MOTT MACDONALD

Great Western Highway Upgrade - Medlow Bath

Hydrology and Hydraulic Impact Assessments

May 2021

Mott MacDonald
383 Kent Street
Sydney
NSW 2000
PO Box Q1678
QVB Sydney NSW 1230
Australia

T +61 (0)2 9098 6800
mottmac.com

Transport for New South Wales

Great Western Highway Upgrade - Medlow Bath

Hydrology and Hydraulic Impact Assessments

May 2021

Mott MacDonald Australia Pty Limited is a subsidiary of Mott MacDonald International Limited. Registered in Australia, ABN 13 134 120 353

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	24/02/2021	J. Mail	S. Reilly		Coordination Draft
B	25/05/2021	J. Mail	S. Reilly	N. Wade	Technical Paper Issue

Document reference: 419899 | 01 | B

Information class: Standard

Contents

Tables

Figures

Executive summary

A desktop hydrologic and hydraulic 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 drainage system, watercourses and catchment flow.

Four existing cross drainage structures under the highway have been assessed in addition to three local access roads drainage structures and three downstream structures under the rail alignment. The hydraulic standards of these structures vary substantially from approximately 10% AEP to greater than 1% AEP.

The hydraulic analysis developed a recommended sizing of the potential upgrade drainage structures to achieve the desired 1% AEP hydrological standard under the recommended climate change scenario (19.7% increase in rainfall intensities by 2090). Upon reviewing potential future development in the area, minimal changes to the existing impervious characteristics of the area is likely, therefore no sizing of drainage structures was determined for a future catchment development scenario.

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

The upgrade of Great Western Highway and some local access road improvements would affect the peak runoff rates from the upstream catchments contributing flow to the cross drainage structures. The increase in paved areas would result in an estimated 20% increase in 1%AEP peak flows at the Medlow Park and new cross drainage CD3770 discharge location. These locations are proposed to have attenuation basins for mitigation of the discharge peak flows to no greater than under the existing conditions.

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

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.

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
ARR2019	Australian Rainfall and Runoff 2019
GWH	Great Western Highway
GWHUP	Great Western Highway Upgrade Project
OEH	Office of Environment and Heritage
RCP	Representative Concentration Pathway
REF	Review of Environmental Factors
TfNSW	Transport for New South Wales, formerly known as RMS

1 Introduction

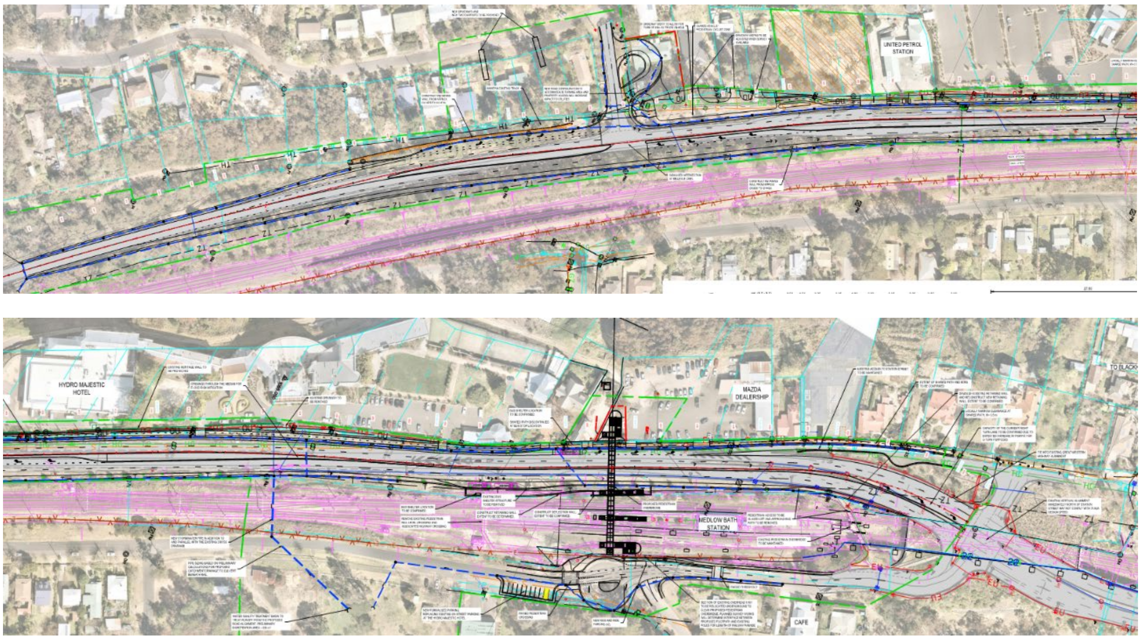
1.1 The Proposal

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:

