Transport Roads & Maritime Services

QA SPECIFICATION PS371

HYDROLOGY AND DRAINAGE DESIGN

IC-QA-PS371

VERSION FOR: ***Macquarie Park Bus Priority and Capacity Improvement Project - Stage 2***
DATE: ***November 2018 (~~RFT Issue~~ Addendum 3)***

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FOREWORD

ROADS AND MARITIME SERVICES COPYRIGHT AND USE OF THIS DOCUMENT

When this document forms part of a contract

This document should be read with all the documents forming the Contract.

PROJECT SPECIFIC CHANGES

Any project specific changes have been indicated in the following manner:

(a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. ***Additional Text***.

(b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

RMS SPECIFICATION PS371

HYDROLOGY AND DRAINAGE DESIGN

1 INTRODUCTION

1.1 PROFESSIONAL SERVICES SPECIFICATION

This specification is one of a set of Professional Services Specifications for detailed design. Refer to PS301.

1.2 SCOPE & PROJECT DESCRIPTION

This Specification sets out the requirements for an aspect of detailed design. It requires C72 Panel Deed for Professional Services or equivalent Professional Services Conditions of Contract.

1.2.1 Project Specific Requirements

Refer to Annexure PS371/A for Project Specific Requirements for Hydrology and Drainage Design.

1.3 PROJECT INTRODUCTION

Refer to PS301 for Project Introduction details.

1.4 STRUCTURE OF THE SPECIFICATION

1.4.1 Schedules of HOLD POINTS, WITNESS POINTS, DELIVERABLES, MEETINGS AND WORKSHOPS.

The schedules in Annexure PS371/C list the **HOLD POINTS, WITNESS POINTS, DELIVERABLES, MEETINGS AND WORKSHOPS** that must be produced / observed. Refer to specification PS301 - Professional Service Scope and Requirements for definitions of **HOLD POINTS**.

1.4.2 Design Reference Documents and Support Information.

The schedules in Annexure PS371/M list the **DESIGN REFERENCE DOCUMENTS**, **REFERENCE DOCUMENTS** & **SUPPORTING INFORMTION** that apply to this Specification.

Unless otherwise specified the applicable issue of a referenced document, other than a RMS Specification, is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

2 Hydrology and hydraulics

2.1 OBJECTIVES

As part of the detailed design the PSC must review, supplement and amend, as required, the hydrology/hydraulics assessment undertaken for the concept design and environmental assessment (REF) to provide updated and relevant data for input into the detailed design.

2.2 GENERAL

The detailed design must consider:

(i) For EIS projects, the flooding, hydrology and hydraulic SEARs issued for the project (if required).

(ii) Hydrological impacts of the proposal.

(iii) Flooding and flood immunity requirements.

(iv) Hydrology/hydraulics:

a. Upstream and downstream impacts.

b. Ponding and retention of water.

c. Inundation times.

d. Mitigation of any adverse hydraulic affects.

e. Fish friendly structures (where appropriate).

The PSC must undertake further investigations, assessment and flood modelling as maybe necessary in order to confirm and enhance the understanding of flooding within the project catchments. Issues to be addressed include:

(i) Ultimate effects of the road on regional flooding - including a range of flood events e.g. 20, 50 and 100 year average recurrence interval (ARI) events and the Probable Maximum Flood (PMF) and details of appropriate flood mitigation measures.

(ii) The flood plain terrain model must be updated to include any changes resulting from infrastructure development and the cumulative impacts of these changes included in the flood modelling.

(iii) For each bridge or bridge size culvert opening affected by flooding, review the hydrological study to confirm for each bridge:

a. Serviceability effects of afflux on adjacent properties and the stability of the adjacent road embankment – 100 years Average Recurrence Interval (ARI).

b. Ultimate limit state of bridges, major drainage structures and major retaining walls – refer Annexure PS371/A2 Minimum ARI (Average Recurrence Interval).

c. Refer also to Bridgeworks and other structures, waterway investigations – PS261 - Bridge and Structure Design.

(iv) Confirm if any navigational clearance is to be provided for the Bridge(s) in conjunction with determination of the road grade line and bridge design.

