VICROADS

Mordialloc Bypass

PRELIMINARY SURFACE WATER IMPACT ASSESSMENT

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WSP | PARSONS BRINCKERHOFF

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VicRoads

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ABBREVIATIONS

AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff
BOM	Bureau of Meteorology
BPEMG	Best Practice Environmental Management Guidelines
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
DS	Drainage Scheme
EPA	Environment Protection Authority
EY	Exceedances per Year
FO	Floodway Overlay
IFD	Intensity Frequency Duration (design rainfall data)
LSIO	Land Subject to Inundation Overlay
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
RFO	Rural Floodway Overlay
SBO	Special Building Overlay
SEPP	State Environment Protection Policy
TSS	Total suspended solids
TP	Total Phosphorus
TN	Total Nitrogen
VPP	Victorian Planning Provisions
WSRD	Water Sensitive Road Design

EXECUTIVE SUMMARY

This report provides a preliminary impact assessment of the flooding, drainage and water quality components of water environments for the Mordialloc Bypass.

The Mordialloc Bypass project will occur largely within the designated Braeside West and Mordialloc Creek Wetlands (also referred to as 'Waterways') catchment areas. Both these catchments contribute tributary runoff flow to the larger Mordialloc Creek drainage system. The project crosses Smythes Drain, Mordialloc Creek wetlands, Dingley Drain, Gartsides South Drainage Scheme, Braeside West Drainage Scheme, Old Dandenong Road Drain, and Gartsides North Drainage Scheme. These drainage systems are covered by either Land Subject to Inundation Overlay (LSIO) or Special Building Overlay (SBO) and therefore any works within these areas will require a permit from Melbourne Water.

It is expected that potential impacts to surface water will be addressed in two phases for Mordialloc Bypass as described below:

- Preliminary Assessment (this report): includes a preliminary qualitative desktop assessment by reviewing available information and identifying areas where surface flow regimes will be potentially impacted. This phase does not include any modelling; and
- Detailed Assessment (future reports): expected to include a detailed quantitative assessment, including hydrologic and hydraulic modelling and water quality modelling to define existing conditions and quantify the magnitude of impacts to surface water from the project.

The preliminary impact assessment covers potential surface water impacts during both construction and operational phases, including:

- Benefits and opportunities;
- Changes to flooding conditions such as frequency and duration of flooding, increases to flood levels or flow velocities;
- Reduction of floodplain storage or other changes to flow regimes leading to increases to peak flows or floodwater volumes;
- Discharge of polluted water; and
- Impacts to future works by Melbourne Water.

Anticipated works as part of the Mordialloc Bypass project have the potential to impact surface water. This includes:

- New bridge or culvert crossings over waterways have the potential to increase upstream flood levels;
- Earthworks associated with the Project may result in a reduction of floodplain storage; and
- New roads and shared paths will increase the impervious areas leading to increased runoff rates and pollutant loads.

Based on this preliminary assessment, recommendations for mitigation options to be investigated include:

- Incorporate relevant parts of the Melbourne Water drainage schemes into the Project design;
- Adopt steep batters, retaining walls or bridge structures across floodplains to minimise the loss of floodplain storage, or adopt cut and fill balance between road embankments and new excavation, such as basins or wetlands; and

- Allocate space for stormwater detention and WSRD elements.

Detailed surface water assessments will be undertaken in subsequent projects phases, either as part of detailed design or part of further environmental assessment. The recommended general methodology for a detailed surface water assessment, in addition to the methodology covered in this preliminary assessment, include:

- Hydrologic and hydraulic modelling to define existing flood and drainage conditions, quantify the magnitude of impacts and develop mitigation options, for both permanent and temporary works;
- Water quality modelling, using the MUSIC model, to assess the effectiveness of WSRD elements;
- Environmental risk assessment; and
- Consultation with relevant stakeholders.

1 INTRODUCTION

WSP has been commissioned by VicRoads to provide technical advisory services for the Mordialloc Bypass: Dingley Village (Springvale Road to Dingley Bypass) Project. This technical advisory role includes the reference design and environmental impact assessment of the Mordialloc Bypass.

This report provides a preliminary assessment of the surface water impacts of the Mordialloc Bypass.

1.1 Project description

Melbourne's southern movement corridor connects the Mornington Peninsula and Southern and Bayside suburbs to the central city and to National Employment Clusters in Monash and Dandenong. In addition to enabling cross-city movements, the corridor provides road users with access to residential zones, recreation areas and employment and activity centres within the City of Kingston and adjacent municipalities, including the significant national employment cluster in the City of Monash. This project connects the Mornington Peninsula Freeway in the south to the Dingley Bypass to the north

This upgrade includes:

- Provision of a new road connection with a minimum of two lanes in each direction with a grade separated intersection at Springvale Road;
- An elevated structure over Bowen Parkway, Mordialloc Creek and the adjacent wetlands, and critical utilities;
- Wherever practical, provisions for future grade separated interchanges are made;
- A shared cycling and pedestrian path crossing of the alignment south of Lower Dandenong Road along with a number of major culverts/small bridges at the key waterway crossings; and
- Supporting upgrades of the crossroads, particularly where these interface with new interchanges on the Mordialloc Bypass.

1.2 Scope of report

This report provides a preliminary impact assessment of the flooding, drainage and water quality components of water environments for the Mordialloc Bypass. Other components of water environments are covered by the Preliminary Groundwater Impact Assessment, and the Summary of potential ecological impacts report. This preliminary assessment includes a qualitative desktop assessment by reviewing available information and identifying areas where surface flow regimes will be potentially impacted. Recommendations for the scope of subsequent detailed assessments are also provided.

2 LEGISLATION, POLICY AND GUIDELINES

This section summarises the current legislative requirements and guidelines relevant to surface water for Mordialloc Bypass.

2.1 Key legislation and policy

2.1.1 Environment Protection Act 1970

The Environment Protection Act 1970 aims to prevent pollution and environmental damage by setting environmental quality objectives and establishing programs to meet them. The Act establishes the powers, duties and functions of the Environment Protection Authority (EPA). These include the administration of the Act and any regulations and orders made pursuant to it, recommending State environment protection policies (SEPPs), issuing works approvals, licences, permits, pollution abatement notices and implementing National Environment Protection Measures.

2.1.2 State Environment Protection Policy (Waters of Victoria)

The SEPP (Waters of Victoria) sets the framework for the protection of the uses and values of Victoria's surface water environments. The policy sets uses and values of water environments that communities want to protect (known as beneficial uses), establishes objectives and indicators which describe the environmental quality required to protect beneficial uses (known as environmental quality objectives), and provides guidance to authorities, agencies, businesses and communities to protect and rehabilitate environmental water to levels to meet the environmental objectives (known as the attainment program).

The SEPP uses segments to group areas with common features. The segments, and the SEPP Schedules that apply to them, relevant to the Projects are:

- Schedule F6 (Waters of Port Phillip Bay); and
- Schedule F7 (Waters of the Yarra Catchment).

Clause 46 of the SEPP classifies runoff from roads as urban stormwater. Therefore, the Projects must meet the requirements of the SEPP for urban stormwater runoff, which includes the protection of beneficial uses and the demonstration of best practice.

Best practice is defined in the SEPP as "the best combination of techniques, methods, processes or technology used in an industry sector or activity that demonstrably minimises the environmental impact of that industry sector or activity." This approach requires proposed road projects meet the best practice performance objectives and process outlined in Urban Stormwater: Best Practice Environmental Management Guidelines, Victorian Stormwater Committee (1999) (BPEMG). At a minimum, these are as follows:

- Total suspended solids (TSS) – 80% retention of the typical urban annual load;
- Total phosphorus (TP) – 45% retention of the typical urban annual load;
- Total nitrogen (TN) – 45% retention of the typical urban annual load;
- Litter – 70% retention of the typical urban annual load; and
- Flows – maintain discharges for the 1.5 year Average Recurrence Interval (ARI) at pre-development discharges.

Clause 56 of the SEPP requires construction works be managed to minimise land disturbance, soil erosion and the discharge of sediment and other pollutants to surface waters.

Groundwaters are excluded from the SEPP (Waters of Victoria) as they are covered by the SEPP (Groundwaters of Victoria).

2.1.3 Planning and Environment Act 1987

The Planning and Environment Act establishes a framework for planning the use, development and protection of land in Victoria. Victorian Planning Provisions (VPPs) are set out in the Act to assist in proving a consistent and coordinated framework for planning schemes. Parts of the VPPs relevant to surface water on the Projects are summarised in Section 2.1.4.

2.1.4 Victorian Planning Provisions

2.1.4.1 State Planning Policy Framework

The State and Local Planning Policy Frameworks contain the long term directions and outcomes sought by the scheme. The requirements relevant to surface water on the Projects are:

- Clause 12.05 – Environmental and Landscape Values – Rivers
  - Consideration of Healthy Waterways Strategy 2013, Melbourne Water
- Clause 13.01 – Environmental Risks - Climate change impacts
  - Plan for possible sea level rise of 0.8 metres by 2100
- Clause 13.02 – Environmental Risks – Floodplains
  - Identify land affected by flooding (1 in 100 year flood event);
  - Avoid intensifying the impacts of flooding through inappropriately located uses and developments;
  - Consideration of:
    - SEPP (Waters of Victoria);
    - Any surface water policy, practice or strategy adopted by the responsible floodplain management authority;
    - Any best practice environmental management guidelines for stormwater adopted by the EPA; and
    - Victoria Floodplain Management Strategy (Department of Natural Resources and Environment, 1998).
- Clause 14.02 – Natural Resource Management – Water
  - Consider impacts of catchment management on downstream water quality and water environments;
  - Retain natural drainage corridors with vegetated buffer zones of at least 30m;
  - Undertake measures to minimise the quantity and retard flow from developed areas;
  - Encourage measures to filter sediment and wastes from stormwater prior to its discharge into waterways;
  - Ensure land use and development minimise nutrient contributions to waterways;
  - Use appropriate measures to restrict sediment discharges from construction sites;
  - Coordinate with activities of catchment management authorities;
  - Ensure activities potentially discharging contaminated runoff or wastes to waterways are sited and managed to minimise such discharges and protect the quality of water environments;
  - Consideration of:
    - SEPP (Waters of Victoria);

- Plans, works programs and strategies approved by Catchment Management Authorities (CMAs);
- Technical Guidelines for Waterway Management (Department of Sustainability and Environment, 2007);
- Construction Techniques for Sediment Pollution Control (EPA, 1991); and
- Environmental Guidelines for Major Construction Sites (EPA, 1996).