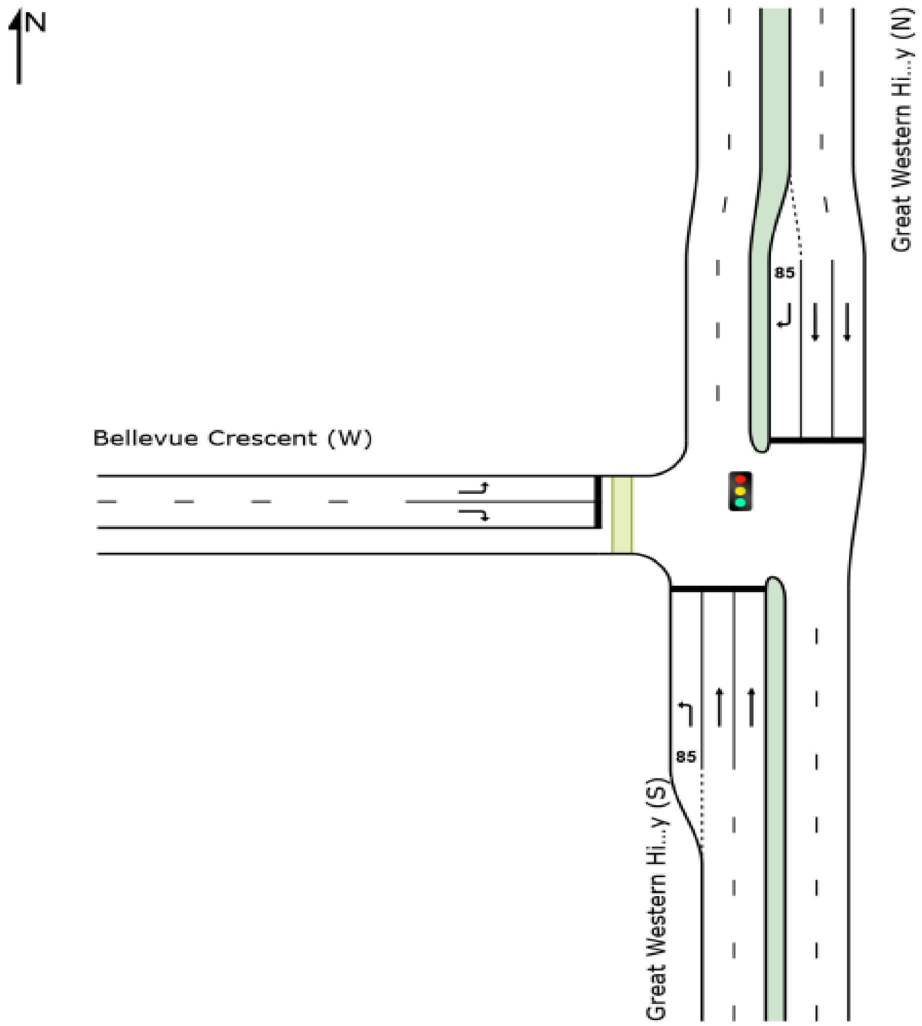
- Construction of a four lane divided carriageway with consolidated access points at upgraded intersections including.
  - Upgraded Bellevue Crescent intersection to include three way traffic signals for safe access/egress
  - Provision of a U-turn bay for traffic turning east bound to west bound at 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 3.1.1)

- 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
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 Orana 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 existing cross drainage infrastructure in terms of the hydraulic amenity provided and makes recommendations for works to mitigate the impacts from changes identified for the Great Western Highway Upgrade at Medlow Bath.

This includes:

- Hydrologic and hydraulic analysis of existing cross drainage structures.
- Hydraulic analysis to identify culvert upgrades required for the works.
- Development of a high-level strategy for discharging runoff from the new pavement drainage system.
- Impact assessment of the proposed works.

A surface and groundwater assessment has been provided in a separate technical paper detailing the water quality review of the proposal.

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 an increased paved area. This can change the existing flood behaviour and alter the flood risk to existing sensitive receivers including adjacent commercial and private properties. To mitigate the changes in these potential flooding risks and to address the requirements of the proposal, this assessment approach includes:

- Collation, analysis and interpretation of the available hydrology and hydraulic data.
- An assessment of the existing drainage and flooding conditions, and an assessment of the existing cross drainage culvert capacities.
- Providing cross drainage structure sizing estimates for potential future upgrades,
- Review of potential future development in the upstream catchments and the impact of climate change.
- Preparation of a high-level pavement drainage strategy accounting for both nuisance and major flooding.
- Assessment of potential impacts to upstream and downstream properties 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.

2.2 Legislation

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

- Environmental Planning and Assessment Act 1979.
- Local Government Act 1993.
- New South Wales Floodplain Development Manual (NSW Government, April 2005).
- 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.

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.