(v) Take consideration of staging issues (to ensure positive drainage at all times) and consideration of any special requirements for working in or realigning of creeks.

(vi) Water quality issues and treatment structures (refer to Section 3 - Drainage and water quality) must be considered in terms of flooding.

(vii) For projects considered "high risk" for erosion and sedimentation control as defined in RMS 'Erosion and Sedimentation Management Procedure (RTA 2012), water quality devices for construction and operation (if deemed necessary) must be proposed and integrated into the design plans, including any staging plans. Where required you must engage a registered soil conservationist (refer Clause 3.2.14).

(viii) Drainage requirements of relevant agencies such as OEH and Local Government.

(ix) The potential effect arising from climatic change should be considered in the modelling.

(x) Consideration of the 'Floodplain Development Manual: the management of flood liable land' (Department of Infrastructure Planning and Natural Resources (DIPNR), 2005), including the floodplain risk management process.

The hydrology/ hydraulics assessment must be suitable for use as a working paper to the environmental assessment or alternately, form the basis of a separate working paper report. The PSC is to submit a methodology and table of contents for approval by RMS. For EIS projects the working paper report appended to the EIS must address the SEARs.

2.3 PERFORMANCE REQUIREMENTS

The project must be designed such that the carriageways are not inundated for a flood event with an Average Recurrence Interval (ARI) of not less than that specified in Annexure PS371/A2 Minimum ARI (Average Recurrence Interval).

2.4 GROUNDWATER

Further requirements for groundwater investigations and reporting are covered in PS331, Geotechnical Investigation and Design.

3 DRAINAGE AND WATER QUALITY

3.1 OBJECTIVE

To develop and design a water management system that complies with the RMS Water Policy, 1997, and achieves the performance requirements of this Specification.

3.2 GENERAL

3.2.1 General Drainage Requirements

The roadway drainage design must:

(i) be in accordance with Australian Rainfall and Runoff (ARR), (current edition) and authorities (including RMS) guidelines and standards.

(ii) Approval to the drainage design must be obtained from RMS, and relevant authorities are to be consulted.

(iii) form a complete system (permanent, subsurface, and temporary drainage) for carrying water through and away from the project. Drainage systems must effectively drain upstream catchments and protect the works.

(iv) model the storm producing the largest peak discharge.

(v) hydraulically model all watercourses, which cross the roadway or flow adjacent to the project, for flooding, impact of the probable maximum flood (PMF) and must provide flood mitigation measures where required.

(vi) separate cross drainage systems from pavement drainage systems.

(vii) not increase upstream/downstream inundation levels by more than those levels determined in the REF, or any conditions of approval which may exist, refer to Item 8 "Minimum ARI" Table PS371.A2 for the design storm event.

(viii) not flow beyond noses and across the main carriageway for run off from ramps or turning roadways in a 1 in 2 year storm event.

(ix) (ix) The pipe network must have a minimum grade of 0.5% and have a water velocity in the pipe of 0.6m/s for the 1 in 6 month storm event, for self-cleansing purposes.

(x) be designed to allow for settlement where soft soils are an issue.

(xi) take into account and, where applicable, comply with the referenced (Department of Primary Industries, Fisheries) documents regarding "fish friendly roads".

(xii) take consideration of staging issues (to ensure positive drainage at all times) and any special requirements for working in or realigning of creeks when designing cross drainage structures (pipes ~~and box culverts~~).

(xiii) comply with the following requirements for blockage of transverse culverts:

a. For transverse pipe culverts with hydraulic design capacity less than or equal to 600mm diameter, ~~or 600mm height for box culverts~~, a blockage factor of 50% should be applied.

b. Comply with local Council design requirements for blockage;

c. Must consider the site specific risk of blockage of the culverts, that is, the design must consider the likelihood of partial or full blockage based on the catchment features (for both current and future land use) and the consequences of partial or full blockage on the project

d. Where there is a risk of blockage, the design must incorporate features to reduce the risk of blockage such as:

1. Appropriate capacity allowance for blockage;
2. Increase the height of the culvert above flood level or
3. Include debris deflector walls or other debris and sediment management devices at inlets

e. Where there is a risk of debris blockage, provide all weather access to enable structures to be maintained and cleared.

f. Where the hydraulic design of the culvert is outlet controlled and there is a risk of siltation, provide all weather access to the outlet for maintenance.

