



Report

Victorian Urban Drainage Manual Framework Development

Stormwater Victoria

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1 INTRODUCTION

Stormwater management and drainage design are critical parts of the civil infrastructure. Every development or re-development, from a 2-lot subdivision to a new Precinct Structure Plan ultimately requires planning, design, construction and maintenance of surface water management systems.

Across Victoria the broad objectives relating to drainage services are relatively consistent through the requirements of the Victorian Planning Provisions and municipal Planning Schemes. However, the methods and reference documents for guiding how surface water system compliance is achieved, tend to vary from place to place.

Feedback from industry suggests that current practices, processes, and the interaction between responsible authorities and consultants are not meeting the community's needs in terms of efficient and effective outcomes that support the planning and development process. This is evident through:

- The number of iterations often required to attain approval for stormwater management designs.
- The burden (in terms of human resources) on both authorities and consultants.
- The significant length of time taken to resolve detailed drainage design issues.

Currently, there are numerous drainage manuals or guidelines applied across Victoria such as:

- Australian Rainfall and Runoff (ARR) 2019 - Geoscience Australia,
- The Infrastructure Design Manual (IDM) - Local Government Infrastructure Design Association,
- The Engineering Design and Construction Manual for Subdivision in Growth Areas (EDCM) - Victorian Planning Authority,
- Various Local Council Manuals,
- Guide to Road Design Part 5B: Drainage-Open Channels, Culverts and Floodways - Austroads,
- Numerous Melbourne Water Corporation Documents/Guidelines:
 - Waterways
 - Wetlands
 - Bioretention Systems
 - Flood Safety
 - Hydrologic and hydraulic design
- Numerous other CMA Documents (such as individual floodplain development guidelines etc) and
- Many others.

Stormwater Victoria (SV), a key industry body with respect to stormwater management in Victoria, has identified a desire within industry for a consolidated manual, that would cover broad aspects of drainage design, assessment and maintenance, across multiple spatial scales. The aim of this manual is to:

“Provide a centralised set of processes to assist drainage professionals in the design and review of drainage assets”



It is envisaged that the ultimate document may take a similar form to that of the Queensland Urban Drainage Manual (QUDM). Whilst QUDM is considered to provide some broad direction for the proposed project, it is considered important that VUDM is not constrained in scope or style by existing reference documents such as QUDM.

This investigation is intended to explore the potential scope and governance arrangements for the proposed VUDM and has included the following tasks:

- A literature review of similar or related existing guidelines across other jurisdictions within Australia.
- Workshops with industry (the Association of Land Development Engineers (ALDE) and SV) to gather feedback on the drivers and possible contents of the VUDM.
- Development of a VUDM framework and table of contents that outlines what form and function a VUDM may have.
- A proposed governance structure and framework.
- A proposed way forward.



2 LITERATURE REVIEW

2.1 Overview

A review of existing guidelines and reference documents across Victoria and other states was undertaken. It is recognised that statutory responsibilities for drainage and the established processes for design and delivery of surface water management assets is different across the country, for historic reasons, rather than any technical drivers. It is also clear that water management is progressively becoming a more integrated field, requiring consideration and interaction with multiple disciplines and interest groups. At the same time, we live in a world of hyper-specialisation, where experts often have a very narrow field of focus. Reconciling these two realities is a challenge for any contemporary guideline that seeks to be broad in scope but potentially detailed in content. This is clearly one of the key obstacles to developing a functional VUDM reference document that is appealing and has utility for a wide target audience.

Irrespective of the ultimate form of the document, it is important that the target audience and purpose of the VUDM is very clear and transparent. It may be that an initial, limited scope may be more practical to implement with additional content, covering a wider scope and audience, could follow later.

The following tables contain a summary of existing literature on guidelines that has been gathered.

Table 2-1 lists a range of guidelines (both local and national) that are presently applied in Victoria. Table 2-2 shows examples of some Victorian Local Council advice documents, which are typical of the type of guides that are available at the municipal level. Table 2-3 provides summarises a range of guides from other jurisdictions around the country.

2.2 Findings

The findings of the literature review are summarised in the following sections.

2.2.1 Victorian State Perspective

It is evident that Victoria has a significant number of documents that are relevant to stormwater management and design. Many documents reference other documents (for example some MW guidelines reference ARR and state floodplain guides). There are a significant number of reference documents that need to be considered, and there does not appear to be a clear, overarching guide on which parts should be applied where in the design process. Some documents are relatively broad, whilst others are quite technical and specific (ARR for example).

Melbourne Water have developed a significant number of guiding documents. Many of these appear to be somewhat independent of each other and there is no overarching framework that explains how they fit together. In general, they tend to be quite detailed and prescriptive. Whilst prescriptive guides may allow for efficiencies to develop through repeatable practices, and consistency of outcome, they also have the potential to stifle innovation and embed inefficient practices, if not subject to periodic industry feedback and revision.

2.2.2 Victorian Local Council Guides

It is the case that most council documents reference some other guide for certain elements of design detail. For example it is common for there to be reference to Melbourne Water guides (which are sometimes seen as the de facto State Standard) or the Infrastructure Design Manual (IDM), and sometimes both. Where MW guides are adopted, council engineering and/or planning departments typically aren't adequately resourced to manage or oversee these processes. Hence the MW type approach of strict compliance to design criteria is not always practical.



The purpose of the IDM is to provide a set of consistent requirements and standards for the design and development of infrastructure across participating municipalities. The IDM provides good guidance on a range of design aspects. However, there are also some gaps in technical descriptions and worked examples.

The IDM does not have a great deal of content related to Integrated Water Management (IWM) or waterway health aspects. Other emerging issues including the impacts of climate change on design and consideration of heat hazard do not have prominence in the IDM.

There is not a significant focus on maintenance within the IDM. As with many guides that have been developed from a more traditional “engineering” perspective, it is (intentionally) more design focussed than investigations or master planning. The section on SWMP is quite brief and there are no worked examples included.

2.2.3 Other Jurisdictions

It is noted that a consistent theme across all jurisdictions appears following review of the different documents and what they relate to. Despite efforts over the past 20 years to move towards a more integrated surface water management philosophy, that transition still appears to have some way to go. This is because the guidelines (which reflect the industry more broadly) are typically separated into traditional stormwater design (pipes and Pits) and then WSUD.

Review of number of documents reveals that QLD has the most consistency in its State and Council guidelines, with QUDM referenced commonly and in a similar way. This suggests there is widespread adoption and acceptance of QUDM as the authoritative document on stormwater management design in QLD.

With respect to QUDM it is also noted that the latest revision has two volumes. The main manual and then a background document with more of the technical detail and explanation. This is considered to be a practical and desirable split that can reduce the size and complexity of the main document, whilst providing the more detailed reference material for those who are looking for it.

