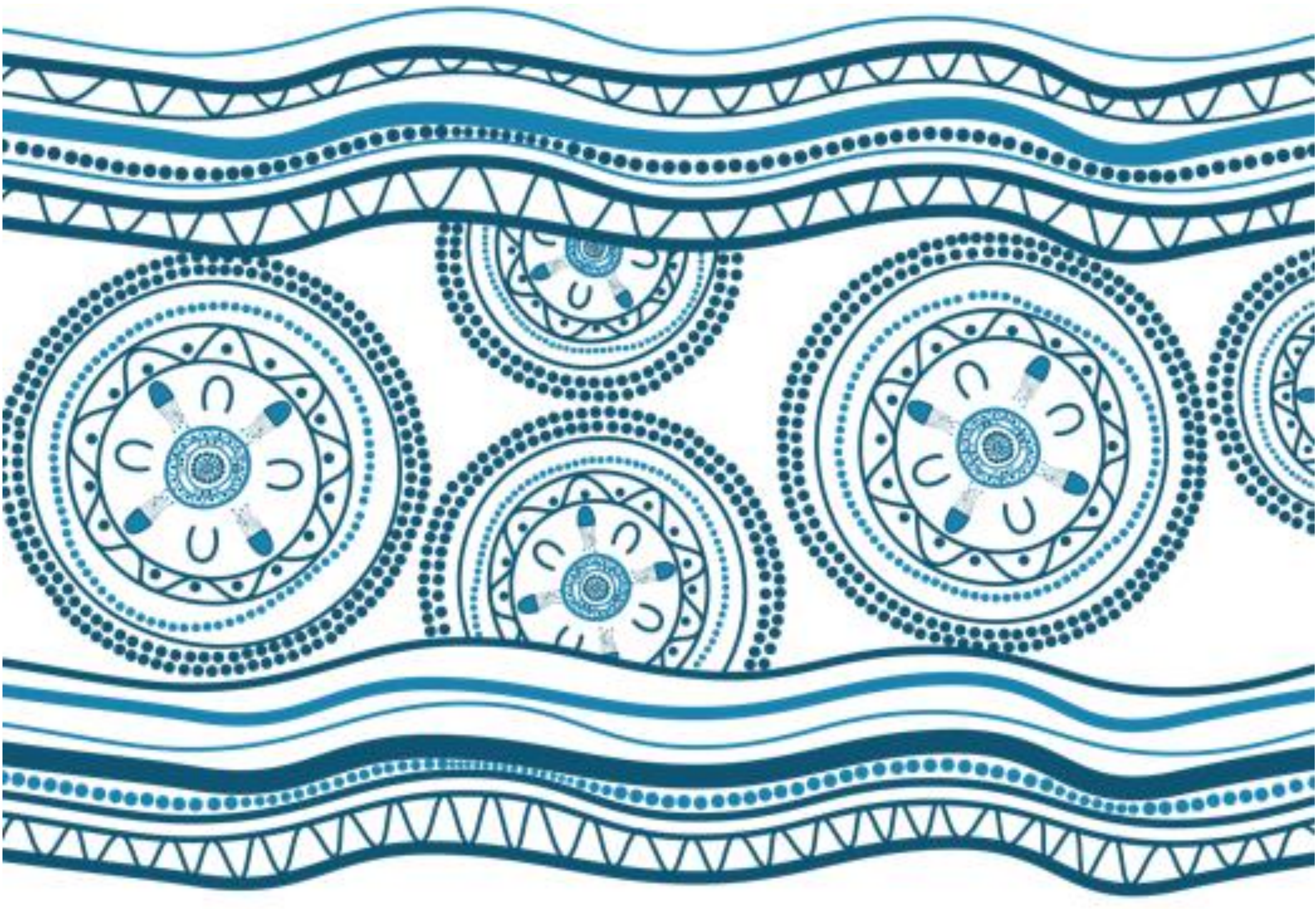
Chapter 17

Soil, water and contamination



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17 Soil, water and contamination

This chapter presents an assessment of the impacts of the project on soil, water (including groundwater, surface water and marine water) and contamination and identifies mitigation and management measures to minimise and reduce these impacts.

The assessment presented in this chapter draws on information from Appendix Q (Targeted Site Investigation), Appendix Q1 (Preliminary Site Investigation - La Perouse), Appendix Q2 (Preliminary Site Investigation – Kurnell), Appendix R (Groundwater Assessment Report) and Appendix S (Surface Water Assessment Report).

17.1 Assessment methodology

The methodology for the soil, water and contamination assessment involved:

- A desktop study of the existing groundwater, surface water and marine water conditions and sensitive receiving environments and water users.
- A Preliminary Site Investigation (PSI) which included a desktop review of publicly available information and the development of a conceptual site model (CSM). This identified past and present potentially contaminating activities and land uses by looking at historical aerial imagery, publicly registered contaminated areas, zoning, etc.
- A site inspection to validate the information within the PSI and to identify any other potential areas of contamination.
- A Targeted Site Investigation (TSI) which included marine and landside sediment sampling and analysis of these samples to identify existing contaminants and the development of CSM. This testing was carried out in parallel to the geotechnical site investigations. Therefore, there were a limited number of soil and sediment samples collected which limited the ability to classify contaminants for waste classification purposes.
- An assessment of the project impacts on soil disturbance and sediment mobilisation based on the extent of construction works required, distance from potentially contaminated areas, soil characteristics, and nearby sensitive receivers.
- An assessment of the likely impacts to water quality and quantity from construction and operation of the project.
- Recommendation of mitigation measures to avoid and/or minimise potential impacts.

The project would require minimal land disturbance (only excavating about 4,390 cubic metres at La Perouse and 2,723 cubic metres at Kurnell) and would result in limited changes to the existing topography or creation of new impervious surfaces. There is limited potential for interaction with groundwater and there are no nearby surface water courses which would be affected (excluding marine waters of Botany Bay). Due to the limited potential impact, it was determined that no flood modelling or groundwater monitoring would be carried out for this project.

The construction and operation of the project would not require a high level of water use (refer to Chapter 5 (Project description). While the project aims to conserve water, a detailed water balance assessment was not carried out.

17.1.1 Policy framework

The following policies and guidelines were considered for this assessment:

Soil and contamination

- *Contaminated Land Management Act 1997* (NSW) (CLM Act)
- *Protection of the Environment Operations Act 1997* (NSW) (POEO Act)
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEMP) (as amended May 2013) (Australian Government, 2013)
- State Environmental Planning Policy No. 55 – Remediation of Land (NSW Government, 2020b)
- Acid Sulfate Soils Manual (Acid Sulfate Soils Management Advisory Committee, 1998).

Water

- *Water Management Act 2000* (NSW)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Online resource) (Australian and New Zealand Governments, 2018)
- Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australian and New Zealand (ARMCANZ), 2000)
- NSW Water Quality and River Flow Objectives (NSW Government, 2006)
- Flood Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments (NSW Department of Environment, Climate Change and Water (DECCW), 2010c)
- Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004)
- Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions (NSW Office of Environment and Heritage and Environment Protection Authority, 2017).

As dredging would not be undertaken as part of the project, the National Assessment Guidelines for Dredging (Commonwealth of Australia, 2009) as identified in the SEARs have not be considered for this assessment.

17.2 Existing environment

17.2.1 Topography and bathymetry

The highest point within the La Perouse construction boundary is about 13.5 metres above sea level (near the Macquarie Watchtower). The ground gradually slopes to the west, south and east, and drops off the steep rocky cliffs towards the shoreline.

The topography within the Kurnell construction boundary is generally open and flat. The land gently slopes from around two to three metres above sea level to the shoreline. The area to the east of the construction boundary, near the Kurnell Visitor Centre, slopes steeply up to 16 metres above sea level.