(xiv) Design the culvert inlet and surrounding inlet and outlet embankment for stability, piping failure and scour protection to accommodate the surcharge flow without damage where surcharge of a culvert is possible for a 100 year ARI event or less.

(xv) Consider the risk (for both current and future land use) of blockage or surcharge in the design of other drainage inlet structures such as kerb inlets and median pits at sags and other critical locations.

(xvi) include a Clash analysis to verify any possible crashes between existing and proposed utilities and proposed drainage system. If any clashes are identified, PSC must coordinate with relevant utility authority / utility designer and provide a suitable solution.

3.2.2 Minimum ARI Table

Refer to Annexure PS371/A2 for the Minimum ARI value(s) that apply to the drainage design.

3.2.3 Pavement Drainage

Pavement drainage must be designed to a minimum ARI as specified in Table PS271.A2 Item No.7. An ARI as specified in Table PS271.A2 Item No.8 must be modelled and a check made of flow levels to ensure nuisance flooding is minimised.

The stormwater drainage system must be designed to pick up all pavement water (including drainage layers).

3.2.4 Design Modelling

Drainage system design modelling must:

(i) Be undertaken using a design program which is capable of.

a. Pit entry capacity.

b. Bypass flow to next pit.

c. Culvert sizing.

d. Detention basins.

e. Overland flow times.

f. Infiltration rates.

(ii) Provide a routed reach outlet hydrograph.

Where a pipe is to run full, it must be analysed to determine its hydraulic performance, i.e. indicate flow type and produce a hydraulic grade line. Pit entry and exit losses must be considered.

3.2.5 Aquaplaning

The following criteria must be adopted.

(i) 50mm per hour rainfall design event:

(ii) For calculation purposes the macro texture depth to be used for all concrete and asphaltic pavement surfaces is 0.5mm, except spray sealed surface where a greater texture depth may be used

(iii) A maximum water film depth of 4mm applies to

1. Sections where the design speed is equal to or greater than 80km/h
2. Intersections and roundabout including the approaches and exits
3. Steep downhill sections
4. Superelevated curves approaching limiting curve speed.

(iv) The maximum change in the depth of flow across the pavement must not exceed 4mm over 10 metres

(v) A maximum water film depth of 5mm applies to all other situations.

3.2.6 Width of flow

The allowable width of flow shall be in accordance with Austroads Guide to Road Design, Part 5A: Drainage - Road Surface, Networks, Basins and Subsurface, Table 5.1 and RMS Supplements.

3.2.7 Catchment Drawings

Catchment drawings must show, as a minimum:

(i) Catchment areas.

(ii) Pervious and impervious percentages.

(iii) Coefficients of runoff.

(iv) Overland flow times.

(v) Extent of proposed works, showing the design contours, and drainage system layout.

3.2.8 Drainage Pipes

Drainage pipes must comply with the following criteria:

(i) RMS QA Specification R11 Stormwater Drainage.

(ii) The class of pipe and its installation type must be designed in accordance with the Concrete Pipe Association's, "Concrete Pipe Selection and Installation" guide. The use of HS3 type installation is the minimum permitted.

(iii) Take account of construction traffic.

(iv) Take consideration of soil conditions including Potential Acid Sulphate Soils (PASS).

(v) Consideration of inlet and outlet treatments.

(vi) Pipes must be spigot and socket types with rubber ring seal.

(vii) The minimum drainage pipe sizes allowed are 375mm for longitudinal drainage pipes and 450mm for transverse drainage pipes.

(viii) The depth of pipes must be such that the top of the pipe is a minimum 300mm below the bottom of the selected material zone.

(ix) The depth of drainage pits must provide for connection of the subsoil drainage systems.

