



Great Western Highway Upgrade - Medlow Bath

Surface and Groundwater Impact Assessments

May 2021

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Executive summary

A desktop surface and groundwater assessment has been undertaken to assess existing conditions of the Great Western Highway at Medlow Bath, and the potential impact of the road upgrade on the local and regional groundwater system, and water quality reaching watercourses.

Existing drainage structures and the flow of runoff has been determined through a separate hydrology and hydraulic assessment, with the standards of these structures vary substantially from approximately 10% AEP to greater than 1% AEP. These catchments comprise a number of pollutant sources including a variety of land use and transport infrastructure.

A summary of the main impacts of the proposal as determined through the assessment are noted below:

- The upgrade of Great Western Highway and some local access road improvements would affect the volume and peak runoff rates from the upstream catchments.
- Pollutant loads from the widened road infrastructure will provide increased runoff pollutants from the new road pavements
- New excavation to the road corridor where widening occurs toward the southern end of the proposal will have local impacts on the groundwater levels of the area

Upon analysis of the potential impacts the following recommendations are made:

- Provide all runoff discharge locations with level spreaders for limits on the scour potential of runoff entering the existing watercourses
- Runoff discharge locations are proposed to have attenuation basins for mitigation of the discharge peak flows to no greater than under the existing conditions. Bioretention is proposed to be integrated into the basin floor to provide stormwater quality filtration and treatment.
- Consult with Council around the integration of attenuating basin to the Medlow Park masterplan area. The dimensions and depth to be developed in consultation with Council engineers to ensure safe operation of the infrastructure.
- Consult with the owner of groundwater bore near the boundary of the proposal area to understand the access and GW061451 quality requirements of the bore into the future and confirm no adverse impacts.

Glossary and Abbreviations

Term	Definition and Abbreviation
AHD	Australian Height Datum, the datum of vertical control mapping in metres
AEP	Annual Exceedance Probability
ARI	Annual Recurrence Interval
EPA	Environment Protection Authority
GDE	Groundwater Dependent Ecosystems
GWH	Great Western Highway
GWHUP	Great Western Highway Upgrade Project
NorBE	Water quality assessment standard: Not worse or better than (existing conditions)
OEH	Office of Environment and Heritage
RCP	Reinforced Concrete Pipe
REF	Review of Environmental Factors
TfNSW	Transport for New South Wales, formerly known as RMS

1 Introduction

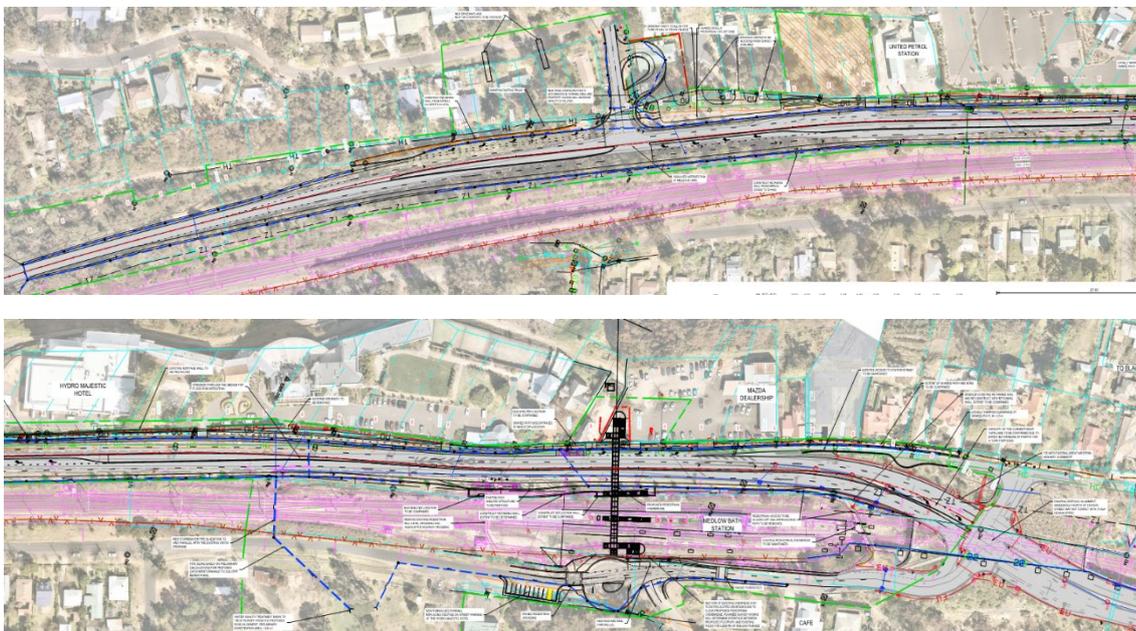
1.1 The Proposal

Transport for NSW (Transport for NSW) proposes to upgrade approximately 1.2 kilometres of the Great Western Highway at Medlow Bath between Railway Parade and approximately 330m south of Bellevue Crescent (the proposal). This upgrade is part of the Great Western Highway Duplication project between Katoomba and Lithgow which aims to provide a safer and more efficient link between Central West NSW and the Sydney Motorway Network for freight, tourist and general traffic.

In addition to the road modifications, the proposal will also improve active transport links and public transport accessibility.

The proposal is shown in Figure 1.1.

Figure 1.1: GWH Upgrade Proposal



Source: MRB - Medlow Bath Concept Design

Key features of the proposal would include:

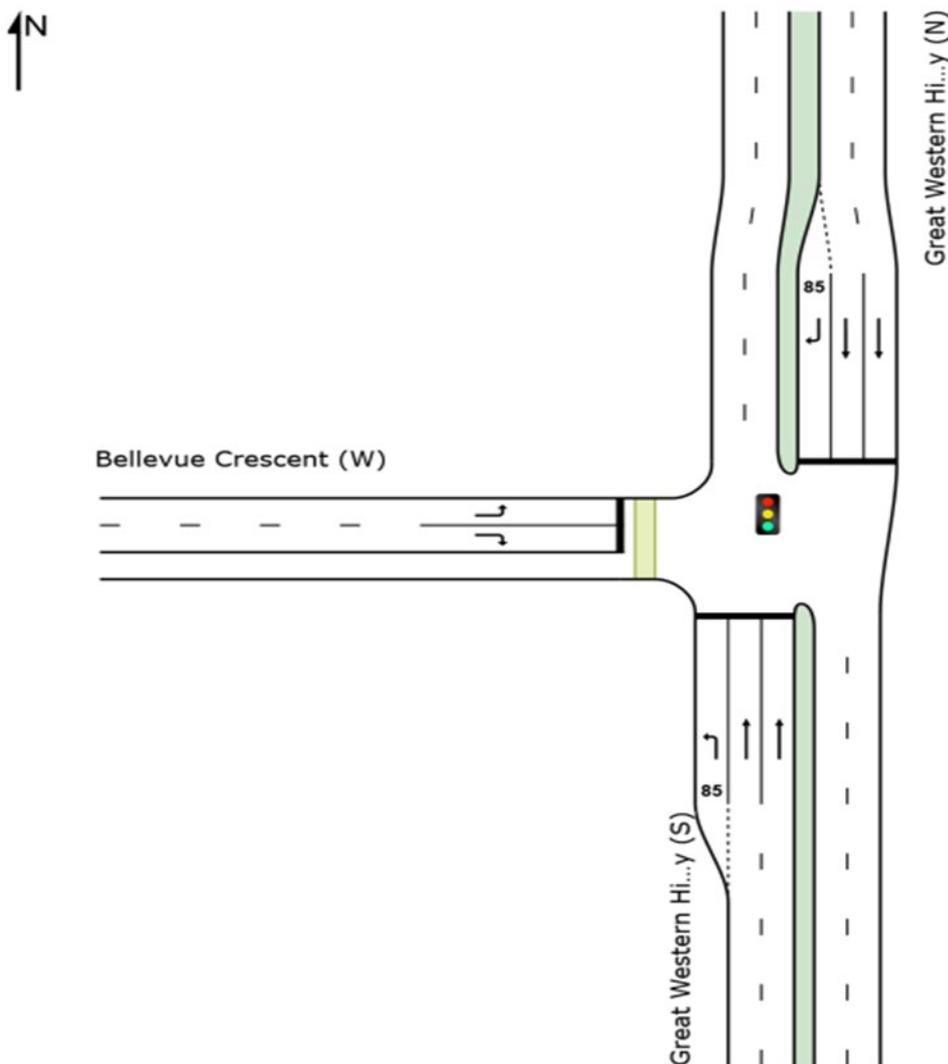
- Construction of a four lane divided carriageway with consolidated access points at upgraded intersections including:
 - Upgraded Bellevue Crescent intersection to include three way traffic signals for safe access/egress
 - Provision of a U-turn bay for traffic turning east bound to west bound at Bellevue Crescent
 - Right turn bay in east bound carriageway median for Hydro Majestic Hotel (no right turn egress)
 - Improvements on Railway Parade to formalise parking provisions, U-turns and commuter parking
- Construction of full depth highway pavement and associated local road, driveway, footpath, kerb and gutter reconstruction work within the proposal area

- Construction of a new pedestrian bridge that connects Railway Parade, Medlow Bath Station and new indented bus bays on both sides of the Highway in line with Transport Access Program requirements (See 1.1.1)
- Shared use (pedestrian/cyclist) path adjacent to westbound carriageway
- Retaining wall and traffic barrier construction adjacent to existing rail corridor
- Utility relocation and stormwater drainage upgrade as required over length of the project including water quality control measures in Railway Parade
- Provision of 6m raised landscaped median for trees protected with modified redirective kerb.