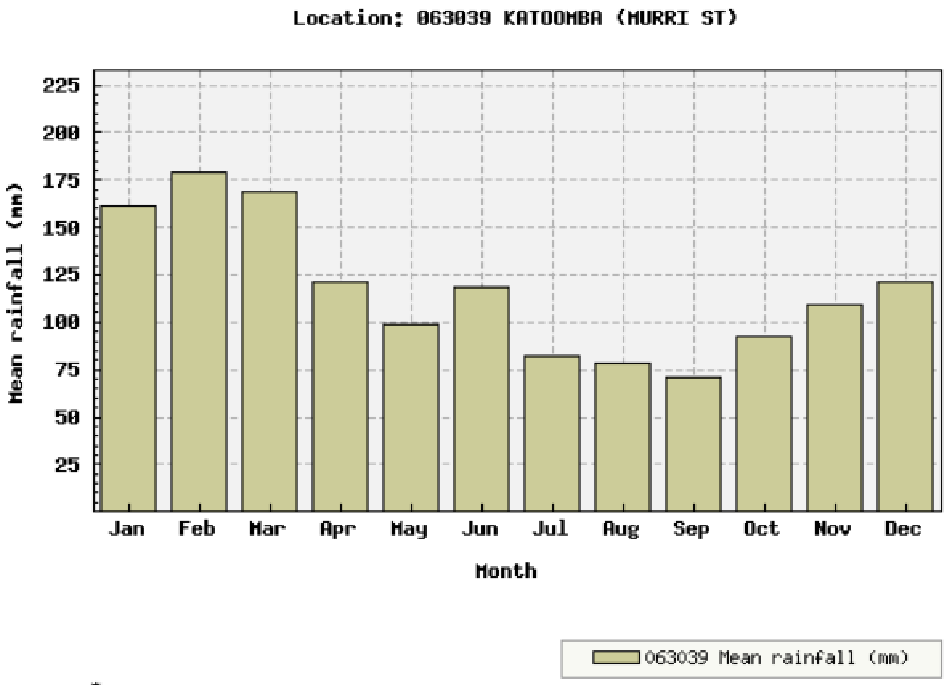
Figure 3.1: Study Area and Topography

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.

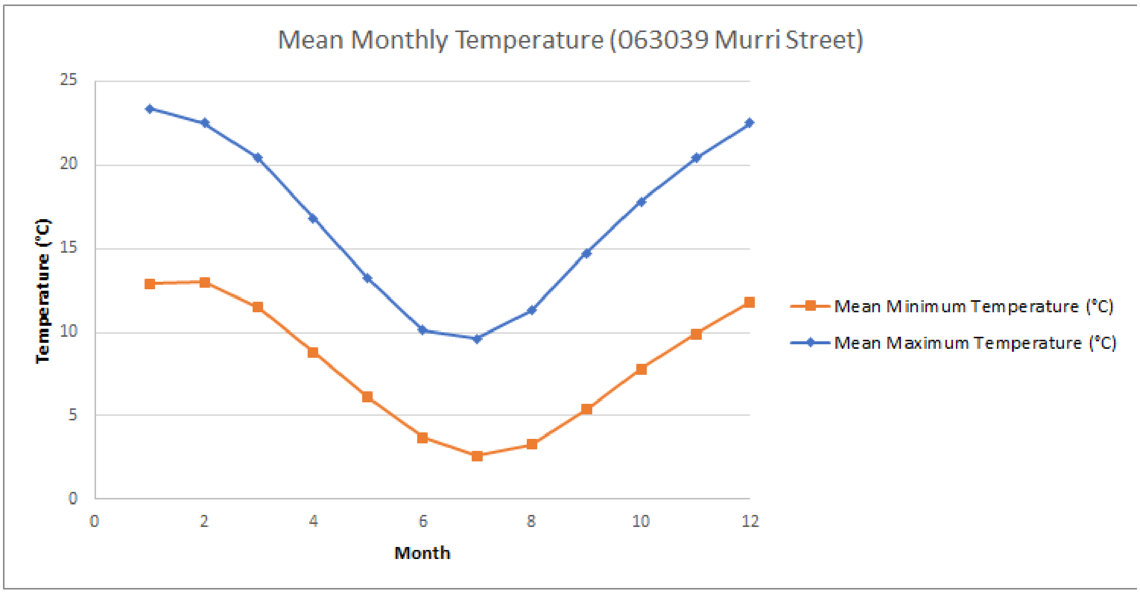
Figure 3.2: Average Monthly Rainfall Data