Botany Bay has a catchment of approximately 55 square kilometres and is relatively shallow, with most of Botany Bay being less than five metres deep, except for the navigation channel which runs between Port Botany, the Kurnell Port and Berthing Facility and the harbour entrance. Botany Bay is fed by Georges River from the west and Cooks River from the north, and tidal flow. The nearshore environment at La Perouse and Kurnell are tidally affected.

17.2.2 Geological and soil characteristics

The geology in the La Perouse and Kurnell project areas is comprised of Hawkesbury Sandstone with some quaternary and marine sediments along the foreshore. Hawkesbury Sandstone is a sandstone rock comprising fine to coarse sand with quartz, shale and laminite lenses. In particular:

- At terrestrial surface weathering likely results in residual soils
- Along the foreshore, sandy beach deposits can be expected
- In the marine environment, the sandstone is overlain by sandy/silty marine sediments with shell fragments.

The soils at both La Perouse and Kurnell are prone to erosion. This can lead to sediment runoff and the generation of wind-blown dust. The impact from dust generation is assessed in Chapter 20 (Air quality).

Test pits carried out within the project footprint in November 2020 encountered bedrock between 0.8 and 1.3 metres at La Perouse and 0.8 to 1.1 metres at Kurnell.

17.2.3 Groundwater

Aquifers and groundwater levels

The project is within the Sydney Basin Central Groundwater Source, part of the Greater Metropolitan Region Groundwater Sources Water Sharing Plan (NSW Government, 2015).

The project areas at both La Perouse and Kurnell are underlain by two aquifer systems:

- An unconfined aquifer associated with the unconsolidated coastal sands of the Botany Sands aquifer
- An unconfined to regionally semi-confined aquifer associated with the underlying Hawkesbury Sandstone aquifer.

There is likely a hydraulic connection between the two aquifers.

The Hawkesbury Sandstone aquifer is unconfined/semi-confined. This means that it is partly overlain by rock that has a low permeability and water can slowly pass through the rock to recharge the aquifer. Groundwater takes longer to replenish and recharge, and the flow rate is expected to be low (around 0.001 metres per day) (Hatley, 2004).

The Botany Sands aquifer is unconfined. This means that it is overlain by permeable rock which allows it to replenish and discharge quickly. Groundwater will rise and fall quickly following rainfall. Water levels within the Botany Sands aquifer generally follow the topography of the land, sloping towards Botany Bay. The groundwater flow rate within this aquifer is also expected to be relatively high (up to 85 metres per day) (Hatley, 2004). Groundwater levels within the Kurnell construction boundary are expected to be close to the surface due to it being located close to sea level.

Both aquifers are recharged from a combination of direct precipitation, pervious areas, and leakages from utilities and services in the urban areas. The unconfined nature of these aquifers also indicates that they are likely to have some connectivity with marine water near coastal areas.

Groundwater quality

The groundwater within the project has the potential to be saline, particularly in the submerged and intertidal zones (area where the water meets the land between high and low tide). This is due to the hydraulic connection with the saltwater of Botany Bay which allows for freshwater to mix with the dense saline water.

The Botany Sands aquifer is known to be contaminated with chlorinated hydrocarbons due to the permeability of the sands, shallowness of the aquifer and history of industrial activities within the aquifer catchment. The groundwater would be polluted above the ANZECC guidelines (ANZECC and ARMCANZ, 2000). The Botany Sands aquifer is divided into four management zones to manage groundwater use for the aquifer. The La Perouse project area is partially within Zone 4, where all domestic groundwater use is banned.

As outlined in section 17.2.6**,** there are industrial activities located near the project areas, which historically have contributed to reduced groundwater quality in the area.

Groundwater users

There are seven existing groundwater boreholes within one kilometre of the La Perouse construction boundary, the nearest being 500 metres to the north of the proposed wharf (see Figure 17-1). There are 98 groundwater boreholes within one kilometre of the Kurnell construction boundary, the nearest being 450 metres to the southwest of the proposed wharf (see Figure 17-2). Most of these groundwater boreholes are within the Botany Sands aquifer and are used for monitoring, domestic, industrial or licenced water supply purposes.

There is currently a ban on domestic groundwater use around La Perouse as well as a ban on new applications for licences to extract groundwater from the Botany Sands aquifer due to contamination of underground water from past land uses/industries (NSW Government 2003; NSW Government, 2007b).

Groundwater Dependent Ecosystems

A preliminary desktop review of the Groundwater Dependent Ecosystems (GDE) Atlas (Australian Government Bureau of Meteorology, 2020a) indicates the potential for GDEs within the Kurnell project area, but outside of the construction boundary to the south and southeast (refer to section 3.4 of Appendix I (Biodiversity Development Assessment Report)). This ecosystem is the Coastal Sand Forest which relies on groundwater near the surface, as associated with the Hawksbury Sandstone aquifer. There are no GDE's mapped in the La Perouse project area.

17.2.4 Landside surface water

There are no freshwater rivers or streams within the construction boundaries. The closest watercourse is known as Captain Cooks Stream (about 200 metres northeast of the Kurnell construction boundary) which only flows during and shortly after rainfall. The Cooks River is about eight kilometres west of Kurnell and Georges Rivers is about 6.7 kilometres northwest of Kurnell.

Flooding

A preliminary topographical assessment was carried out to identify any potential flooding/drainage risk near the project. At La Perouse, the headland is located well above the normal and extreme tidal levels. There are no depressions within the construction boundary that are likely to accumulate high flow rates during rainfall. Water from rainfall would likely flow over the land in shallow sheet flow until it is intercepted by man-made infrastructure.

At Kurnell, the low elevation means the area has potential to be affected by tidal flooding. Sutherland Shire Council completed a flood study for Kurnell in 2009 (WMAwater, 2009). This identified that the Kurnell suburb would be at risk of flooding from rainfall runoff and tidal inundation. The results presented in the flood study show shallow flooding up to a depth of 250 millimetres at Captain Cook Drive (next to the construction boundary) in the 20 per cent Average Exceedance Probability (AEP) event. Flood depths are shown to exceed 250 millimetres and 500 millimetres along the eastern kerb line of Captain Cook Drive in the five per cent AEP and one per cent AEP flood events respectively. The flood study did not extend beyond Captain Cook Drive into the Kamay Botany Bay National Park. As there are no natural depressions within the remainder of the construction footprint, it is expected that stormwater runoff would be in the form of shallow sheet flow and would permeate through grassed areas.

Existing drainage

Natural overland flow paths at La Perouse would be intercepted by Anzac Parade and associated drainage infrastructure. Stormwater drainage consists of kerb inlet pits and surface drains along Anzac Parade, which discharge directly into Botany Bay.

The stormwater drainage at Kurnell also consists of kerb inlet pits along Captain Cook Drive, which are likely to discharge directly to Silver Beach. There is no subsurface drainage infrastructure along Monument Track, so rain falling on this footpath would run off onto nearby grassed areas.