1.1.1 Proposed alternative intersection at Bellevue Crescent

As part of the design for the proposal, a new alternative signalised intersection is being considered to the Great Western Highway with a new road through vacant Lots to connect to the existing Bellevue Crescent and approximately 25 metres south of the United Petrol Station (refer to Figure 1.2).

Figure 1.2: Proposed alternative intersection at Bellevue Crescent



Source: MRB - Medlow Bath Concept Design

At the time of writing of this report, an alternative design was being considered for Bellevue Crescent includes the following key design features:

- A signalised intersection will be built along the southern perimeter of the United Petrol Station in Medlow Bath utilising a corridor (anticipated to be 20 metres) through vacant Lots.
- Closing the existing Bellevue Crescent and Great Western Highway intersection but still maintaining a service road/shared zone for the properties fronting the highway
- Creating new access options from Bellevue Crescent to the petrol station Hydro Majestic Pavillion
- Allows left and right turns out of Bellevue Crescent on to the Great Western Highway (enabling west and east bound movement) and left turn into new Bellevue Crescent from Great Western Highway westbound

1.1.2 Transport Accessibility Program

The NSW Government is improving accessibility at Medlow Bath Station. This portion of the project is being delivered as part of the Transport Access Program (TAP), a NSW Government initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure.

As part of this program, the Medlow Bath Station Upgrade (part of the proposal) would provide a station precinct that is accessible to people with a disability or limited mobility, parents/carers with prams, and customers with luggage.

The key features of the TAP project included within the proposal are summarised as follows:

- construction of a new pedestrian footbridge including:
 - four new lifts to provide access between the footbridge, bus stops on the Great Western Highway, Station platforms and Railway Parade
 - provision of accessible paths between the lifts, stairs and bus stops on the Great Western Highway
- upgrade of the station entrance on Railway Parade including:
 - modifications to the commuter car park along Railway Parade, and provision of new accessible parking spaces
 - provision of a new accessible kiss and ride space on Railway Parade adjacent to the new station entry
 - provision of accessible paths between the footbridge entry, kiss and ride and accessible parking
- upgrade of the station power supply to provide adequate power for the new footbridge and lifts
- modifications to overhead wiring and HV at the station to accommodate the construction of the new footbridge
- internal station building work including:
 - minor building modifications that may be required to accommodate new or upgraded electrical equipment including a main switchboard, new or upgraded station communications equipment and other station services

ancillary work including adjustments to lighting, relocation or replacement of existing customer facilities (platform seating, bins, payphone, Opal card readers, fencing) and improvement to station systems including additional closed circuit television (CCTV) cameras, hearing loops and wayfinding signage.

1.2 Design

The following sections provide a description of the design criteria, major design features and engineering constraints of the proposal. These features are based on the concept design and would be further refined during detailed design.

1.2.1 Design Criteria

The concept design for the proposal was prepared in accordance with the following standards:

- T HR CI 12030 ST Overbridges and Footbridges Design Standard (Transport for NSW, 2020)
- Australian Standards: amended by RMS Supplement (2012)
- Austroads Guide to Road Design (Austroads, 2009) and RMS supplements to the Austroads Guide
- Austroads Road Safety Audit Manual (Austroads, 2009)
- Beyond the Pavement 2020: Urban design approach and procedures for road and maritime infrastructure planning, design and construction (Transport for NSW Centre for Urban Design, 2020)
- NSW Speed Zone Guidelines (Roads and Traffic Authority of NSW, 2011)
- Road Safety Audit Manual and Checklist (Roads and Traffic Authority of NSW, 2011)
- RMS Delineation Manual (2012)
- RMS Road Design Guide (RMS, undated)
- Soils and Construction – Managing Urban Stormwater, Volume 1 (Landcom, 2004) and Volume 2D (Department of Environment and Climate Change, 2008). Guide to Road Design – Austroads (Austroads, 2009).
- Disability Standards for Accessible Public Transport 2002 (DSAPT)

Table 1.1: Key Design Criteria

Design Features	Requirement
Number of lanes	Typical lane arrangement of two lanes in each direction with some turning lanes (for access to roads off Great Western Highway and to key commercial places).
Lane widths	3.35m for through lanes and 3.30m for turn lanes (plus lane widening at curves, as required).
Design vehicle for main road Alignment	Main road alignment - 19 metre B-Double (over 50 tonnes)
Design vehicle at intersections	Bellevue Crescent (including u-turn) –prime mover and semi-trailer (up to 19 metres) Right hand turn bay into Hydro Majestic Hotel – service vehicle (upto 8.8m)
Posted Speed Limit	Main road alignment - 60km/h Side roads – 50km/h
Design Speed	Main road alignment - 70km/h Intersection (at Bellevue Crescent) – 60km/h Turn in to side roads – 60km/h
Median width	Southern portion (at Bellevue Crescent intersection) – 5.10 metres southern approach and 1.8 metres for northern approach to allow for right hand turn bay at signals. Mid portion (at Hydro Majestic Hotel) – typically 5.10m raised median and 1.80 metres at right hand turn bay into the hotel. Northern portion (between Hydro Majestic Hotel and Railway Parade) – 1.8 metres
Pavement type	Pavement structure which would consist of asphalt over lean mix concrete and consider acoustic requirements.
Footpaths/cycle paths and shared zones	Southern portion (at Bellevue Crescent intersection) – includes a shared zone for local traffic only (to access 100 to 104 Great Western Highway) and pedestrians and is typically 6.7 metres wide Mid portion (at Hydro Majestic Hotel) – 2.5 metre shared path on the western side of the road and pedestrian path from footbridge to bus stop on the eastern side. Northern portion (between Hydro Majestic Hotel and Railway Parade) – 2.5 metre shared path on the western side of the road

Design Features	Requirement
Pedestrian Bridge	To allow safe access to the area, a pedestrian bridge (including stairs and lifts) will be installed to span from Railway Parade to Medlow Bath Station and then across to the western side of Great Western Highway (as well as access to the eastern side of the Highway to enable use of bus stop serviced by east bound services).
Flood Considerations	Not considered to be within a flood prone area. One in 100 Average Recurrence Interval (ARI) Minor and Major Tributary flood under current climatic conditions.

1.3 Objectives

1.3.1 Program Objectives (GWHUP)

The Great Western Highway (GWH) is a 201-kilometre highway crossing of the Great Dividing Range through the World Heritage listed Blue Mountains, connecting Bathurst and the surrounding Central West and Orange regions to Sydney.

Crossing the Great Dividing Range, the GWH follows a narrow and difficult alignment constrained by the Blue Mountains National Park, steep topography, a railway line and existing towns for which the highway acts as the main street.

The highway's topography and constrained two lane carriageway design (which in places is almost 200 years old) results in the following constraints:

- reduces freight efficiency by limiting access for safer and more sustainable high productivity vehicles
- limits access during incidents and natural disasters
- slows travel speeds with limited overtaking opportunities and steep gradients (more than double the recommended maximum level)
- causes delays of up to 80 minutes in peak times
- has higher than state average crash rates
- impairs amenity for local communities with high through traffic volumes and congestion, and
- Without the GWH Upgrade Program, the infrastructure along the Katoomba to Lithgow section will continue to face a number of challenges and related impacts.

1.4 Purpose of the Report

The purpose of this report is to provide a detailed analysis for input into the Review of Environmental Factors (REF), as required under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). This report summarises the impacts from the operation and construction of the proposed upgrade on surface water and groundwater including sensitive receptors in accordance with the assessment requirements for the Great Western Highway Upgrade at Medlow Bath.

This includes:

- Identification of existing surface water and groundwater conditions.
- Assessment of the potential construction impacts as a result of the works.
- Assessment of the potential operational impacts as a result of the works.
- Development of a high-level strategy including mitigation measures for minimising impacts to as a result of the works.
- Make recommendations for further investigations and opportunities for impact mitigation.

A hydrology and hydraulic assessment has been provided in a separate technical paper detailing the impacts of the proposal on the drainage and flooding aspects of the proposal, covering changes to the volumes of runoff anticipated from the contributing catchments.

2 Methodology

2.1 Study Approach

The Medlow Bath proposal for upgrade of the Great Western Highway is in the vicinity of multiple tributaries comprising ephemeral streams that feed into the larger river systems of the Coxs River and Grose River. These catchments are predominantly native vegetation with small portions of urban development located adjacent the transport corridor of the GWH and adjacent rail corridor.

The proposed upgrade includes changes in the road geometry and widening which creates changes the groundwater table adjacent the cut areas and results in 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 sensitive receivers including environmental communities and adjacent commercial and private properties. To mitigate the changes in these potential water quality risks and to address the requirements of the proposal, this assessment approach includes:

- 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.

This assessment was based on the following information:

- Combined digital rail utility plans for the corridor, or DSS data.
- GIS layouts for planning and environmental characteristics of the area, and the proposal area.
- Draft masterplans for the recreational area at Medlow Park.
- CAD Concept Design layout data including preliminary proposed drainage network.
- LiDAR and detailed survey in digital formats from government agencies including Geoscience Australia and TfNSW, respectively.
- Rainfall, groundwater and bore data by the Bureau of Meteorology
- Contaminated land data by the NSW Environment Protection Authority (EPA)

2.2 Legislation

Legislation and guidelines relating to works within flood liable land in New South Wales include:

- Environmental Planning and Assessment Act 1979.
- Protection of the Environment Operations Act 1997.
- Protection of the Environment Administration Act 1991.
- Local Government Act 1993.
- State Emergency Service Act 1989.
- State Emergency and Rescue Management Act 1989.