2.1.4.2 Overlays

The type and purpose of overlays relevant to surface water on the Projects are:

- Clause 44.03 – Floodway Overlay (FO or RFO)
  - to identify waterways, major floodpaths, drainage depressions and high hazard areas which have the greatest risk and frequency of being affected by flooding;
  - to ensure that development maintains the free passage and temporary storage of floodwater, minimises flood damage and is compatible with flood hazard, local drainage conditions and the minimisation of soil erosion, sedimentation and silting;
  - to protect water quality and waterways as natural resources in accordance with the provisions of relevant SEPPs; and
  - to ensure development maintains or improves river and wetland health, waterway protection and flood plain health.
- Clause 44.04 – Land Subject to Inundation Overlay (LSIO)
  - to identify land in a flood storage or flood fringe area affected by the 1 in 100 year flood or any other area determined by the floodplain management authority;
  - to ensure that development maintains the free passage and temporary storage of floodwater, minimises flood damage and is compatible with flood hazard, local drainage conditions and will not cause any significant rise in flood level or flow velocity;
  - to protect water quality in accordance with the provisions of relevant SEPPs; and
  - to ensure development maintains or improves river and wetland health, waterway protection and flood plain health.
- Clause 44.05 – Special Building Overlay (SBO)
  - to identify land in urban areas liable to inundation by overland flows from the urban drainage system as determined by, or in consultation with, the floodplain management authority;
  - to ensure that development maintains the free passage and temporary storage of floodwater, minimises flood damage and is compatible with flood hazard, local drainage conditions and will not cause any significant rise in flood level or flow velocity;
  - to protect water quality in accordance with the provisions of relevant SEPPs.

A permit is required to construct or carry out works in the above flood overlays. An application must be referred to the relevant floodplain management authority (Melbourne Water Corporation).

2.1.5 Water Act 1989

The Water Act 1989 provides the legal framework for water management and use across Victoria, including the issuing and allocation of water entitlements and the provision of water services by state-owned water corporations and catchment management authorities.

Under the Act, the designated waterways, regional drainage and floodplain management authority for the Port Phillip and Westernport catchment region is Melbourne Water Corporation (Melbourne Water).

The Act states that Melbourne Water have the power to make By-laws, which include:

- By-law No. 1: Water Supply Protection, 2008; and
- By-law No. 2: Waterways, Land and Works Protection and Management, 2009.

Under the Act, a permit from the relevant waterway authority is required for works within or in proximity of designated waterways.

2.1.6 Melbourne Water Corporation By-Law No.2: Waterways, Land and Works Protection and Management (2009)

The objectives of Melbourne Water By-Law No. 2, made under the Water Act 1989, are:

- the management, protection and use of lands, waterways and works under the management and control of Melbourne Water;
- preventing or minimising interference with or obstruction of the flow of water;
- preventing or minimising the silting up of a designated waterway or designated land or works or any injury to or pollution of it or them, including prohibiting the deposit of material in or near it or them;
- prohibiting or regulating the removal of any material from land forming part of a designated waterway or designated land or works;
- regulating activities carried out on land forming part of a designated waterway or designated land or works; and
- the general management and control of any designated waterways or designated land or works.

The By-Law prohibits works and certain activities on designated waterways or designated lands or works without a permit issued by Melbourne Water.

2.2 Guidelines

A number of guidelines are relevant to surface water on Mordialloc Bypass, including:

- Australian Rainfall and Runoff 2016;
- Austroads Guide to Road Design;
- VicRoads Supplements to AGRD;
- Integrated Water Management Guidelines, VicRoads 2013;
- Urban Stormwater: Best Practice Environmental Management Guidelines (BPEMG), 1999;
- Melbourne Water Guidelines for Development in Flood-prone areas;
- Melbourne Water Flood Mapping Projects Guidelines and Technical Specifications 2012;
- Melbourne Water MUSIC Guidelines
- Healthy Waterways Strategy, Melbourne Water 2013;
- Victoria Floodplain Management Strategy, Department of Natural Resources and Environment, 1998;
- Technical Guidelines for Waterway Management, Department of Sustainability and Environment 2007;
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000.
- EPA Publication No. 275. Construction Techniques for Sediment Pollution Control (1991); and
- EPA Publication No. 480. Environmental Guidelines for Major Construction Sites (1996).

3 METHODOLOGY

It is expected that potential impacts to surface water will be addressed in two phases for Mordialloc Bypass as described below:

- Preliminary Assessment (this report): includes a preliminary qualitative desktop assessment by reviewing available information and identifying areas where surface flow regimes will be potentially impacted. This phase does not include any modelling; and
- Detailed Assessment (future reports): expected to include a detailed quantitative assessment, including hydrologic and hydraulic modelling and water quality modelling to define existing conditions and quantify the magnitude of impacts to surface water from the project.

3.1 Preliminary assessment

The preliminary assessment comprised the following general steps:

- Review of relevant legislation, policy and guidelines;
- Review of relevant previous studies and other available information;
- Undertake high-level qualitative desktop assessment of potential surface water impacts during both construction and operation phases;
- Consultation with relevant stakeholders; and
- Provide recommendations to support detailed surface water impact assessments.

3.1.1 Available information

Available information relevant to surface water on the Project includes:

- Previous studies – reports and models;
- Aerial photography;
- Topographic data;
- Waterway, channel, underground pipe, water body, wetland and other drainage infrastructure GIS data;
- As-built drawings;
- Drainage Scheme (DS) information;
- Planning Scheme Overlays (e.g. LSIO, SBO); and
- Project boundaries.

Surface water overview maps, showing some of the above information, are provided in Appendix A.

A review of previous studies is provided in Appendix B.

3.1.2 Preliminary impact assessment

The preliminary impact assessment covers potential surface water impacts during both construction and operational phases, including:

- Changes to flooding conditions such as frequency and duration of flooding, increases to flood levels or flow velocities;
- Reduction of floodplain storage or other changes to flow regimes leading to increases to peak flows or floodwater volumes;

- Discharge of polluted water; and
- Impacts to future works by Melbourne Water.

3.1.3 Assumptions / Limitations

The preliminary surface water impact assessment is based on the following assumptions and limitations:

- It is assumed that temporary works and permanent works will be limited to the project boundary;
- It is assumed that flood information provided by Melbourne Water is valid – this information has not been comprehensively reviewed and no calculations or modelling has been completed to verify this information; and
- The extent of areas currently identified as being flood affected by the planning scheme overlays (FO, RFO, LSIO and SBO) are not exhaustive. This is because flood studies, which are used to inform the extent of flood overlays, have not been completed for all waterways and drainage systems. Therefore, it may not been appropriate to assume an area not covered by flood overlay is not flood-affected.

3.2 Stakeholder engagement

Stakeholder consultation specific to surface water has been limited to Melbourne Water. A summary of meetings with Melbourne Water is provided in Table 3.1.

Table 3.1 Melbourne Water interface meetings

DATE	MATTERS DISCUSSED
7/11/2016	Kick-off meeting, project status, general requirements and guidelines
11/01/2017	Project update / program, drainage and water quality requirements
30/01/2017	Technical requirements, inc WSUD requirements, tender process
01/03/2017	Technical requirements, data sharing, program, Hallam Valley, Mordialloc Bypass, Hallam Road
21/03/2017	Environment and stakeholder meeting
29/03/2017	Data sharing, program, Hallam Valley, Mordialloc Bypass, Koo Wee Rup Road
04/04/2017	Ecology meeting
19/04/2017	Technical requirements, high-level modelling approach
24/05/2017	Review of proposed flood modelling approach, technical requirements

3.2.1 Melbourne Water requirements

Melbourne Water have developed a series of technical requirements documents specifically for Mordialloc Bypass. The Melbourne Water requirements relating to surface water are provided in Appendix C.

The key Melbourne Water requirements for surface water include:

- No increase in 1% Annual Exceedance Probability (AEP) flood level / velocities as a result of the Project;
- No loss of floodplain storage volume;
- If an existing road level is being raised, then the following assessment is required:
  - 200 and 500 year ARI events should be considered;

- Application of blockage factors as per AR&R 2016 guidelines;

→ For bridge widening:

- Cross sectional area of waterway should be maintained;
- Piers should align with existing piers;
- 100 year ARI flood level should not be increased by more than 30mm and shall be dissipated within 50m upstream.