Figure 17-1: Nearest groundwater users at La Perouse

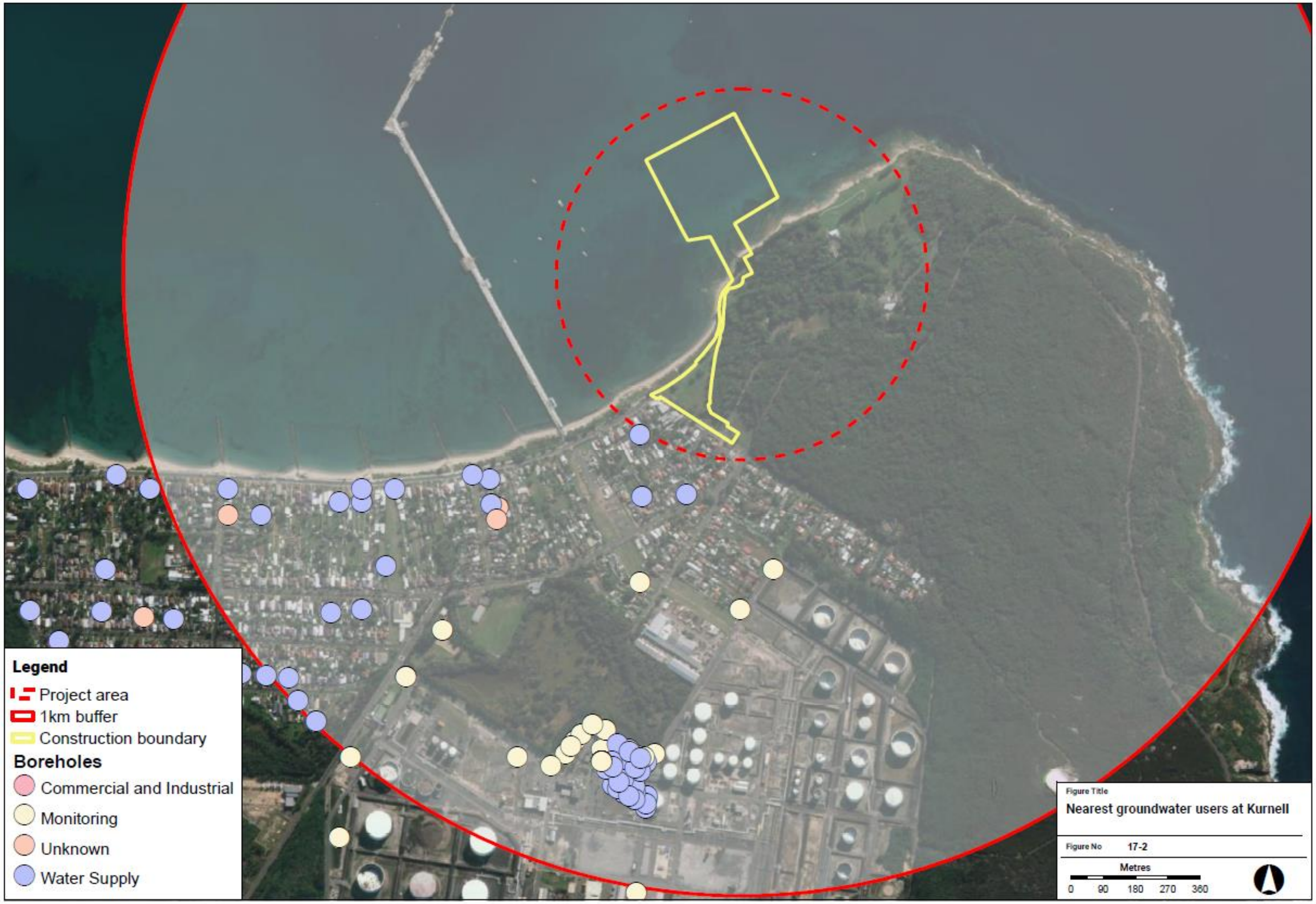

Figure 17-2: Nearest groundwater users at Kurnell

17.2.5 Marine water

Botany Bay is used by a variety of commercial and recreational users for fishing, swimming and boating. Refer to Chapter 14 (Socioeconomic) for further details on Botany Bay users. There are no aquiculture users near the construction boundaries. The closest is located at Quibray Bay which is about 1.5 kilometres west of Kurnell.

Botany Bay has important habitat areas of saltmarsh, seagrass and mangroves, particularly around Towra Point Wetland (refer Chapter 10 (Marine biodiversity) for details of habitats and species in Botany Bay).

Water quality

The quality of the water in Botany Bay is influenced by runoff from Cooks River, Georges River and other smaller tributaries in the Botany Bay catchment. Around 40 per cent of the water catchment is used for residential, industrial and commercial purposes, with the remainder from parkland/bushland.

The project is within the estuary component of the Georges catchment for the Water Quality and River Flow Objectives (NSW Government, 2006). The following objectives apply:

- Aquatic ecosystems – maintaining or improving the ecological condition of waterbodies and their riparian zones over the long term
- Visual amenity – aesthetic qualities of waters
- Secondary contact recreation – maintaining or improving water quality for activities such as boating and wading, where there is a low probability of water being swallowed
- Primary contact recreation – maintaining or improving water quality for activities such as swimming in which there is a high probability of water being swallowed
- Aquatic foods (cooked) - refers to protecting water quality so that it is suitable for the production of aquatic foods for human consumption and aquaculture activities.

Water quality monitoring at 15 beaches within Botany Bay is undertaken by the Department of Industry, Planning and Environment (DPIE) weekly between October and April, and monthly between May and September. In 2019 to 2020 about 93 per cent of Botany Bay and lower Georges River swimming sites were graded as 'Good' in terms of water quality, which means the location has "generally good microbial water quality and water is considered suitable for swimming most of the time". This was an improvement from 80 per cent which was recorded in 2018-2019 (NSW DPIE, 2020g).

In 2012 modelling was undertaken at Kurnell to understand the potential dispersion of dissolved tributyltin (TBT) within the water column if marine sediments were disturbed (Cardno, 2012). TBT is a chemical substance that is toxic to marine ecology and human health. Its use was banned in 2003, however it is still possible that paint used on vessels/ships hulls prior to this, contained TBT as an antifouling agent. The study found that the sediments in Botany Bay have concentrations of TBT and exceed the water quality limits outlined in the Guidelines for Fresh and Marine Water Quality 2000 (ANZECC & ARMCANZ, 2000).

Suspended sediment concentrations in Botany Bay vary due to fluvial and oceanic conditions. Average sediment concentrations across Botany Bay were recorded at five milligrams per litre during calm conditions and 25 milligrams per litre after heavy rainfall (Cardno, 2012).

17.2.6 Sources of contamination

This section describes the potential sources of existing contamination around the project area.

Historical onsite and surrounding land uses

Botany Bay has a history of industrial activities which are potential sources of contamination for soils, groundwater and the marine waters of Botany Bay. The Botany Sands aquifer is known to be contaminated, and there are groundwater extraction exclusions at La Perouse.

There is potential for contamination at La Perouse associated with the use and storage of equipment from the former sand mining undertaken within Frenchmans Bay (about 85 metres north of the La Perouse construction boundary). Bare Island located about 230 metres southwest of the La Perouse construction boundary may also contain contaminated material due to its former use as a military fort and fortification facility.

At Kurnell, there are nearby industrial activities which are known sources of contamination. The Kurnell Port and Berthing Facility is located about 300 metres south of the Kurnell construction boundary and is currently regulated by the NSW Environment Protection Authority. It was previously a crude oil refinery, but was converted to a fuel supply terminal in 2014 (Caltex, n.d.). The associated Kurnell Terminal Wharf located about 200 metres west of the Kurnell construction boundary is used for large shipping vessels.

The potential contaminants resulting from historical and surrounding land uses include; Per and Polyfluoroalkyl Substance (PFAS), Tributyltin (TBT), acid sulfate soils (ASS), ethylbenzene and xylenes (BTEX), semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), heavy metals, nutrients and inorganics.