- Water Act 1912. Licencing through OEH is required (under Section 112 of the Water Act 1912) prior to the installation of any bores for potential purposes of investigation, extraction, dewatering, testing or monitoring during construction.
- Water Management Act 2000.
- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011
- The State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

3 Existing environment

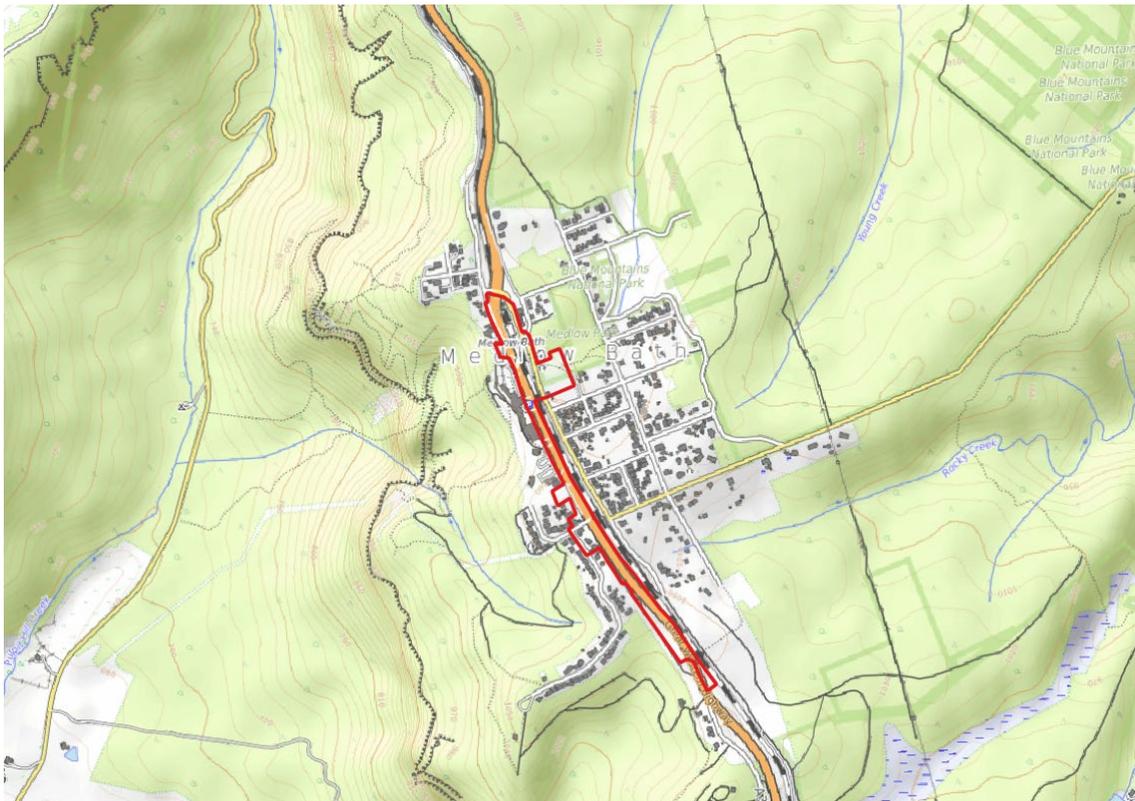
3.1 Regional Context

The Great Western Highway traverses a ridgeline running approximately north to south between the Grose River catchment to the east and the Coxs River catchment in the west. Local watercourses in the vicinity of the study area comprise Adams, Young and Rocky Creek tributaries of the Grose River, and Pulpitt Hill and Back Creek tributaries of the Coxs River.

The study area covers 10.58ha including Medlow Bath station and transport interchange, as well as Medlow Park to the east and downstream of the major sag location and cross drainage structures for the transport corridor. This major sag just south of the existing railway station collects runoff from the majority of the study area and directs the flow to the receiving Adams Creek to the west. Smaller portions of the study area drain to the remaining watercourses.

Figure 3.1 indicates the topographical features in the vicinity of the study area, including the location of receiving watercourses.

Figure 3.1: Study Area and Topography

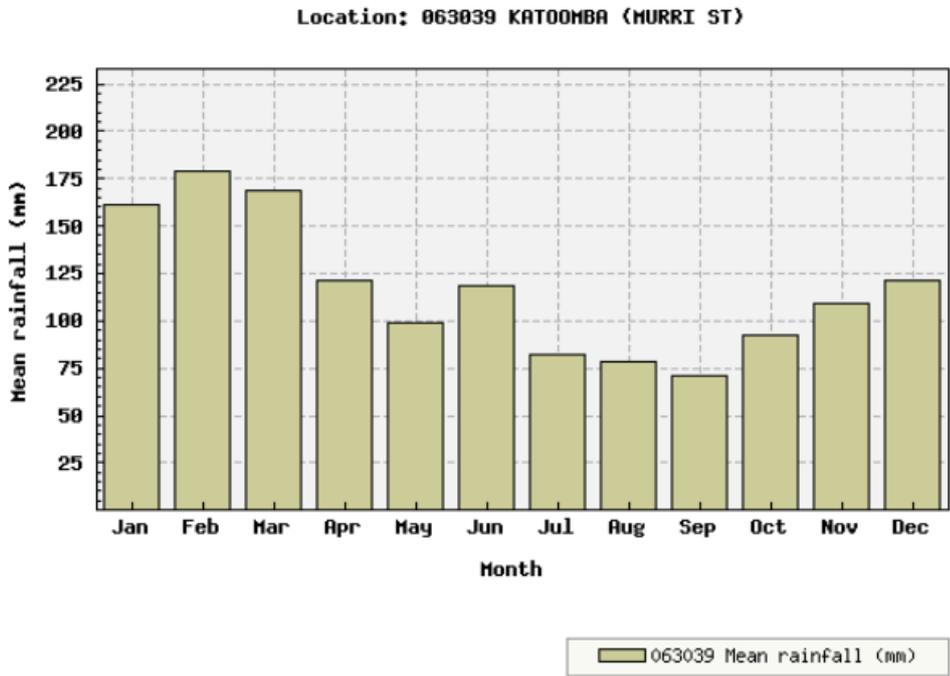


Source: Open Topo Map by OpenStreetMap

3.2 Climate

Average monthly rainfall for the nearest rainfall station at Katoomba (063039, Murri Street) indicates the area experiences larger summer rainfalls than during the winter months. This is indicated in the Figure 3.2 average monthly plot, with the annual average rainfall at 1400mm across the 134 year record.

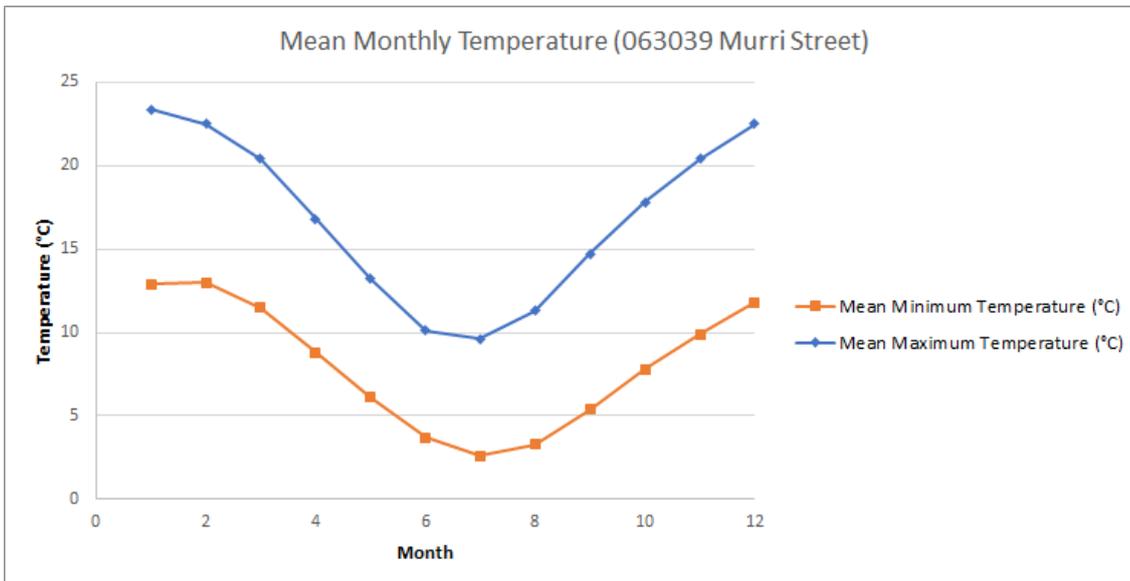
Figure 3.2: Average Monthly Rainfall Data



Source: Bureau of Meteorology Climate Data (2021)

The average monthly minimum and maximum temperatures are displayed on Figure 3.3 showing the variability throughout the year based on the full 92 year record at Katoomba, approximately 4km from the study area.