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

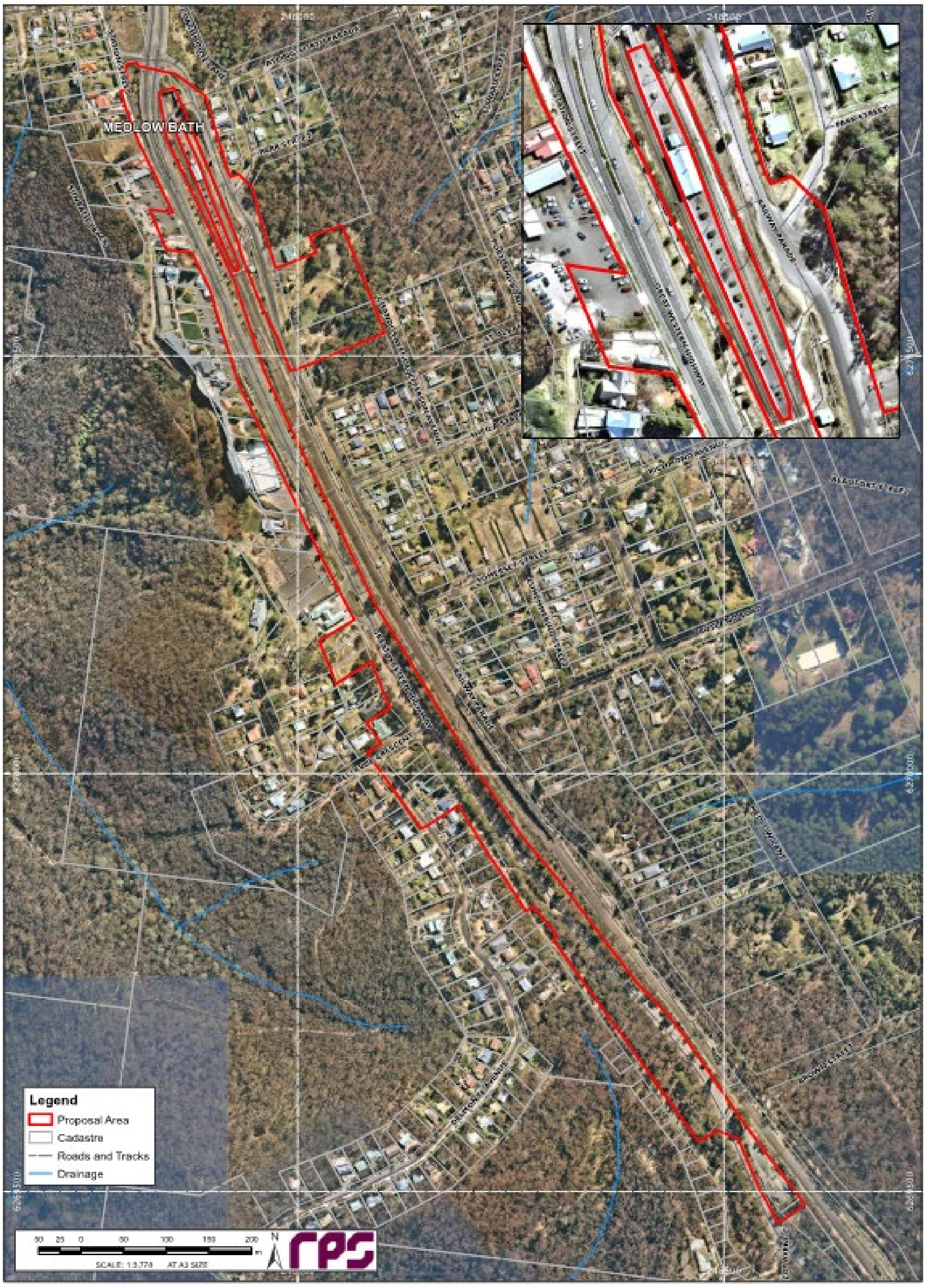


Source: Bureau of Meteorology Climate Data (2021)

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 Culvert Crossings

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

3.5 Hydrological standard

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.

Table 3.2: Drainage Standard of Existing Drainage Structures

Cross drainage	Chainage	Existing structure	Approximate Standard	Comments
CX3480	3480	1 x 375mm RCP	2% AEP	Discharges freely
CX3770	3770	1 x 450mm RCP	1% AEP	Assumes unblocked rail cross drainage downstream. Rail hydraulic standard less than 1% AEP
CX3960	3960	1 x 450mm RCP	10% AEP	Assumes unblocked rail cross drainage downstream. Rail hydraulic standard less than 1% AEP
CX4200	4200	1 x 450mm RCP	20% AEP	Constrained by downstream rail cross drainage.
CX4220	4220	1 x 375mm RCP	20% AEP	Constrained by downstream rail cross drainage.

The tables below provide a summary of each of the cross drainage structures performance in the 1%, 2%, 5%, 10% and 20% AEP storm events.

Table 3.3: Existing Drainage Structures - 1% AEP

Cross drainage	Existing structure	Structure flow m³/s	Overflow m³/s
CX3480	1 x 375mm RCP	0.243	0.019
CX3770	1 x 450mm RCP	0.281	0.000
CX3960	1 x 450mm RCP	0.298	0.097
CX4200	1 x 450mm RCP	0.200	0.179
CX4220	1 x 375mm RCP	0.161	0.309

Table 3.4: Existing Drainage Structures - 2% AEP

Cross drainage	Existing structure	Structure flow m³/s	Overflow m³/s
CX3480	1 x 375mm RCP	0.232	0.000
CX3770	1 x 450mm RCP	0.249	0.000
CX3960	1 x 450mm RCP	0.295	0.059
CX4200	1 x 450mm RCP	0.199	0.119
CX4220	1 x 375mm RCP	0.161	0.247

Table 3.5: Existing Drainage Structures - 5% AEP

Cross drainage	Existing structure	Structure flow m³/s	Overflow m³/s
CX3480	1 x 375mm RCP	0.200	0.000
CX3770	1 x 450mm RCP	0.224	0.000
CX3960	1 x 450mm RCP	0.289	0.016
CX4200	1 x 450mm RCP	0.195	0.093
CX4220	1 x 375mm RCP	0.161	0.177

Table 3.6: Existing Drainage Structures - 10% AEP

Cross drainage	Existing structure	Structure flow m³/s	Overflow m³/s
CX3480	1 x 375mm RCP	0.174	0.000
CX3770	1 x 450mm RCP	0.193	0.000
CX3960	1 x 450mm RCP	0.266	0.000
CX4200	1 x 450mm RCP	0.192	0.052
CX4220	1 x 375mm RCP	0.161	0.118

Table 3.7: Existing Drainage Structures - 20% AEP

Cross drainage	Existing structure	Structure flow m³/s	Overflow m³/s
CX3480	1 x 375mm RCP	0.143	0.000
CX3770	1 x 450mm RCP	0.151	0.000
CX3960	1 x 450mm RCP	0.222	0.000
CX4200	1 x 450mm RCP	0.172	0.000
CX4220	1 x 375mm RCP	0.15	0.000

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. Refer section 5.2 for discussion of the mitigation measures associated with drainage structures.