~~**3.2.9 Box Culverts**~~

~~Box culverts must comply with the following design documents and criteria:~~

~~(i) AS1597.2 - Precast reinforced concrete box culverts - Large culverts~~

~~(ii) Bridge Technical Direction BTD2008/04 - Design of Precast Reinforced Concrete Box Culverts~~

~~(iii) Crown units to be used on the road upgrade are to be designed for SM1600 and T54 design loadings. Refer to PS361.~~

~~(iv) Concrete work is to comply with RMS QA Specification B80 Concrete Work for Bridges.~~

~~(v) Take consideration of soil conditions including Potential Acid Sulphate Soils (PASS).~~

~~(vi) Take account of construction traffic.~~

~~(vii) The invert RL's and design of the culvert bases are to be "fish friendly" (where appropriate).~~

~~(viii) Consideration of inlet and outlet treatments.~~

~~(ix) The top of the culvert is to be a minimum 300mm below the underside of the bottom of the selected material zone.~~

~~(x) The need for careful design detailing in areas where settlement is likely.~~

~~(xi) Subsurface drainage, select backfilling and unsuitable materials are to be considered when designing and detailing culvert foundations.~~

~~(xii) Note that box culverts (and pipes) may also need to be designed for fauna passage as dedicated or combined structures.~~

3.2.10 Subsurface Drainage

Refer to PS341 for subsurface drainage requirements.

3.2.11 Surface Drainage

Surface drainage must be designed in accordance with the following criteria:

(i) Drainage must be provided where the works intercept runoff, floodplains, watercourses, depressions or drainage lines.

(ii) The transverse drainage system must be designed for a ARI storm without structure collapse. Refer to Table PS271.A2.

(iii) All outlets of the drainage system must incorporate energy dissipation, erosion and sediment control.

(iv) In designing the drainage system consideration is to be given to Potential Acid Sulphate Soils (PASS).

(v) In designing the drainage system consideration is to be given to the possibility of settlement effects.

(vi) The drainage system must meet the requirements of the brief and the requirements of all relevant authorities.

(vii) Batter catch drains must be provided up-slope of all cut batters and at the foot of fill embankments where the ground slopes towards the embankment. Batter and catch drains are to be connected to the drainage system.

(viii) Grated or slotted drains and hollow kerbs shall only be used in short lengths after all other avenues for drainage have been considered. Where grated or slotted drains are proposed they must be discussed with RMS before implementation. RMS may agree to the installation, nominate another treatment or may vary the standard locally. The designers shall present implications on flows should the grated drains not be installed as part of the discussion.

3.2.12 Temporary Drainage

Where required by construction staging, temporary drainage must be designed in accordance with the requirements of this Specification and Table PS371.A2 and satisfy all relevant authorities.

3.2.13 Detention Basins

Local authorities (Council, local catchment authorities) are to be consulted to determine the need for stormwater detention. Wherever possible consideration should be given to the use of existing detention facilities both upstream and downstream of the project.

3.2.14 Soil and water quality management sub-plan (if required)

If a soil and water quality management sub-plan is required by the REF process or a "Condition of Approval", it may need to be prepared in consultation with the Office of Environment and Heritage, Department of Planning and Infrastructure Department of Primary Industries, Fisheries and local Council. The sub-plan must be prepared in accordance with the Department of Housing's Publication Managing Urban Stormwater - Soils and Construction and where appropriate, Office of Environment and Heritage S Constructed Wetlands Manual.

The soil and water quality management sub-plan must contain, but not be limited to:

(i) Management of the cumulative impacts of the development on the quality and quantity of surface and groundwater, including stormwater in storage, sedimentation dams and flooding impacts.

(ii) Details of short and long term measures to be employed to minimise soil erosion and the discharge of sediment to land and/or waters including the locations and capacities of sedimentation basins.

(iii) Detailed erosion and sedimentation controls including a strategy to manage the extent of exposed ground surface during construction.

(iv) Details of nature and location of all creek bank protection works.

(v) Progressive site rehabilitation requirements.

(vi) Management of the impacts of the development on creeks and water bodies.

(vii) Identification of all potential sources of water pollution and a detailed description of the remedial action to be taken or management systems to be implemented to minimise emissions of these pollutants from all sources within the subject site.

(viii) Detailed description of water quality monitoring to be undertaken during the pre-construction, construction and operation stages of the project including identification of locations where monitoring would be carried out.