Figure 17-3: Potential contaminated areas at La Perouse

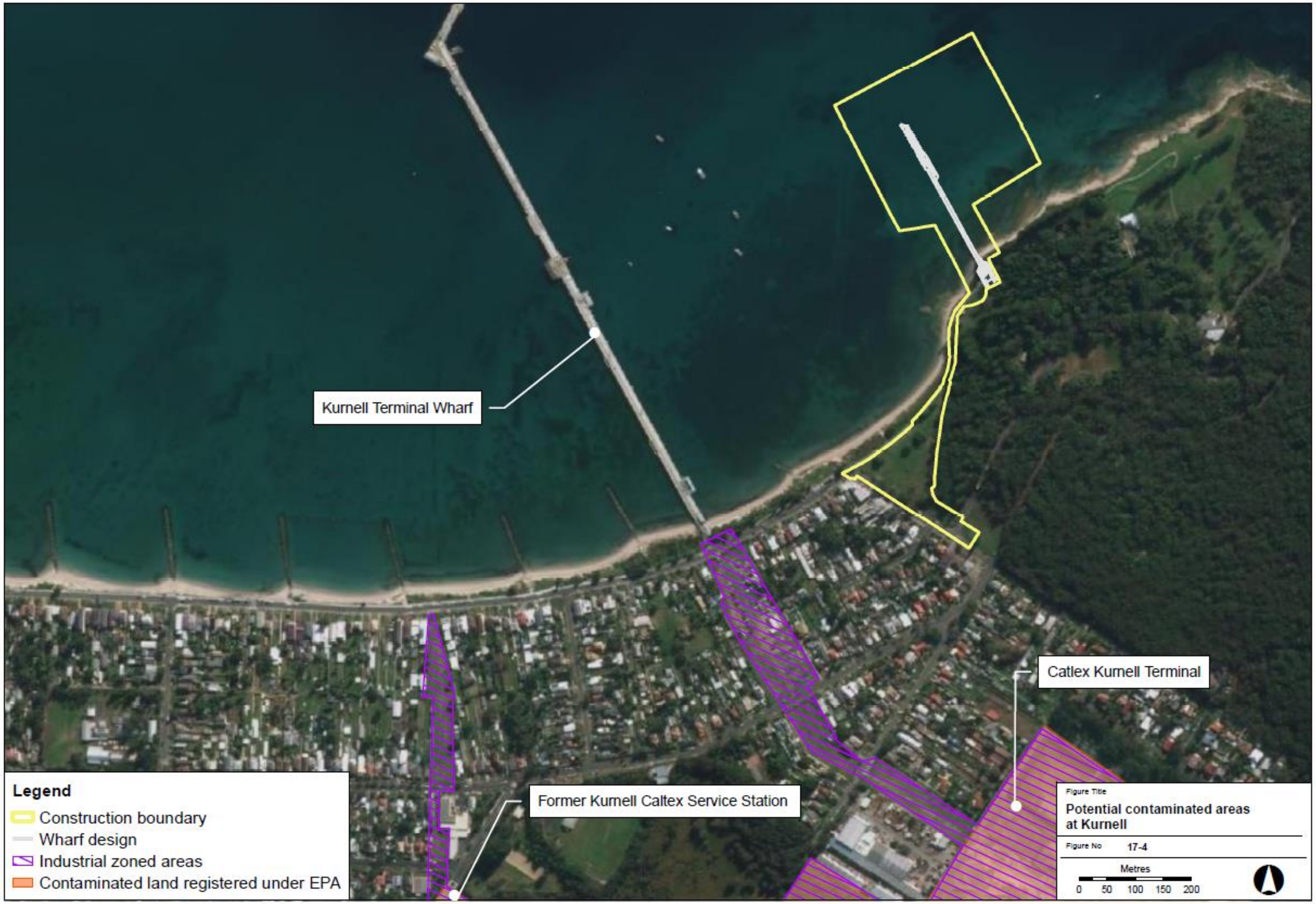

Figure 17-4: Potential contaminated areas at Kurnell

Acid sulfate soils

Acid sulfate soils (ASS) are sediment deposits that contain iron bearing sulphides and create sulfuric acid when disturbed and exposed to oxygen. The Atlas of Australian Acid Sulfate Soils by the Commonwealth Scientific and Industrial Resource Organisation (CSIRO) and the National Committee for Acid Sulfate Soils maps the probability of ASS occurrence. This ranges from high probability (greater than 70 per cent chance), low probability (six to 70 per cent chance), extremely low probability (one to five per cent chance), and no probability of occurrence (less than one per cent chance)[1].

As shown in Figure 17-5 and Figure 17-6, the marine sediments within Botany Bay have a high probability of encountering ASS. On land, the La Perouse project area has an extremely low probability of encountering ASS, while the Kurnell project area has a low to extremely low probability.

[1] The ASS Planning Maps classify the risk of encountering ASS using a Class 1 to 5 scale. A high probability occurrence is roughly equivalent to Class 1 and 2, low probability equivalent to Class 3 and 4, and an extremely low probability equivalent to Class 5.