Figure 3.3: Average Monthly Temperature Data

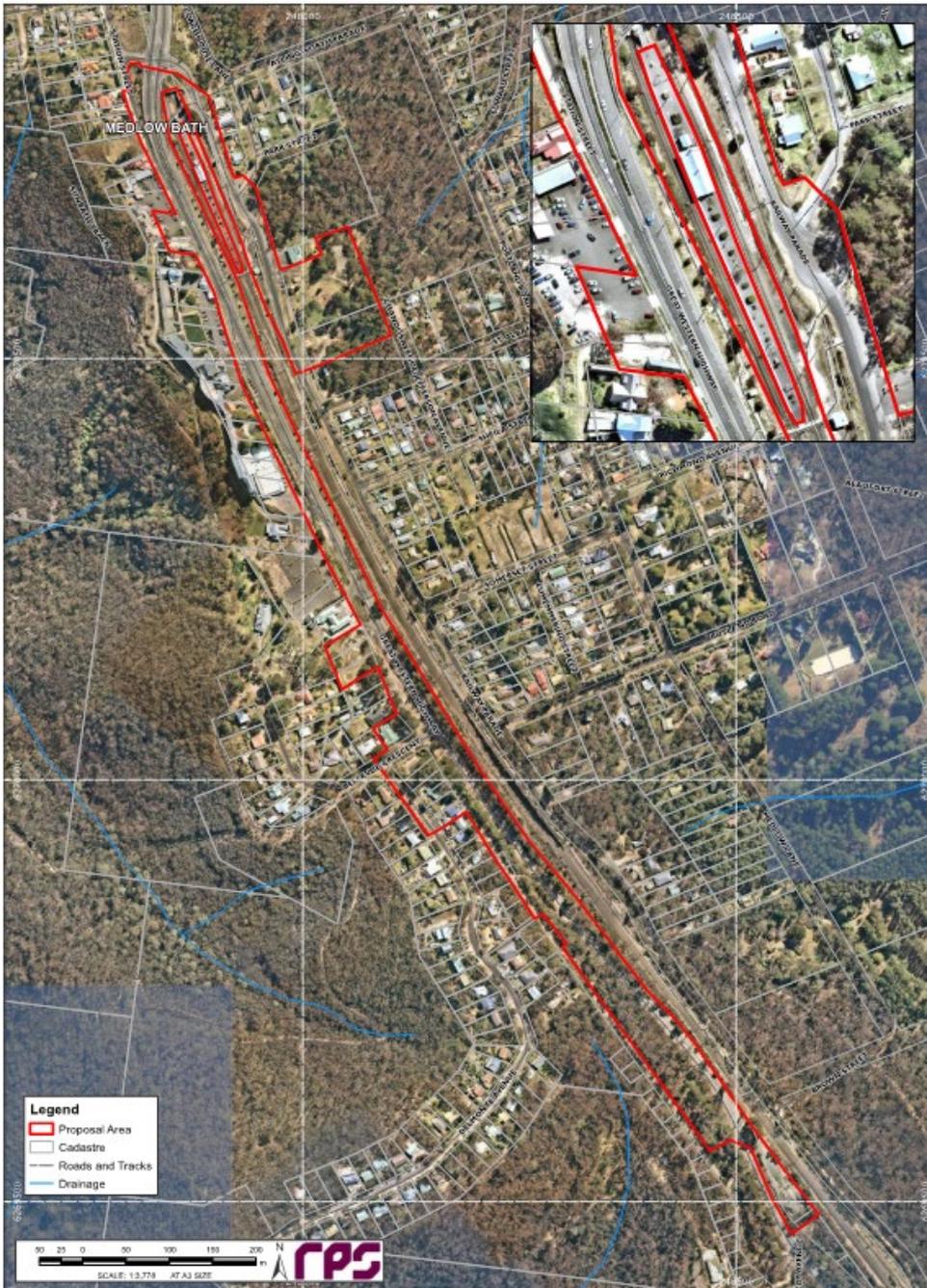


Source: Bureau of Meteorology Climate Data (2021)

3.3 Land Use

The central corridor of Medlow Bath comprises the road and adjacent rail corridor in a north-south alignment, with a predominantly commercial land use immediately adjacent to the road corridor on the western side of the transport corridor. Beyond the rail alignment to the east is predominantly a residential land use with community and recreational uses also. The Medlow Park recreational area is included within the study area, for which a *Medlow Park - Draft Plan of Management for Adoption* (Blue Mountains City Council, March 2013) study indicates the future objectives for the site.

Figure 3.4: Land Parcels and Aerial Imagery of Land Use



Source: RPS Concept Design spatial mapping

3.4 Surface water features

The table below indicates the existing cross drainage structures along the GWH providing capture and conveyance of upstream runoff. These culverts have been identified from the detailed survey information including the invert level, position and dimension of the culvert.

Table 3.1: Schedule of Cross Drainage Structures

Cross drainage	Chainage	Existing structure	Invert inlet	Invert outlet
CX3480	3480	1 x 375mm RCP	1059.390	1058.990
CX3770	3770	1 x 450mm RCP	1056.409	1056.095
CX3960	3960	1 x 450mm RCP	1053.341	1053.016
CX4200	4200	1 x 450mm RCP	1048.542	1047.894
CX4220	4220	1 x 375mm RCP	1048.580	1048.470

*RCP Reinforced Concrete Pipe

The hydrological standard of the culvert is theoretical and the actual performance relies on the degree to which sediment and debris build-up and vegetation intrusion prevents the free draining flow through the stormwater system. The hydrological standard has been assessed through the development of an existing conditions DRAINS model, inclusive of the regional catchments delineated by review of LiDAR and detailed survey, and key features of the stormwater drainage system comprising:

- Pipes
- Culverts
- Open channels
- Headwalls

The catchments are mapped in GIS and attached in Appendix A. Due to the small and urban nature of the upstream catchments, the flow regime reflecting the critical storm conditions are consistently short and flashy events with high intensity rainfall. Some assumptions have been made on the size of cross drainage structures downstream of CX3770, CX3960, CX4200 in the rail corridor as this information is not embedded into the DSS digital utility information on the drainage features within the corridor.

3.5 Geology and soils

The area is characterised by the crest along which the GWH runs in a north south direction, with the steep escarpments on either side of Medlow Bath, with geological mapping indicating rocks and residual soils of the Narrabeen sedimentary group. A search of the NSW Department of Planning, Industry and Environment eSPADE website (undertaken on 27 November 2020), and the 1:100,000 Geology of Penrith Map (Geological Survey of NSW, 1991), identifies the regional geology of the Study area as Medlow Bath (residual), characterised by a combination of Warragamba (colluvial), Hassans Walls (colluvial) and Wollangambe (erosional) landscapes adjacent to the study area.

There are no known sites or risk of acid sulphate soils occurring in the vicinity of the study area based on a search of the Department of Planning, Industry and Environment's database on Eastern Australian Acid Sulphate Soils (undertaken on 26 November 2020).

Refer the Medlow Bath Stage 1 Contamination Report for further details.

3.6 Groundwater recharge

Through inspection of typical landscape characteristics of the area through The Department of Planning, Industry and Environment eSPADE website, the sandstone escarpment is associated with moderately to steeply inclined colluvial slopes and drainage lines.

Without the presence of contaminated land parcels on the NSW EPA contaminated land record (undertaken on the 8 December 2020 for records within the Blue Mountains City Council) within the vicinity of the study area, the general groundwater quality is considered high.

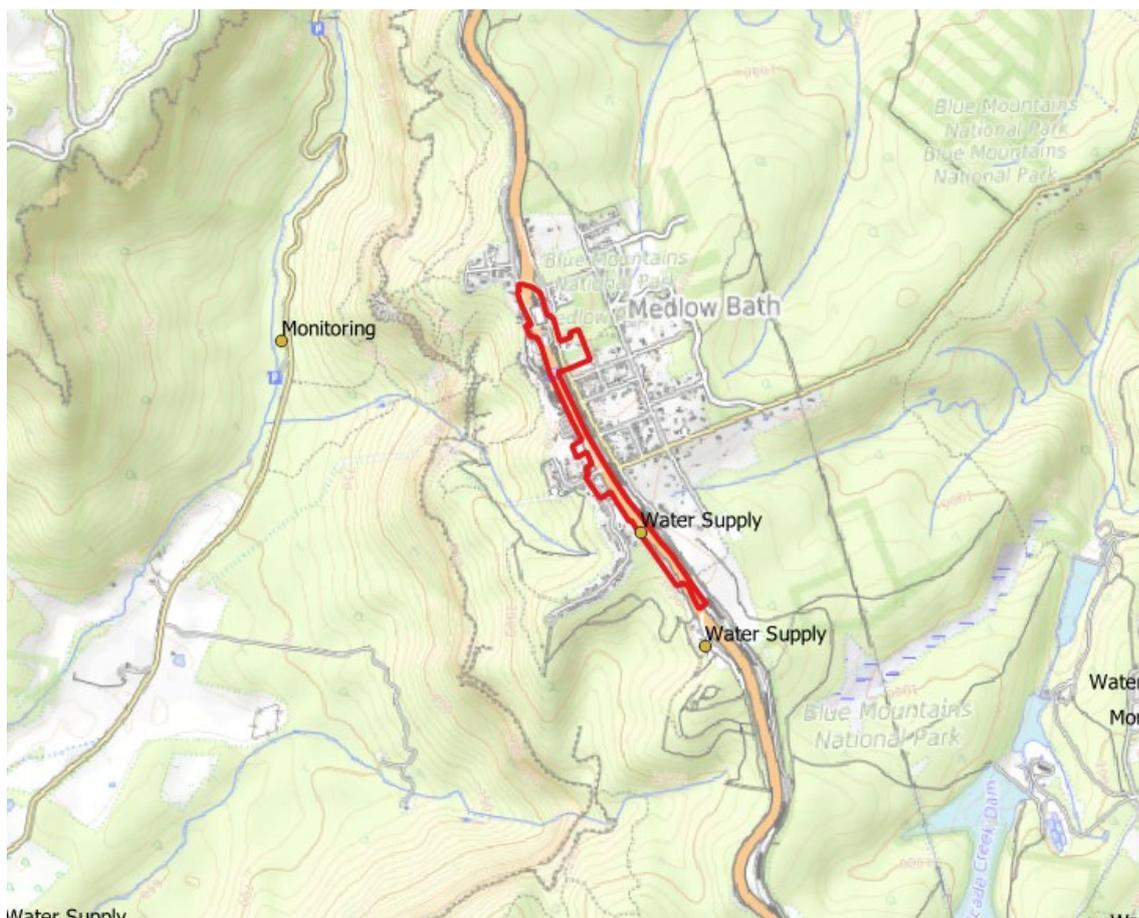
3.7 Registered groundwater users

A review of local registered bores near the proposal area was conducted on 25th February 2021 using both:

- NSW groundwater map (WaterNSW), and;
- Australian Groundwater Explorer (Bureau of Meteorology)

Two bores within the township of Medlow Bath were identified, both for the purpose of water supply. The location of these is indicated in Figure 3.5 with the key data summarised in Table 3.2. No monitoring data is available for the bores, with depths ranging from 46.8m up to 96.0m.

