6.3 Surface water and groundwater

The *Great Western Highway Upgrade Medlow Bath Surface and Ground Water Impact Assessments* (Mott MacDonald, 2021b) is included in Appendix F and summarised in this section. The hydrological catchment areas (study area) for the assessment are shown in Figure 6-4.

Figure 6-4: Hydrological catchment areas for the proposal (Mott MacDonald, 2021b)

6.3.1 Methodology

The proposed upgrade includes changes in the road geometry and widening which potentially creates changes to the groundwater table and an overall increased paved area. This can change the existing groundwater infiltration and alter the flow paths of surface water as it becomes runoff and is discharged to existing receivers. To assess potential water quality risks and to address the requirements of the proposal the assessment included:

- collation, analysis and interpretation of the available sensitive ecosystem and groundwater bore data including registered users
- an assessment of the existing soil and potential contamination conditions, including a review of exiting subsurface strata from geological records and geotechnical data
- review of contribution pollutants from the existing catchment
- preparation of a high-level water quality strategy accounting for both increases and changes in the surface and groundwater transportation

- assessment of potential impacts to water quality through the neutral or beneficial effect on water quality (NorBE) assessment tool published by WaterNSW, as a result of the proposal being located within the Sydney Drinking Water Catchment. The NorBE assessment is provided in Appendix C.

The assessment was completed based on draft masterplans for Medlow Bath Park, digital survey, utility and environmental GIS data, contaminated land information, and road design information as detailed in Appendix F.

6.3.2 Existing environment

Regional context

The regional context is described in Section 6.2.2.

Groundwater dependent ecosystems

Refer to the Section 6.1 for a discussion on groundwater dependent ecosystems.

Groundwater

The study area does not have any recorded hydrological landscape data according to the NSW Department of Planning, Industry and Environment; however, it lies adjacent to the Megalong Valley Hydrological Landscape, which provides data that is useful to determine the likely nature of groundwater in this landscape. Characteristics of this adjacent landscape were obtained through the NSW Department of Planning, Industry and Environment eSPADE website.

The key hydrogeological landscape characteristic of the Megalong Valley Hydrological Landscape is a long sandstone escarpment with moderately to steeply inclined colluvial slopes and drainage lines. This characteristic is positively associated with the soil and geology landscape seen within the Medlow Bath Landscape. This landscape is of low salinity, with a low salt load (export) and a relatively high quality of fresh water. In correlation with the acid sulphate data for the area, pyrites are not present. It is an area of moderate rainfall.

As the Medlow Bath Landscape is that of shallow soil, and with a topography leading to a rapid cliff-like drop, it is highly likely that the groundwater flow from the Medlow Bank Landscape discharges into the lithosols/siliceous sands below the sandstone escarpment, flowing then on the surface of the granite bedrock.

Figure 6-5 shows the conceptual cross-section for Megalong Valley Hydrological Landscape showing the distribution of regolith landforms, salt sites and flow paths of water infiltrating the system.