(ix) Contingency plans to be implemented in the event of fuel spills or turbid water discharge from the site.

(x) A program for reporting on the effectiveness of the sediment and erosion control system against performance goals.

3.2.15 Erosion and Sedimentation Control

Erosion and sedimentation control and waste control must be designed in accordance with the requirements of:

(i) The OEH's Publication "Managing Urban Stormwater – Soils and Construction".

(ii) The CSIRO's "Urban Stormwater - Best Practice Environmental Management Guidelines".

(iii) The environmental assessment (EIS / REF).

Where the *Erosion and Sedimentation Management Procedure* (RTA, 2008) requires the project to engage a registered soil conservation scientist the following applies: The PSC must engage a registered service provider from RMS 'Erosion, Sedimentation and Soil Conservation Consultancy Services' panel to provide assessment and design input. The Soil Conservation Consultant must:

(i) Develop detailed designs for the major erosion and sedimentation control measures.

(ii) Assess erosion and sedimentation risks and impacts.

(iii) Develop erosion and sedimentation avoidance, mitigation and management measures for the project.

(iv) Provide advice and deliverables in accordance with RMS procedure PN 143 Erosion and Sedimentation Management Procedure (RTA, 2008).

All runoff from construction activities must receive treatments prior to discharging into SEPP14 or other coastal wetlands.

The design must include both temporary and permanent control measures that could include:

a. Constructed wetlands.
b. Sedimentation basins.
c. Sedimentation traps.
d. Stormwater interceptors.
e. Refuse filters.
f. Energy dissipators.
g. Associated drains including clean water by-pass drains etc.
h. Grass swales, etc.

Scour protection must be provided for all areas susceptible to scouring such as batters and bridge abutments and culvert outlets. For those areas where new bridge piers are within four (4) metres of the stream bank, scour protection must be designed for a minimum maintenance free life of 50 years.

The final locations of basins are to be carefully considered taking into account all pertinent inputs including: topography, geotechnical, construction staging, road boundaries etc. The detailed design is to include a preliminary assessment of the location of sedimentation basins.

Sedimentation basins are to be designed to the requirements of, "Managing Urban Stormwater – Soils and Construction". Geotechnical input may be required for sedimentation basin design.

Consideration is also to be given to ground water inflow in determining the size, location and treatment of sedimentation basins. Where basins are built into the final formation, consideration is to be given to protecting the road embankment from the moisture effects due to the varying water level in the basins.

Any temporary sedimentation basins that will be built and then decommissioned, at various times during construction to allow further construction work to proceed, are to be fully addressed in association with staged construction.

Provision must be made in the detailed design for access to basins for maintenance purposes.

Fencing requirements for the basins must be assessed.

The design of sedimentation basins must ensure that the basins are located wholly within the road reserve. Should this not be possible, the RMS Representative must be immediately advised.

3.2.16 Accidental Spill Management

A risk assessment must be carried out to determine the need for accidental spill management. The assessment must consider the following factors:

- Compliance with the REF if completed and any conditions of approval which may exist.
- Potential vehicle conflict areas (i.e. intersections, interchanges)
- Road geometry
- Heavy vehicle and / or dangerous goods route
- Speed environment
- Proximity of sensitive receiving environment
- Impact on sensitive receiving environment
- Topographical or man-made features which may enhance the spill reaching a sensitive area.

Should the need for spill management be identified measures should be built into the drainage system to prevent spillages from reaching the downstream ecosystems and waterways. These measures may include:

(i) Stormwater channels that can be temporarily bunded to contain runoff.

(ii) Lockable shut-off valves provided at all points that discharge directly to natural watercourses.

(iii) "First flush" tanks/basins located upstream of all proposed constructed wetlands and sized to fully contain 1.2 times the potential spill volume (typically 20,000 litres to 30,000 litres) from a tanker.

(iv) General pavement drainage incorporating methods for a retention capacity of up to 30,000 litres.

3.2.17 Independent Verification

Refer to PS301Requirements for any requirements for Independent Verification.