→ For new bridges;

- Bridge soffit should be 600mm above 100 year ARI flood level;
- Piers within waterways should be minimised;
- Pier scour rock protection must be provided to avoid scouring of natural surface within waterway;
- Maintenance access to be considered, including flood protection;
- Set pile caps below surface level;

→ Modifications to the existing Watercourses must be approved by Melbourne Water. This includes new or upgrading connections to the Watercourses;

→ For underground drainage systems, the 5, 10, 20 and 50 year ARI event, in addition to the 100 year ARI event should be assessed to demonstrate no impacts as a result of proposed works.;

→ Stormwater runoff rates are to be controlled such that there is no significant increase in peak flows across a wide range of ARIs as well as to ensure no adverse impacts on downstream properties resulting from increased runoff volumes;

→ No polluted discharge is permitted into the existing stormwater system;

→ Any proposed works associated with this project within Melbourne Water Drainage Schemes should not be built in way to preclude future Drainage scheme works. This would be developed further in detail after Road alignment and associated works and flood mitigations works are set for Schemes area; and

→ VicRoads must meet the State Environment Protection Policy (SEPP) (Waters of Victoria)(2004) for urban stormwater runoff, which requires the protection of beneficial uses and the demonstration of best practice.

Melbourne Water have additional requirements for construction phase, works on waterways, and for works on or in the vicinity of Melbourne Water assets, including Stormwater Main Drains.

3.3 Detailed assessment

Detailed surface water assessments will be undertaken in subsequent project phases, either as part of detailed design or part of further environmental assessment. The recommended general methodology for a detailed surface water assessment, in addition to the methodology covered in the preliminary assessment, includes:

→ Hydrologic and hydraulic modelling to define existing flood and drainage conditions, quantify the magnitude of impacts and develop mitigation options;

→ Water quality modelling, using the MUSIC model, to assess the effectiveness of WSRD elements. This should also a normal flow regime impact analysis;

→ Environmental risk assessment; and

→ Consultation with relevant stakeholders.

4 REGIONAL CONTEXT

4.1 Dandenong catchment

According to the Melbourne Water Healthy Waterways Strategy, waterways within the Dandenong catchment support multiple and varied uses and values, including flood mitigation, significant plant and animal species (including platypus, dwarf galaxias, growling grass frogs) and amenity.

There has been extensive modification to rivers and creeks for flood protection (e.g. pipe, concrete lining and channel straightening) within the Dandenong catchment. The Dandenong Valley Authority Act 1963 established the Dandenong Valley Authority, the responsibilities of which were transferred to Melbourne Water under the Melbourne Water Corporation Act 1992.

A large number of ecologically and culturally significant wetlands occur throughout the Dandenong system. These include natural and semi-natural wetlands such as Edithvale-Seaford Wetlands, Wannarkladdin Wetlands and Boggy Creek Waterway Reserve and large constructed wetlands such as Dandenong Valley, Hallam Valley and Boggy Creek Stormwater Wetland.

The Mordialloc Bypass Project is located within the Dandenong major catchment area, within the Mordialloc Creek waterway system.

4.1.1 Mordialloc Creek

The Lower Dandenong Creek, Patterson River and Mordialloc Creek were all created to drain the once extensive Carrum Carrum Swamp that existed prior to European settlement. Dandenong Creek flows into Mordialloc Creek and the Patterson River via diversion structures upstream of Perry Road in Dandenong South. The main tributaries of Mordialloc Creek include the Haileybury Drain, Keysborough South Drain, Smythes Drain, Heatherton Drain, Mordialloc Settlement Drain and Braeside West Drain. Key sites within the catchment include Karkarook Lake and Wetlands, Woodlands Wetlands, Mordialloc Creek Wetlands (also known as Waterways wetlands) and several retarding basins.

The Edithvale-Seaford Wetlands are remnant ecosystems in the southern part of this system. They have cultural significance as the last and deepest remnant of the once extensive Carrum Carrum Swamp. Listed under the Ramsar convention, they are internationally significant, providing important habitat for a variety of birds and wildlife.

The Healthy Waterways strategy lists the following management objectives for Edithvale-Seaford wetlands:

- Frogs – improve abundance, distribution of expected species and species richness;
- Vegetation – maintain vegetation to high quality; and
- Amenity – improve level of amenity.

5 PRELIMINARY IMPACT ASSESSMENT

5.1 Existing conditions

The Mordialloc Bypass Project will occur largely within the designated Braeside West and Mordialloc Creek Wetlands (also referred to as 'Waterways') catchment areas. Both these catchments contribute tributary runoff flow to the larger Mordialloc Creek drainage system.

The Braeside West catchment is consistently flat and covers an area of approximately 21 km² within the municipalities of Kingston and Greater Dandenong (GHD, 2013). It consists of several different land use types including residential, industrial, special use and green wedge zones. The main drainage asset for this catchment is the Braeside West Drain which discharges to the Mordialloc Main Drain approximately 1 km east of the Wells Road Bridge. The Project crosses the Braeside West drain as well as several tributary drains.

The Mordialloc Creek Wetlands catchment is very flat and covers an area under two square kilometres within the municipality of Kingston. It consists of medium to high density development surrounding a wetland and lake system. Drainage is through the network of wetlands and eventual discharge into the Mordialloc Creek Main drain less than approximately two kilometres east of the Wells Road Bridge. A crossing over the Mordialloc Creek wetlands is proposed for the Mordialloc Bypass project.

The Mordialloc Bypass project crosses the following drainage lines (South to North):

- Smythes Drain open channel, east of Bowen Parkway – covered by LSIO;
- Mordialloc Creek Wetlands, between Mordialloc main drain and Governor Road – covered by LSIO;
- Dingley Drain open channel – covered by LSIO;
- Lower Dandenong Road
  - Gartsides South Drainage Scheme open channel – covered by SBO;
  - Gartsides Drainage Scheme underground drainage – covered by SBO;
  - Braeside West Drainage Scheme open channel – covered by LSIO
- Centre Dandenong Road
  - Old Dandenong Road Drain waterway – covered by SBO;
  - Gartsides North Drainage Scheme underground drainage– covered by SBO; and
- Old Dandenong Road Drain waterway.

A surface water overview map is provided in Appendix A.

5.1.1 Previous studies

Previous studies relevant to the Mordialloc Bypass Project include:

- Draft Mordialloc Bypass Desktop Hydrology Assessment (GHD, Oct 2016);
- Dingley Bypass Cross-Drainage Hydraulic Assessment, (GHD, Oct 2014); and
- Mordialloc Settlement Drain Flood Mapping (GHD, May, 2013).

A review of these studies is provided in Appendix B.

5.1.2 Melbourne Water planned works

The Mordialloc Bypass project crosses two Melbourne Water drainage schemes, has a short interface with a further two schemes and will occur downstream of one scheme;

- Bowen Road DS (1124) – shows planned channel on Smythes Drain across project alignment;
- Gartsides South DS (1107) – scheme has been completed;
- Gartsides North DS (1111) – upstream of Project;
- Carrum Lowlands DS (1101); and
- Braeside South DS (1128) – shows planned wetland on northern side of Mordialloc Creek.

The planned works which interface with the Mordialloc Bypass project include the proposed channel along Smythes Drain which crosses the project alignment.

5.1.3 Hydrologic and hydraulic models

Hydrologic and hydraulic models are available from previous studies. These are summarised in Table 5.1.

Table 5.1 Mordialloc Bypass - available flood models

DRAINAGE LINE	HYDROLOGY	HYDRAULICS	COMMENTS
Mordialloc Settlement Drain (Includes Braeside West and Waterways catchments)	RORB model (2013)	TUFLOW model (2013)	Does not cover Project extent south of Mordialloc Creek

5.2 Benefits and opportunities

Potential benefits and opportunities for surface water for the Mordialloc Bypass project include:

- Construction of part of Bowen Road DS crossing project will facilitate completion of the scheme, this includes a planned channel on Smythes Drain across project alignment; and
- Investigation of potential to create constructed wetlands as part of the Project. A feasibility study is currently being undertaken to investigate the opportunity to create a wetland or wetlands in the proximity to the Project.

5.3 Preliminary impact assessment

The preliminary impact assessment covers potential surface water impacts during both construction and operational phases, including:

- Changes to flooding conditions such as frequency and duration of flooding, increases to flood levels or flow velocities;
- Reduction of floodplain storage or other changes to flow regimes leading to increases to peak flows or floodwater volumes;
- Discharge of polluted water; and
- Impacts to future works by Melbourne Water.

5.3.1 Construction phase

The placement of temporary works, stockpiles, equipment and plant can result in a reduction in flood conveyance or floodplain storage, potentially leading to increases to flood levels, flow velocities and flood frequency.

Erosion from construction sites has the potential to contribute large sediment loads to downstream areas. Clause 56 of the SEPP requires construction works be managed to minimise land disturbance, soil erosion and the discharge of sediment and other pollutants to surface waters. To achieve this, construction works should be consistent with guidance in the EPA Publications Construction Techniques for Sediment Pollution Control (1991) and Environmental Guidelines for Major Construction Sites (1996).

Water supplies may be needed during construction for controlling dust and other purposes. Depending on the quantities required and the source of the water, this may have potential impacts on users of the water resource and aquatic fauna and flora.

All VicRoads maintenance and construction projects are required to develop a Construction Environmental Management Plan (CEMP). The CEMP should outline how the contractor will comply with any environmental conditions for the project and provide a framework to ensure that environmental risks are properly managed.

5.3.2 Operational phase

Changes to ground levels, including new embankments or widening of existing roads, and changes to drainage elements, including bridges, culverts and underground drainage, can result in changes to drainage or flooding behaviour during operation. These changes need to be assessed and mitigated as part of the design phase.

Increases to impervious areas, due to new, widened or duplicated roads, will increase the stormwater pollutant loads from roads within the Project area. Increases to pollutant loads need to be assessed and mitigated using Water sensitive Road Design (WSRD) elements, such as swales, bioretention systems, basins and wetlands, as part of the design phase.

