12 Water management

This chapter presents the water requirements during construction and the potential impacts on surface water during construction and operation of the project.

The Director-General's requirements
The Environmental Assessment must include consideration of, and a management framework for water impacts, including an assessment of potential water course impacts during construction and in particular the need for and operation of temporary water treatment plants during construction.

12.1 Overview

Surface water quality in urban areas is generally related to the nature of the sediments within the catchment, the extent of urban development, the management of stormwater from that development, and the quality of any licensed or other discharges into the catchment.

Soils in the project corridor
The project corridor passes through a variety of soil landscape units (Chapman et al 1989). These soil landscape units and their erodibility are:

- The Lucas Heights and Blacktown soil landscape units. The different soil materials within this unit have low to high erodibility. The areas within the project characterised by these soil landscape units are parts of the alignment from Central Station to Town Hall Square Station and Town Hall Square Station to Martin Place Station.
- The Gymea soil landscape unit. The different soil materials within this unit have low to high erodibility. This soil landscape unit covers all of the alignment within Rozelle Station, Pyrmont Station and much of the CBD alignment.
- The Deep Creek soil landscape unit. The soil material in this unit has low to very low erodibility. Deep Creek soils may be encountered within the Central Station construction site.
- Disturbed terrain, which has highly variable erodibility. It occurs near and along the harbour foreshore in areas that have typically been landscaped and artificially drained (Chapman et al 1989). Within the project area, this includes the foreshore areas around Barangaroo-Wynyard and Pyrmont stations, the area of land known as White Bay and the former Rozelle Marshalling Yard.

The soil types within the project corridor include fill, alluvium, sands and residual soils. The fill is typically present in most developed areas, particularly the reclaimed areas adjacent to the harbour and foreshore areas. At the former Rozelle Marshalling Yard and White Bay power station areas, fill is predominantly building rubble (such as sand, bricks, concrete and roadbase), ash, slag and of sandstone origin.

Acid sulfate soils

Acid sulfate soils are associated with marine/estuarine areas in NSW, particularly where elevations are below reduced level (RL) 10 metres Australian Height Datum (AHD). Acid sulfate soils occur where sulfate from seawater has combined with iron within sediments (under anaerobic conditions) to form pyrite, which, on exposure, creates sulfuric acid. The oxidation of pyrite not only acidifies the soil and groundwater, but also mobilises aluminium, iron and manganese from the soils.

Acid sulfate soils can weaken concrete and steel infrastructure, which can increase maintenance and replacement costs. In addition, sulfuric acid can damage aquatic environments, if allowed to be released during construction.

The majority of the project corridor comprises areas designated as ‘no risk’ of acid sulfate soils on maps available from the former NSW Department of Land and Water Conservation. Areas of ‘high probability of occurrence’ are associated with estuarine bottom sediments in Darling Harbour, Johnstons Bay and the White Bay water body and in foreshore areas surrounding these water bodies.

Water quality

The CBD Metro project area is located within various subcatchments of Sydney Harbour and the receiving water bodies for those subcatchments include Darling Harbour, Johnstons Bay, Blackwattle Bay, Rozelle Bay and White Bay.

The water quality within much of the subcatchment areas is considered to be poor, predominantly as a result of poor quality stormwater and run-off from hard paved areas where there is little infiltration of water and poor filtration through substrates (City of Sydney 2008). Along with urban run-off pollutants (from industry and roads), this can result in poor stormwater quality, particularly during wet weather periods.

The Harbourwatch program run by DECCW monitors and reports on water quality at swimming sites across Sydney. Since 1996, Darling Harbour has frequently been the most polluted of the Harbourwatch sites (DECC 2008). The levels of faecal coliform and enterococci within Darling Harbour frequently exceed the guidelines for swimming and diving (that is, primary contact), and compliance with the secondary contact guidelines (that is, for boating, fishing and sailing) is variable. Sources of pollution in Darling Harbour would most likely include sewage overflows and stormwater discharges, and may also include illegal waste discharges from recreational vessels (DECC 2008).

The construction of the project would require large quantities of water and would also generate significant quantities of wastewater, some of which may be contaminated and require treatment prior to disposal or reuse. During operation, the stations and the stabling and maintenance depot would require water, the majority of which would be used for train washing. Train wash water would not be suitable for immediate reuse or direct disposal to the sewer system and, therefore, a treatment plant would be required at the depot to treat the water to a quality suitable for reuse or discharge. Water reuse is discussed in section 19.8.

The project would require a tunnelled crossing under Darling Harbour and another at Johnstons Bay. The preferred construction methodology for these sections of tunnel is not expected to affect water quality or the sea bed at these locations. However water quality may be affected as a result of sediment or pollutant-laden run-off from the White Bay construction sites to stormwater or directly to the nearby water bodies.

12.2 Objectives and strategy

Sydney Metro has set the following objective for the project to minimise the potential for, or the extent of impacts on local waterways:

- Objective: Minimise the possibility of the project having a negative impact on the water quality of surrounding surface watercourses.