3.2.18 Performance Requirements

The PSC must develop a drainage and water quality management system that complies with RMS Water Policy, (current) and the following requirements:

(i) The drainage system of any new bridges must be connected to the road drainage system.

(ii) The drainage of any existing bridges must be connected to the road drainage system by the retro-fit of drainage elements.

(iii) Preservation of existing elements such as natural channels, wetland and riparian vegetation.

(iv) A stormwater management system which manages both the quality and quantity of stormwater as close to its source as possible. This must include devices which will treat stormwater and retain run-off so that the system changes the existing water regime by the smallest amount practicable.

(v) Integration of the system with the construction process so that the total investment in drainage infrastructure is minimised and access is available to all devices which need on-going maintenance during both the construction phase and subsequent maintenance.

(vi) The drainage system must be designed for a ARI storm without structure collapse – refer to Item No.9 Table P3271.A2.

(vii) The drainage system must be capable of being partitioned to contain spillage from incidents.

(viii) Culvert design and placement across flood plains and wetlands must ensure that fish passage is unhindered and site drainage, tidal inundation and areas of wetland are minimally impacted.

(ix) Minimise impacts of construction of waterway crossings on aquatic organisms and marine vegetation.

(x) The drainage system must be designed to allow for any predicted settlement of the study area and embankments over time. Note the importance for projects where soft soils are an issue.

3.2.19 Design Life

Refer to PS301 for Design Life requirements.

3.2.20 Detailed Design Drawing and Model Requirements

Pits shall be named in a clear simple logical consistent form. Pits shall be named in terms of drainage line then pit number, for example 03.15 for pit drainage line number 3, pit number 15. Where the works are divided into multiply construction work packages, include the stage in the name, i.e. A.03.15. 'A' representing construction package A, 03 for the drainage line, pit number 15

Any other form of pit naming convention, including chainage based naming, requires the approval of RMS.

Refer to Annexure PS371/A for detailed design drawing and model requirements for the project.

~~4 CONSTRUCTED WETLAND DESIGN~~

~~4.1 OBJECTIVE~~

~~To design constructed wetland habitat areas in accordance with the requirements of the wetlands management plan (refer to PS311 or PS312)) and to meet all project (including urban design, landscape, visual (refer to PS381) and relevant authority requirements.~~

~~4.2 DESIGN~~

~~4.2.1 General~~

~~Design of constructed wetland areas must be completed in accordance with the requirements of the wetlands management plan (refer to PS311 or PS312)~~

~~The detailed design must fully detail all of the components required to build the constructed wetlands areas. The design must take into account the sensitivity of wetlands to the levels of water inundation and the impacts of inundation on plants associated with the wetlands community.~~

~~The detailed design must detail all plant species required to be planted as a part of the overall built wetlands environment. Detailing of plant species must consider natural re-colonisation by endemic genetic stock of plants associated with the wetlands community.~~

~~The design approach must be consistent with the existing adjoining wetland areas.~~

~~The design must permit wetlands construction to be undertaken in an environmentally sensitive manner.~~

~~During the detailed design, any additional environmental impacts which become evident must be documented, investigated and management measures are to be incorporated into the wetlands management plan.~~

~~4.2.2 Construction contract tender documents~~

~~If additional clauses are required in the technical specifications for the construction of wetlands, they must be drafted to adequately specify the unique requirements of the constructed wetland including the proposed maintenance regime.~~

~~4.2.3 Independent verification~~

~~Refer to PS301 any requirements for Independent Verification.~~

~~4.2.4 Detailed Design Drawing and Model Requirements~~

~~Refer to Annexure PS371/A for detailed design drawing and model requirements for the project.~~