Melbourne Water and Councils should be consulted during design phase to understand if any works that may impact surface water are planned in the vicinity of the Project. These often take the form of Drainage schemes (also known as Development Services Schemes) that are master plans for drainage in specific catchments and are developed and managed by Melbourne Water

Anticipated works as part of the Mordialloc Bypass project have the potential to impact surface water. This includes:

- New bridge or culvert crossings over waterways have the potential to increase upstream flood levels;
- Earthworks associated with the Project may result in a reduction of floodplain storage; and
- New roads and shared paths will increase the impervious areas leading to increased runoff rates and pollutant loads.

5.4 Design Recommendations

Based on this preliminary assessment, recommendations for mitigation options to be investigated include:

- Incorporate relevant parts of the Melbourne Water drainage schemes into the Project design;
- Adopt steep batters, retaining walls or bridge structures across floodplains to minimise the loss of floodplain storage, or adopt cut and fill balance between road embankments and new excavation, such as basins or wetlands; and
- Allocate space for stormwater detention and WSRD elements.

5.5 Recommendations for detailed assessment

Detailed surface water assessments will be undertaken in subsequent projects phases, either as part of detailed design or part of further environmental assessment. The recommended general methodology for a detailed surface water assessment, in addition to the methodology covered in this preliminary assessment, include:

- Hydrologic and hydraulic modelling to define existing flood and drainage conditions, quantify the magnitude of impacts and develop mitigation options, for both permanent and temporary works;
  - Extend or develop new RORB hydrologic model to cover the Project area not covered in previous studies;
  - Extend the Melbourne Water TUFLOW hydraulic model to cover the whole Project area;
- Water quality modelling, using the MUSIC model, to assess the effectiveness of WSRD elements;
- Environmental risk assessment; and
- Consultation with relevant stakeholders.

6 CONCLUSION

This report provides a preliminary impact assessment of the flooding, drainage and water quality components of water environments for the Mordialloc Bypass.

The Mordialloc Bypass project will occur largely within the designated Braeside West and Mordialloc Creek Wetlands (also referred to as 'Waterways') catchment areas. Both these catchments contribute tributary runoff flow to the larger Mordialloc Creek drainage system. The project crosses Smythes Drain, Mordialloc Creek wetlands, Dingley Drain, Gartsides South Drainage Scheme, Braeside West Drainage Scheme, Old Dandenong Road Drain, and Gartsides North Drainage Scheme. These drainage systems are covered by either Land Subject to Inundation Overlay (LSIO) or Special Building Overlay (SBO) and therefore any works within these areas will require a permit from Melbourne Water.

The preliminary impact assessment covers potential surface water impacts during both construction and operational phases, including:

- Benefits and opportunities;
- Changes to flooding conditions such as frequency and duration of flooding, increases to flood levels or flow velocities;
- Reduction of floodplain storage or other changes to flow regimes leading to increases to peak flows or floodwater volumes;
- Discharge of polluted water; and
- Impacts to future works by Melbourne Water.

Anticipated works as part of the Mordialloc Bypass project have the potential to impact surface water. This includes:

- New bridge or culvert crossings over waterways have the potential to increase upstream flood levels;
- Earthworks associated with the Project may result in a reduction of floodplain storage; and
- New roads and shared paths will increase the impervious areas leading to increased runoff rates and pollutant loads.

Based on this preliminary assessment, recommendations for mitigation options to be investigated include:

- Incorporate relevant parts of the Melbourne Water drainage schemes into the Project design;
- Adopt steep batters, retaining walls or bridge structures across floodplains to minimise the loss of floodplain storage, or adopt cut and fill balance between road embankments and new excavation, such as basins or wetlands; and
- Allocate space for stormwater detention and WSRD elements.

Detailed surface water assessments will be undertaken in subsequent projects phases, either as part of detailed design or part of further environmental assessment. The recommended general methodology for a detailed surface water assessment, in addition to the methodology covered in this preliminary assessment, include:

- Hydrologic and hydraulic modelling to define existing flood and drainage conditions, quantify the magnitude of impacts and develop mitigation options, for both permanent and temporary works;
- Water quality modelling, using the MUSIC model, to assess the effectiveness of WSRD elements;
- Environmental risk assessment; and
- Consultation with relevant stakeholders.

APPENDIX A
SURFACE WATER OVERVIEW MAPS

PRELIMINARY

HEATHERTON ROAD
DINGLEY BYPASS
DINGLEY BYPASS
GRANGE ROAD
GOLF COURT
JUNCTION ROAD
OLD DANDENONG RD DRAIN 6
OLD DANDENONG ROAD
WYNDARRA CRES
CENTRE DANDENONG ROAD
CHESTNUT COURT
BOUNDARY ROAD

Legend

- Drainage Pit
- Drainage Pipe
- Watercourses
- MWC Underground Pipe
- MWC channel (centreline)
- MWC channel (alignment)
- MWC Natural Waterway (centreline)
- MWC Underground structure
- Land Subject to Inundation Overlay
- Special Building Overlay
- Contour (1m)
- Road
- Wetlands
- Project boundary

Map: 2135645A_GIS_160_A3	Author: MAB
Date: 23/06/2017	Approved by: SH

0 50 100 m

1:5,000

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

Engineering and Technical Services for Mordialloc Bypass

Surface Water Overview - Map 1

PRELIMINARY

RIDDER COURT
BARDOEL COURT
AUSTRALIS COURT
LOBELIA COURT
OPLOO COURT
JETSKE COURT
FREDMAN COURT
RIPS COURT
KINGSTON DRIVE
ALBERT PLACE
GLENELG COURT
CORMORANT PLACE
HERON COURT
SHANNON COURT
SHERIDAN COURT
SIDDELEY COURT
GUMLEY COURT
SAROSE COURT
RAINSFORD COURT
VILLAGE DRIVE
WESTBURY COURT
DONHAVEN COURT
FERNHILL DRIVE
RUBY PLACE
CENTRE DANDENONG ROAD
MANUELA COURT
HOWARD ROAD
CHIPP COURT
RUDOLF COURT
KUBIS CRESCENT
PICKWORTH DRIVE
EARLWOOD STREET
CAMPBELL GROVE
TIMMS CRESCENT
LIBERTY COURT
ROOSEVELT COURT
GLENWAY DRIVE
PLAZA CRESCENT
BISCAY COURT
TAMBO COURT
BOTANY COURT
BAYVILLE DRIVE
BALCOMBE PLACE
BRIDGEWATER DRIVE
CASCO PLACE
SWAN PLACE
HOWARD ROAD TRAIL
WOODLANDS DRIVE
BELL GROVE
LOWER DANDENONG ROAD
PLANE TREE AVENUE
LARCH LANE
CONIFER CRESCENT
BOUNDARY ROAD
SILVER BIRCH AVENUE
FIR STREET
HOLLY DRIVE
LAKE DRIVE
WILLOW STREET
ELM TREE DRIVE
OAK STREET
GARDEN BOULEVARD
REDWOOD DRIVE

Legend

- Drainage Pit
- Drainage Pipe
- Watercourses
- MWC Underground Pipe
- MWC channel (centreline)
- MWC channel (alignment)
- MWC Natural Waterway (centreline)
- MWC Underground structure
- Land Subject to Inundation Overlay
- Special Building Overlay
- Contour (1m)
- Road
- Project boundary

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Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

Data source: VicRoads. Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2016. Drainage data provided by Melbourne Water and VicRoads (2016)

vicroads

wsp

Engineering and Technical Services for Mordialloc Bypass

Surface Water Overview - Map 2

PRELIMINARY

MILLS ROAD
KEVLAR CLOSE
WOODLANDS DRIVE
FEDERATION TRAIL
RED GUM TRAIL
PHOENIX COURT
CYPRESS DRIVE
HOWARD ROAD TRAIL
PARK WAY
VENTURE WAY
MALCOLM ROAD
ENDEAVOUR WAY
LAKEWOOD BOULEVARD
WETLANDS TRAIL
DINGLEY DRAIN
Braeside Metropolitan Park Lake (West)
Braeside Metropolitan Park Lake (West)

Legend

- Drainage Pit
- Drainage Pipe
- Watercourses
- MWC Underground Pipe
- MWC channel (centreline)
- MWC channel (alignment)
- MWC Natural Waterway (centreline)
- MWC Underground structure
- Land Subject to Inundation Overlay
- Contour (1m)
- Road
- Wetlands
- Project boundary

Map: 2135645A_GIS_160_A3	Author: MAB
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0 50 100 m

1:5,000

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

Engineering and Technical Services for Mordialloc Bypass

Surface Water Overview - Map 3

PRELIMINARY

DINGLEY DRAIN
WETLANDS TRAIL
Braeside Metropolitan Park Lake (West)
Braeside Metropolitan Park Lake (East)
GOVERNOR ROAD
BRADY CLOSE
BATE DRIVE
CANTERBURY ROAD
BARMAH PLACE
MITTA AVENUE
COORONG CIRCLE
ARTESIAN PLACE
BINGLE BAY AVENUE
WATERSIDE DRIVE
DEEPWATER DRIVE
WESTBRIDGE COURT
BULOKE LANE
BLACKSWAN LANE
ISLAND POINT AVENUE
LORIKEET LANE
STARLING COURT
MORDIALLOC CREEK
SUTHERLAND AVENUE
REEF COURT
ATLANTIS COURT
JACKIE COURT
BOWEN PARKWAY
WELLS ROAD
LINDY COURT
MANGROVE COURT
ALEXANDER COURT
KEATON WAY
LORENZO WAY
MARINIQUE DRIVE
PACIFIC DRIVE
NORFOLK PLACE
ROYAL PALMS
BANGALOW WAY
MAIDENHAIR MEWS