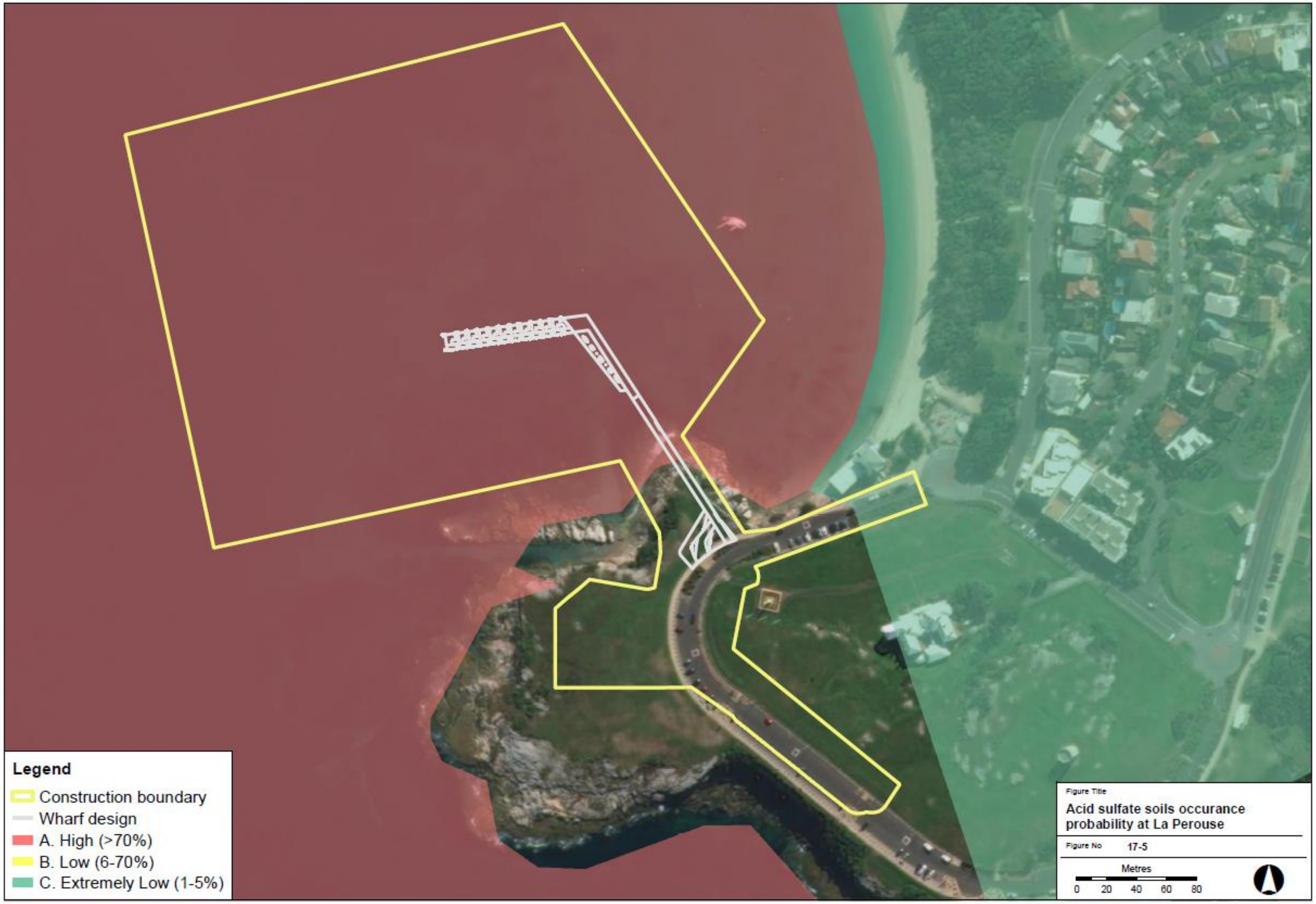

Figure 17-5: ASS occurrence probability at La Perouse

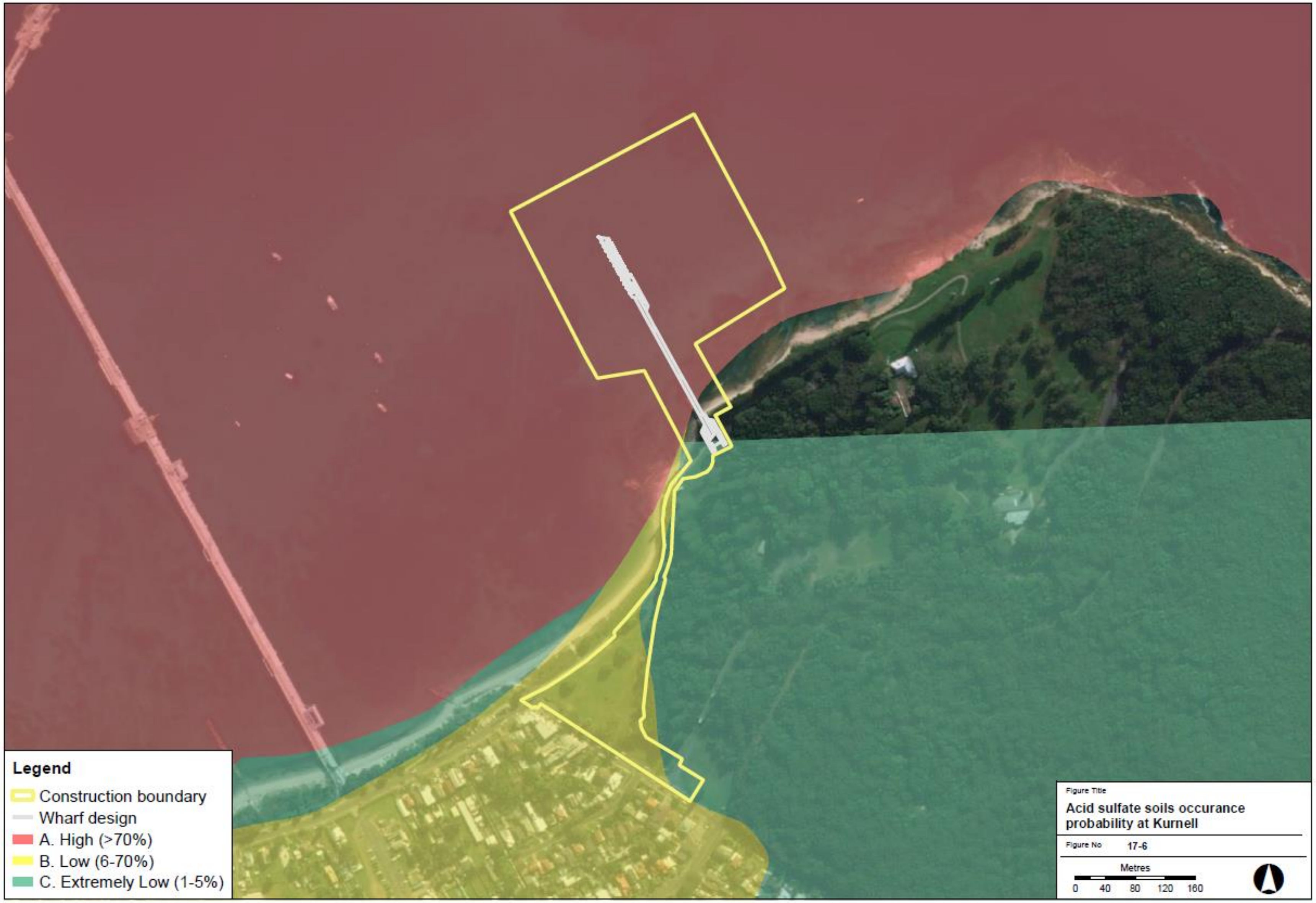

Figure 17-6: ASS occurrence probability at Kurnell

Per and Polyfluoroalkyl Substance (PFAS) investigations

PFAS are man-made chemicals that resist heat, oil, stains and water and have been used in applications such as firefighting foam. These chemicals do not break down and will accumulate in the environment and/or human body over time. While there is currently no consistent evidence to show that PFAS is harmful to humans, studies have shown that they can be toxic to fish and some animals (Australian Health Protection Principal Committee, 2016; Australian Government Department of Health, 2020; and NSW Government Environmental Health, 2017).

PFAS has been detected in soil and water samples near the project area. Sampling at the Kurnell Port and Berthing Facility (300 metres to the south of the Kurnell construction boundary) detected PFAS from the historic use of firefighting foam. PFAS was detected in samples across Botany Bay as part of a State-wide PFAS investigation program, however due to the number of potential sources of PFAS in the area, it makes it difficult to attribute detections to individual sources.

Test excavations carried out within the La Perouse and Kurnell construction boundaries identified PFAS in two soil samples at La Perouse, but none at Kurnell. Both positive samples were below the adopted assessment criteria and are likely to be isolated occurrences from imported fill material rather than from site wide contamination. PFAS was not identified within the marine sediment samples.

Due to PFAS having been identified in fish species in Botany Bay, the Department to Primary Industries advises people to limit the number of servings of individual species consumed.

EPA contaminated land records

The NSW EPA contaminated land database identifies sites that have been notified under section 60 of the CLM Act. A search of this database was carried out which identified two registered sites:

- The Kurnell Port and Berthing Facility (Site ID number 3200) at 2 Solander Street. This site is 300 metres south of the Kurnell construction boundary. The known contamination is currently regulated by a licence under the POEO Act.
- Former Kurnell Caltex Service Station on the Corner of Captain Cook Drive and Solander Street. This site is 850 metres south of the Kurnell construction boundary. Regulation under the CLM Act is not required.

The database search did not show any registered sites within one kilometre of the La Perouse project area.

National Pollutant Inventory (NPI)

The NPI provides information on emission estimates for 93 toxic substances and locations for where these emissions occur. The Kurnell Port and Berthing Facility was the only site within a 500 metre radius of the project area that was registered in the NPI. This is for petroleum refining and manufacturing.

Licensed activities

The POEO Act includes environment protection licence (EPL) requirements for certain activities to control localised, cumulative and acute pollution impacts in NSW. There is only one site licenced under the POEO Act within a 500 metres radius of the project area. This is the Kurnell Port and Berthing Facility Terminal[2] (EPL number 837), who hold a licence for chemical storage waste generation, petroleum products storage, and shipping in bulk.

There are five surrendered licences under the POEO Act within a one kilometre radius of the Kurnell project area. While these licences have been surrendered, they are still regulated by the EPA. They are for mostly licences for discharging to water and water based extractive activities. One of these surrendered licences is within the Kurnell construction boundary owned by Ausgrid

[2] Referred to as ‘Caltex Refineries (NSW) Pty Ltd in the PSI

(licence number 13112). There are 11 clean-up and penalty notices which have been issued under the POEO Act within a one kilometre radius of the project area. All of these relate to the Kurnell Port and Berthing Facility Terminal[3].

