responsibilities and measures to manage potential soil and water quality impacts during construction, including potential impacts associated with the presence of existing contamination, stockpile management, saline soils and acid sulfate soils. The Construction Soil and Water Management Plan will be prepared in accordance with relevant guidelines and standards, including *Managing Urban Stormwater – Soils and Construction*, Volume 1 (Landcom, 2004) Volume 2B Waste landfills (DECC, 2008a) and Volume 2D (DECC, 2008b) (the Blue Book).	Pre-construction, construction
Acid sulfate soils	CS6	An Acid Sulfate Soils Management Plan will be prepared as part of the Construction Soil and Water Management Plan in accordance with the *Acid Sulfate Soils Assessment Guidelines* (ASSMAC, 1998). The plan will define the process and measures to manage actual and potential acid sulfate soil and sediment disturbed during construction. The plan will include a summary of available acid sulfate soil information relevant to the project site and identify any further soil/water analysis required as a precursor to implementing the management plan. Acid sulfate soils will be disposed off-site (where required) in accordance with the *Waste Classification Guidelines - Part 1 and Part 4: Acid sulfate soils* (NSW EPA, 2014a).	Pre-construction, construction

Impact/issue	Ref	Mitigation measure	Timing
Impacts on sediments in Alexandra Canal during construction	CS7	A plan of management will be developed in accordance with the remediation order and implemented to manage work within Alexandra Canal and minimise the disturbance and migration of contaminated sediments. The plan will identify specific methodologies to minimise disturbance and dispersion of potentially contaminated sediments. The plan will be prepared in consultation with Sydney Water Corporation and submitted for the NSW EPA's approval in accordance with the remediation order requirements.	Pre-construction, construction
Impacts on the former Tempe landfill	CS8	An assessment will be undertaken of the potential hazards associated with landfill gas during construction and operation. The assessment will consider the potential for ingress and build-up of gases that may pose a risk to safety. Where the need for measures to manage landfill gases post-construction is identified, such measures will be described in the RAP(s) (measure CS3). Measures could include the design and installation of a landfill gas management system to provide a preferential flow path for landfill gas below the road infrastructure and emplacement mounds.	Detailed design
	CS9	A settlement and slope stability analysis will be undertaken to ensure that the emplacement mounds are designed to suitable engineering standards such that the long-term stability of the capping layer is maintained. The design and construction of the emplacement mounds will be described in the RAP(s) (measure CS3) and will be in accordance with *Environmental Guidelines: Solid waste landfills* (NSW EPA, 2016a). The design will be prepared in consultation with the NSW EPA.	Detailed design
	CS10	The location of all existing landfill management infrastructure, including the bentonite wall, leachate collection system and passive gas collection system, will be confirmed and (if required) the design will be further refined to avoid impacts on this infrastructure. Measures will be developed, and included in the RAP (if required) to protect the landfill management infrastructure during construction, or reinstate the infrastructure such that it continues to operate effectively after construction is finished.	Detailed design
	CS11	The potential for settlement will be considered as part of the siting and layout of construction compounds and work areas in the former Tempe landfill. Where required, ground treatment (eg foundation layers or sheet piling) will be provided to minimise this risk.	Pre-construction, construction
	CS12	Landfill material will be appropriately handled and stockpiled, to ensure minimal impact to the surrounding community, on-site workers and the environment. Landfill waste will be managed in accordance with the requirements of *Environmental Guidelines: Solid waste landfills* (NSW EPA, 2016a). Excavated landfill waste to be disposed of will be classified in accordance with the *Waste Classification Guidelines*, Part 1: Classifying waste (NSW EPA, 2014a) before being disposed of at an appropriately licensed waste facility.	Construction
Landfill gas intrusion	CS13	Protocols to address and manage landfill gases within the construction footprint in the former Tempe landfill and Sydney Airport northern lands car park will be developed and implemented during construction. The protocols will consider confined and/or enclosed spaces and appropriate controls as required (eg. forced ventilation), and will include appropriate occupational monitoring.	Pre-construction, construction
	CS14	Hot works within the former Tempe landfill and Sydney Airport northern lands car park will be restricted where there is a potential for fire or explosion. Monitoring for potentially flammable gases will occur during all hot works.	Construction