To achieve this objective, a Construction Water Management Sub-Plan would be developed and implemented in accordance with the CEMP and would include a strategy for managing water quality during construction. Relevant water quality guidelines (ANZECC 2000) would be used to identify requirements for water quality prior to discharge to stormwater or directly to receiving waters.

The strategy would be implemented in accordance with relevant legislative requirements and accepted industry practice.

Environmental Construction Method Statements (ECMSs) would be prepared for each construction site and would document all water management measures to be implemented.

An Operation Water Management Plan would be developed and implemented to address the management of groundwater inflows, wash water and deluge water, and to ensure water discharged to the waterways from the project meets relevant water quality guidelines (ANZECC 2000).

12.3 Specific issues

12.3.1 Construction water requirements

Water would be required during the construction of the project for the excavation and tunnelling works (particularly at White Bay and at each of the station construction sites), for the batching plant at White Bay and for dust suppression and wheel washing at the construction sites, where required. During the most intense construction period, over 1,000 cubic metres of water would be used each day.

The water used for the tunnelling and any site run-off (such as from dust suppression, wheel washing or rain water) is likely to be contaminated with sediment and possibly with chemicals such as fuels, oils, and lubricants.

12.3.2 Potential impacts during construction

The following potential impacts would need to be managed during construction:

- Erosion. There is a potential for erosion of the soil landscape units in section 12.1, with loose or excavated materials potentially draining from the construction sites to local stormwater systems and/or waterways. Potential water contaminants include sediment from exposed surfaces, excavations, stockpiles or road surfaces, chemicals such as drilling fluids, oils, fuels and construction waste and packaging litter.

- Groundwater inflows. The presence of perched aquifers and the nature of the geology suggest that some limited groundwater inflow may occur during tunnel construction and the excavation of the station caverns. The potential for groundwater inflows and required management measures are discussed in section 19.5.

- Acid sulfate soils. There is a potential for contaminants to enter the waterways as a result of the exposure of acid sulfate soils. The construction sites with the greatest risk of exposing acid sulfate soils are White Bay, Barangaroo-Wynyard, and the Rozelle stabling and maintenance depot site. The oxidation of pyrite not only acidifies the soil and groundwater, but also mobilises aluminium, iron and manganese from the soils. Following heavy rains these products may enter drains and other waterways.

- Contaminated water. Groundwater and surface water inflows into deep excavations are unlikely to be of a quality suitable for immediate reuse on site or for disposal to the stormwater system. Groundwater in the Sydney Basin is generally high in iron (ranging from 40–110 milligrams per litre), may contain manganese and other contaminants, with a relatively high total dissolved salts (TDS) and a low pH (that is, high acidity). Any contaminated water would therefore need to be treated on site, or taken off-site by tanker for treatment.

The two waterway crossings – Darling Harbour and Johnstons Bay – would be about 400 and 150 metres long, respectively, and up to 20 metres below the seabed. The preferred method of construction is to use TBM to bore the tunnels within the substrate below the waterways and install a sealed concrete lining (refer Chapter 7). This method would not result in any perceptible permanent or temporary adjustments to the perimeter of these waterways or to the condition of the seabed. No impacts to water quality are expected as a result of the construction of the waterway crossings.

Construction of the tunnel and stations would be undertaken with consideration to minimise water ingress so as to minimise the volume of water requiring treatment and/or disposal. Construction methods to minimise water ingress may include construction of a barrier around the construction site such as a diaphragm wall or secant piles. Temporary sumps would be installed within the tunnels, crossovers and station caverns. Water collected within these sumps would be treated prior to discharge into the sewer

It is possible that any structure would still allow some inflow of surface or ground waters into the caverns that would need to be collected and treated or disposed of. If this occurs, a temporary water treatment plant may be installed at each construction site to treat any sediment-laden water collected on site. Should the groundwater seepage be excessively high, localised grouting may be carried out to temporarily control these inflows.

A water treatment plant would be installed at the White Bay construction site. All wastewater generated during construction would be pumped to a holding tank within the construction site and treated to a level necessary to achieve discharge goals. The treatment technology would primarily involve flocculation and the addition of chemicals to neutralise pH. Once treated, the water would be transferred to a holding area for reuse or disposal. Waste material generated during the treatment process (such as iron sludge) would be collected and disposed of at an appropriately licensed landfill.

12.3.3 Potential impacts during operation

The completed rail tunnels would be fully tanked and lined and are expected to have negligible water ingress during operation. Permanent sumps would be provided in the track slab, at low points within the tunnels and other areas, to collect any groundwater, water that enters the tunnels via the rolling stock and also any occasional spillage from fire hydrants.

This water would be pumped to each station or removed by a pump train before being treated and discharged to the stormwater system.

The service buildings and stations would be built as drained-concrete lined caverns and adits. The drainage system would be typical of a normal CBD commercial building basement. This would result in the requirement for sump pumps and water treatment before discharge to the stormwater system.