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
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

*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 will create disturbed ground raising the potential for sediment transport, particularly during periods of wet weather with overland flows carrying the sediment. Vehicle movements 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. Method of limitation for sediment transport are managed through standard construction techniques.

There is a construction stage risk of potential 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 also 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.

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 Flooding impacts

4.3.1.1 Upstream

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.

4.3.1.2 Downstream

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 Environmental

The water quality impacts are partly addressed by this assessment in terms of scour potential, erosion and quantity management. A separate assessment of the water quality of discharge flows is detailed in the Surface and Groundwater Assessment.

4.4 Future development

The future development of the area is not anticipated to have a significant impact on the runoff rates from upstream catchments. As discussed in section 3.3 the existing commercial land use along the western side of the road corridor already has significant impervious surface area which is not likely to increase with future development. The remainder of the area will likely retain its existing character and impervious portions through future development.

4.5 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

5.1 Construction measures

Construction mitigation measures are comprised of the following items:

- Sediment basins – for the collection of runoff sediment through reduction of velocity of runoff flows
- Flow diversion bunds and sediment fencing – redirection of overland flows to dedicated management areas including sediment basins and ultimately to discharge locations
- 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

5.2 Operational measures

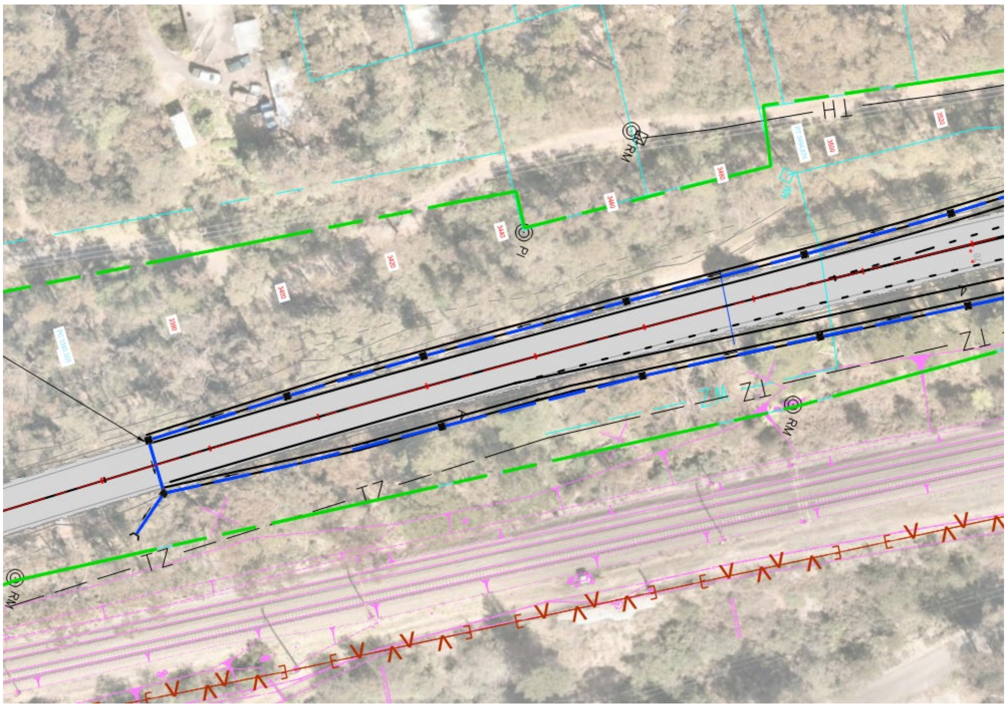
The following list of measures indicates a baseline methodology for mitigating the increases in runoff volume and peak flow as a result of the proposed upgrade.

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
Increased extreme rainfall events due to climate change	Upgrade cross drainage capacity to the 1% AEP inclusive of climate change uplift for the RCP 8.5 in line with ARR 2019	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
Blockage causing increased flooding potential	Develop a blockage assessment of the pavement and cross drainage strategy	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, with discharge control structure to target a reduction of peak flow runoff by approximately 20% to maintain existing peak flow rates.