Impact/issue	Ref	Mitigation measure	Timing
Works within Sydney Airport land	CS15	Any material imported and used within Sydney Airport land will be tested prior to use to ensure it does not exceed the acceptable limits in the PFAS National Environmental Management Plan (HEPA, 2018) and Schedule 3 of the Airports (Environment Protection) Regulations 1997.	Construction
Stockpile management and handling	CS16	Storage and containment systems for the stockpiling of contaminated material during construction will be designed to be impervious to the materials stored, resistant to fire (where required), covered to prevent contact with rainfall, and managed and maintained to prevent any release of liquids and contaminated run-off to stormwater drains, waters and land.	Pre-construction, construction
Management of previously unidentified contaminated material	CS17	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated finds procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime, 2013b) and detailed in the CEMP. Awareness training will be provided for all on-site staff to assist in the identification of potentially contaminated material as per the unexpected contaminated finds procedure. In the event that unexpected indicators of contamination are encountered during construction (such as odours or visually contaminated materials), work in the area will cease, and the finds will be managed in accordance with the unexpected contaminated finds procedure.	Construction
PFAS impacted soil and groundwater	CS18	PFAS contaminated materials will be managed in accordance with the risk-based framework presented in the *PFAS National Environmental Management Plan* (HEPA, 2018). If soil and/or water containing PFAS is proposed for reuse, the proposed reuse must not result in an unacceptable or increased risk to human health and/or the environment. A health and environmental risk assessment and consultation with the NSW EPA (and the Airport Environment Officer where the works are on Sydney Airport land) will be required before any reuse of PFAS contaminated soil and/or water.	Construction
Remediation/ management of existing contamination	CS19	Validation of remediation will be undertaken during construction and a validation report prepared by a suitably qualified environmental consultant as defined in Schedule B9 of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* to confirm the requirements of the RAP(s) have been met. For works on land subject to the EP&A Act, the validation report will be reviewed by a site auditor accredited in accordance with the site auditor scheme under the CLM Act. For works on Sydney Airport land, Sydney Airport Corporation and the Airport Environmental Officer will review the report.	Construction
	CS20	The requirements for ongoing monitoring and maintenance of any installed or reinstated remediation systems will be documented in EMP(s) prepared for the respective areas. The EMP(s) will be prepared and implemented in accordance with the following requirements: ■ The voluntary remediation proposal, EMP and any RAPs in place for the former Tempe landfill, including requirements for ongoing gas monitoring ■ The requirements of the Sydney Airport RAP and EMP (if applicable) ■ *National Environment Protection (Assessment of Site Contamination) Measure 1999* ■ *Environmental Guidelines: Solid waste landfills* (NSW EPA, 2016a) (for reinstatement of the capping layer and/or design of the new capping layer and final road pavement at the former Tempe landfill).	Operation

Impact/issue	Ref	Mitigation measure	Timing
		The EMP(s) will be: ■ Prepared in consultation with the Airport Environmental Officer and NSW EPA (as relevant) ■ For works on land subject to the EP&A Act – approved by an independent site auditor accredited under the site auditor scheme under the CLM Act ■ For works on Sydney Airport land – approved by Sydney Airport Corporation and endorsed by the Airport Environment Officer. Following implementation and validation of the RAP(s) (if required by the existing EMP), and approval of the EMP(s), the site auditor will prepare a Site Audit Statement confirming the suitability of the project site for the proposed development (for works on land subject to the EP&A Act). For works on Sydney Airport land, the Airport Environmental Officer will confirm the objectives of the remediation have been met.	
Erosion impacts post construction	CS21	A rehabilitation strategy will be prepared to guide the approach to rehabilitation of disturbed areas following the completion of construction.	Pre-construction, construction
Contamination during operation	CS22	Spills and leaks of vehicles or maintenance plant and equipment will be managed in accordance with Roads and Maritime's standard operating procedures.	Operation
	CS23	Ongoing management measures will be implemented for any areas where contamination remains following construction, and has the potential to cause an ongoing risk to maintenance works, the community and/or the receiving environment. These management measures will be documented in the EMP(s).	Operation

13.6.3 Managing residual impacts

Residual impacts are impacts of the project that may remain after implementation of:

- Design measures to avoid and minimise impacts (see sections 6.4 and 6.5)
- Construction planning and management approaches to avoid and minimise impacts (see sections 6.4 and 6.5)
- Specific measures to mitigate and manage identified potential impacts (see section 13.6.2).

As described in section 13.2.5 there is existing contamination throughout the project site. The project also has the potential to cause additional issues through the proposed management of existing contamination (eg the emplacement mounds) and where there are existing remediation systems present. However, through implementation and validation of the RAP(s) and ongoing implementation of the EMP(s), where required, any residual risks associated with the presence of existing contamination are expected to be minimal.