In NSW many Councils appear to use the AUS-SPEC widely. These guidelines are very process based and rely more heavily on ARR and Austroads etc. It is also the case that most councils essentially have their own guides and there is no co-ordination across the state.

2.3 Summary

In summary:

- QLD, through the QUDM has the most consistent set of design guidelines (which also relies on Water By Design guides).
- There is generally (even in QUDM) a lack of integration of IWM and WSUD into the standard design process.
- The main gaps in the current guides for Victoria are:
 - Integration and consistency across the different technical components of drainage design.
 - The need to be forward looking and address IWM (incorporating issues such as stormwater volume management (healthy waterways), impacts of climate change and heat hazard).

It is noted that the context for where each individual guide sits in the process of stormwater design could be mapped in a similar way to the example shown in Figure 2-1. This provides a useful framework for referencing different existing documents and understanding where they fit in the process.



Planning	Concept design	Detailed design	Construction	Establishment	Operation & maintenance
Strategic waterways Water by Design (2019)					
Living waterways Water by Design (2019)					
Concept design guidelines for water sensitive urban design Water by Design (2009)					
MUSIC modelling guidelines Water by Design (2018)					
Bioretention technical design guidelines Water by Design (2014)					
Wetland technical design guidelines Water by Design (2017)					
Deemed to comply solutions Water by Design (2010)					
Drainage and water quality standard drawings Institute of Public Works Engineering Australasia (IPWEA) (2017)					
Stormwater harvesting guidelines Water by Design (2009)					
Best practice erosion and sediment control International Erosion Control Association (IECA) (2008)					
Erosion and sediment control fact sheets Water by Design (2021)					
Guidelines for improving the biology of bioretention systems Water by Design (2022)					
Guidelines for the construction and establishment of bioretention systems and wetlands Water by Design (2022)					
Transferring ownership of vegetated stormwater assets Water by Design (2012)					
Maintaining vegetated stormwater assets Water by Design (2012)					
Rectifying vegetated stormwater assets Water by Design (2012)					

Figure 1.1 WSUD tools and guidelines.
Go to www.waterbydesign.com.au to access these tools and guidelines.

Figure 2-1 Extract from “Guidelines for the construction and establishment of bioretention systems and wetlands”, Water By Design, (2022)



Table 2-1 Local, State or National Guidelines/References Currently Used in Victoria

Guideline	Published By	Technical Oversight	Description
Australian Rainfall and Runoff (ARR): A guide to flood estimation, (2019)	Geoscience Australia (GA)	National Committee on Water Engineers (NCWE) - a specialist committee of Engineers Australia (EA)	Detailed guide to calculation of design flows for rural and urban areas. Also provides guidance on aspects of floodplain management (such as flood hazard).
Australian Runoff Quality – A guide to Water Sensitive Urban Design (2006)	Engineers Australia (EA)	National Committee on Water Engineering (of EA)	Similar to ARR, intended to provide technical background and guidance for water quality analysis and design. Not widely referenced or utilised in Victoria.
National Water Quality Management Strategy – Australian Guidelines for Urban Stormwater Management (2000)	AWA	Agriculture and Resource Management Council of Australia and New Zealand, and the Australian and New Zealand Environment and Conservation Council.	Overview of approaches to stormwater management. Does not include information on analysis of design of stormwater infrastructure. Not widely referenced or used in Victoria.
Urban Stormwater - Best Practice Environmental Management Guidelines (1999)	CSIRO	EPA (Vic), Melbourne Water, Council, State Government, and Industry Representatives	Provides overview of stormwater treatment approaches and recommended methods for planning and design. Design guidance with some detail. Mainly focuses on quality, not quantity. Foundation of WSUD policy in Victoria (and in many cases interstate) over the last 20+ years.
WSUD Engineering Procedures, Stormwater (2005)	CSIRO	Compiled by consultant team, overseen by Reference Group consisting of Councils, authorities and consultants. Review by Monash University and Melbourne Water.	Detailed design guide for WSUD measures. Foundational document that has informed most WSUD guides around Australia in the last 15+ years.
Engineering Design and Construction Manual for Subdivision in Growth Areas, (2019)	Victorian Planning Authority (VPA)	Project Group consisting of Melbourne Growth Area Councils, Consultants, Government Authorities and Professional Organisations (ALDE and CCF).	Provides a series of shared engineering standards and specifications for urban engineering design of subdivisions in greenfield areas on the fringes of Melbourne.



Guideline	Published By	Technical Oversight	Description
Guide to Road Design Part 5, 5A and 5B (2023)	Austrroads	Governed by a Board consisting of representatives from 11 member Transport/Roads entities across Australia (including Department of Transport and Planning Victoria)	Provides detailed design guidance for drainage aspects of road design, including crossings, and roadside surface and piped drains.
Guidelines for Development in Flood Affected Areas (2019)	Department of Energy, Environment and Climate Action (DEECA)	Prepared in consultation with floodplain managers from the nine regional Catchment Management Authorities, Melbourne Water and representatives from 22 local councils.	Describes the process for managing land use and development in flood affected areas across Victoria. Sets out the criteria for assessing floodplain development performance.
Urban stormwater management guidelines (2021)	EPA Victoria	EPA Internal Review	Provides general guidance on the management of stormwater quality and volume with particular reference to the MW Healthy Waterways Strategy (2018) and the General Environmental Duty (GED) defined in the <i>EPA Amendment Act 2018</i> . Implementation depends on what is “reasonably practicable” from a design and implementation perspective.
Infrastructure Design Manual (IDM), (2023, regularly updated)	Local Government Infrastructure Design Association (VIC)	The IDM is owned and maintained by the Local Government Infrastructure Design Association which comprises 44 municipal councils from across rural and regional Victoria.	The (IDM) is a joint initiative of Victorian rural and regional Councils working together to formulate and maintain a set of consistent requirements and standards for the design and development of infrastructure.
Constructed Waterway Design Manual (2019)	Melbourne Water (MW)	Melbourne Water, with consultation with industry	This is a detailed and prescriptive design manual that covers the design, construction, and establishment of constructed waterways on behalf of Melbourne Water.
Wetland Design Manual (2020)	Melbourne Water	MW Steering Committee, Industry stakeholder interviews/feedback	This is a detailed and prescriptive design manual that covers the design, construction, and establishment of constructed wetlands on behalf of Melbourne Water.