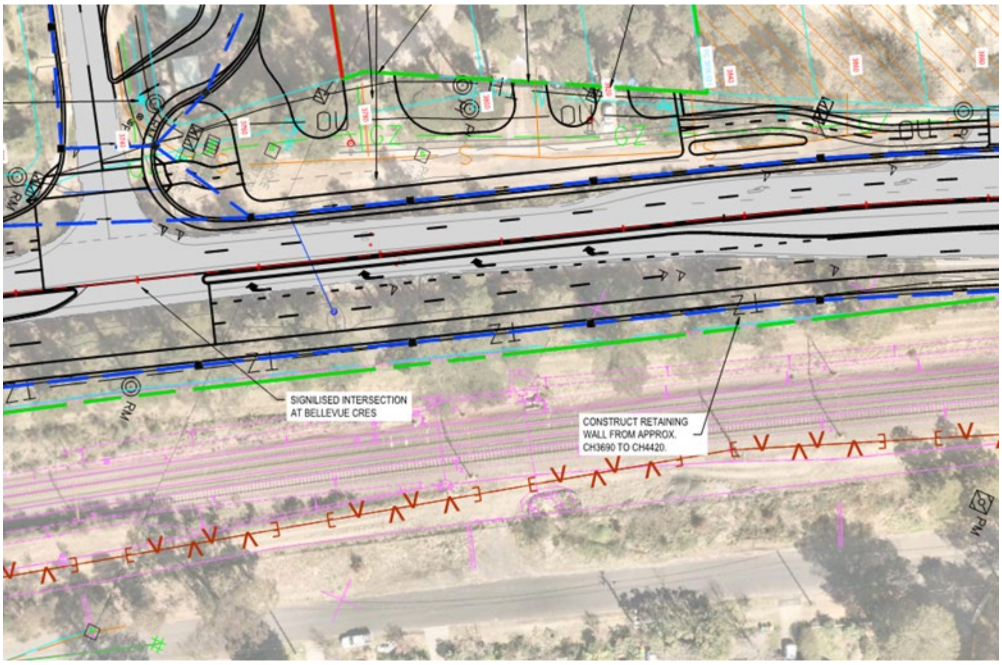
Figure 5.1: CD3370 Discharge Mitigation



Source: Medlow Bath Concept Design

Under existing conditions, the discharge of the drainage system downstream of CX3770 is to the rail culvert RD3770. A new 450mm diameter connection to the existing rail drainage swale upstream of RD3770 is proposed as part of the concept design. Flows in excess of the 450mm diameter connection shall bypass this rail drainage outlet and continue downstream to subsequent discharge locations.

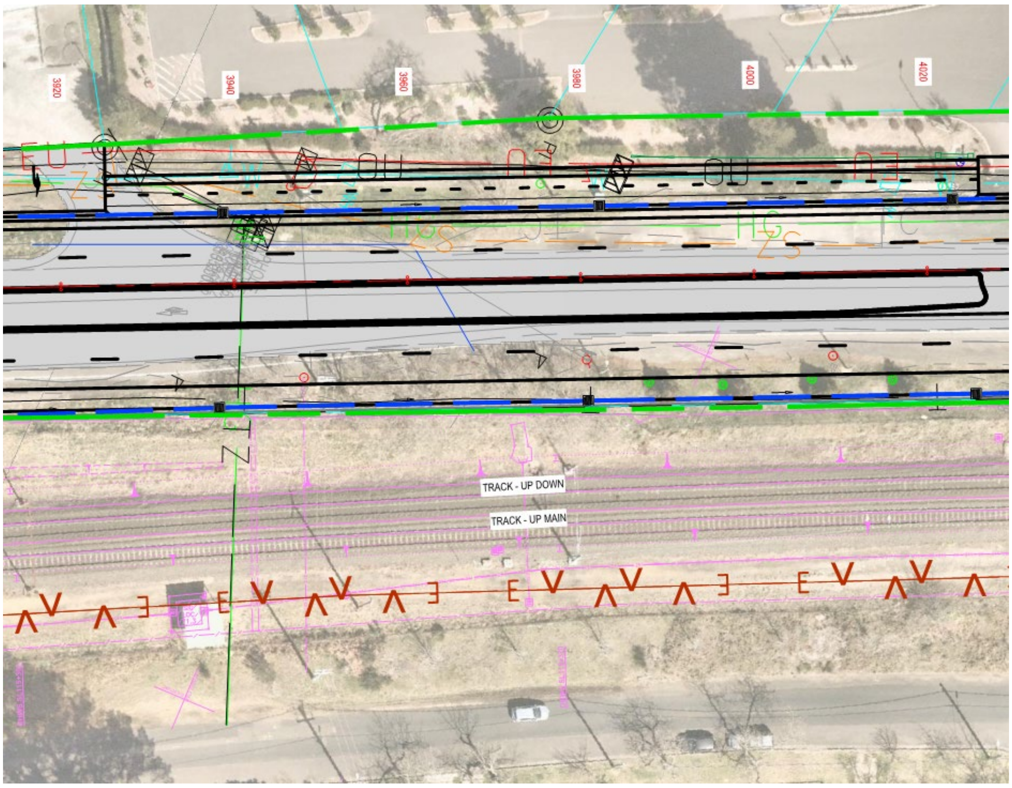
Figure 5.2: CX3770 Discharge Mitigation



Source: Medlow Bath Concept Design

Under existing conditions, the discharge of the drainage system downstream of CX3960 is to the rail culvert RD3960. A new 450mm diameter connection to the existing rail drainage swale upstream of RD3960 is proposed as part of the concept design. Flows in excess of the 450mm diameter connection shall bypass this rail drainage outlet and continue downstream to subsequent discharge locations.