ANNEXURE PS371/A – PROJECT SPECIFIC REQUIREMENTS

A1 PROJECT DETAILS

Table PS371.A1 – Project Details

Project Name	***Macquarie Park Bus Priority and Capacity Improvement Project - Stage 2***
Project Number	***P.0023019***
Location	***Epping Road, Herring Road, Waterloo Road and Lane Cove Road, Macquarie Park***
Local Council	***Ryde Council***
Length (size) of the project	***MR 373 Epping Road to MR 162 Lane Cove Road via Herring Road (7486) and Waterloo Road at Macquarie Park and MR 162 Lane Cove Road from Waterloo Road to Epping Road.*** ***Project length approximately 2.8km.***
Project features	• ***Upgrade of the state and local road network in the Macquarie Park precinct to improve travel times and reliability for buses and for other road users*** • ***3 new signalised intersections and upgrades to the existing signalised intersections*** • ***Installation of bus lanes and road widening with improved pedestrian and cyclist crossing facilities at signalised intersections*** • ***Partial (strip) property acquisitions along Herring Rd, Waterloo Road, Byfield St, Khartoum Rd and Lane Cove Rd to enable the road widening and intersection upgrade works*** • ***Service relocations to allow kerb relocation and lane widening***

Refer PS301: Professional Services for Detailed Design Scope and Requirements, Annexure PS301/A for project details, background and project specific requirements.

A2 MINIMUM ARI TABLE

The following are the minimum ARI's that apply to the drainage design:

Table PS371.A2 – Minimum ARI

Item No.	Item	Minimum ARI
1	Channels and open drains	5 years
2	Piped system (including pits)	10 years
3	Culverts where surcharge is allowable	50 years
4	Structures where surcharge is undesirable	100 years
5	Gross pollutant traps	1 year

6	Pavement drainage wearing surface	10 years
7	Major storm event checks for no property damage	100 years
8	Major storm event checks for no structural damage	2000 years
9	Cycleway	1 year
10	Temporary Drainage	2 year

In addition to the design requirements for pavement wearing surfaces in Table PS371.A2, pavement wearing surfaces must be modelled for a 1 in 100 year ARI event to assess and determine flow levels and to ensure that at least one traffic lane is trafficable in each direction in the 100 year ARI storm event.

Notwithstanding the above:
The main carriageways, ramps and side roads, including footways and share paths, must be designed to comply with the design criteria and requirements in the Macquarie Park Bus Priority and Capacity Improvement Stage 1 - AFC Detail Design Report.

In particular Sections:
- ***3.3 Design Guidelines***
- ***3.5 Design Speed***
- ***3.6 Geometric Design Criteria***
- ***3.9 Median Type***
- ***3.10 Road Cross-fall – note comment on cross-falls being addressed in this Stage 2 design work***
- ***3.14 Kerbs, Gutter, Ker Ramps and Vehicular Crossings***
- ***3.16 Stormwater and Flooding Design Criteria***
- ***5.1 Flooding and Stormwater Drainage***

In addition, the following additional design standards have been agreed in the Stage 1 design and must be included in the Stage 2 design:
- ***At intersections, all pram ramps in accordance with RMS standards***
- ***Subsurface drainage to the City of Ryde Council owned roads must be in accordance with PS341.3.2.11***

All existing footways along City of Ryde Council owned roads, affected by the work (including grass verges), must be design with full footway width granite paving or concrete, like material finish for like material finish.

In general:
- ***City of Ryde design specifications and standards apply to Herring Road and Waterloo Road.***
- ***RMS design specification and standards apply to Lane Cove Road and Epping Road.***

The exact interface of the different design specifications will be determined during the concept phase of the design in consultation with RMS and City of Ryde Council.

A3 DETAILED DESIGN DRAWING AND MODEL REQUIREMENTS

Table PS371.A3 – Detailed Design Requirements

Element	Depicted on the drawings Y/N	Included in the Model Y/N	Element	Depicted on the drawings Y/N	Included in the Model Y/N
Drainage Design					
Hydrology/hydraulics analysis for the detailed design.	***Y***	***Y***			
Catchment drawings	***Y***	***Y***			
Drainage design fully integrated to detailed design model	***Y – As part of detailed design***	***Y – As part of detailed design***			
Drainage sheets design with contours and showing all pits pipe and outlets locations	***Y – As part of detailed design***	***Y – As part of detailed design***			
Indicative locations of sedimentation basins, constructed wetlands and stormwater interceptors	***Y***	***Y***			
Water Quality					
Soil and water quality management plan as a component of road design report	***Y***	***Y***			
~~**Constructed Wetland Design**~~					
~~Constructed wetland design report as a component of road design report~~	***N***	***N***			

ANNEXURE PS371/B – PAYMENT

Payment will be made for all costs associated with completing the work detailed in this Specification in accordance with the Pay Item(s) in **PS301**.