Figure 3.5: Registered bores near Medlow Bath



Source: Australian Groundwater Explorer (BOM, 2021) and Open Topo Map

Table 3.2: Registered bore data

Bore ID	Purpose	Bore Depth (m)	Elevation (m AHD)	Salinity	Status
GW061451	Water Supply	46.8	1053.59	Unknown	Unknown
GW115835	Water Supply	96	Unknown	Unknown	Unknown

Source: Australian Groundwater Explorer (BOM, 2021)

The desktop review has returned no groundwater quality data and based on the location and type of bores in the area groundwater use is limited and the primary beneficial use of groundwater in the vicinity of the site would be environmental (ie providing base flow to waterways).

3.8 Groundwater dependent ecosystems

Review of potential Groundwater Dependent Ecosystems (GDE) was performed using the Australian Groundwater Explorer tool (BOM, 2021), identifying the locations of GDE in the two receiving catchments. The mapped GDEs included “aquatic” ecosystems that rely on the surface expression of groundwater, and “terrestrial” ecosystems that rely on the subsurface presence of groundwater. No moderate and high potential GDEs were located in and surrounding the proposal area, and given the distance from the proposal it is not expected that there would be an impact. Figure 3.6 and Figure 3.7 indicate the high priority groundwater dependent ecosystems in the receiving Grose/Nepean River catchment and Coxs River Catchment respectively.

To the west of the proposal area moderate potential and high potential GDE are located in the valley of the Cox River catchment. A search for the wider local government area reveals Commonwealth listed threatened species are likely or known to live in the area. For a full listing of the species refer to Appendix D protected matters report.

Figure 3.6: Sydney Basin Blue Mountains, Grose River



Source: Appendix 2 - Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011

3.10 Water quality

Water draining from the subject area via the Grose River and Coxs river catchments are subject to controls under the Sydney Drinking Water Catchment. The requirements of the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 for proposals within drinking water catchments is that an assessment must be carried out to the NorBE guidelines for demonstration of a neutral or beneficial effect on water quality. Refer section 4.3.3 for the potential impacts of the project on water quality, section 5.2 for the mitigation of impacts, and Appendix C for NorBE assessment summary.

Runoff from the study area under existing conditions is directly from the cross drainage structures through Rail cross drainage culverts to the receiving drainage network in local roads and surface flows within the road corridor.

Minimal existing treatment measures are installed to the urban runoff system prior to discharge to the natural receiving watercourses.

4 Potential impacts

The sections below describe the potential impacts of the proposed GWH upgrade, including a description of construction and operational impacts. The potential impact of future development and climate change inform the operational impacts of the upgrade proposal.

4.1 Concept design

The proposal includes widening of the road from south of Bellevue Crescent to north of the Medlow Bath Station at the intersection of the Great Western Highway with Station Street and Railway Parade. This widening increases the area of road pavement including formalisation of the existing verge area to new road pavement and verge profile, and additional cut/fill to enable widening of the road corridor. Significant change to the road vertical geometry is not proposed due to the multiple interfaces along the corridor at existing properties, driveways and roads.

4.1.1 Drainage design

The design includes provision for capture of surface runoff from the road corridor and conveyance in a pit and pipe network. This is a significant upgrade on the existing conditions where minimal piped infrastructure exists. 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 Park. Table 4.1 below summaries the new and retained cross drainage structures for the Great Western highway upgrade. The TfNSW design criteria for blockage of cross drainage structures has not been considered in the capacity assessment below, but will form part of the design criteria for the cross drainage structures in Detailed Design. Refer section 5.2 for discussion of the mitigation measures associated with the cross drainage system.

Table 4.1: Drainage Standard of Design Drainage Structures

Cross drainage	Chainage	Drainage structure	Approximate Standard	Comments
CD3370	3370	1 x 600mm RCP	1% AEP with Climate Change	Discharges to new basin. Refer to mitigation measures identified in section 5.2
RD3770*	3770	1 x 450mm RCP connection to rail drainage	1% AEP	Existing GWH cross drainage removed. Pipe and headwall connection to remaining rail cross drainage pipe.
RD3960*	3960	1 x 450mm RCP connection to rail drainage	10% AEP	Existing GWH cross drainage removed. Pipe and headwall connection to remaining rail cross drainage pipe.
RD4200*	4200	1 x 450mm RCP connection to rail drainage	20% AEP	Existing GWH cross drainage removed. Pipe and headwall connection to remaining rail cross drainage pipe.
CD4220	4220	1 x 600mm RCP	1% AEP with Climate Change	Discharges to new basin via upsized rail cross drainage Refer to mitigation measures identified in section 5.2

*Note the RD drainage series are lateral connections from the pipe drainage network to the rail cross drainage. Refer section 5.2.

4.2 Construction impacts

During construction activities there are areas of vegetation being cleared, demolition of existing pavements and in-ground structures, trenching and general excavation and fill to achieve the desired road grading and verge profiles. These activities have the potential to cause the following impacts:

- areas of disturbed ground raises the potential for sediment transport, particularly during periods of wet weather with overland flows carrying the sediment.
- vehicle movements including temporary access and through traffic diversions in the area also creates disturbances to sediment increasing the risk of sediment transport either immediately through vehicle movements or subsequently through wind and water runoff.
- blockages in the waterways and drainage lines temporarily due to earthworks and other construction activities. Blocking or diversion of local drainage lines may result in localised flooding upstream of the safety works and may change the ultimate discharge location of overland flows into the receiving watercourses.
- diversion of drainage lines may create localised areas of flooding and scour. These temporary impacts are expected to be minor and would be managed through the implementation of standard construction techniques.
- drawdown of groundwater levels to surrounding landuses including affects to groundwater use and settlement of adjacent structures
- pollution of groundwater due to leaching of contaminants
- changes to the groundwater movement and resources, resulting in changed conditions for groundwater dependent ecosystems

4.3 Operational impacts

This section identifies areas where there is a major change to existing impervious areas or change in horizontal/vertical alignment which would result in changes to upstream flood levels or downstream peak flow rates affecting properties, or related environmental impacts. It also identifies future upgrade considerations due to the potential impact on peak flows of future development and climate change.

4.3.1 Surface water impacts

Upstream impacts are caused by increased runoff volumes by the increase in impervious portions of catchments, the increase in catchment size through regrading of the area to create the design pavement profiles, or the redistribution of flows as a result of a change in the formal drainage infrastructure. All three components are influencing the post construction flood impacts however the impacts are generally considered minor, with a limitation of vertical alignment changes, maintenance of flow discharge splits to downstream receivers, and general increase in available stormwater storage within the drainage system.

Downstream flooding impacts are to be limited through the use of flow control structures at:

- a new detention basin downstream south of the existing cross drainage location (CX3480) where a major flow culvert upgrade across the transport corridor is proposed,
- a new detention basin downstream of the existing sag rail cross drainage location (CX4200 & CX4220) where a major flow culvert upgrade across the transport corridor is proposed, and;
- existing intermediate rail cross drainage locations (CX3770 & CX3960) where the GWH stormwater system discharges flows to the existing rail cross drainage structures without major flow culvert upgrades

4.3.2 Scour

Scour potential is increased with higher velocities and larger flow rates than experienced under existing conditions. With the increase in impervious areas as the road widening is constructed, runoff volumes

will increase having the potential for scour events in receiving watercourses. Mitigation for this increase in flow rates is proposed at the discharge location to manage potential increases in velocity and peak flow.

4.3.3 Water quality

The water quality impacts are partly addressed by this assessment in terms of water quality treatment. The runoff from urban portions of the catchment contribute pollutants in the form of gross pollutants, dissolved solid materials and suspended sediments including organic compounds and oils. Mitigation of the increases in pollutant loadings at discharge locations as a result of larger impervious surfaces within the contributing catchments is discussed in section 5.2. The NorBE assessment carried out for the project, including MUSIC modelling 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.

A separate assessment of the quantity of discharge flows is detailed in the Hydrology and Hydraulics Assessment.

4.3.4 Groundwater

All the construction stage potential impacts are relevant in the operational phase including groundwater level drawdown and changes to the access of contaminants to the groundwater. In addition the potential long term effects of the changes in impervious surfaces with road widening could alter the recharge rates in the immediate vicinity and continue the impacts to sensitive receivers such as groundwater dependent ecosystems.