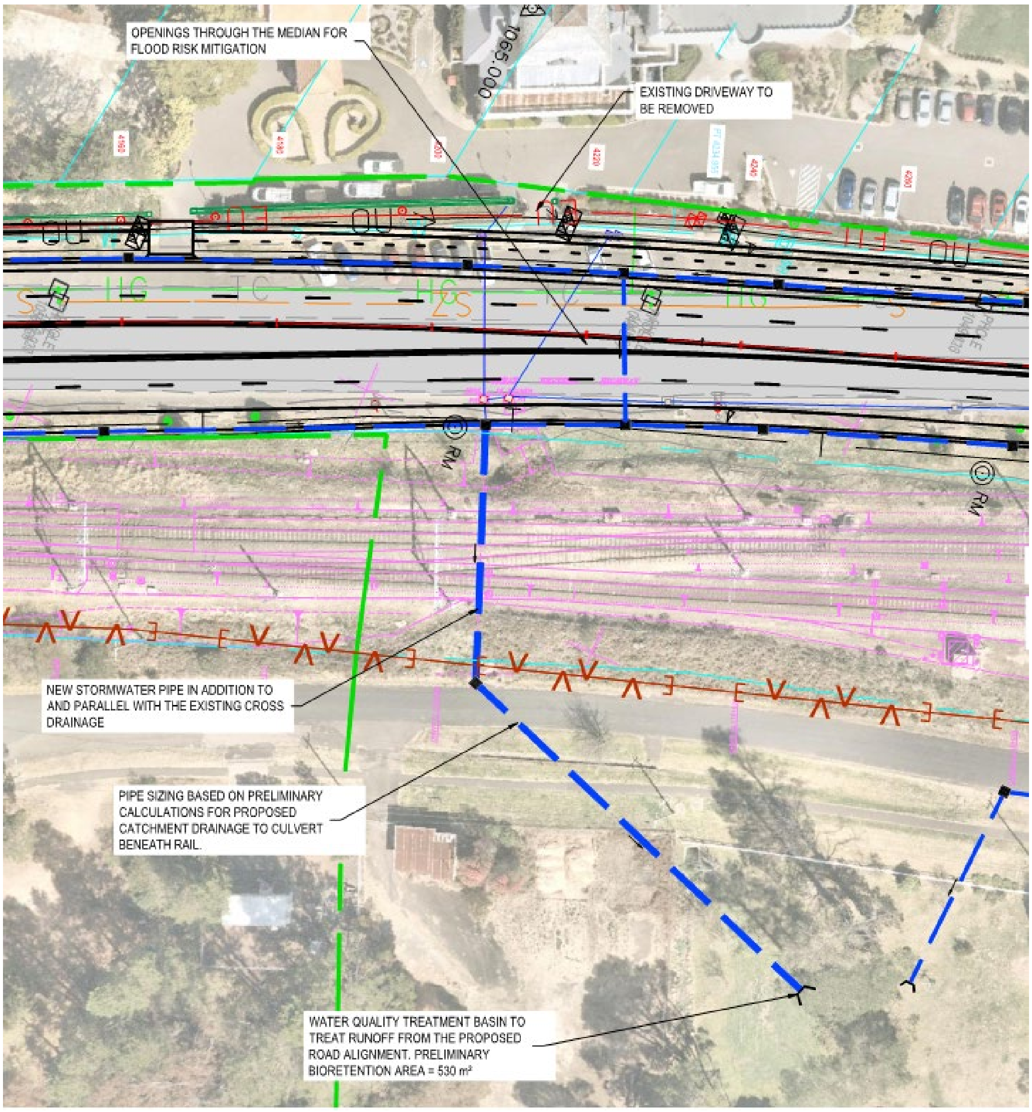
Figure 5.3: CX3960 Discharge Mitigation



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, Council and detailed design coordination. The details of the discharge control structure of the basin will be based on cross drainage culvert capacity once the blockage assessment of the GWH cross drainage design is confirmed in detailed design.

Figure 5.4: CD4220 Discharge Mitigation



Source: Medlow Bath Concept Design

6 Recommendations

These recommendations are based on the principles of achieving cross drainage capacity of 1%AEP inclusive of the affects of climate change to the ARR2019 guidelines and potential future development.

The following components of the detailed drainage design network are to be implemented once the vertical profile of the road is confirmed and drainage lines are graded hydraulically:

- Scour protection to all overland flow routes comprising grass cover by default, and concrete lining channels for velocities greater than 2m/s.
- New quantity management basins to the discharge location of CD3370 and CD4220 to attenuate post construction peak flow rates to existing discharge peak flows for all AEP events up to and including the 1% AEP. The performance of the detention basin is required to reduce the post-construction peak flows by approximately 20% to maintain peak flow rates in the existing conditions.
- Coordination with the Medlow Park masterplan for stormwater quantity management and quality treatment, with integration to the draft masterplan for adoption. Further stakeholder consultation with Council on the specification for the mitigation measures.

7 References

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.