Guideline	Published By	Technical Oversight	Description
Retarding Basin Design and Assessment Guideline (~2015)	Melbourne Water	MW Internal Review	Describes Melbourne Water's general requirements for the design, construction, operation and maintenance of drainage retarding basins.
Waterway Corridors - Guidelines for greenfield development areas within the Port Phillip and Westernport Region (2013)	Melbourne Water	MW Internal Review	These guidelines are intended to provide a consistent, strategic approach to the management of riparian zones in greenfield developments. They provide a basis for the overall waterway corridor width and requirements. They are not a detailed design guide.
Constructing waterway Crossings (2011)	Melbourne Water	MW Internal Review	This is a guide on the design and approval process for constructing (Bridge/Culvert) crossings across Melbourne Water's waterways and drains.
Biofiltration systems in Development Services Schemes Guideline (2020)	Melbourne Water	MW Steering Committee, Industry stakeholder interviews/feedback	This is a detailed and prescriptive design manual that covers the design, construction, and establishment of biofiltration systems.
Water Sensitive Urban Design Guidelines - South Eastern Councils (2013)	Melbourne Water	MW and collection of SE Melbourne urban and peri-urban Councils	Broad guideline on the approach and application of WSUD for council areas.
Guidelines for stormwater harvesting on Melbourne Water drainage assets (2016)	Melbourne Water	MW Internal Review	Detailed guide for the design and operation/maintenance of stormwater harvesting schemes on MW drainage assets.
WSUD maintenance guidelines - A guide for asset managers/Inspection and maintenance activities (2013)	Melbourne Water	MW Internal Review	Detailed, prescriptive guideline looking at the maintenance requirements of WSUD assets.
MUSIC Guidelines (2018)	Melbourne Water	MW Internal Review	Detailed guide on the use of MUSIC software to model and assess the anticipated performance of proposed WSUD measures.



Guideline	Published By	Technical Oversight	Description
Healthy Waterways Strategy Stormwater Targets – Practitioners Notes (2021)	Melbourne Water	MW Internal Review	Provides guidance on the implementation of stormwater volume reduction targets associated with the Healthy Waterways Strategy (2018).
Land Development Manual (LDM), (Online, various dates)	Melbourne Water	MW Internal Review	The LDM covers an extensive range of policy and process information regarding land development in Melbourne Water’s area of responsibility. There is a significant amount of technical reference information, although there are also links to various separate, stand-alone MW design guidelines as listed above.

Table 2-2 VIC Local Government Guidelines/References

Guideline	Published By	Technical Oversight	Description
Banyule City Council - Stormwater Drainage Requirements for New Developments (2019)	Banyule City Council	Internal Review	Outlines broad requirements for stormwater drainage investigations and designs. Refers to other documents such as ARR and Melbourne Water guidelines (in general). As with many councils, addresses technical specifics related to matters not covered by MW such as On Site Detention (OSD). Also references Council Standard Drawings.
City of Greater Bendigo - Water Sensitive Urban Design, Resource Kit	City of Greater Bendigo	Internal Review	Broad introduction and advice on WSUD approached for developers with case studies. Not a design guide. Refers to BPEMG (CSIRO, 1999)
City of Frankston - WSUD Guidelines (2011)	City of Frankston	Internal Review	Overview document outlining approach to planning, design, construction and maintenance of WSUD assets. Not a design guide. Refers to MW for detailed design guidance.
City of Frankston - Guidelines for On-Site Stormwater Detention (2021)	City of Frankston	Internal Review	Outlines requirements for the design of onsite detention systems. Addresses matter not covered by other guides.
City of Greater Geelong - MUSIC – Modelling approach and parameters (2019)	City of Greater Geelong	Internal Review	Specific guidance on the use of MUSIC for GOGG. References MW design guides and IDM.



Guideline	Published By	Technical Oversight	Description
Knox City Council – Stormwater Drainage Guidelines (2006)	Knox City Council	Internal Review	Overview of stormwater design with some basic technical details. Does not cover WSUD.
Merri-bek City Council – Drainage design criteria for development (2009)	Merri-bek City Council	Internal Review	Outlines the design and application requirements for developments. Not a design guide.
Wyndham City -	Wyndham City	Internal Review	Overview of design requirements for stormwater infrastructure. Not a design guide. Refers to VPA for engineering standards for new subdivisions.

Table 2-3 Interstate Guidelines/References

Guideline	Published By	Technical Oversight	Description
QLD - Water by Design - Multiple Guidelines on WSUD design and maintenance including: Guidelines for the construction and establishment of bioretention systems and wetlands (2022), MUSIC Modelling Guidelines (2018), and Wetland Technical Design Guidelines (2017) plus others	Water by Design, which is part of Healthy Land and Water LTD based in SE QLD	Typically a combination of Healthy Land and Water staff and selected consultants.	Series of detailed design and maintenance guidelines for WSUD infrastructure. Many references back to QUDM (primarily for hydrology and hydraulic design).
QLD - Queensland Urban Drainage Manual (2016)	Institute of Public Works Engineering Australasia, Queensland (IPWEAQ)	Review Panel comprising IPWEAQ, State Government, council, and industry representatives.	Detailed design manual for many aspects of urban drainage. Includes significant section on policy and legal aspects. Major focus is on hydrology, hydraulic design and erosion management. Higher level advice on WSUD (reference to Water By Design for WSUD design) and Natural Channel Design (reference to Brisbane City Council guidelines).



Guideline	Published By	Technical Oversight	Description
QLD – Sunshine Coast Council, Flooding and Stormwater Management Guidelines (2020)	Sunshine Coast Council	Council led with project consultants	Overview document tying local policy to design reference documents with some local guidance.
QLD – Mackay City Council, Stormwater Drainage Design (2008)	Mackay City Council	Internal review	Overview document, references QUDM frequently
NSW - Wingecarribee Shire Council, Engineering Design Specification D09 Stormwater Drainage (Design)	Wingecarribee Shire Council	Internal review	Overview document with local recommendations. References many other documents including ARQ (2006), ARR (2016), Austroads (2013) and Australian Guidelines for Urban Stormwater Management (2000). Based on AUS-SPEC 0074. Also references QUDM significantly.
NSW – Armidale Regional Council, Engineering Design Code, Supplement to D5, Handbook of Stormwater Drainage Design (2016)	Armidale Regional Council	Internal review	Based on AUS-SPEC. Local recommended parameter values with details drawing on other documents such as QUDM, Water By Design, ARR, Austroads, NSW Floodplain Development Manual.
NSW – City of Parramatta, Development Engineering Design Guidelines (2018)	City of Parramatta	Internal review	Sets design standards and parameters. No significant analysis or design detail.
NSW – City of Sydney, Stormwater Drainage Manual (2017)	City of Sydney	Internal review	Brief overview document, primarily referencing local planning policy. No specification of design or recommended parameters.
NSW – Midcoast Council, AUS-SPEC Infrastructure Specifications 0074 Stormwater Drainage (2020)	Midcoast Council	Internal review	Overview document based on AUS-SPEC (as per similar council guides above) with general approaches rather than detailed methods.