Legend

- Drainage Pit
- Drainage Pipe
- Watercourses
- MWC Underground Pipe
- MWC channel (centreline)
- MWC channel (alignment)
- MWC Natural Waterway (centreline)
- MWC Underground structure
- Land Subject to Inundation Overlay
- Contour (1m)
- Road
- Wetlands
- Project boundary

Map: 2135645A_GIS_160_A3	Author: MAB
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0 50 100 m

1:5,000

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

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Engineering and Technical Services for Mordialloc Bypass

Surface Water Overview - Map 4

PRELIMINARY

MORDIALLOC CREEK
PILLARS ROAD
SPRINGVALE ROAD
SODEN ROAD
PANDAN PLACE
RIBBON COURT
PACIFIC DRIVE
FERNTREE GROVE
APOLLO COURT
GILCHRIST WAY
WELLS ROAD
ROCHELLE COURT
WILDOER DRIVE
ROSE COURT
BRANAGAN DRIVE
EGRET DRIVE
PIPER DRIVE
EDITH VALE ROAD
KESTREL CLOSE
EAMONT CLOSE
ISABELLA CLOSE
PICKWICK PLACE
NIMROD RISE
WAYVILLE CLOSE
ENTERPRIZE AVENUE
AQUILLA COURT
ARMISTAN CRESCENT
REBECCA CLOSE
CONWAY COURT
NARIEL COURT
LARNARK COURT
HARTWOOD COURT
BRADINA COURT
TIKANTI COURT
AMAROO DRIVE
MORNINGTON PENINSULA FREEWAY

Legend

- Drainage Pit
- Drainage Pipe
- Watercourses
- MWC Underground Pipe
- MWC channel (centreline)
- MWC channel (alignment)
- MWC Underground structure
- Land Subject to Inundation Overlay
- Contour (1m)
- Road
- Wetlands
- Project boundary

Map: 2135645A_GIS_160_A3	Author: MAB
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0 50 100 m

1:5,000

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

Data source: VicRoads. Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2016. Drainage data provided by Melbourne Water and VicRoads (2016)

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Engineering and Technical Services for Mordialloc Bypass

Surface Water Overview - Map 5

APPENDIX B
REVIEW OF PREVIOUS STUDIES

B1. Draft Mordialloc Bypass Desktop Hydrology Assessment (GHD, Oct 2016)

GHD completed the Mordialloc Bypass Desktop Hydrology Assessment for VicRoads in October 2016. The purpose of the report was to provide preliminary sizing for cross-drainage to enable the development of a business case proposal for the Mordialloc Bypass. It follows previous work undertaken for the concept design completed for VicRoads (GHD, 2013) and utilises the flood modelling and mapping completed for Melbourne Water (GHD, 2013).

Key points from the draft report include:

- Based on the concept design (GHD, 2013), the proposed bypass crosses existing flow paths at 11 identified existing flow paths, as listed in Table B.1;
- Existing conditions flood levels and flows for the cross drainage assessment have been adopted from the Melbourne Water Mordialloc Settlement Drain flood mapping project, which included a TUFLOW hydraulic model covering most of the alignment of the MBP.
- A short southern section of the Mordialloc Bypass project was not covered by the extent of the TUFLOW model. The assessment assumed it did not correspond to any major flow path or overland flooding.
- One-dimensional hydraulic modelling using HEC-RAS steady state and/or SWMM was undertaken to determine preliminary sizes for cross drainage structures. Features and assumptions of the modelling include:
  - Model extent was limited to within the road corridor;
  - The TUFLOW 'model geometry' was adopted; and
  - Flow and flood levels were extracted from the TUFLOW model to use as upstream and downstream boundary conditions
- Outstanding issues and limitations outlined in the report include:
  - Effects of loss in floodplain storage not accounted;
  - Consultation with Melbourne Water and Kingston City Council potential for works within Braeside Park (Waterways Area);
  - Consultation with Melbourne Water about works close to the sewer pump station on the southern side of Lower Dandenong Road;
  - Consultation with Melbourne Water, Kingston City Council and land owners about the potential for works outside the project boundary, specifically upstream and downstream of Centre Dandenong Road (proposed swale option); and
  - Confirmation of afflux and blockage requirements by Melbourne Water is needed.
-

Table B.1 Identified locations of existing flow paths crossed by the MBP

GENERAL LOCATION	EXISTING FLOW PATH
Waterways	MC1 – Mordialloc Creek MC2 – Waterways Wetland

GENERAL LOCATION	EXISTING FLOW PATH
Governor Road	DD1 – Dingley Drain (via Braeside wetlands) DD2 – Dingley Drain DD3 – Dingley Drain breakaway
Lower Dandenong Road	G1 – Gartsides South G2 – Gartsides G3 – Gartsides breakaway 1 G4 – Gartsides breakaway 2
Centre Dandenong Road	OD1 – Old Dandenong Road Drain
Dingley Bypass	OD2 – Old Dandenong Road Drain

B2. VicRoads / Thiess Dingley Bypass Cross-Drainage Hydraulic Assessment, (GHD, Oct 2014)

GHD completed a cross drainage hydraulic assessment for the Dingley Bypass detailed design. The purpose of the report was to confirm the hydraulic design of cross drainage for review and acceptance by Melbourne Water.

Key points from the report include:

- The existing conditions flood levels and flows for cross-drainage were adopted from the Mordialloc Settlement Drain flood mapping project (GHD, 2013)
- A table extract of cross drainage infrastructure with relevance to the Mordialloc Bypass project catchment area is shown in Table B.1;
- Regarding the cross drainage culvert at location ‘G’ (adjacent Grange Road), it was noted that ‘at some point in the future a new pipe will be constructed that will divert flood flows from the Deals Road Drainage Scheme to crossing G ’.
- The effect of the diversion on total catchment flow, as it relates to the Mordialloc Bypass catchment, is insignificant in that its main impact is diverting flood flow which would otherwise flow through Dunlops Drain (also known as Old Dandenong Road Drain), which already occurs within the Mordialloc Bypass catchment.
- Flows from Crossing ‘G’ will be conveyed to Dunlop’s Drain along a proposed channel running parallel to Grange Road.
- Tuflow hydraulic modelling of a design case scenario with cross-drainage assets found that there is limited increase in flood levels downstream of the bypass. Furthermore, there was generally no significant increase in flood levels upstream from the bypass.
- It was recommended that Grange Road is lowered to increase the conveyance of flood flows in Dunlops Drain for the 100 year ARI event. This would in turn lower the increase in flood levels upstream of the Road which currently acts as a partial barrier. Tuflow modelling indicated that Grange Road would need to be lowered by 200 mm and its verges by 500 mm, where it crosses the drain, to prevent the upstream afflux in flooding.

Table B.2 Identified locations of existing flow paths crossed by the MBP

WATERWAY CROSSING	STRUCTURE TYPE	COMMENTS
Crossing 'F' for Mordialloc Settlement Drain	Bridge	
Crossing 'G' to accommodate Deals Road Drainage Scheme	Culvert	Channel required downstream to connect into Dunlop's Drain adjacent to Grange Road.
Crossing 'I' at Dunlops Drain / Old Dandenong Road Drain	Culvert	
Crossing 'J'	Culvert	An unnamed drain, west of Tootal Road. Not included in MWC supplied GIS

B3. Mordialloc Settlement Drain Flood Mapping (GHD, May 2013)

GHD completed flood modelling and mapping for Melbourne Water in 2013. The study area covers the Braeside West and Mordialloc Creek wetlands (Waterways) catchments, which the MBP is a part of. Hydrologic modelling was undertaken through RORB models of the assessed catchments, with the purpose of providing hydrographs for input into a TUFLOW hydraulic model. The TUFLOW model was created using drainage details and LiDAR-based terrain data from Melbourne Water and inflow hydrographs from RORB.

As part of the flooding impact assessment of the MBP, it is proposed that the aforementioned RORB and TUFLOW models be used as a basis for the development of (a) a base case (existing conditions) TUFLOW model which covers the study area catchment, and (b) a proposed case TUFLOW model which contains the MBP design alignment. The following considerations will be accounted for during the modelling task (refer recommendations for corresponding actions):

- A short southern section of the MBP project is not covered by the extent of the RORB and TUFLOW models. A review of the existing flooding and hydrology information is required to determine a suitable approach the flooding assessment at this section, and particularly if detailed modelling is required.
- The adopted data and modelling assumptions were described as generally being the best available for the time the data was obtained. In some instances, the RORB and TUFLOW models may not reflect changes (if any) to development or drainage detail that have taken place since finalisation of the models in 2013. One such example, which was discussed with Melbourne Water, was where the TUFLOW model made allowance for a temporary retarding basin which was yet to be built near Moorabbin Airport. Since then, the basin, at present known as Moorabbin Airport Retarding Basin, has been built.

APPENDIX C
MELBOURNE WATER REQUIREMENTS

C1. Performance Criteria for Waterways and Floodplain Planning and Management – Mordialloc Bypass, June 2017

C2. Protection of and Modifications of Melbourne Water Storm Water Main Drains – Performance Criteria for Major Road and Rail Projects

C3. Mordialloc Bypass Stormwater Quality Performance Criteria

Performance Criteria for Waterways and Floodplain Planning and Management – Mordialloc Bypass, June 2017

June 2017
Melbourne Water

Victoria

Melbourne Water

Version History

Date	Version	Description	Author
30/06/2016	1.1	Draft for internal Review	M Coffey
13/06/2018	1.2	Issue for Mordialloc Bypass	S Kelly

1. General

1.1 Wider Context of Assets

Melbourne Waters drainage assets function within a wider context of floodplain management including:

- Floodplains and flood ways requiring consultation with Melbourne Water as a floodplain planning referral agency.
- Catchments which are managed either by MW or local councils.
- Council owned drainage assets (requiring engagement with the other asset owners)
- Major water courses
- Flood ways
- Development and/or Redevelopment Drainage Schemes which are administered or managed by MW, Development Agencies or Local Government where provision for drainage services and Water Sensitive Urban Design is needed to service growing communities.(*Notes under in respect to road and rail networks within the Melbourne catchment.)