There are no clean-up or penalty notices issued under the POEO Act within one kilometre radius of the La Perouse project area.

Unexploded Ordnance Area

An area of Botany Bay about 170 metres southeast of the La Perouse construction boundary in Congwong Bay is mapped as a potential unexploded ordnance area (UXO) as a result of mortar shooting by the Australian Department of Defence during World War II (see Figure 17-3).

Uncontrolled fill

There is potential for uncontrolled fill materials to have been imported to the project area from unknown sources during the construction of roadways (eg Anzac Parade and Captain Cook Drive) and from nearby industrial sites. This uncontrolled fill material is associated with current and historical built structures and nearby industrial sites. These may include the following contaminants:

- Asbestos
- Total recoverable hydrocarbons (TRH)
- Benzene
- Toluene
- BTEX
- SVOCs
- VOCs
- Heavy metals
- Polycyclic aromatic hydrocarbons (PAHs)
- Phenols
- Organochlorine pesticides (OCP)/Organophosphorus pesticides (OPP).

Hazardous building material

No evidence of illegal dumping was noted during the site inspection, however there is potential for historically dumped waste materials and/or hazardous building materials to occur within the study area based on the historical uses of the project area and the surrounding land uses. These waste materials could include asbestos, polychlorinated biphenyls (PCBs) and lead which have the potential to impact human health if it is touched, inhaled and/or ingested.

Asbestos

Test excavations carried out in November 2020 identified Asbestos Containing Materials (ACM) within fill materials in several locations onshore in both the La Perouse and Kurnell construction boundaries. At La Perouse, ACM was identified at the wharf tie-in area and the proposed car parking site, while at Kurnell ACM was identified near Captain Cook Drive where the proposed utilities trench is located (see Figure 17-7 and Figure 17-8).

Laboratory results identified that asbestos was bonded (asbestos fibres are bonded with another material and cannot be crumbled, pulverised or reduced to a powder by hand pressure when dry) with no asbestos fibres identified within the collected samples.

Laboratory test results

Laboratory testing was carried out for soil and marine sediment samples taken in October and November 2020. Table 17-1 summarises the contaminants identified in this analysis. Note that other contaminants of potential concern (CoPCs) were tested for but not identified in the laboratory analysis. However, this may be due to the limited number of samples collected and the reduced sample volumes. Therefore, there may be some unexpected contaminants that were not identified in the analysis.

[3] Referred to as the 'Caltex Refinery' in the PSI

Table 17-1: Contaminants identified in laboratory analysis

Contaminant	La Perouse	Kurnell	Concentration
Landside soil			
Asbestos	✓	✓	ACM was identified in fill material at several locations in La Perouse and Kurnell.
PFAS	✓	×	Above the level of reporting but below the adopted assessment criteria (see section 7.1 of Appendix Q (Targeted Site Investigation) for assessment criteria).
Total Recoverable Hydrocarbons (TRH) C^{10}-C^{40}	✓	✓	Ranged between 140mg/kg to 700mg/kg Above the level of reporting but below the adopted screening criteria of 3300mg/kg. One of the sample locations returned a concentration of 6000 mg/kg but this is expected to be associated with historical road base materials and not indicative of significant or widespread anthropogenic contamination.
Benzo[a]Pyrene	✓	×	Above the hazardous waste classification criteria in one sample. However, this is likely associated with historical road infrastructure (bitumen) and not indicative of significant contamination.
Nickel	×	×	-
Monobutyltin (MBT)	Not tested	Not tested	This contaminant would only occur in the marine environment due to its historic use in protecting vessel hulls prior to its ban in 1991.
Several Organochlorine Pesticides	×	×	-
Marine sediment			
Asbestos	×	×	-
PFAS	×	×	-
Total Recoverable Hydrocarbons (TRH) C^{10}-C^{40}	×	×	-
Benzo[a]Pyrene	Not tested	Not tested	Unlikely to be present
Nickel	×	✓	Above the adopted screening criteria in one sample at Kurnell. However, this is likely to be indicative of natural/background concentrations.
Monobutyltin (MBT)	✓	✓	Ranged between 0.75 mg/kg to 3.8 mg/kg. Above the level of reporting. There is no screening criteria for MBT, however based on the depth of the sample (3.5 metres below ground level) this is likely to represent natural/background concentrations and not indicative of widespread and/or significant anthropogenic contamination.
Several Organochlorine Pesticides	Potentially	Potentially	Organochlorine pesticides were not detected onsite; however, the level of reporting was above the screening criteria. Therefore, it is possible that contaminants exceed this criterion. However, this is unlikely.

17.2.7 Potential receptors

People, ecology and the environment can be sensitive to certain contaminants. Receptors in the project area may include:

- People on site during construction, nearby recreational park users, adjacent residential and commercial receivers
- Groundwater users near the project areas
- Marine water of Botany Bay
- Groundwater within the underlying aquifers
- Native flora and fauna within the project areas (outlined in Chapter 10 (Marine biodiversity) and Chapter 11 (Terrestrial biodiversity)).

Figure 17-7: Testing sites and identified asbestos containing material (ACM) at La Perouse

Figure 17-8: Testing sites and identified asbestos containing material at Kurnell

17.3 Assessment of potential impacts

This section assesses the potential impacts from construction and operation of the project on soil, water and contamination. The SEARs also require an assessment of wastewater. Wastewater during construction would occur from the use temporary ablution blocks. The wastewater from these ablution blocks would be managed as liquid waste and disposed of at a licenced facility as discussed in Chapter 23 (Waste). There are no wastewater utilities proposed to be upgraded or installed as part of the operation of the project.

17.3.1 Erosion and sediment runoff

As outlined in section 17.2.2, the soils within the project area at both La Perouse and Kurnell are prone to erosion. Excavation required during construction would increase the risk of erosion. This could potentially impact environmentally sensitive receivers, water quality and human health through the generation of dust and sediment runoff. Due to the limited scale of the proposed soil disturbance and the relatively flat topography of the area, the risk of erosion and sedimentation during construction is considered to be low. The construction works would be staged over a 13 month period, therefore limiting the amount of soil disturbed at any one time. Any excavation and soil disturbance would be managed by an Erosion and Sediment Control Plan as outlined in section 17.4.

The impact on ecological sensitive receivers is assessed in Chapter 10 (Marine biodiversity) and Chapter 11 (Terrestrial biodiversity). Impacts to human health from dust are also discussed in Chapter 20 (Air quality).

17.3.2 Groundwater impacts

Groundwater levels, flow and connectivity

The construction of the wharves would involve the installation of piles into bedrock in the intertidal area and marine water. It is possible that this piling would encounter groundwater. The piles would be between 400 to 900 millimetres in diameter and there would be about 50 piles required at each wharf. Therefore, due to the limited size and number of piles, the impacts to flow and displacement of groundwater in the underlying aquifers would be localised and minor.

The piles installed offshore would penetrate through the seabed sand sheet deposits and intersect with the groundwater. This could cause a temporary connection between the marine water and groundwater, leading to a possible reduction in water quality for shallow groundwater. This impact is expected to be minor as it would be localised around the piles and is unlikely to significantly alter the groundwater chemistry of the aquifer. The proposed piling methods are likely to be driven tubular steel piles in soil, and bored concrete piles in the rock below. This would form a tight interface minimising the mixing between marine and groundwater and therefore reducing the potential impact to groundwater quality.

On land, groundwater is expected to flow towards Botany Bay and be close to the surface. Piling may act as barriers to groundwater flow and could cause localised changes to groundwater levels and flow direction. These impacts would be minor as they would be limited to the area surrounding the works and are unlikely to impact the wider aquifer.