Guideline	Published By	Technical Oversight	Description
SA - Water Sensitive Urban Design – Greater Adelaide Region Technical Manual –(2010)	SA Government	Technical Sub-Committee consisting of multiple Council, Authority and Industry representatives.	Detailed and extensive document with 16 chapters covering planning and design aspects of WSUD.
SA – Adelaide Hills Council, Storm Water Drainage Design Guidelines (2015)	Adelaide Hills Council	Internal review	Brief overview document, setting performance standards but with no detailed design guidance.
SA - Stormwater Management Planning Guidelines (2007)	Stormwater Management Authority	Natural Resources Management Council	Planning document describing the requirements of Stormwater Management Plans in SA.
WA – City of Swan, Handbook of Stormwater Drainage Design (2022)	City of Swan	Internal review	Based on AUS-SPEC. Contains design specification for drainage with basic level of detail consistent with AUS-SPEC and local requirements.
TAS - Stormwater System Management Planning, A Guide for Local Government in Tasmania (2016)	IPWEA (Tas)/Local Government Association Tasmania	IPWEA (Tas)/Local Government Association Tasmania	Provides an overview of what should be included in stormwater management plans. No design details or technical guides provided.
TAS - WSUD Engineering Procedures for Stormwater Management in Tasmania (2012)	EPA Division of the Department of Primary Industries, Water and Environment	Derwent Estuary Program and NRM South and NRM North	Detailed design guide for a range of WSUD elements.
ACT – Stormwater, Municipal Infrastructure Standard 08 (2021)	Transport Canberra and City Services	Internal	Provides overview of multiple aspects of technical drainage calculations and design (including WSUD).
ACT – Practice Guidelines for Water Sensitive Urban Design	ACT Government	Internal	Provides detailed planning and design guidance for WSUD assets.



3 INDUSTRY FEEDBACK

3.1 Overview

Two industry workshops were conducted in April and May 2023 with the Association of Land Development Engineers (ALDE) and Stormwater Victoria respectively. A summary of the nature of these events is provided below in Table 3-1. Each workshop included an introduction by the SV Vice President and was facilitated by staff from WT and E2. Both sessions were productive, with good interaction and feedback from attendees.

Table 3-1 VUDM Industry Workshops

Workshop	Date and Format	Feedback Method (s)	Attendance
ALDE	19 April 2023 (evening, in person)	In person work groups with worksheets and Poll Everywhere ¹ .	Approximately 80
Stormwater Vic	16 May 2023 (morning online webinar)	Online via Padlet ²	Approximately 100

3.2 ALDE Workshop

3.2.1 Overview

For the ALDE session, the attendees were split into 6 groups of around 10-15 people. Handout sheets used to facilitate group discussion and written responses. Poll Everywhere was used to develop some word clouds and to gather electronic responses to some questions. **Error! Reference source not found.** shows an example Poll Everywhere word cloud response. An example of a group activity slide and worksheet response is provided in Figure 3-2. The outputs of the worksheets were manually transcribed to spreadsheets with around 140 responses in total recorded from the session. The full list of summarised responses is provided in Appendix A.

¹ Poll Everywhere is an online service for audience response systems. Poll Everywhere's product allows audiences to use mobile phones to respond to questions and provide immediate feedback.

² Padlet is a cloud-based software-as-a-service, hosting a real-time collaborative web platform in which users can upload, organise, and share content to virtual bulletin boards called "padlets".

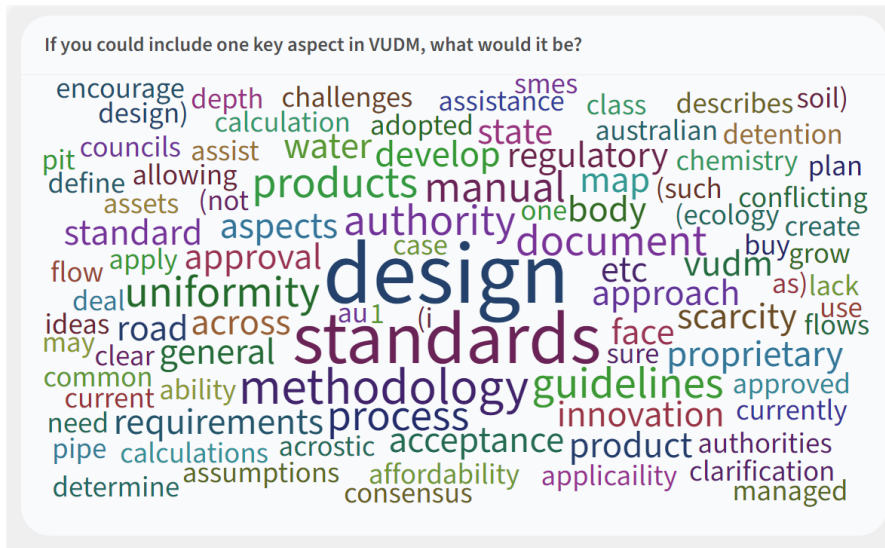


Figure 3-1 Example Poll Everywhere Word Cloud

Small group activity #1

Aim: Establish the 'need' and identify drivers for creation of VUDM.

- What are the main challenges, barriers and gaps?
- Would a VUDM help? (If so, how?)
- What would be critical success factors?

Each group to report back to the room in 20 mins

Group Activity #1

Aim: Establish the need and identify drivers for creation of VUDM

Q1 – What are the main challenges, barriers and gaps?

- COMPETING SPECIFICATIONS
- WHO HAS OVERALL AUTHORITY
- AS DEVELOPMENT MOVES OUTSIDE TERRITORIAL DEVELOPMENT AREAS

Q2 – Would a VUDM help? (if so, how?)

Yes - A FRAMEWORK RESOURCE WOULD HAVE SIGNIFICANT BENEFITS

Yes - LINKS WATER DOCUMENT FOR SENIOR AND WATER

Q3 – What are critical success factors for VUDM?

Buy in - involve water and councils

Having council specific addendums

Having an authority take ownership

Figure 3-2 Example Group Activity Slide and Worksheet Response

3.2.2 ALDE Workshop Responses

The main theme emerging from the responses are listed below for each session.

Main Challenges and Barriers?

Top response themes were:

- Discrepancies b/w different authorities/councils.
- Guidance on suitability of different approaches.
- Multiple guidelines at present, consistency/coordination across them required.
- Challenge will be buy-in from authorities (and funding).



What are critical success factors for VUDM?

Top two response themes (by a margin) were:

- Authority/Council buy-in (but also consultants, developers etc).
- Clarity and ease of use.

What should be included in VUDM?

There were 23 response themes grouped out of the responses for this session, the top 10 were:

- Links to other relevant documents/guidelines.
- Volume management (incl GW, Infiltration).
- Part of enhanced overall process.
- Downstream impacts (incl interim/temporary works).
- Training and support.
- Should cover all design.
- Asset management/maintenance.
- Examples/case studies.
- Recommended processes/methods.
- Proprietary systems (SQIDIP).