*Drainage Schemes are initiated through development planning which conceptualise drainage and flood conveyances both within the development precinct and in the wider catchment context.

An important aspect of Schemes is the creation of the funding or “contributions” systems supporting the capital works.

Where transport networks are concerned, whilst the project initiators (Authorities) are generally exempted from participating or making financial contributions to a Development Drainage Scheme, they nonetheless are required to meet the needs of Schemes in two general ways:

1. Conveying flows across a road reserve meeting the requirements of existing and proposed Drainage Schemes as instructed by the Drainage Authority.
2. Designing and creating Water Sensitive Urban Design Water treatment works meeting Best Environmental Practice Management standards (or compensating for an impact as equivalent through an offsetting mechanism.)

Stormwater runoff must achieve State Environmental Protection Policy (Waters of Victoria) objectives for environmental management of stormwater as set out in the ‘Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO) 1999.

Further general guidance principles and documents relating all classes of assets and floodplain functions can be sourced within the MW Land Development Manual: http://www.melbournewater.com.au/Planning-and-building/land-development-process/Pages/LDM-References.aspx

1.2 Limitations of Advice

The Performance Criteria provided in this document is general advice only. Melbourne Water does not warrant or guarantee that the information provided is exhaustive or without omissions or errors.

Prior to commencing any works on or near any of MW's assets the Contractor will be required to obtain MW's written consent to the works and enter into an Asset Interface Agreement with MW.

For the avoidance of doubt, nothing in this Performance Criteria document is to be taken as consent to any works being undertaken on or near MW's assets.

1.3 Communication, Review and Response Times

All correspondence with MW should initially be directed to the nominated Major Infrastructure Projects interface manager. As the project progresses, a communication protocol will be developed appropriate to the circumstance and timing of the project.

Once a communication protocol is established, MW generally meets the following response times:

- Review of design documentation – 28 working days
- Responses to minor queries, RFI's and the like– 10 working days unless otherwise advised

1.4 Melbourne Water Standard Documents

MW asset management standards shall be followed, including but not limited to, those listed in the table below. These are available on request from MW.

Standards and Related Procedures / Guides
CORP AM P005 *Asset Numbering, Labelling & Data Capture*
CORP AM P006 *Preparation of Drawing Documents*
CORP AM P007 *Documenting Operation & Maintenance Manuals*
CORP AM P008 Documenting Standard Maintenance Instructions
CORP CW P062 *Safety in Design*
CORP CW P085 *Quality Plans*
MELBOURNE WATER SURVEY STANDARDS AND GUIDELINES

1.5 Standards

All works on MW assets shall comply with current MW's Land Development Manual, Australian Standards and Industry Codes of Practice unless otherwise agreed. All new MW underground drains and structures must comply with the Melbourne Water Standard Drawings (Dwg. 7251/08/404 to 7251/08/426. These are available on request from MW.

2. Existing Assets

2.1 Asset Information[1]

MW has a range of information available on the waterways and floodplain e.g.:

- GIS data (Indicative alignments only)
- Hydraulic models
- Drawings

The accuracy of positional and condition data is not a warranty of MW. On-site investigations are required to confirm the accuracy of all information relevant to the proposed design or construction.

It should be noted that the true position of the MW underground drain will require an asset proving survey to be undertaken by the project prior to design. This may involve MW in-drain Confined Space Entry procedures.

2.2 Ownership of assets

Drainage assets may be owned by a range of entities other than MW including local councils and road authorities. Typically ownership depends on the catchment size and type of flow (such as confined, overland or open channel). The ownership of assets impacted by a project needs to be confirmed sufficiently early in the process to allow the engagement and consent of the actual asset owners.

MW will not accept ownership of new drains unless part of a modification of an existing MW Main Drain asset or where it is within its Agency floodplain management responsibility. Any asset created to convey purely overland flows will not be accepted to be owned by MW. In particular, assets created to convey overland flow under rail and roads will become the responsibility of the applicable authority.

Where it has been agreed that the drainage structure is to be owned by MW, then it shall be structurally independent of the rail/road and operationally accessible. If it is not structurally independent of the road/rail, the drainage asset will remain under the ownership of the applicable road/rail authority (incl. Local Government for council roads). Melbourne Waters responsibilities in these cases is for maintenance of the hydraulic capacity of the asset.

Design drawings must define the proposed ownership of all new and modified drainage assets.

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1 The accuracy of data is not warranted by Melbourne Water, inaccuracies are likely to be present. On site investigation is required to confirm all information relevant to design or construction elements. It should be noted that the true alignment and depth of the Melbourne Water underground drains will require asset proving and a survey to be undertaken by the project prior to design. This may involve in-drain confined space survey.

2.3 Availability Requirements

No interruption to flow from any catchment may be caused by the project. (Typically there is no alternative flow path for storm water in the MW drainage network. Construction plans shall be submitted to MW and consider the impacts to drainage and demonstrate that the risk to public and property outside the transport reserve is mitigated. Dry flow works should be planned for in ‘cut overs'.

2.4 Health and Safety

All works associated with the project shall accord with MW’s Health and Safety policies.

3. Waterways and Floodplain Planning and Management Performance Criteria

Climate Change Provisions – General Note

These criteria should be understood in the context that Climate Change is defined as:

1. Sea Level Rise (SLR) of 0.8m by the Year 2100
   Rainfall intensity increase of 19% by Year 2100

2. The role of waterways in climate adaptation and resilience is becoming increasingly important for city-wide planning and resilience strategies. The Mordialloc Bypass project must be delivered in a way that does not limit Melbourne Water and other land managers and city planners from delivering on long term responsibilities and objectives for waterways, including responsibilities for working with communities to achieve place-based outcomes.

3.1 Floodplain Management Requirements

The following requirements shall be met for all works occurring in the project area:

- No increase in 1% year AEP (Annual Exceedance Probability) flood level / velocities as a result of the project.
- No loss of floodplain storage volume.
- Stormwater runoff rates are to be controlled such that there is no significant increase in peak flows across a wide range of AEP's as well as to ensure no adverse impacts on downstream properties resulting from increased runoff volumes. The hydraulic assessment , in additional to the 1% AEP (1 in 100 year ARI)extent should model outputs for storm events including the 20%, 10% , 5%, 2% AEP (1 in 5, 1 in 10, 1 in 20, 1 in 50 year ARI) storm demonstrating no impacts as a result of proposed works.
- No polluted discharge is permitted into the existing stormwater system.
- If an existing the road level was to be raised then the following assessment is required to determine the potential flood risk to upstream properties.
    - Hydraulic modelling will be required to be undertaken considering 0.5% and 0.2% AEP (1 in 200 and 1 in 500 year ARI) storm event.
    - Application of a blockage factor as per AR&R guidelines 2016.
    - If u/s properties are flooded as a result of the raising of road surfaces, flood mitigation works will be required to be undertaken.
- Whilst every effort has been made to develop a clear and consistent document, it remains the responsibility of the Service Provider to identify any key deficiencies based on their understanding of Melbourne Water's project objectives and requirements and seek clarification from Melbourne Water as required.
- Additional information and details of requirements are contained in the Melbourne Water documents "Guideline for Development in Flood Prone Areas" from the Melbourne Water website.

- Modifications to the existing Watercourses must be approved by Melbourne Water. This includes new or upgrading connections to the Watercourses.
- Any proposed works associated this project within MWC Drainage Schemes should not be built in way to preclude future Drainage Scheme works. This would be developed further in detail after road alignment and associated works and flood mitigations works are set for Schemes area.
- The above should be read in conjunction with Melbourne Waters "*Performance Criteria for Modifications to and Protection of MW Drainage Assets*"

Modelling criteria:

- The following 1D and 2D hydraulic models are approved for use by Melbourne Water:
  - 1D models: HEC-RAS
  - 2D model: TUFLOW

Additional information and details of requirements are contained in the Melbourne Water documents "*Guidelines for Development in Flood prone Areas*" https://www.melbournewater.com.au/Planning-and-building/Applications/Documents/Flood-prone-area-development-guidelines.pdf

3.2 Waterway Asset Requirements

The guiding principles in determining the design of a waterway/watercourse crossing consists of:

- Minimisation of environmental impacts
- No increase in flood levels to surrounding properties
- Maintenance access
- Safety and risk criteria

Environmental requirements:

The following requirements shall be met for all works occurring in the project area that may have an impact on waterways/ watercourses:

- Detailed plans must be developed and submitted to Melbourne Water for approval that show:
  - Vegetation to be removed (appropriate authorisations from State and Federal governments for such removal/ impact may need to be obtained by the project i.e. *EPBC Act*); and
  - Associated site revegetation/ reinstatement plans.

- Development and submission of an acceptable Environmental Management Plan detailing how the project will mitigate impacts on the Waterways / Watercourses during construction including water quality monitoring procedures, sediment control systems and scour protection.

Additional information and details of requirements are contained in the Melbourne Water documents "*Constructing Waterway Crossings Guideline*" https://www.melbournewater.com.au/Planning-and-building/Applications/Documents/Constructing-waterway-crossings-guidelines.pdf

3.3 Waterway Bridge

In the case of widening an existing bridge or building a new bridge, the following conditions are to be satisfied.