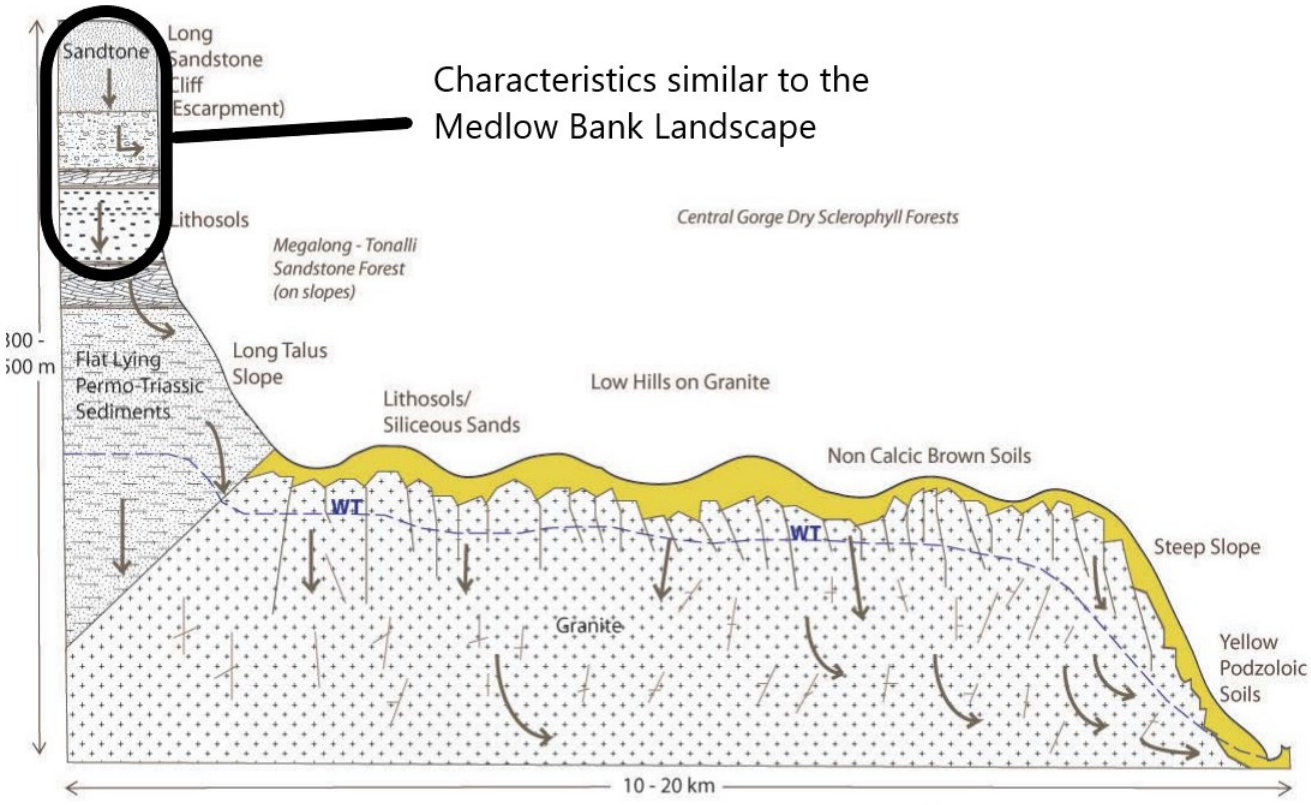

Figure 6-5: Conceptual cross-section for Megalong Valley (Source: Department of Planning, Industry and Environment)

Water quality

Water draining from the study area flows towards the Grose River and Coxs river catchments which are subject to controls under the Sydney Drinking Water Catchment. In the current condition, minimal existing treatment measures are installed in the cross drainage structures to treat the urban runoff from the area flowing into the system prior to discharge to the natural receiving watercourses.

Surface water features

A schedule of existing cross drainage structures for providing capture and conveyance of upstream runoff are listed in Section 6.3.2. The existing cross drainage discharge locations across the rail corridor are to be maintained to continue the connectivity of flow paths to the downstream receiving watercourses. These discharge locations are typically open drains leading to the rail corridor or existing overland flow paths in Medlow Bath Park.

6.3.3 Potential impacts

Construction

In addition to sedimentation and scour impacts which are described in Section 6.2.3 which can contribute to poor water quality there is also a risk of releasing potentially harmful chemicals and other substances in the environment due to spills. This could occur as a result of equipment malfunction and maintenance or refuelling, inappropriate storage, handling and use of contaminated sediment and via treatment and curing processes for concrete. Potential contaminants could include acids and chemicals from washing down of vehicles, construction fuels, oils, lubricants, hydraulic fluids and other chemicals.

Groundwater impacts during construction include risks to groundwater quality as a result of spills or poor management of groundwater encountered during earthworks. Drawdown of groundwater levels may also impact surrounding land uses including affects to groundwater use and settlement of adjacent structures.

Operation

Increases in impervious surface areas have the potential to result in increased runoff due to changes in the hydrological regime. This could lead to water quality impacts associated with increased erosion and sedimentation and increased concentrations or the introduction contain pollutants such as sediments, nutrients, oils and greases, petrochemicals and heavy metals, which could potentially impact on water quality when discharged into receiving waterways.

The operation of the proposal is likely to impact on water quality due to discharge of drainage at new locations or increased discharge at existing locations where road and drainage upgrades have occurred. Increased flow rates can impact on the bed and bank stability of the existing watercourses making them highly susceptible to erosion. Stream erosion increases sediment and nutrient loads leading to decreased water quality which would potentially affect the protection of the nominated environmental values and scour potential is also increased with higher velocities and larger flow rates.

Surface water impacts during operation of the proposal would be minimised by:

- providing level spreaders to limit scour potential at runoff discharge locations entering the existing watercourses
- implementing attenuation/detention basins for mitigation of the discharge peak flows to no greater than under the existing conditions
- integrated bioretention into the basin floor to provide stormwater quality filtration and treatment.

The NorBE assessment carried out for the proposal (included at Appendix C), included MUSIC modelling and is the quantitative approach to assess the potential impacts and provide a basis of pollutant generation that is used in determination of the mitigation measures. The assessment found that assuming the mitigation recommendations are adopted, the proposal would achieve a beneficial outcome with regard to surface water quality. The new treatment measures would remove gross pollutants and further reduce residual pollutants through biofiltration prior to discharge, contributing to a lower level of pollutants than before construction.

With respect to groundwater, all the construction stage risks are also relevant in the operational phase. In addition, the potential long term effects of the changes in impervious surfaces with road widening could alter the groundwater recharge rates in the immediate vicinity and continue the impacts to sensitive receivers such as groundwater dependent ecosystems.