3.2.3 ALDE Workshop Summary

Overall there was strong support for the concept of VUDM, with the main challenges being the disparate nature of existing guides and the inconsistency in the way they are applied across different authorities. There is clearly a desire to streamline existing processes in design development and approvals.

Content was broad-ranging, including strong support for worked examples and case studies. Another major emphasis was covering the end-to-end process of stormwater management, from master planning and concept design to detailed design, construction and maintenance.

3.3 Stormwater Victoria Workshop

3.3.1 Overview

For the Stormwater Victoria session, the online meeting was hosted on Zoom and attendees were split into 6 breakout rooms of around 10-15 people for discussion over 3 separate parts. The online platform Padlet was used to interactively record feedback, with each breakout room facilitated by a member of the SV VUDM working group or project team. Figure 3-3 shows an example Padlet feedback window. The Padlet system allows attendees to post a response to the question, then others in the group can like or comment on these, allowing for a very interactive process.

The outputs of the breakout rooms were exported from Padlet into spreadsheets and then manually categorised and consolidated into a summary spreadsheet with around 310 individual responses in total recorded from the session. The full list of summarised responses is provided in Appendix B.

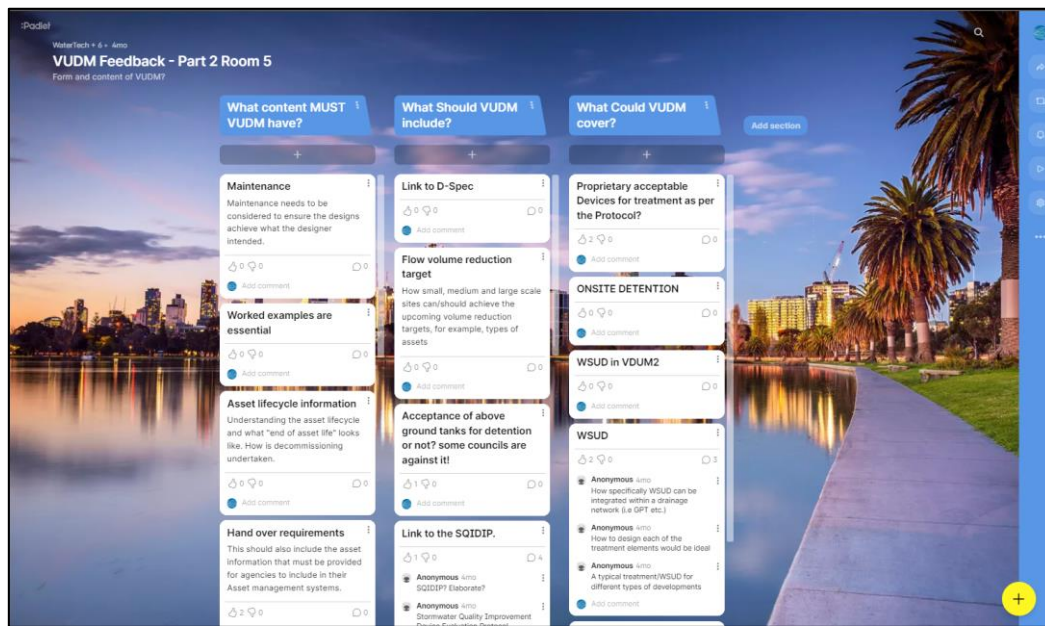


Figure 3-3 Example Padlet Window

3.3.2 Stormwater Victoria Workshop Responses

The main theme emerging from the responses are listed below for each session.

What are the main challenges, barriers & gaps?

Top response themes were:

- Discrepancies b/w different authorities/councils
- Challenge will be buy-in from authorities (and funding)
- Multiple guidelines at present, consistency/coordination across them required
- Clarity on maintenance of public/private assets
- Cover End to End - Planning to Design
- Need a manual that promotes integrated outcomes (future focused)

What are critical success factors for VUDM?

Top response themes were:

- Authority/Council buy-in (also consultants, developers etc)
- Clarity and ease of use
- Leverages/incorporates existing information (not reinvent wheel)
- Good governance, long term consistency, updates
- Consultation/engagement with stakeholders in development

Note top 2 here were the same as ALDE



What should be included in VUDM?

Out of 54 response themes, the top 13 were:

- Asset management/maintenance
- Examples/case studies
- Guidance on key parameters (ie losses)
- Links to other relevant documents
- Volume management (incl GW, Infiltration)
- Climate Change
- IWM
- Flexibility of approach
- OSD
- Recommended processes/methods
- Software compliance/guidance
- Stormwater Harvesting
- WSUD Design

There were some strong similarities (discrepancies between authorities, maintenance, examples/cases-studies) with the ALDE feedback, but also some differences (climate change, software guidance). It is noted that was a very open question, so it is expected that there would be some spread of results.

3.3.3 SV Workshop Summary

Overall there was strong support for the concept of VUDM, with the main challenges being the inconsistency in the way standards/guidelines are applied across different authorities (this was the same for both workshops). There was a clear theme around the need to clarify technical approaches to a range of design challenges with integrated stormwater management and how that feeds into the approvals process.

Content was broad-ranging as per the ALDE workshop. Similarly, there was strong support for worked examples and case studies. A major challenge identified was the need for buy-in from a range of interested parties, particularly drainage and planning authorities. Issues around good governance were also raised.

3.4 Overall Industry Engagement Summary

In summary the key outcomes of the engagement were:

- Strong support for VUDM.
- Key drivers are consistency and streamlining overall process. It is clear that the present time delays in drainage/stormwater design approvals are impacting the delivery of housing, major infrastructure and other development for the community. Any improvements to processes that assist both approving authorities and designers, will be of significant benefit to the community overall.
- Desire for a comprehensive, end-to-end manual that covers planning, through design to construction and maintenance.
- No need to re-invent the wheel and hence should make use of existing information.



- Buy-in from water and planning authorities is crucial to success of document.
- Strong governance is critical to acceptance of manual and to ensure ongoing publishing/availability and updates and revisions.
- There is a strong desire for linked training programs to complement the content (i.e., in person, webinars, videos).



4 VUDM FRAMEWORK

4.1 Overview

Based on the feedback from the workshops, along with the literature review, a draft table of contents and structure has been proposed. There was particular interest with respect to QUDM, given its well established and adopted status in the Queensland industry and the view that this could be a useful model as a starting point. In this respect it is noted that:

- QDUM is a detailed design manual for many aspects of urban drainage. There is a major focus on hydrology, hydraulic design and erosion management.
- QUDM provides high level advice for WSUD/IWM, with reference to Water By Design for these aspects. Similarly, natural channel design references Brisbane City Council guidelines. This is consistent with the situation across Australia where, despite WSUD becoming common practice over the past 20 years, traditional stormwater design and WSUD are poorly integrated in most guidelines and manuals.
- QUDM has detailed sections on planning and legal aspects of drainage which is particularly helpful as this type of information is generally not well documented. This places the engineering design of stormwater management assets within the broader planning and legal framework of integrated surface water management.