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the work.

ANNEXURE PS371/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS, DELIVERABLES, MEETINGS AND WORKSHOPS

C1 SCHEDULE OF HOLD POINTS AND WITNESS POINTS

The PSC must give the RMS Representative at least five working days written notice prior to reaching any hold point for which a release by the RMS's Representative is required. Only items with a **Y** are required for this project.

Table PS371.C1 – Hold Point Requirements

Section	Type and required Y/N	Process Held	Submission details	Release of hold point
Not Applicable				

C2 SCHEDULE OF DELIVERABLES AND SUBMISSION DETAILS

The PSC must give the RMS's Representative at least ten working days to review all deliverables identified in the table below. Only items with an **Y** are required for this project.

Table PS371.C2 – Deliverables and Submission Details

Section	Description of Deliverables	Delivery timeframe	Required Y/N
2	Detailed hydrology/hydraulics assessment of the study area	To be include in the ~~20~~ ***50***% submission and onwards.	***Y***
3	Catchment Drawings	To be include in the 80% submission and onwards.	***Y***
3	Electronic copies of all data files used in the computer modelling for the detailed design.	To be included in the 80% submission.	***Y***
3	Detailed drainage design fully integrated into the detailed design drawings.	To be included in the 80% submission.	***Y***
3	Detailed design drawings of sedimentation basins, constructed wetlands and stormwater interceptors included in the detailed design drawings	To be included in the 80% submission.	***Y***
3	Detailed drainage report and included with the detailed	To be included in the 80% submission.	***Y***

Section	Description of Deliverables	Delivery timeframe	Required Y/N
	design report.		
2, 3, 4	Independent verification report, (if required by PS301)	To be included in the final submission.	***Y***
~~4~~	~~Constructed wetland design report and included with the detailed design report~~	~~To be included in the 80% submission and onwards~~	***N***
~~4~~	~~Detailed constructed wetland design drawings~~	~~To be included in the 80% submission and onwards~~	***N***
~~4~~	~~Schedule of quantities for the constructed wetland design~~	~~To be included in the 80% submission and onwards~~	***N***
2,3,4	***If required*** draft technical specification clauses for inclusion in the construction contract tender documents (including details of the proposed maintenance regime)	To be included in the 80% submission and onwards	***Y***

C3 SCHEDULE OF MEETINGS REQUIRED

Refer to PS301/A and PS301/C for meeting and workshop requirements and details.

Table PS371.C3 – Meeting Requirements

Clause	Description of Workshops	Required	Location	Minimum Expected Duration
	Refer PS301/A and PS301/C			

C4 SCHEDULE OF WORKSHOPS REQUIRED

Refer to PS301/A and PS301/C for meeting and workshop requirements and details.

Table PS301.C4 – Workshop Requirements

Clause	Description of Workshops	Required	Location	Minimum Expected Duration
	Refer PS301/A and PS301/C			

ANNEXURES PS321/D TO PS321/L – NOT USED

ANNEXURE PS371/M – REFERENCE DOCUMENTS & SUPPORTING INFORMATION

M1 DESIGN REFERENCE DOCUMENTS

Refer to clause 1.4.2

RMS Technical Directions and Quality Alerts

RMS Design Guides

RMS Standard Drawings

RMS Specifications

Austroads Guides

Australian Standards

Urban Design

Software Programs

All City of Ryde Specifications and Standards including:

- ***City of Ryde Stormwater and Floodplain Management, City of Ryde***
- ***Council Stormwater and Floodplain Management Technical Manual***
- ***City of Ryde Standard drawings and specifications***
- ***City of Ryde, Macquarie Park Corridor, Public Domain Technical Manual***
- ***City of Ryde Development Control Plan 2014 Part 8.3 Driveways***

City of Ryde Development Control Plan 2014 Part 8.5 Civil Works

M2 REFERENCE DOCUMENTS

Refer to clause 1.4.2

M3 SUPPORTING INFORMATION

Refer to clause 1.4.2