4.4 Climate change

The climate change uplift in rainfall intensities as a result of temperature increases under the latest climate projections incorporated into the guidance for stormwater and flooding practitioners, Australian Rainfall and Runoff 2019 (ARR2019), is to be incorporated into design infrastructure. The recommendations for rainfall uplift at the proposed upgrade is 19.7% on the ARR2019 rainfall data for the year 2090. These recommendations are based on a Representative Concentration Pathway (RCP) of 8.5 and provided through the ARR2019 datahub.

5 Mitigation measures

During design development, the selection of geometrical alignment of the proposed road pavement has mitigated against significant groundwater impacts. By matching the vertical profile of the design to the existing GWH corridor the likelihood of groundwater drawdown from the construction earthworks interception of the groundwater tables is significantly reduced.

5.1 Construction measures

Construction mitigation measures are comprised of the following items including a range of standard construction techniques previously used on similar projects and recommended by the literature:

- Sediment basins – for the collection of runoff sediment through reduction of velocity of runoff flows. Sedimentation basins are to be maintained through emptying of sediment build-up after each rainfall event causing the transportation of material from the construction footprint.
- Flow diversion bunds and catch drains– redirection of overland flows to dedicated management areas including sediment basins and ultimately to discharge locations, to be implemented in the initial stages of construction for discharge quality management and flood risk management.
- Sediment fencing – implemented in a similar approach as for flow diversion bunds but for use in areas only experiencing minor upstream contributing catchments.
- Check dams – velocity managing devices for installation into flow paths particularly in areas with steep gradients.
- Level Spreader – at all discharge locations to the natural surface, level spreaders should be used to reduce velocity and depth of the flows reaching the natural watercourses.
- Exclusion zones for fill placement - limits the exposure of stockpiles from the risk of washing into overland flow paths
- Stabilised construction entry – removes a large portion of sediment from vehicles prior exit from the construction areas to public roads. Assists in containing sediments

These measures are to be implemented in accordance with the 'Blue Book' guidelines or Managing Urban Stormwater – Soils and Construction Volume 1 (Landcom 2004).

- During construction, monitor groundwater levels where potential impacts in the form of damage to buildings from settlement, is possible as a result of shallow groundwater conditions prior construction. If lowering of the water table is identified, then further mitigation measures will be implemented.
- Store potential contaminants in specific banded enclosures to prevent the possibility of groundwater contamination in the event of spills from stored construction materials

5.2 Operational measures

The following list of measures indicates a baseline methodology for mitigating the increases in runoff volume, pollutant loads and peak flow as a result of the proposed upgrade.

- Water quality (Biofiltration) basins - embedded biofiltration inside water quantity management basins provide water quality improvements of the discharge runoff from the permanent stormwater system. A basin including minimum 160m² of bioretention area is proposed for the Medlow Park basin downstream of CD4420.
- Accidental spill containment – dedicated diversion equipment for the storage of spills to avoid direct discharge to receiving watercourses.

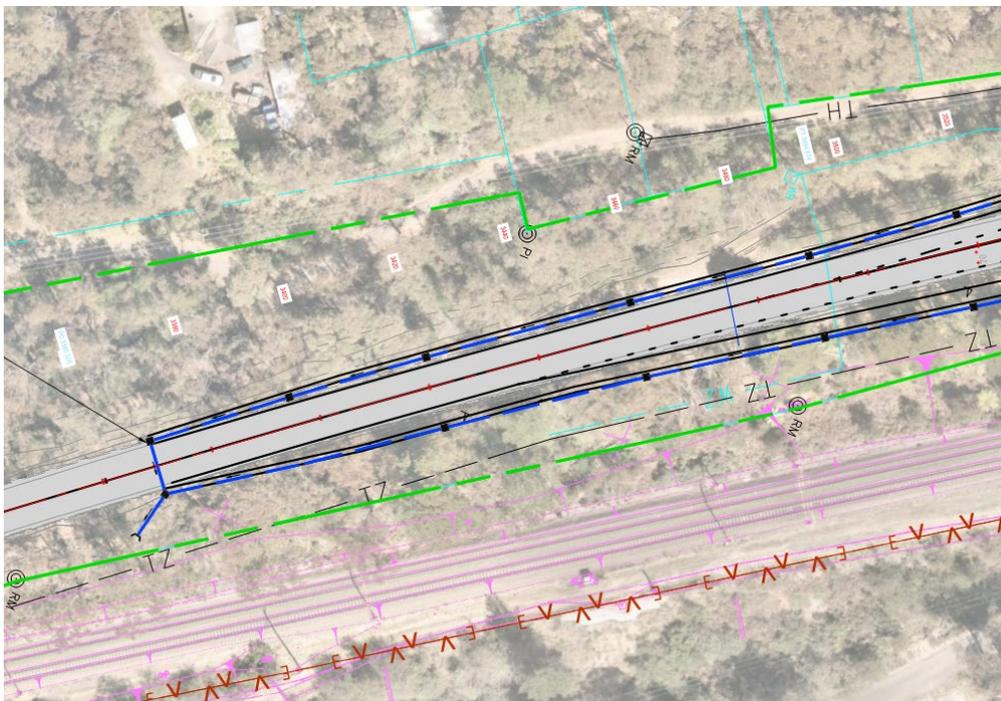
- Grassed swales – vegetated flow carrying infrastructure providing filtration of stormwater flows during low flow storm events through soil infiltration
- Level Spreader - at all discharge locations to the natural surface, level spreaders should be used to reduce velocity and depth of the flows reaching the natural watercourses.

Table 5.1: Mitigation Measures

Impact	Environmental Safeguard	Responsibility	Timing
Increase in peak flow	Develop storage basins at the two locations identified, CD3370 and CD4420	TfNSW	Concept Design
Increase in pollutant loads from larger impervious surfaces	Design for biofiltration basins and grassed swales for primary and secondary treatment of the urban runoff prior to discharge. Design standard of the water quality improvement is to the NorBE guidelines	TfNSW	Concept Design
Scour potential increases at discharge locations	Develop culvert/channel scour protection to the TfNSW standard details ensuring suitability for velocity and peak flow protection	TfNSW	Detailed Design

At the discharge of the drainage system downstream of CD3370, a new cross drainage culvert proposed as part of the concept design, a new detention basin is required to attenuate the peak flows to downstream and limit the discharge velocity. The position and shape of the basin is subject to the batter design of the upgrade works. The size of biofiltration bed within the basin is anticipated to be 2% of the contributing catchment area.

Figure 5.1: CD3370 Discharge Mitigation

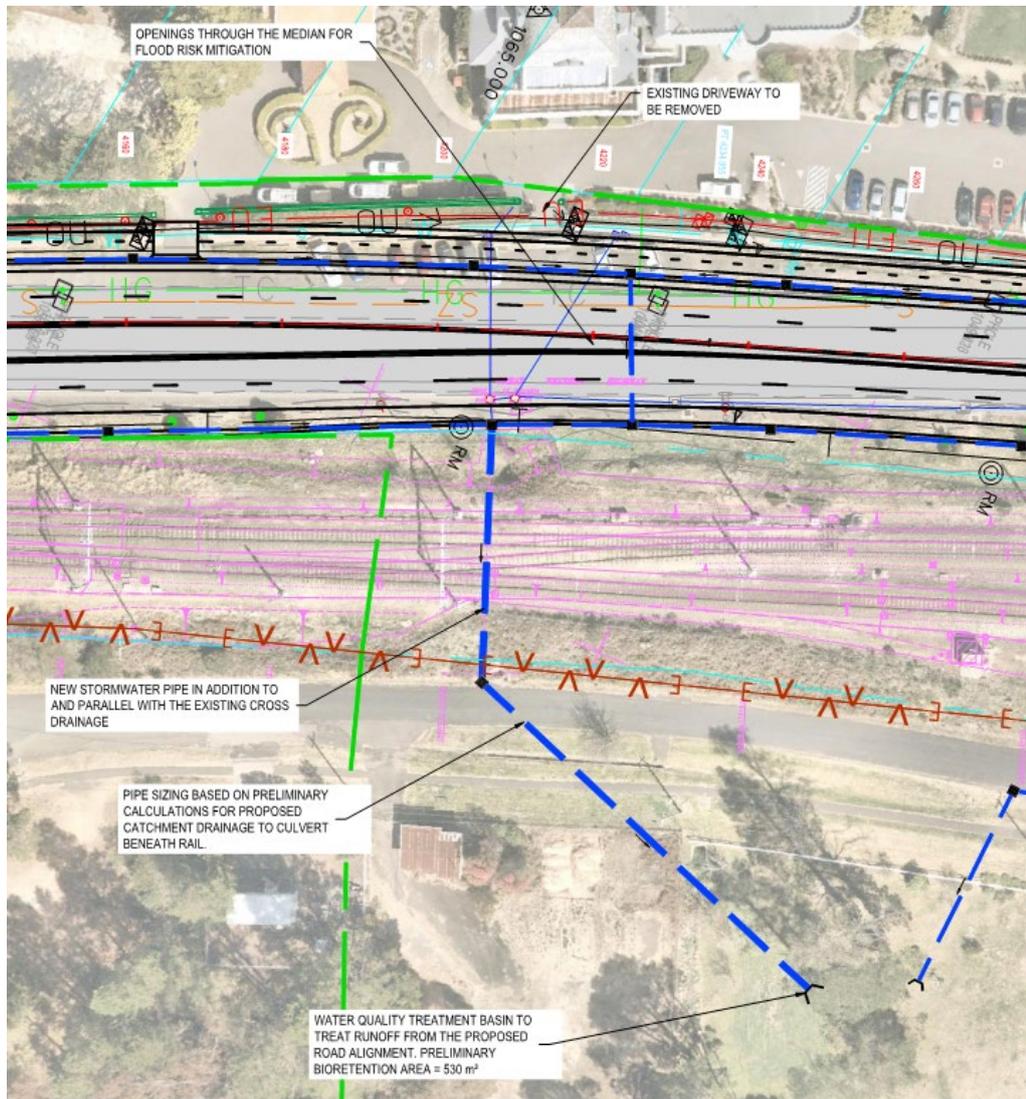


Source: Medlow Bath Concept Design

At the discharge of the drainage system downstream of CD4420, a new cross drainage culvert is proposed as part of the concept design, a new detention basin is required to attenuate the peak flows to downstream and limit the discharge velocity. The position and shape of the basin is subject to coordination with the Medlow Park masterplan as well as consultation with Council and any applicable government agencies. The details of the discharge control structure of the basin based on culvert

capacity once the blockage assessment of the GWH cross drainage design is confirmed in detailed design. The size of biofiltration bed within the basin is anticipated to be 2% of the contributing catchment area, and not less than 160m² to achieve the NorBE objectives for a beneficial outcome.