It is apparent that, in the face of contemporary and future challenges to the community and environment (such as population and economic pressures, social issues, ecology and biodiversity, and climate change), our approach to surface water management (incorporating drainage), needs to be wholistic and responsive to the broader context of urban systems. This should incorporate an element of risk management and decision making, that balances the requirements of policies and guidelines with the practicalities of delivering sustainable and fit-for-purpose infrastructure. One specific example of this tension is the area of flood risk management where there are challenges currently being experienced to reconcile urban renewal with existing and future (exacerbated by climate change) flood risk.

There is an opportunity with the VUDM to present a truly integrated approach to drainage management that draws together the different elements of design in a way that has not historically been the case.

4.2 Table of Contents

The following table of contents is proposed. This provides the broad structure and main headings (i.e., is deliberately high-level). There would be significant nesting of additional headings underneath these. Some of the detailed content would be directly referenced to external existing documents. Others aspects of the detailed information could be contained in a separate Background Document, similar to QUDM.

1. Introduction
 - a. Scope of VUDM
 - b. Intended audience
 - c. How to use document
2. IWM Approach
 - a. Objectives and principles of stormwater management within IWM context
 - b. Goals (sustainability, amenity, biodiversity, healthy country)
 - c. Drivers (maintenance, efficiency, affordability, traditional custodian values)



- d. Risks (climate change, population, land-use change)
- 3. Planning and Legal Framework (Vic)
 - a. Victorian Strategic and Statutory Planning Framework
 - i. Planning Schemes
 - ii. PSPs
 - iii. Drainage Schemes
 - b. Legal Framework for water in Victoria (Water Act, EPA etc)
- 4. Stormwater Management Planning and Investigations
 - a. Stormwater Management Plan
 - i. WSUD Objectives (spans across everything)
 - ii. Flow Management
 - iii. WQ Management
 - iv. Waterway Management
 - v. Amenity
 - vi. Worked Examples
 - b. Investigations
 - i. Catchment Hydrology
 - ii. Hydraulic Behaviour
 - iii. WQ and flow regime baseline
 - iv. Modelling options and recommended uses
 - v. Waterway, ecology and cultural considerations
 - vi. Worked Examples
- 5. Stormwater Design (Concept/Functional/Detailed)
 - a. Flow Management
 - i. Minor system (pipe design)
 - A. General Concepts (refer to ARR)
 - B. Mannings
 - C. HGL
 - D. Friction Losses
 - E. Pit Losses
 - F. Other Losses
 - ii. Major System (overland flow)
 - A. Retarding Basins (dry/wet)
 - B. On site detention
 - C. Waterway capacity, crossings and outfalls



- D. Flood risk and impact (greater than 1% and Climate Change)
 - E. Surface flow modelling (1D and 2D)
 - F. Worked Examples
 - b. Volume
 - i. Volume management targets
 - ii. Harvesting and Reuse
 - iii. Long term simulation/modelling
 - iv. Annual and seasonal flow variations
 - v. Downstream impacts (peak flow and volume)
 - vi. Surface water – groundwater interactions
 - vii. Worked Examples
 - c. Water Quality (treatment train)
 - i. End of line Systems
 - A. Wetlands
 - B. Bioretention
 - ii. Distributed systems
 - A. Tanks
 - B. Tree pits
 - C. Swales
 - iii. Other
 - iv. Worked Examples
 - d. Waterway Design
 - i. Refer existing guidelines
 - ii. Worked Examples
 - e. Safety in Design
6. Construction Issues
7. Operation and Maintenance considerations

Appendices

- A. Summary of Existing Standards
- B. Template Checklists



5 VUDM GOVERNANCE

5.1 Overview

A Strong governance framework was a key issue highlighted by participants in the engagement workshops. The key themes in this area are outlined as follows:

- The need for a “living” document that is available (through publishing and online presence) and has a regular update schedule to ensure that changes/updates to legislation, policies and standards are considered and incorporated.
- There is a strong case for ownership of the VUDM by an independent body with sponsorship from both industry and government. Noting that QUDM has joint ownership by the Institute of Public Works Engineering Australasia, Queensland (IPWEAQ) and the Department of Energy & Water Services (DEWS), now the Department of Environment and Science (DES).
- The manual should have technical rigor and be backed by a broad-based technical steering committee (or equivalent). This would ensure the process has broad acceptance and is robust and defensible. Input from a range of sectors (water authorities, local government, state government, industry and academia) would enhance the quality and credibility of the material.
- There is a need to consider innovations and emerging technologies and the potential impact they may have on design data and methods in the future. Aspects such as machine learning or other methods that may have an impact on future stormwater management should be considered as and when appropriate.

Two options for the responsibility and ownership of VUDM have been considered. These are a result of feedback from industry and review of other existing arrangements in different jurisdictions. These are outlined below in Table 5-1 with a list of advantages and disadvantages.

Table 5-1 VUDM Governance Options

Governance Arrangement	Advantages	Disadvantages
Single government or non-government agency/entity lead	<ul style="list-style-type: none"> ■ Clarity around responsibility and ownership of IP and publishing responsibilities. ■ Simplified arrangements for management and less complicated contractual or agreement processes. ■ If leg by gov. agency (DEECA for example) then likely better chance of buy-in from drainage authorities 	<ul style="list-style-type: none"> ■ May be less successful with engagement for whichever side is not the owner (i.e., either industry or gov. will not feel sense of ownership or obligation to support). ■ May be more difficult to form a broad-based technical reference committee. ■ Risk is not distributed amongst multiple owners.



Governance Arrangement	Advantages	Disadvantages
Partnership or joint ownership of document	<ul style="list-style-type: none"> ■ Increases opportunity for buy-in and acceptance from both industry and authorities. ■ Shared ownership spreads financial and technical risk. ■ Opportunity for multiple funding sources for development, maintenance and updates. ■ Industry partner may be best suited to manage commercial aspects (sales and support). 	<ul style="list-style-type: none"> ■ Roles and responsibilities need to be clearly defined. ■ Processes for decision making and any potential dispute resolution set out.

5.2 Recommended Structure

5.2.1 Governance

Based on the experience with QUDM and for the reasons outlined above, there appears a strong case for a joint governance arrangement with IP shared between say DEECA (as the lead agency for water management in Victoria) and Stormwater Victoria (as the lead organisation behind the genesis of VUDM). There is scope for other organisations to participate in a “governance committee” that could see representatives from say ALDE, AWA, EA, MAV, VPA, CMAs or other organisations (Infrastructure Design Association, that over sees the IDM for example) participate and broaden the opportunity for wide acceptance of the VUDM.

It is noted that there is a risk that, by making the participation too broad, competing interests and perspectives could lead to a lack of agreement on direction, slowing down the process.