The excavation required during installation of car parking reconfiguration at La Perouse and utilities at both sites may encounter shallow groundwater levels, particularly where the aquifer is unconfined. Excavations would be shallow and only reach a maximum depth of 900 millimetres. If groundwater is encountered, this would be removed, tested for water quality and discharged appropriately in accordance with a Soil and Water Management Plan. The impacts on groundwater flow and direction would be localised to the excavation areas, and drawdown impacts are not anticipated due the limited scale of the excavations and temporary nature of the works.

Groundwater quality

The Botany Bay Sands aquifer is known to have elevated levels of contaminants. If the piling works intercept this aquifer, it could create connectivity between different groundwater aquifers and cause cross-contamination or saline intrusion. The works are limited in duration and scale; therefore, any cross-contamination of groundwater is not expected to change the groundwater quality to a measurable extent considering the large size of the aquifers. As such, no specific mitigation is required.

It is possible that any groundwater encountered during excavations could be contaminated (this is assessed below in section 17.3.5). Any groundwater encountered would be stored, tested and disposed of appropriately in accordance with a Soil and Water Management Plan. This would prevent any cross-contamination of groundwater into surface water or marine water.

Groundwater users

Excavation for car parking and the utilities at La Perouse would be located at least one kilometre away from the closest water supply bore at La Perouse. Due to this separation distance, there would be no impacts to groundwater availability for groundwater users at La Perouse.

The closest borehole to the excavation activities and the utilities at Kurnell is about 100 metres away and most boreholes are located at a higher hydraulic gradient from the project area. Given the shallow nature of the works, there would be no impact to groundwater flow or availability for other groundwater users.

The unlikely event of a hazardous or contaminated material spill during construction could impact groundwater quality. As nearest groundwater users are generally located up gradient of the excavation works, the groundwater carrying contaminants would not flow to these users. It is unlikely that a major spill would occur during construction (refer to Chapter 18 (Hazards and risk)) and the impact to groundwater is expected to be negligible given the distance to the boreholes.

Ground dependent ecosystems

There are no potential GDEs near the La Perouse project area. At Kurnell, the potential GDEs are at a higher hydraulic gradient than the construction boundary. Therefore, any localised changes to groundwater flow during construction of the project are unlikely to impact GDEs.

Impacts to other sensitive receiving environments such as wetlands, seagrass, and water dependent fauna are discussed in Chapter 10 (Marine biodiversity) and Chapter 11 (Terrestrial biodiversity).

17.3.3 Landside surface water impacts

There are no surface water tributaries or rivers within the project area which could be impacted by the construction of the project. While Captain Cooks Stream is about 200 metres northeast of the Kurnell construction boundary, it would not be impacted by the proposed works.

The project will require excavation that exposes soils during installation of utilities at both sites and the reconfiguration of car parking at La Perouse. Disturbed sediments can be adequately managed, and impacts avoided using standard measures that are proven effective in their implementation. This would include measures such as sediment fences, diverting surface water around the project area, controlled site entry/exit, protecting water inlets (eg kerbs) with sandbags, and stabilising/covering stockpiled material.

There is also the risk of spills or excess construction material and waste entering the formal drainage system (eg stormwater pits). A Spill Management Plan would be implemented to avoid and manage any impacts from spills.

17.3.4 Marine water impacts

No dredging is required for construction of the project. The disturbance of marine sediment would be from piling, construction of the temporary causeway and crane platform and movement of construction vessels (ie from jack up barges, anchoring and propeller wash).

The piling required for the wharves would drill down into the Hawkesbury sandstone through the surface marine sediments. These piles have the potential to create sediment plumes (clouds) which could increase turbidity levels and spread contaminated material. Chapter 18 (Coastal processes) assesses the potential impacts of sediment plumes. It is estimated that the sediment disturbed during piling activities would be very low and remain close to the seabed (ie not visible on the sea surface).

Sediment plumes would also be caused by the installation and removal of the temporary causeway at Kurnell. As outlined in Chapter 18 (Coastal processes), suspended sediment concentrations may be detected at the surface within 20 metres of the causeway, but the wave energy in Botany Bay would be enough to disperse these sediments very quickly.

The disturbance of sediment would not impact the marine water quality of Botany Bay to an extent that would affect the water quality objectives which apply to the estuary environment of the Georges River catchment.

Impacts on seagrass from sediment disturbance and marine water quality are assessed in Chapter 10 (Marine biodiversity)).

17.3.5 Contamination

The conceptual site model (CSM) shown in Table 17-2 identifies the likely sources of contamination, migrant pathways and the potential receptors.

The potential sources of contamination are outlined in section 17.2, and include:

- Uncontrolled fill
- Contamination from historical onsite and surrounding land uses
- Hazardous building materials
- UXO.

The potential migrant pathways of exposure to contamination include:

- Breathing in contaminated vapour and dust
- Touching and/or ingesting contaminated materials
- Transporting contaminated material through surface water flows
- Transporting contaminated material to underlying groundwater aquifers
- Mobilising and transporting contaminates through mechanical construction vehicles and equipment/machinery.

The potential receptors are outlined in section 17.2.3.

Table 17-2: Summary of potential contamination risk (CSM)

Potential source	Pathways	Sensitive receivers	Risk of contamination La Perouse	Kurnell	Impact
Uncontrolled fill	Dermal contact and/or incidental ingestion with contaminated surface water and/or soil	• Current and future site users • Construction workers.	Low	Low	Impacts to human health depending on concentration levels. Concentrations of contaminants of potential concern (CoPCs) were less than the adopted assessment criteria except for asbestos.
	Transport of contamination through surface water flows	• Adjacent sensitive receptors • Current and future site users • Construction workers.	Low	Low	Impacts to human health and water quality through runoff of contaminated soil into Botany Bay. Indirect impacts to sensitive ecological receivers if present.
	Transport of contamination to underlaying groundwater aquifers	• Adjacent sensitive receptors • Future groundwater users.	Low to Moderate	Low to Moderate	Impacts to groundwater quality through contaminated material infiltrating the groundwater aquifers within the project area. Indirect impacts to sensitive ecological receivers if present.
	Transport of contaminants by vehicles	• Construction workers • Nearby sensitive ecological receivers.	Moderate to High	Moderate to High	Contaminated materials may be disturbed and/or transported by transport vehicles and machinery which could impact human health for construction workers on site.
Historical onsite and surrounding land uses	Dermal contact and/or incidental ingestion with contaminated surface water and/or soil	• Current and future site users • Construction workers.	Low	Low	Impacts to human health depending on concentration levels. Concentrations of CoPCs were less than the adopted assessment criteria except for asbestos.
	Transport of contamination though surface water flows	• Adjacent sensitive receptors • Current and future site users • Construction workers.	Moderate	Low	Impacts to human health and water quality through disturbance and runoff of contaminated soil into Botany Bay. Indirect impacts to sensitive ecological receivers if present.
	Transport of contamination to underlying groundwater aquifers	• Adjacent sensitive receptors • Future groundwater users.	Low to Moderate	Low to Moderate	Impacts to groundwater quality through contaminated material infiltrating the groundwater aquifers within the project area. Indirect impacts to sensitive ecological receivers if present.

Potential source	Pathways	Sensitive receivers	Risk of contamination La Perouse	Kurnell	Impact
	Transport of contaminants through vehicles during excavation phase	• Construction workers.	High	Moderate to High	Impacts to human health due to contaminates being disturbed and/or transported on and/or off-site by construction vehicles and machinery. This would be limited to the immediate area surrounding construction and potentially along haulage routes.
Hazardous building materials	Inhalation of contaminated dust/fibres	• Current and future site users • Construction workers.	Low to Moderate	Moderate to High	Impacts on human health from possible hazardous historical and/or illegally dumped material such as asbestos, PCBs and lead. The impacts from dust generation are discussed in Chapter 20 (Air quality).
	Transport of contaminants through vehicles	• Current and future site users • Construction workers.	Low to Moderate	Moderate to High	Contaminated materials may be disturbed and/or transported by transport vehicles and machinery which could impact human health for construction workers on site.
UXO	Disturbance of UXO during construction	• Construction workers • Nearby sensitive ecological receivers.	Low to Moderate	N/A	Potential impacts from UXO would only occur if the area containing UXO is directly disturbed. As the construction boundary is outside the potential area, it is unlikely that UXO would be encountered.