Figure 5.2: CD4220 Discharge Mitigation



Source: Medlow Bath Concept Design

To mitigate the potential impacts on groundwater during the operational phase,

- swales are to be vegetated where possible to maintain groundwater recharge rates.
- bioretention areas are to be unlined, encouraging groundwater recharge after treatment of the surface runoff which removes much of the pollutants
- spill containment measures and pollutant traps are to be inspected regularly as part of the maintenance program to ensure they remain functional and the adequacy of storage volumes for subsequent potential contaminants is maintained.

6 Recommendations

These recommendations are based on the principles of not worsening the existing conditions for runoff and ground water quality. The recommendations in this report will contribute to achieving a beneficial outcome with regard to surface water quality as indicated by the NorBE assessment, and a negligible impact on groundwater due to the design alignment selection, no active use of groundwater; and the proximity of the site in relation to the location of the existing bores:

- Provide all runoff discharge locations with level spreaders for limits on the scour potential of runoff entering the existing watercourses
- Runoff discharge locations are proposed to have attenuation basins for mitigation of the discharge peak flows to no greater than under the existing conditions. Bioretention is proposed to be integrated into the basin floor to provide stormwater quality filtration and treatment. Minimum bioretention area is to be 160m², with a recommended 2% of catchment area to be provided to achieve a beneficial outcome.
- Scour protection to all overland flow routes comprising grass cover by default, and concrete lining channels for velocities greater than 2m/s.
- Consult with Council around the integration of attenuating basin to the Medlow Park masterplan area. The dimensions and depth to be developed in consultation with Council engineers to ensure safe operation of the infrastructure.
- Consult with the owner of groundwater bore near the boundary of the proposal area to understand the access and GW061451 quality requirements of the bore into the future and confirm no adverse impacts.
- During construction, monitor groundwater levels where potential impact in the form of damage to buildings from settlement, is possible as a result of shallow groundwater conditions prior construction.

7 References

Australian Government 2013, Guidelines for groundwater quality protection in Australia: National Water Quality Management Strategy, Department of Agriculture and Water Resources, Canberra.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2019, Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia

NSW Department of Infrastructure, Planning and Natural Resources, 2005, Floodplain Development Manual: the management of flood liable land, NSW Government, Sydney.

NSW Department of Primary Industries, 2012, NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities.

A. Catchment Mapping

Medlow Bath Review of Environmental Factors

Hydrological Catchment Layout Map

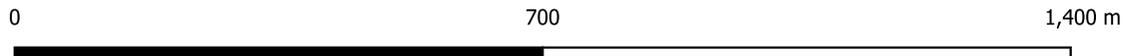
Legend

Spatial Data

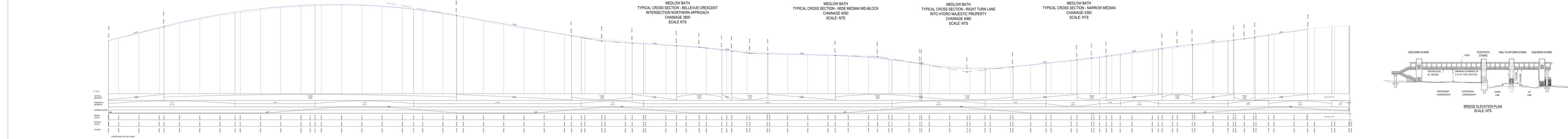
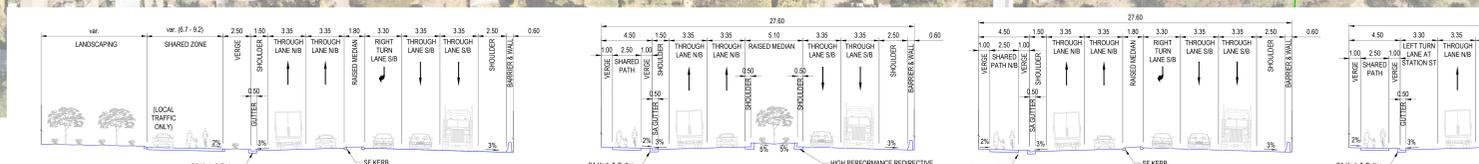
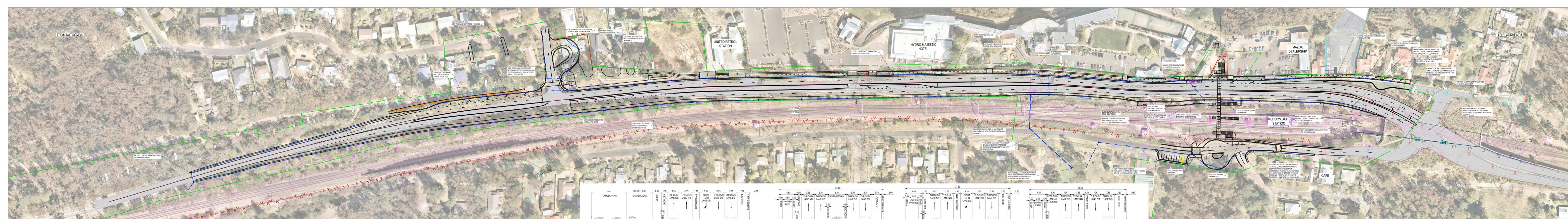
 REF Assessment Catchments

 Study Area

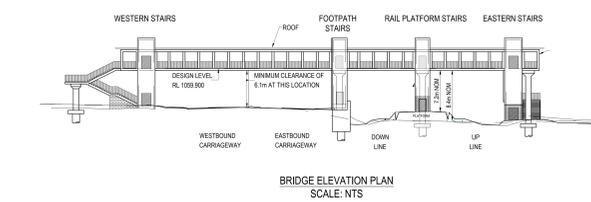
OpenTopoMap



B. Drainage Concept Design



HW5 GREAT WESTERN HIGHWAY - MEDLOW BATH
 LONGITUDINAL SECTION - MEDLOW BATH - CONTROL LINE MCM0
 HORIZ SCALE = 1:500 VERT SCALE = 1:100



LEGEND

- EXISTING DP PROPERTY BOUNDARY
- NEW DESIGN
- DESIGN CONTROL LINE
- EXISTING SURVEY
- RAILWAY CORRIDOR
- EXISTING PAVEMENT
- ENVIRONMENTAL STUDY BOUNDARY
- PROPERTY ACQUISITION LINE
- RETAINING WALL
- POTENTIAL CONSTRUCTION COMPOUND SITE
- EXISTING HERITAGE WALL
- NEW DRAINAGE DESIGN
- NEW DRAINAGE PITS
- THROUGH LEFT ONE WAY LT
- THROUGH RIGHT ONE WAY RT
- ELECTRICAL HIGH VOLTAGE - ABOVE GROUND

08/03/21	DR	DR ISSUE FOR CONCEPT DESIGN	WT	YS
18/03/21	DR	DR ISSUED FOR CONCEPT DESIGN	WT	YS
	CHK	CHK	CON	APR

Scale Stamp: **CONCEPT DESIGN**

MRB
 TECHNICAL SERVICES
 CONSULTING ENGINEERS AND ARCHITECTS

Client: **Transport Roads & Maritime Services**

GWHP - MEDLOW BATH
 GENERAL ARRANGEMENT PLAN &
 ROAD LONGSECTION

Design	L-0486	MRB	ENR/ENK	MRB/ENR/ENK	MRB
Drawn	L-0486	MRB	CON/STR	MRB/ENR/ENK	MRB
Eng. Check	L-0486	MRB	APR/APP	MRB/ENR/ENK	MRB
MRB/ENR/ENK Number	419899	Scale	AS/NZS	1:500	Security
Scale	AS/NZS	Scale	AS/NZS	1:500	Security
Scale	AS/NZS	Scale	AS/NZS	1:500	Security

Scale: 1:500

C. NorBE Assessment Summary

Neutral or Beneficial Effect Assessment

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 relates to the use of land within the Sydney drinking water catchment. In accordance with Clause 12 of the SEPP, Roads and Maritime is required to consider whether or not an activity to which Division 5.1 of the EP&A Act applies will have a neutral or beneficial effect on water quality before carrying out the activity.