5.2.2 Technical Oversight

Irrespective of the size and structure of the governance committee, there is a strong basis for an independent Technical Steering Group to oversee the initial content, publication, and maintenance of the document. This will be important to ensure there is credibility and acceptance of the material and the document has appropriate status across industry and government sectors.

Representation from a range of interested organisations (gov and industry) will enhance the overall process and most importantly ensure that “all bases are covered” from a content oversight and review perspective. Inclusion of academic representation would also enhance the outcome (selection of an individual(s) with practical perspectives as well as academic rigor would be preferred).

It is important to note that the authors of the document will not necessarily be the same and the oversight group. Experience from ARR suggests that a broad group of authors (and volunteers) could significantly delay the document development. A more practical model may be to seek funding to engage a small number of authors to compile the initial content with the technical steering group providing review and recommendations along the way.



5.2.3 Development, Publishing and Maintenance

With the high workload on all professionals across government and private sectors (now and into the foreseeable future), it is unlikely that a group of individuals with the specialist knowledge and experience would be available, on a volunteer basis, to develop the content.

As mentioned above, the initial development of the document could be overseen by a Technical Reference Group, with the work undertaken by an author(s) engaged by the lead party on a commercial basis. This would be reliant on securing significant seed funding from government or other organisations (or a combination) to develop the initial draft.

It is expected that the document would be published digitally via PDF and/or some other digital publication method. There would be advantages to hosting the document on a web site where resources such as training material (videos) could be made available. By charging for the manual (as is the case in QLD for QUDM), an income stream could be generated to allow for regular review and updates of the document into the future.



6 RECOMMENDATIONS

The following recommendations are made with respect to the ongoing development of the VUDM:

- Engagement with key authorities is essential before further progress on the project can occur. There is strong feedback from industry to support this. Unless there is buy-in from key/multiple agencies it will be difficult to justify any significant further investment by industry.
- The early establish of a governance and delivery framework will enhance the prospects of buy-in by providing a clear direction and structure. Being transparent about the accountabilities and expectations of different interested parties will increase the likelihood of success.
- The first decisions will be to agree on the broad scope and intent of the document. This report makes the following recommendations with respect to this:
 - VUDM takes the position that drainage design is an integral part of the broader IWM framework and there are multiple interests and drivers with respect to stormwater management design.
 - The document seeks to cover the full range of relevant topics for planning, design, construction and maintenance of stormwater infrastructure. In doing so:
 - It should not be overly prescriptive.
 - It should not repeat or reproduce material that already exists.
 - The focus should be on providing an overview, directing users to the appropriate external reference where appropriate, and filling gaps in common practice or knowledge where appropriate.
 - Guidance to users on local variation and/or recommended parameters for different techniques is warranted.
 - There should be a strong focus on worked examples, where appropriate, to provide interpretation of techniques that may not be clear to users.



APPENDIX A ALDE WORKSHOP - FEEDBACK TABLES





Table A-1 Gather ideas on the form and content of a VUDM

Theme	Number of Responses
Links to other relevant documents (with context)	7
Soakage/Infiltration (volume management)	7
Part of enhanced overall process	6
Downstream impacts (incl temporary works)	5
Training and support (custodianship)	5
Cover all design	4
Asset management/maintenance	3
Examples/case studies	3
Recommended processes/methods	3
SQIDIP/proprietary systems	3
Flood risk management	2
Risk Management Approach	2
Climate Change	1
Design checklists	1
Governance Framework	1
Incorporate innovation/research	1
IWM	1
OSD	1
Reference to planning scheme	1
Software compliance/guidance	1
Stormwater Harvesting	1
Tools (GIS, other)	1
WSUD	1
Grand Total	61

Table A-2 Brainstorm options for document governance

Theme	Number of Responses
Stakeholder Engagement	2
Funding	1
Implementation	1
Grand Total	4



Table A-3 Q1 - What are the main challenges, barriers and gaps?

Theme	Number of Responses
Discrepancies b/w different authorities/councils, metro/region	8
Guidance on suitability of different approaches (models/methods)	7
Multiple guidelines at present, consistency/coordination across them required	5
Challenge - buy-in from authorities (and funding)	4
Deemed to Satisfy - Prescriptive Guidelines (Can be challenging/stifle innovation)	3
Need consistent Standard Drawings	2
Bridge gaps in existing guidelines (parts of ARR)	1
Clarity on maintenance of public/private assets	1
Cover End to End - Planning to Design	1
Limited knowledge base within authorities	1
Need a consistent approach for authorities & consultants	1
Grand Total	34

Table A-4 Q2- Would a VUDM help? (If so, how?)

Theme	Number of Responses
Need a consistent approach for authorities & consultants	10
Bridge gaps in existing guidelines (parts of ARR)	1
Deemed to Satisfy - Prescriptive Guidelines (Can be challenging/stifle innovation)	1
Need more worked examples/training (cf IDM)	1
Grand Total	13

Table A-5 Q3 - What are critical success factors for VUDM?

Theme	Number of Responses
Authority/Council buy-in (+consultants, developers etc)	10
Clarity and ease of use (prescriptive?)	8
Improved overall process for all stakeholders	3
Cover End to End - Planning to Design	2
Leverages/incorporates existing information (not reinvent wheel)	2
Training and support (custodianship)	2
Details in separate background document	1
Good governance, long term consistency, updates	1
Grand Total	29



APPENDIX B STORMWATER VICTORIA WORKSHOP - FEEDBACK TABLES





Table B-1 Q1 What are the main challenges, barriers & gaps?

Theme	Number of Responses
Discrepancies b/w different authorities/councils, metro/region	11
Challenge - buy-in from authorities (and funding)	5
Multiple guidelines at present, consistency/coordination across them required	5
Clarity on maintenance of public/private assets	3
Cover End to End - Planning to Design	3
Need a manual that promotes integrated outcomes (future focused)	3
Compliance with new guidelines vs legacy issues	2
Deemed to Satisfy - Prescriptive Guidelines (Can be challenging/stifle innovation)	2
Guidance on suitability of different approaches (models/methods)	2
Guidelines can be out-of-date. Need format that is easily updated	2
Need a consistent approach for authorities & consultants	2
Need consistent Standard Drawings	2
Need more worked examples/training (cf IDM)	2
Bridge gaps in existing guidelines (parts of ARR)	1
Consultants use different guidelines	1
Cost	1
Cover Planning Control Requirements	1
Guidance on acceptable afflux, margin for error, site specific assessment	1
Guidelines independent of single authority	1
Include legal issues/principles	1
Limited knowledge base within authorities	1
Priority waterways	1
Grand Total	53



Table B-2 Q2 What would be critical success factors for VUDM?