Existing Bridge

- The existing cross sectional areas of waterways should not be reduced.
- Piers and abutment must be built in line with exiting piers.
- 1% AEP (1 in 100 year) storm flood level should not be increased by more than 30mm and shall be dissipated within 50m upstream. No freeboard loss will be accepted.

New Bridge

- Bridge underside should be set 600mm above the 1 in 100 year AEP flood levels.
- Piers within the waterways must be minimised.
- Bridge design shall include an assessment of scour and incorporate appropriate rock scour protection.
- Endeavour to provide a 4 m X 4 m minimum maintenance envelope under the bridge for maintenance purposes. The level of flood protection for maintenance access will be agreed by MW on a case by case basis; however the minimum flood protection standard is to the 1 in 5 year AEP.
- Pile caps of any piers within the Waterways or adjacent to river banks should be set below the natural surface or river bed profile to facilitate scour protection rockwork.

A Hydraulic and Hydrologic report and associated models will be required to demonstrate how the above conditions have been satisfied.

3.4 Retarding Basins

In the case where the proposed works impact on a Retarding Basins, the works are to be assessed against ANCOLD guidelines (Australian National Committee on Large Dams) with structures designed and reviewed by qualified dams engineers to the satisfaction of Melbourne Water.

4. Construction Phase Requirements

4.1 Construction Phase Planning

MW requires the following Construction Phase Documentation be prepared and submitted for MW's review and comment prior to construction commencing:

1) Asset Protection Plan

2) Quality Management Plan, including Inspection and Test Plans, any commissioning requirements

3) Safety and Environmental Management Plan and where relevant Cultural and Heritage Management Plans.

4.2 Temporary Works (Construction phase)

Construction activities may impact MW's systems and floodplain/overland flows.

The methodology for construction should be carefully considered in the planning of the works in order to minimize flood risk to properties and infrastructure.

Prior to the commencement of any works, detailed design plans and hydraulic modelling are required to be submitted to MW demonstrating minimum flood impacts as a result of the temporary works.

Where there is a temporary impact on the floodplain, the project will be required to submit a method of mitigation to eliminate or reasonably manage such risk.

The floodway including banks and beds of waterways will be re-instated after construction to Melbourne Waters satisfaction

Additional links:

Shared pathway Guidelines: https://www.melbournewater.com.au/Planning-and-building/Applications/Documents/Shared-pathways-guidelines.pdf

APPENDIX A- Drainage Summary Table

Protection of and Modifications of Melbourne Water Storm Water Main Drains

Performance Criteria for Major Road and Rail Projects

June 2017
Melbourne Water

Victoria

Melbourne Water

Version History

Date	Version	Description	Author
30/06/2016	1.0	Draft for internal Review	D Carshalton
30/06/2016	1.1	Draft for internal Review	M Coffey
18/01/2017	1.2	Draft for internal Review	S Kelly
07/04/2017	1.3	OSAR South East issue	S Kelly
13/06/17	1.4	Mordialloc Bypass Issue	S Kelly

1. General

1.1 Purpose

Major infrastructure projects (the Project) frequently involve or impact Melbourne Water's (MW) drainage assets. To maximise community benefit of the Project, modifications of drains may be accepted provided they do not adversely impact in-situ assets and overall conveyance functions including provision for broader floodplain functions.

This document summarises the performance requirements relating particularly to major road and rail projects so as to meet need for the protection and modification of drainage assets and to ensure their safe operation.

Further general guidance principles and documents relating all classes of assets and floodplain functions can be sourced within the MW Land Development Manual: http://www.melbournewater.com.au/Planning-and-building/land-development-process/Pages/LDM-References.aspx

1.2 Limitations of Advice

The Performance Criteria provided in this document is general advice only. Melbourne Water does not warrant or guarantee that the information provided is exhaustive or without omissions or errors.

Prior to commencing any works on or near any of MW's assets the Contractor will be required to obtain MW's written consent to the works and enter into an Asset Interface Agreement with MW.

For the avoidance of doubt, nothing in this Performance Criteria document is to be taken as consent to any works being undertaken on or near MW's assets.

1.3 Wider Operational Context of Assets

Melbourne Waters drainage assets function within a wider context of floodplain management including:

- Floodplains and flood ways requiring consultation with Melbourne Water as a floodplain planning referral agency.
- Catchments which are managed either by MW or local councils.
- Council owned drainage assets (requiring engagement with the other asset owners)
- Major water courses
- Flood ways
- Development and/or Redevelopment Drainage Schemes which are administered or managed by MW, Development Agencies or Local Government where provision for

drainage services and Water Sensitive Urban Design is needed to service growing communities.(*Notes under in respect to road and rail networks within the Melbourne catchment.)

*Drainage Schemes are initiated through development planning which conceptualise drainage and flood conveyances both within the development precinct and in the wider catchment context.

An important aspect of Schemes is the creation of the funding or “contributions” systems supporting the capital works.

Where transport networks are concerned, whilst the Project initiators (Authorities) are generally exempted from participating or making financial contributions to a Development Drainage Scheme, they nonetheless are required to meet the needs of Schemes in two general ways:

1. Conveying flows across a road reserve meeting the requirements of existing and proposed Drainage Schemes as instructed by the Drainage Authority.
2. Designing and creating Water Sensitive Urban Design Water treatment works meeting Best Environmental Practice Management standards (or compensating for an impact as equivalent through offsetting.)

As the road/rail land reserves are normally ‘pre-factored’ in the whole-of-catchment planning sense, they are unlikely to trigger obligation for flood mitigation or attenuation work to be created within the reserve.

1.4 Communication, Review and Response Times

All correspondence with MW should initially be directed to the nominated Major Infrastructure Projects interface manager. As the project progresses, a communication protocol will be developed appropriate to the circumstance and timing of the project.

Once a communication protocol is established, MW generally meets the following response times:

- Review of design documentation – 28 working days
- Responses to minor queries, RFI’s and the like– 10 working days unless otherwise advised

1.5 Melbourne Water Standard Documents

MW asset management standards shall be followed, including but not limited to, those listed in the table below.

Standards and Related Procedures / Guides
CORP AM P005 *Asset Numbering, Labelling & Data Capture*
CORP AM P006 *Preparation of Drawing Documents*
CORP AM P007 *Documenting Operation & Maintenance Manuals*
CORP AM P008 Documenting Standard Maintenance Instructions
CORP AM P031 *Asset Decommissioning*
CORP CW P062 *Safety in Design*
CORP CW P085 *Quality Plans*
MELBOURNE WATER SURVEY STANDARDS AND GUIDELINES
CORP AM S021 Handrail Standard

The above are available on request from MW

1.6 Standards

All works on MW assets shall comply with current MW's Land Development Manual, Australian Standards and Industry Codes of Practice unless otherwise agreed. All new MW underground drains and structures must comply with the Melbourne Water Standard Drawings (Dwg. 7251/08/404 to 7251/08/426). These are available on request from MW.

2. Existing Assets

2.1 Asset Information

MW has a range of information available on the drainage assets e.g.:

- GIS data (Indicative alignments only)
- CCTV footage (availability and currency varies)
- Hydraulic models
- Drawings

The accuracy of positional and condition data is not a warranty of MW. On-site investigations are required to confirm the accuracy of all information relevant to the proposed design or construction.

It should be noted that the true position of the MW underground drain will require an asset proving survey to be undertaken by the Project prior to design. This may involve MW in-drain Confined Space Entry procedures.

2.2 Ownership of assets

Drainage assets may be owned by a range of entities other than MW including local councils and road authorities. Typically ownership depends on the catchment size and type of flow (such as confined, overland or open channel). The ownership of assets impacted by a project needs to be confirmed early in the process to allow the engagement and consent of the appropriate asset owners. Any proposed modification to any MW asset will require the relevant Departments consent.

MW will not accept ownership of new drains unless part of a modification of an existing MW Main Drain asset or where it is within its Agency floodplain management responsibility. Any asset created to convey purely road reserve flows is the responsibility of the road constructor/manager.

Assets created or modified to convey overland flow across the rail and roads will become the responsibility of the applicable authority.

Where it has been agreed that the drainage structure is to be owned by MW, then it shall be structurally independent of the rail/road and operationally accessible. If it is not structurally independent of the road/rail, the drainage asset will remain under the ownership of the applicable road/rail authority (incl. Local Government for council roads). Melbourne Waters responsibilities in these cases is for with maintenance of the hydraulic capacity of the asset.

Design drawings must define the ownership of all new and modified drainage assets

2.3 Availability Requirements

No interruption to flow from any catchment may be caused by the project. (Typically there is no alternative flow path for storm water in the MW drainage network.

Construction plans shall be submitted to MW and consider the impacts to drainage and demonstrate that the risk to public and property outside the transport reserve is mitigated. Dry flow works should be planned for in ‘cut overs'.

2.4 Health and Safety

All works associated with the project shall accord with MW’s Health and Safety policies.

3. Protection of Assets

3.1 Asset Condition Investigation

An Asset Condition Investigation shall be carried out to determine the state of the MW drain.

This analysis shall include:

- Structural analysis of the assets to determine the allowable limits of any impacts.
- Hydraulic analysis to determine the limits of any impacts of the Project.
- Designing monitoring protocols and systems that will be undertaken to demonstrate that the asset is not being adversely impacted. Trigger levels and alerting means for each variable being monitored shall be determined.