The drainage system at the Rozelle stabling and maintenance depot would collect surface water runoff on-site and any overland flow that enters the site from upstream catchments, and transfer this to

Rozelle Bay. The system would be sized to convey the 100-year ARI flow from the contributing catchments so that there would no adverse flood impact.

Wastewater from the station plant rooms, platforms and concourses would be collected separately and pumped to the municipal sewer via an oil separator plant.

During operation, and without mitigation, there would be potential for the following impacts:

- Pollutants may be introduced to waterways by surface run-off from the depot. Without mitigation, this would put the local waterways is at risk, particularly given the close proximity of the stabling and maintenance depot to Rozelle Bay.
- The train wash plant at the Rozelle stabling and maintenance depot would be the main source of wastewater generated on the site and would pose an environmental risk to the receiving waters located within Rozelle Bay if discharged without treatment.

12.4 Mitigation and management

12.4.1 Construction

A Construction Water Management Sub-Plan would be prepared to provide a framework for water management and identify management measures to be applied across the project. The management measures would include:

- Specific erosion and sediment control measures for all areas of surface disturbance, spoil handling and stockpiling, consistent with *Managing Urban Stormwater: Soils and construction* (the Blue Book) (Landcom 2004).
- A contingency plan to be implemented in the event that acid sulfate soils are encountered.

The following measures would also be implemented to minimise water quality impacts:

- All reasonably practicable measures would be taken to prevent the deposition of silt or other material in, and the pollution by sediment of, any existing watercourse, bay or aquifer arising from construction work.
- Any containers of contaminating substances on site would be leakproof and kept in a safe and secure building or compound from which they cannot leak or spill. Containers would be protected by temporary impermeable bunds with a capacity of 110 per cent of the maximum stored volume. Areas for transfer of contaminating substances would be similarly protected.
- Any materials and fuels stored or used on site would be managed to minimise the risk of accidental spills or leakage.
- Only biodegradable hydraulic oils would be used as far as reasonably practicable in machines working near the water at White Bay.
- All washing of vehicles and equipment would take place in designated areas and washwater would be prevented from passing untreated into watercourses.

Construction of the tunnel and stations would be undertaken with consideration to minimise water ingress so as to minimise the volume of water requiring treatment and/or disposal. Any contaminated water not able to be treated on site would be trucked off-site for treatment and disposal.

12.4.2 Operation

An Operational Water Management Sub-Plan would be prepared and implemented to provide a framework for water management and identify management measures to be applied across the project. These measures would include:

- Provision of water treatment plant(s) to treat groundwater inflows captured during the operation of the project. Relevant water quality guidelines including ANZECC (2000) would be used to identify requirements for water quality prior to discharge to stormwater or directly to receiving waters.
- A water treatment plant would be provided at the Rozelle stabling and maintenance depot to treat water used by the train wash plant. The treatment plant would treat wash water to a sufficient quality that up to 95 per cent of this water would be reused within the wash plant. Any solid or chemical waste generated during the treatment process would be collected and sent to a licensed waste facility. Waste water discharged from the treatment plan would meet statutory requirements and would be discharged to the stormwater system.
- Supply of emergency equipment for accidental spills including emergency shut-off valves and operating procedures, the provision of spill kits, mats and bunding devices. During construction the contractor would install temporary sumps within the tunnels, cross overs and station caverns. Water collected within these sumps would be treated prior to discharge into the public sewer system.
- Protection of the tunnel portal entrance from floodwater inundation. Rainwater would be captured in cut-off drains, treated, and directed into a stormwater containment tank located under the tunnel portal structure, where it would be pumped out to the stormwater drainage system.
- All stormwater leaving the Rozelle stabling and maintenance depot would, as a minimum, be treated for gross pollutants. To minimise the amount of stormwater requiring treatment, the following measures would be investigated further during detailed design:
  - Installation of rainwater tanks to minimise run-off potable water use (refer section 19.8).
  - Creation of a vegetated stormwater detention basin at the western end of the site. This would allow water to slowly infiltrate into the ground and act as a natural filter.
  - Incorporation of water-sensitive urban design principles (such as permeable paving and bio-retention swales) in the design of the site.
  - Provision of water quality measures such as gross pollutant traps and oil separators to capture and contain pollutants carried within the stormwater runoff. Grassed swales would be used to provide water quality benefits such as suspended solid, phosphate and nutrient uptake, where possible.

12.5 Conclusion

During construction, the main water quality issues would be the potential for contaminants to enter the waterways due to eroded soils and acid sulfate soils. Some limited water inflow may also occur, with the water unlikely to be of a quality suitable for immediate reuse on site or for disposal to the stormwater system.

The CBD Metro project would incorporate a number of measures to minimise impacts on water quality during construction and ongoing operation. This assessment has found that, provided these measures are implemented and managed correctly, all water quality guidelines would be met and groundwater inflows would be managed appropriately.