Installation of stormwater detention basin

A key strategy to manage surface water run off during operation is the installation of a new sedimentation basin located adjacent to Medlow Bath (refer Figure 6-6 which shows the proposed location). It is intended that this sedimentation basin would be installed at an early phase of the construction works to be utilised for managing surface water run off during works (including additional pipes below the rail line). The basin would then be used during the operational phase to ensure an acceptable level of water quality is discharged into the existing overland flow paths in Medlow Bath Park.

During both phases, the water would be pre-treated via spill containment (to capture oils from road surfaces) and a gross pollutant trap (to capture sediment, rubbish and vegetation debris). The water would enter the detention basin in order to retard or slow down the flow of water so it is released at a steady state, and this would also enable some water to infiltrate into the ground and potentially allow for storage for use in watering the park. Post treatment, the treated water would discharge into the existing rock lined channel in Medlow Bath Park. Figure 6-7 shows the water quality process that has been incorporated into the design.

Figure 6-6: Proposed location of new sedimentation basin - in yellow (Image source: Mecone Mosaic)

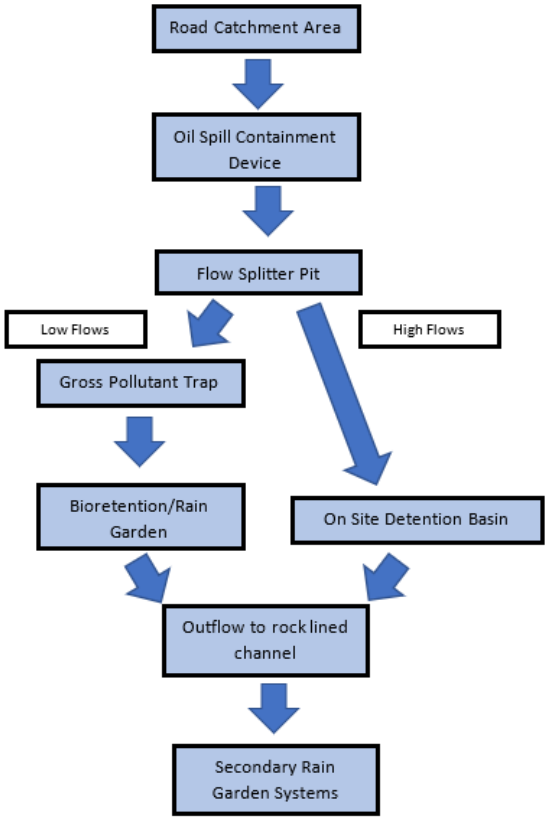

Figure 6-7: Water quality management process for the proposal

6.3.4 Safeguards and management measures

Table 6-11: Safeguards and management measures – Surface water and groundwater impacts

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil degradation and water pollution	A Soil and Water Management Plan will be prepared and implemented as part of the CEMP. The plan will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction. The Soil and Water Management Plan will be reviewed by a soil conservationist on the TfNSW list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The Plan will then be revised to address the outcomes of the review.	Contractor	Detailed design / Pre-construction	Section 2.1 of *QA G38 Soil and Water Management*
Soil degradation and water pollution	Site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the Soil and Water Management Plan. The Plan/s will include 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. The site specific Erosion and Sediment Control Plan/s will be developed in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and *Volume 2D* (DECCW, 2008), commonly referred to as the 'Blue Book'.	Contractor	Detailed design / Pre-construction	Section 2.2 of *QA G38 Soil and Water Management*
Run-off velocity (scour protection)	Level spreaders will be installed at all discharge locations to the natural surface used to reduce velocity and depth of the flows reaching the natural watercourses /s. New discharge outlets will be designed with appropriate energy dissipation and scour protection measures as required to minimise the potential for sediment disturbance and resuspension in the receiving waters. Outlet design and energy	Contractor	Detailed design / Pre-construction	Best practice

Impact	Environmental safeguards	Responsibility	Timing	Reference
	dissipation/scour protection measures will be informed by drainage modelling. Check dams or velocity managing devices are installed into flow paths particularly in areas with steep gradients.			
Water quality	Maintenance requirements for all stormwater treatment systems and devices installed as part of the proposal will be identified and included in relevant operational maintenance schedules/systems.	TfNSW	Post construction	Best practice
Spill containment	Dedicated diversion equipment will be implemented for the storage of spills to avoid direct discharge to receiving watercourses.	Contractor	Detailed design / Pre-construction	Best practice
Sediment run-off from construction site	Sediment basins will be designed and constructed for the collection of sediment runoffs through reduction of flow velocity.	Contractor	Construction	Section 2.2 of *QA G38 Soil and Water Management*
Sediment run-off from construction site	The extent of ground disturbance and exposed soil will be minimised to the greatest extent practicable to minimise the potential for erosion.	Contractor	Construction	Section 2.2 of *QA G38 Soil and Water Management*
Sediment run-off from construction site	Disturbed ground and exposed soils will be permanently stabilised and proposed landscaped areas will be suitably profiled and vegetated as soon as possible following disturbance to minimise the potential erosion.	Contractor	Construction	Section 2.2 of *QA G38 Soil and Water Management*