Factor	Impact
1. Are there any identifiable potential impacts on water quality?	Identified potential pollutants are sediments (fine and coarse), nitrogen, phosphorus, pathogens, hazardous chemicals and contaminants such as oil/fuel.
What pollutants are likely?	These pollutants are not new to the catchment as there is no new landuse proposed as part of the project. However the project increases the generation of these pollutants as widening facilitates more traffic movements through the area, and increased pavement areas reduce the pervious portions of the catchment which provide treatment for runoff and filtration of the pollutants.
During construction and/or post construction?	Specific water quality pollutant generation during construction result from the disturbance of soil in demolition and excavation, stockpiling and sedimentation from unfinished surfaces.
2. For each pollutant, list the safeguards needed to prevent or mitigate potential impacts on water quality (these may be Water NSW endorsed current recommended practices and/or equally effective other practices)	<p>Safeguards, or water quality protection measures, that need to be in place during the construction.</p> <ul style="list-style-type: none"> • Perimeter sedimentation control (fence) and swale drains/bunds • Stabilised construction access including shaker pads • Wash down facilities for trucks and plant • Sedimentation basin • Spill control/oil separator at discharge locations <p>Safeguards, or water quality protection measures, that need to be in place during operational stages of the project.</p> <ul style="list-style-type: none"> • Bioretention basin to Council specification • Gross pollutant trap • Stormwater attenuation
3. Will the safeguards be adequate for the time required? How will they need to be maintained?	<p>The Construction Environmental Management Plan (CEMP) will include the regular maintenance of the construction stage water quality improvement measures including roles and responsibilities for monitoring the quality and effectiveness of the measures at each stage of the construction. This includes regular inspection and cleanout of the mitigation measures which will capture varying loads of pollutants at stages of construction dependent on the current activities on-site.</p> <p>Operational phases of the project will include maintenance regimes to the stormwater reticulation network, gross pollutant trap and bioretention/stormwater attenuation facilities. This includes the management of vegetation, removal of pollutant loads and system blockages, and replacement of any filtration media to a maintenance program dependent on the size and specification of the measures selected during detailed design stages.</p>

Factor	Impact
<p>4. Will all impacts on water quality be effectively contained on the site by the identified safeguards (above) and not reach any watercourse, waterbody or drainage depression?</p> <p>Or will impacts on water quality be transferred outside the site for treatment? How? Why?</p>	<p>The project drains to controlled areas for water quality and as such MUSIC modelling has been undertaken to determine the impacts and treatment required to achieve no worsening of pollutants in discharge water reaching the receiving environment.</p> <p>The impacts on water quality of the project will be managed on-site through collection of runoff, reticulation to the gross pollutant trap and subsequent discharge to the bio-retention basin. Bioretention to be collocated with the stormwater attenuation basin such that runoff peak volumes are not increased as a result of the project.</p>
<p>5. Is it likely that a neutral or beneficial effect on water quality will occur? Why?</p>	<p>When the activity has been completed, the level of pollutants will be lower than before construction. Current water quality improvement measures for the discharge of stormwater are minimal and mainly comprise treatment through informal measures such as overland flows routed through vegetation providing filtration through infiltration. The post developed treatment measures will remove gross pollutants and further reduce residual pollutants through biofiltration prior to discharge.</p>

D. Protected Matters Report

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://environment.gov.au/protection/environment-assessments>

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Significance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Threatened Ecological Communities:	12
Threatened Species:	84
Migratory Species:	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits-and-application-forms>

Commonwealth Lands:	8
Commonwealth Heritage Places:	None
Listed Marine Species:	21
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Regional Forest Agreements:	None
Invasive Species:	54
Nationally Important Wetlands:	1

Details

Matters of National Environmental Significance

World Heritage Properties [\[Resource Information \]](#)

Name	State	Status
Greater Blue Mountains Area	NSW	Declared property

National Heritage Properties [\[Resource Information \]](#)

Name	State	Status
Natural		
The Greater Blue Mountains Area	NSW	Listed place

Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community may occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Temperate Highland Peat Swamps on Sandstone	Endangered	Community known to occur within area
Turpentine-Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species

Name	Status	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	habitat known to occur within area Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
FISH		
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat known to occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
FROGS		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat known to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat likely to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat known to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat known to occur within area
INSECTS		
Paralucia spinifera Bathurst Copper Butterfly, Purple Copper Butterfly, Bathurst Copper, Bathurst Copper Wing, Bathurst-Lithgow Copper, Purple Copper [26335]	Vulnerable	Species or species habitat may occur within area
MAMMALS		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Isodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
OTHER		
Pommerhelix duralensis		
Dural Land Snail [85268]	Endangered	Species or species habitat known to occur within area
PLANTS		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
Acacia flocktoniae		
Flockton Wattle [3134]	Vulnerable	Species or species habitat known to occur within area
Acacia gordonii		
[5031]	Endangered	Species or species habitat known to occur within area
Acacia pubescens		
Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat known to occur within area
Acrophyllum australe		
[3983]	Vulnerable	Species or species habitat known to occur within area
Allocasuarina glareicola		
[21932]	Endangered	Species or species habitat likely to occur within area
Astrotricha crassifolia		
Thick-leaf Star-hair [10352]	Vulnerable	Species or species habitat known to occur within area
Boronia deanei		
Deane's Boronia [8397]	Vulnerable	Species or species habitat likely to occur within area
Callistemon megalongensis		
Megalong Valley Bottlebrush [85098]	Critically Endangered	Species or species habitat known to occur within area
Callistemon purpurascens		
a bottlebrush [88226]	Critically Endangered	Species or species habitat known to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Cynanchum elegans		
White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Epacris hamiltonii		
[8700]	Endangered	Species or species habitat known to occur within area
Epacris sparsa		
[16450]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Eucalyptus aggregata Black Gum [20890]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus benthamii Camden White Gum, Nepean River Gum [2821]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus copulans [56225]	Endangered	Species or species habitat known to occur within area
Eucalyptus macarthurii Camden Woollybutt, Paddys River Box [7827]	Endangered	Species or species habitat likely to occur within area
Eucalyptus pulverulenta Silver-leaved Mountain Gum, Silver-leaved Gum [21537]	Vulnerable	Species or species habitat likely to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Euphrasia bowdeniae [21521]	Vulnerable	Species or species habitat known to occur within area
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat may occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area
Haloragodendron lucasii Hal [6480]	Endangered	Species or species habitat known to occur within area
Homoranthus darwinioides [12974]	Vulnerable	Species or species habitat likely to occur within area
Isopogon fletcheri Fletcher's Drumsticks [19980]	Vulnerable	Species or species habitat known to occur within area
Kunzea cambagei [11420]	Vulnerable	Species or species habitat known to occur within area
Leionema lachnaeoides [64924]	Endangered	Species or species habitat known to occur within area
Leucopogon exolasius Woronora Beard-heath [14251]	Vulnerable	Species or species habitat may occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat known to occur within area
Micromyrtus minutiflora [11485]	Vulnerable	Species or species habitat likely to occur within area
Olearia cordata [6710]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species

Name	Status	Type of Presence
Persoonia acerosa Needle Geebung [7232]	Vulnerable	habitat may occur within area Species or species habitat likely to occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat known to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat likely to occur within area
Pherosphaera fitzgeraldii Dwarf Mountain Pine [40324]	Endangered	Species or species habitat known to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat may occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat may occur within area
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat may occur within area
Pomaderris cotoneaster Cotoneaster Pomaderris [2043]	Endangered	Species or species habitat likely to occur within area
Prasophyllum fuscum Tawny Leek-orchid, Slaty Leek-orchid [19455]	Vulnerable	Species or species habitat known to occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat may occur within area
Pultenaea glabra Smooth Bush-pea, Swamp Bush-pea [11887]	Vulnerable	Species or species habitat known to occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat known to occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat may occur within area
Thelymitra kangaloonica Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Velleia perfoliata [17190]	Vulnerable	Species or species habitat may occur within area
Wollemia nobilis Wollemi Pine [64545]	Critically Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat likely to occur within area
Zieria covenyi Coveny's Zieria [56732]	Endangered	Species or species habitat known to occur within area
Zieria involucrata [3087]	Vulnerable	Species or species habitat known to occur within area
Zieria murphyi Velvet Zieria [4634]	Vulnerable	Species or species habitat known to occur within area

REPTILES

Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area
Eulamprus leuraensis Blue Mountains Water Skink [59199]	Endangered	Species or species habitat known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat known to occur within area

Migratory Species [[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	habitat likely to occur within area Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Commonwealth Land - Airservices Australia Commonwealth Land - Australian Postal Commission Commonwealth Land - Australian Telecommunications Commission Commonwealth Land - Australian Telecommunications Corporation Commonwealth Land - Commonwealth Bank of Australia Commonwealth Land - Defence Housing Authority Defence - AIR HEADQUARTERS AUSTRALIA - GLENBROOK

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species

Name	Threatened	Type of Presence
Chrysococcyx osculans Black-eared Cuckoo [705]		habitat may occur within area Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Blue Mountains	NSW
Ngula Bulgarabang	NSW
Wollemi	NSW
Yellomundee	NSW

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit,

Name	Status	Type of Presence
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Birds

Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
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Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
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Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
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Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
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Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
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Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
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Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
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Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
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Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
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Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
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Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
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Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
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Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
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Frogs

Rhinella marina Cane Toad [83218]		Species or species
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Name	Status	Type of Presence
habitat likely to occur within area		
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species

Name	Status	Type of Presence
Cabomba caroliniana		habitat likely to occur within area
Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera		
Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera		
Boneseed [16905]		Species or species habitat likely to occur within area
Cytisus scoparius		
Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati		
Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes		
Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia		
Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana		
Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana		
Broom [67538]		Species or species habitat may occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana		
Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma		
Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla		
Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Reptiles

Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
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Nationally Important Wetlands

[[Resource Information](#)]

Name	State
Blue Mountains Sedge Swamps	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environment and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-Forestry Corporation, NSW](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

[Please feel free to provide feedback via the Contact Us page.](#)

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