Contamination from disturbance of soil on land

Any existing contamination present in the soils or groundwater underlying the construction footprint has the potential to be disturbed by construction activities. Excavation could expose and mobilise these contaminants.

If contaminants are present, the construction activities would involve the handling and treatment of contaminants. Construction workers would be protected by implementation of contamination management measures including asbestos management that would be outlined in the Soil and Water Management Plan to avoid the risk of inhalation and exposure through dermal contact.

Excavation during construction may mobilise contaminants, which could runoff into the surface water of Botany Bay or seep into groundwater. This could indirectly impact fauna and flora and lead to a reduction in water quality. Erosion and sediment controls would intercept suspended sediments and reduce the risk of runoff to Botany Bay. If contaminated material is encountered, it would be tested, classified and managed appropriately through either treatment or disposal at a licensed waste management facility.

Contamination from disturbance of marine sediment

Construction activities would mobilise marine sediments. Potential contaminants include PFAS, Nickel, MBT, and Organochlorine Pesticides. As discussed in Table 17-1, while certain contaminants were above the adopted screening criteria, they are expected to be consistent with existing background levels of contamination. Therefore, based on the laboratory analysis presented in Appendix Q (Targeted Site Investigation), any dispersed sediments are unlikely to alter the sediment chemistry once it is deposited (eg there would be no increase/decrease in contaminant concentrations).

Contamination from disturbance of Acid Sulfate Soils

Construction of the project may result in the disturbance of ASS. When oxidised, ASS can cause acid leachate and can lead to mobilisation of heavy metals into soils, surface water and groundwater. This can cause a reduction in soil and water quality and be harmful to flora and fauna. It could also have impacts on the health of construction workers and site visitors if they come into contact with leachate through skin contact.

The estimated amount of disturbance on land during construction is about 4,390 cubic metres at La Perouse and about 2,723 cubic metres at Kurnell. However, as mentioned in section 17.2.6, there is a low to extremely low probability of ASS on land at La Perouse and Kurnell. While there is a high probability of ASS within Botany Bay, the estimated level of sediment that would be brought to the surface is very low. Measures to manage ASS would be incorporated into a Soil and Water Management Plan to appropriately manage and mitigate the potential risk of encountering ASS, as outlined in section 17.4.

17.3.6 Assessment of operation impacts

Groundwater flow

The piles required for the wharves would be permanent and could result in mounding and changes to groundwater flow paths. Any changes to groundwater flow would be localised and would have a negligible impact on the wider aquifer.

The project would increase impermeable surfaces (at the wharf tie-in) and lower the rate of permeability. This is unlikely to reduce the rate of infiltration to groundwater permanently due to the limited increase in impermeable surface compared to the size of the aquifer and surrounding catchment. Any impacts to groundwater flow would not cause long term impacts to groundwater users, or GDEs.

Stormwater flow

Additional paved areas could increase the rate of stormwater runoff. The stormwater infrastructure is designed to cater for the additional impervious areas and would avoid any impacts of increased stormwater flow or flooding. Stormwater from the wharf-tie in areas would drain to grassed areas, or into the marine environment, the same as the current situation. The car parking area at La Perouse would be drained to existing stormwater pits.

Stormwater quality

The car parking area at La Perouse would increase capacity, and therefore could increase the risk of contaminant runoff from vehicles. The increase in parking areas is small such that additional water quality measures are not required.

The stormwater runoff from proposed paved areas would flow to the adjacent grassed areas. The grass would act as buffer strips and would filter any discharge of pollutants from the paved areas.

Due to the limited potential for impacts to surface water quality, no specific ongoing water quality monitoring is proposed.

Marine sediment plumes

The operation of the ferry service and increase in vessel use at the proposed wharves would cause sediment disturbance due to propeller wash (refer to Chapter 18 (Coastal processes)). Consistent with the sediments that would be disturbed during construction, indicatively there would be no predicted impact because the chemistry of the tested sediments is likely to be consistent with background levels across Botany Bay.

Contamination from spills

A potential contamination pathway during operation of the project is from fuel/mechanical leaks from the ferries and other vessels due to poor maintenance. These spills could then contaminate surrounding water sources and affect water quality. Spillage of hazardous material may also occur during maintenance works which could affect maintenance workers and nearby sensitive receivers. The potential for contamination as a result of general maintenance activities is considered to be low. These impacts would be avoided and managed through the implementation of an Emergency Spill Management Plan (refer to Chapter 24 (Hazard and risk)).

17.4 Environmental management measures

Table 17-3 outlines the environmental management measures to mitigate against soil, water and contamination impacts. Measures to avoid and manage spills are outlined in Chapter 24 (Hazard and risk).

Table 17-3: Environmental management measures for soil, water and contamination

Impact	ID	Environmental management measure	Responsibility	Timing
Localised stormwater flooding	SW1	All new paved areas will be designed to drain freely.	Transport for NSW	Detailed design
Localised water quality impacts	SW2	All new footpaths will be designed to drain to grassed areas to promote infiltration and cleansing of pollutants.	Transport for NSW	Detailed design
Pollution through discharge of sediment and other pollutants from construction compound and works areas	SW3	A Soil and Water Management Plan (SWMP) will be prepared in accordance with QA Specification G38, Soil and Water Management (Transport for NSW, 2020). It will be implemented under the Construction Environment Management Plan (CEMP). The SWMP will:	Contractor	Pre-construction and construction

Impact	ID	Environmental management measure	Responsibility	Timing
		a. Identify all reasonably foreseeable risks relating to soil erosion, soil contamination, asbestos, acid sulfate soils and water pollution associated with undertaking the activity b. Describe how these risks will be managed and minimised including the management of potential acid sulfate soils and potential contamination c. Include the required processes/procedures for excavation, handling, storage, and transport of sediment and arrangements for managing pollution risks associated with spillage or contamination. d. Consultation with NSW EPA, NSW Environment, Energy and Science Group, Sydney Water, Randwick City Council, Sutherland Shire Council and National Parks and Wildlife Service.		
Reduced soil and water quality due to erosion and sediment runoff	SW4	An Erosion and Sediment Control Plan (ESCP) will be prepared in accordance with Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2 (Blue Book, Landcom, 2004). It will be implemented under the SWMP. The ESCP will include: a. Detailed measures and controls to minimise erosion and manage sediment control risks to prevent pollution of waterways b. Arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Pre-construction and construction
Pollution through fuel leaks	SW5	Equipment, plant and machinery refuelling and maintenance will be carried out in impervious bunded areas. Vessels and associated plant and equipment will be maintained and refuelled at appropriate facilities offsite or adhere to industry standards, Port Authority NSW and pollution prevention regulations during refuelling, transfer, storage and handling of hazardous materials. Refuelling will always be attended. Machinery will be checked daily to ensure that there are no oil, fuel, or other liquid leaks.	Contractor	Construction
	SW6	Vehicle wash-downs will be carried out offsite or within a designated bunded area with an impervious surface.	Contractor	Construction
Encountering groundwater	SW7	Shallow groundwater will be managed in accordance with the Technical Guideline for Environmental Management of Construction Site Dewatering (NSW Roads and Traffic Authority, 2011b).	Contractor	Construction