3.2 Asset Protection Plan

To demonstrate the protection of assets, an Asset Protection Plan shall be prepared and submitted for review and comment by MW. This plan shall include at minimum the following:

- Pre and Post-construction condition surveys, which shall be conducted by a suitably qualified engineer.
- Construction impact assessments to consider what activities that impact the drain, including ground improvement works, changes to loading, settlement, tunnel boring, dewatering, vibration etc.
- Any strengthening works required to mitigate the risk of the asset damage or failure.
- Proof engineering of all investigations affecting the MW drains may be required
- Any works impacting on Retarding Basins will require ANCOLD (Australian National Committee on Large Dams) assessment

4. Performance Criteria for New or Modified Drainage Assets

4.1 General

These performance criteria apply to any modifications to the MW drains, including but not limited to new sections of pipework, strengthening works and temporary modifications.

The Project shall detail any modifications for which MW shall have the opportunity to review, request changes and approve prior to continuing to further design stages.

The design of any modification shall consider future network expansion if requested by MW.

Any modifications must not place additional operational or cost burden on MW. The design of the modified MW drainage asset must be to the satisfaction of MW and comply with MW's asset standards and hydraulic requirements.

4.2 Design Life and Material Requirements

- All new assets shall have a minimum design life of 100 years.
- Any remediated assets will have a minimum design life of 50 years.
- All new pipes shall be concrete Rubber Ring Jointed pipes unless otherwise agreed with MW Asset Management.

4.3 Asset Requirements

The following requirements shall be met for all new or modified assets:

- Designs must comply with the current MW standard drawings.
- Pits are to be cast-in-situ.
- No structures or foundations shall be within:
    - 0.6D + 2.0m from the outside edge of MW drainage pits, where D is the depth to pipe invert level; or
    - 0.6D + 0.5m from the outside edge of MW drainage pipelines, where D is the depth to pipe invert level; and
    - Comply with MW angle of repose requirements.
- Design of drains must allow for future access to maintain the drain and end–of-life replacement.
- Manholes are required at all changes in directions and must not exceed 250m in spacing, unless otherwise agreed to by MW
- No siphons, 'duck-under' structures or pump stations will be accepted.
- No reverse-grading in new or existing assets will be accepted.
- No trees shall be planted within 5m of MW drainage assets.
- Manholes must be a minimum of 5m outside a road reserve.

- All proposed utilities crossings running over or parallel to the MW main drain must comply with the MW publication “Utility installation Near MW Asset Guide”.
- No reduction in the hydraulic performance of assets will be accepted. An assessment of the existing hydraulic performance of the assets will be required to set the hydraulic criteria for the modification of assets.
- The project shall investigate and confirm all service connections prior to works, and provide a report to MW to demonstrate that all connections are being accommodated in the new design and once construction is completed shall certify that the design has been executed completely.

4.4 Asset Abandonment Requirements

All MW drainage assets that are to be abandoned due to the realignment of the drain are to be decommissioned, removed and disposed of appropriately. The details of abandoned assets will need to be detailed on the final ‘As-Built’ drawings.

5.Construction Phase Requirements

5.1 Construction Phase Planning

MW requires the following Construction Phase Documentation be prepared and submitted for MW's review and comment prior to construction commencing:

1) Asset Protection Plan
2) Quality Management Plan, including Inspection and Test Plans, any commissioning requirements
3) Safety and Environmental Management Plan and, where relevant, Cultural and Heritage Management Plans.

5.2 Pre and Post Construction Asset Condition Assessment

The project shall undertake a condition assessment of MW drainage assets in the vicinity of the construction works before and after the construction phase. Any defects noted between inspections shall be remedied as part of the project at no cost to MW.

Pre and post CCTV inspections of the assets are mandatory and should be captured by correctly referencing commencement points.

Other forms of condition reporting may also be considered. The proposed condition assessment shall be submitted to MW for comment and MW may determine that further types of condition assessments are required.

5.3 Survey

All surveys shall be completed using a suitably qualified land surveyor. All survey shall comply with the requirements in the document *Melbourne Water Survey Standards and Guidelines.*

5.4 Defects liability period

The defects liability period for any works shall be 24 months from commencement of operation. At the conclusion of the defect period, the project must undertake an inspection of all new or modified Melbourne Water assets. The Inspection Report and CCTV information must be submitted to MWC to demonstrate the asset is free of defects.

6. Access, Land Ownership and Easements

6.1 Access to Existing Assets

The asset will remain available to MW for emergency management purposes during the construction phase.

In relation to the planning and availability of space, sufficient land or easements shall be provided to allow MW to safely operate and practically maintain the assets.

6.2 Land Ownership and Easements

The points below summarise the key positions from Melbourne Water:

MW does not need to own lands over a **drainage pipeline.** The following may be required to be obtained by the project:

a) Where MW pipes are located within private land, a drainage easement must be created over the asset. Easement width shall be determined by the size of the asset in consultation with MW.
b) Easements must be registered on-Title by the Project. All costs and liabilities associated with planning, design, legal dispute, land acquisition or easement acquisition are borne by the Project.

For further detail refer to the Water Act 1989 including amendments.

7. Handover Requirements

7.1 Handover

Handover acceptance will be based on the asset achieving its required drainage service function.

MW will operate all of the assets at time of handover; however any defects shall be remedied by the project. Further access to rectify defects shall be under the MW Permit to Work system.

7.2 Alteration of Existing MW Drawings

All existing as-built drawings impacted by the project shall be updated and revised as-built drawings shall be submitted for all new or rehabilitated assets.

7.3 Handover Checklist

The table of requirements below shall be completed to satisfy handover of assets to MW. Approval shall be given by the authorised MW Representative.

Requirements	**Completed Signature**
Functional design objectives have been achieved	
Third-party asset approvals and obligations completed	
Final walk through completed	
Schedule of Minor Omissions & Defects Issued	
Post Implementation Safety Audit Completed	
"As-Constructed" information and collated construction records provided by the project	
Completed equipment list	
Post completion CCTV received	
Final cost accounting based on functional components	

Mordialloc Bypass Stormwater Quality Performance Criteria

June 2017
Melbourne Water

Version History

Date	Version	Description	Author
13.06.2017	1.1	Mordiallioc Bypass	S Kelly

1. Stormwater Quality Treatment (SWQT)

1.1 SWQT Requirements

As part of protecting waterways from current and future contamination from road runoff, the State Environment Protection Policy (SEPP) (Waters of Victoria) (2004) classifies runoff from roads as urban stormwater. Therefore as part of its responsibilities, VicRoads must meet the SEPP for urban stormwater runoff, which requires the protection of beneficial uses and the demonstration of the application of best practice.

The SEPP (Waters of Victoria) defines 'best practice' as 'the best combination of techniques, methods, processes or technology used in an industry sector or activity that demonstrably minimises the environmental impact of that sector or activity'. Best practice requires project proponents to demonstrate that the operational impacts of their project are mitigated to an appropriate level. This approach requires demonstration that the proposed road design will meet the best practice performance objectives and process outlined in Urban Stormwater: Best Practice Environmental Management Guidelines. Victorian Stormwater Committee (1999) (BPEMG).

At a minimum, these are as follows:

- 80% retention of the typical urban annual load of total suspended solids (TSS):
- 45% retention of the typical urban annual load of total phosphorus (TP):
- 45% retention of the typical urban annual load of total nitrogen (TN):
- 70% retention of the typical urban annual load of gross pollutants (GP):

2. Water Sensitive Urban Design (WSUD)

2.1 Water Sensitive Urban Design Hierarchy

The hierarchy of how stormwater quality treatment measures are implemented by the project is shown below in order of preference;

1. **WSUD at source -** Within the project corridor via passive diffuse systems implementing 'Water Sensitive Road Design' (WSRD). This includes but is not limited to swales, infiltration swales, wetlands and porous paving etc.

2. **WSUD outside of the project corridor -** WSUD with the focus on protecting sensitive receiving waters, aka "Hotspots" impacted by the project. Many waterways have been classified and identified for specific protection or management actions. The receiving water sensitivity must be understood to determine where treatment measures are focused

3. **WSUD in the wider catchment -** Construction of WSUD measures within the wider catchment. These should focus first on locations directly impacting the receiving waters within the wider catchment and elsewhere in catchment secondly.

4. **WSUD in a separate catchment –** Construction of WSUD measures to meet equivalent treatment requirements in another catchment.

5. A **combination** of the above to meet best practice requirements

6. **Offset Water Quality Treatment Contributions** - Stormwater offsets are a financial contribution for regional water quality works that are undertaken elsewhere within the wider catchment, to offset treatment that is not provided on site. Offsets funds will be levied to account for the capital and operational (recurrent) phases of the WSUD infrastructure. Offsets should only be sought as a last resort as the treatment of pollutant at source is preferable. Should the project necessitate offsets, the project should still seek to maximise the amount of on-site treatment that can be delivered.

The ultimate project aim should be a road network which has a drainage system disconnected from receiving waterways. It is understood that in some areas site constraints (e.g. topography, ground conditions, and space) can make the implementation of WSUD challenging so the above list should serve as a guide as to the available options and the order of preference for their adoption.

Acceptable methods for the design of treatment measures include the stormwater treatment modelling software package 'Model for Urban Stormwater Improvement Conceptualisation' (MUSIC), or the 'Water Sensitive Urban Design Engineering Procedures manual' available at http://www.publish.csiro.au/book/4974 which provides the procedure for design of various treatment measures.

The WSUD requirements can be investigated for implementation across the wider maintenance project extents and is not limited to the capital works boundary extents.

Resources and Further Reading:

- Melbourne Water, Stormwater Management (WSUD)
- Melbourne Water, 2016, MUSIC Guidelines: Input parameters and modelling approaches for MUSIC users in Melbourne Water's Service Area,
- Melbourne Water, Stormwater Quality Offsets
- VicRoads Integrated Water Management Guidelines 2013
- EPA Best Practice Environmental Management Guidelines (BPEMG)
- South Eastern council WSUD guidelines