Theme	Number of Responses
Authority/Council buy-in (+consultants, developers etc)	11
Clarity and ease of use (prescriptive?)	7
Leverages/incorporates existing information (not reinvent wheel)	6
Good governance, long term consistency, updates	5
Consultation/engagement with stakeholders	3
Details in separate background document	2
Keep costs down (equity)	2
Examples/case studies	1
Incorporate tools as necessary	1
Innovation/New Developments	1
Online delivery	1
Training and support (custodianship)	1
Grand Total	41

Table B-3 Q3 What content MUST VUDM have?

Theme	Number of Responses
Asset management/maintenance	8
Guidance on key parameters (ie losses)	7
Examples/case studies	6
Links to other relevant documents (with context)	5
Climate Change	4
IWM	3
Recommended processes/methods	3
OSD	2
Pipe and Pit Design	2
Soakage/Infiltration (volume management)	2
Consistent assumptions	1
Construction (hold points)	1
Cover all design	1
Cover regional and metro areas	1
Downstream impacts (incl temporary works)	1
Drainage design	1



Theme	Number of Responses
Erosion protection	1
Flexibility of approach	1
Flood risk management	1
Guidance on stakeholder engagement	1
Legal principles	1
Multi-benefit outcomes	1
Online access (free?)	1
PSD - Permeable site discharge	1
RB design	1
Reference to planning scheme	1
Similar structure to QUDM	1
Software compliance/guidance	1
Standard Drawings	1
Stormwater Harvesting	1
Strong version control	1
Updates with latest knowledge	1
WSUD Design	1
Grand Total	65

Table B-4 Q4 What Should VUDM include?

Theme	Number of Responses
Asset management/maintenance	4
Examples/case studies	4
Links to other relevant documents (with context)	4
Flexibility of approach	3
Soakage/Infiltration (volume management)	3
Software compliance/guidance	3
Guidance on key parameters (ie losses)	2
Stormwater Harvesting	2
Address catchment scale investigation and design	1
Buy-in from all stakeholders (authorities/industry)	1
Climate Change	1
Cover regional and metro areas	1



Theme	Number of Responses
Design checklists	1
Downstream impacts (incl temporary works)	1
Erosion protection	1
Flood risk management	1
Green Infrastructure	1
IWM	1
Land use (encumbered open space)	1
Online access (free?)	1
OSD	1
Rainwater Tanks	1
Recommended processes/methods	1
River health considerations	1
Safety for design	1
Site specific considerations	1
Small to large scale catchments	1
Soft engineering	1
SQIDIP/proprietary systems	1
Tools (GIS, other)	1
Urban Heat	1
WSUD Design	1
Grand Total	49

Table B-5 Q5 What Could VUDM cover?

Theme	Number of Responses
Examples/case studies	3
Soakage/Infiltration (volume management)	3
Address catchment scale investigation and design	2
Video training	2
WSUD Design	2
Asset mangement/maintenance	1
Climate Change	1
Cover regional and metro areas	1
Design checklists	1
Flood risk management	1



Theme	Number of Responses
Incorporate innovation/research	1
IWM	1
Not just drainage (name)	1
OSD	1
Quantity and Quality	1
SQIDIP/proprietary systems	1
Stormwater Harvesting	1
Tools (GIS, other)	1
Training and support (custodianship)	1
Urban design	1
Wholistic	1
Grand Total	28

Table B-6 Q6 What level of buy-in from which organisations is needed for VUDM?

Theme	Number of Responses
Broad	3
Councils (IDM)	3
Council, State, Drainage Authorities	2
Melbourne Water	2
MW	2
Other	2
VicRoads (DTP)	2
ALDE	1
All	1
CMA's	1
CMA's, Council's	1
CMAs, DEECA	1
Consultants	1
Council, VPA, MW, Water Authorities, CMAs	1
Councils/MW/CMAs/VicRoads	1
DEECA, CMA's	1
DEECA, Industry, Authorities	1
DEECA/MW	1



Theme	Number of Responses
Industry	1
LGAs, State, WAs, CMAs	1
Melbourne Water, CMA, Council	1
Rail Authorities	1
State/MW/Councils/Community Groups, Env Groups, Professional Bodies (EA,PIA etc)	1
Traditional Owner buy-in	1
VicRoads & Victrack	1
VPA (EDCM)	1
Grand Total	35

Table B-7 Q7 What training/education requirements, by who?

Theme	Number of Responses
Webinars	3
SV could run it	2
Annual training	1
Authority personnel	1
Clear scope	1
Collaborate across industry	1
Councils	1
Cross-disciplinary training	1
Design through to construction and maintenance (Clearwater?)	1
Free training	1
Highlight changes (what's new)	1
In person 1-2 Day sessions (Multiple times per year)	1
Leverage existing training providers	1
Maintenance	1
Other	1
Quality trainers	1
Refresher for new starters	1
Seminars	1
Target all levels	1
Technical committee oversight	1
Users and approvers	1



Theme	Number of Responses
Various modes of delivery (video, books, online)	1
Video training	1
Webinars (SV)	1
Grand Total	27

Table B-8 Q8 Who should be responsible for content and publication?

Theme	Number of Responses
DEECA	4
Consortium	2
IPWEA	2
Other	2
Drainage authorities	1
Must be peer reviewed	1
State level	1
SV and DEECA	1
SV or IPWEA	1
Unsure but needs funding	1
Grand Total	16

Table B-9 Combined Q 3,4,5

Theme	Responses
Asset management/maintenance	13
Examples/case studies	13
Guidance on key parameters (ie losses)	9
Links to other relevant documents (with context)	9
Soakage/Infiltration (volume management)	8
Climate Change	6
IWM	5
Flexibility of approach	4
OSD	4
Recommended processes/methods	4
Software compliance/guidance	4
Stormwater Harvesting	4



Theme	Responses
WSUD Design	4
Address catchment scale investigation and design	3
Cover regional and metro areas	3
Flood risk management	3
Design checklists	2
Downstream impacts (incl temporary works)	2
Erosion protection	2
Online access (free?)	2
Pipe and Pit Design	2
SQIDIP/proprietary systems	2
Tools (GIS, other)	2
Video training	2
Buy-in from all stakeholders (authorities/industry)	1
Consistent assumptions	1
Construction (hold points)	1
Cover all design	1
Drainage design	1
Green Infrastructure	1
Guidance on stakeholder engagement	1
Incorporate innovation/research	1
Land use (encumbered open space)	1
Legal principles	1
Multi-benefit outcomes	1
Not just drainage (name)	1
PSD - Permeable site discharge	1
Quantity and Quality	1
Rainwater Tanks	1
RB design	1
Reference to planning scheme	1
River health considerations	1
Safety for design	1
Similar structure to QUDM	1
Site specific considerations	1
Small to large scale catchments	1
Soft engineering	1



Theme	Responses
Standard Drawings	1
Strong version control	1
Training and support (custodianship)	1
Updates with latest knowledge	1
Urban design	1
Urban Heat	1
Wholistic	1
Grand Total	142



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