A. Catchment Mapping

0 700 1,400 m

Medlow Bath

Review of Environmental Factors

Hydrological Catchment Layout Map

M M MOTT MACDONALD

Legend

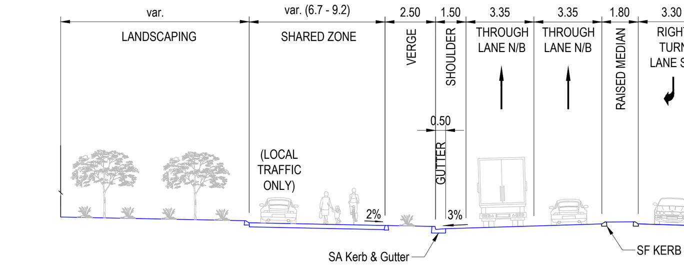
Spatial Data

REF Assessment Catchments

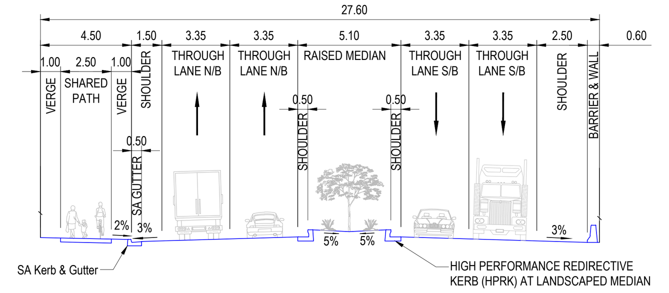
Study Area

OpenTopoMap

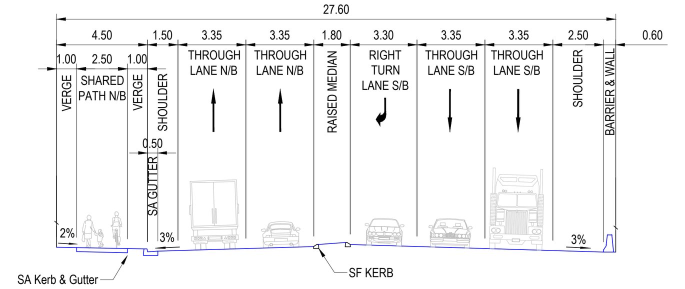
B. Drainage Concept Design



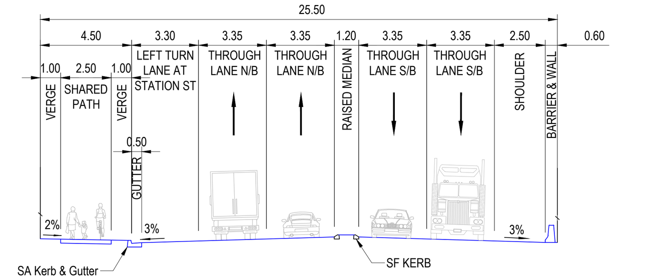
MEDLOW BATH
TYPICAL CROSS SECTION - BELLEVUE CRESCENT
INTERSECTION NORTHERN APPROACH
CHAINAGE 3800
SCALE NTS



MEDLOW BATH
TYPICAL CROSS SECTION - WIDE MEDIAN MID-BLOCK
CHAINAGE 4000
SCALE: NTS

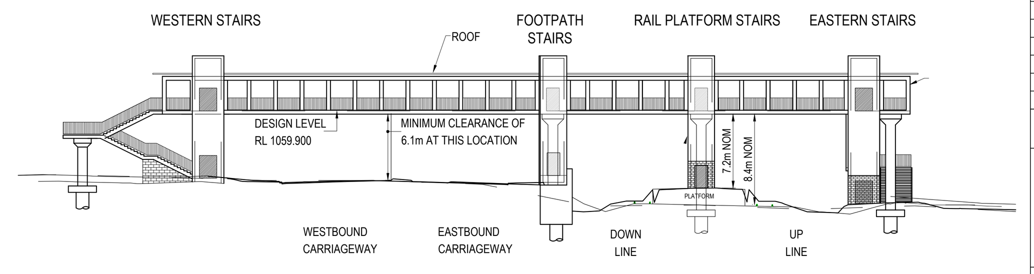


MEDLOW BATH
TYPICAL CROSS SECTION - RIGHT TURN LANE
INTO HYDRO MAJESTIC PROPERTY
CHAINAGE 4060
SCALE: NTS



MEDLOW BATH
TYPICAL CROSS SECTION - NARROW MEDIAN
CHAINAGE 4380
SCALE: NTS

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



BRIDGE ELEVATION PLAN
SCALE: NTS

Notes

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 LIFT
- ONE WAY LIFT
- ELECTRICAL HIGH VOLTAGE - ABOVE GROUND

Date	Drawn	Description	Ch'k'd	App'd
09/02/2021	DK	RE-ISSUE FOR CONCEPT DESIGN	NW	VS
18/12/2020	DK	ISSUED FOR CONCEPT DESIGN	NW	VS

Status Stamp: CONCEPT DESIGN

MRB TECHNICAL SERVICES
CONNECTING COMMUNITIES ACROSS NSW

Client: NSW GOVERNMENT Transport Roads & Maritime Services

GWHUP - MEDLOW BATH
GENERAL ARRANGEMENT PLAN &
ROAD LONGSECTION

Designed	C.ARSENE	MRB	Eng check	M.SCHOFIELD	MRB
Drawn	D.KUMAR	MRB	Coordination		
Dwg check	N.WADE	MRB	Approved	V.SOFREVSKI	MRB

MMD Project Number: 419899
Scale at A0: 1:500
Security:
Suitability Description: Work In Progress
Suit. Code:
Drawing Number: GWHEMB-MRBJ-MED-CV-SKE-101001
Revision: 1

mottmac.com