



Department of  
Sustainability and Environment

# **Strategic Water Information and Monitoring Plan Victoria**

Prepared by the Department of  
Sustainability and Environment

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## Foreword

<i>The issue</i>	In recent years water has become a pressing public policy issue for Australian society. As water demand increases and supply dwindles, the strain on existing water supplies has reached new heights. Protracted drought and mounting evidence of climate change have added momentum behind a growing community and political will to see improvements in both our understanding of water resources and the way we manage them.
<i>The challenge</i>	Better management of water poses a national challenge, requiring a coordinated response. Our ability as a community to reach agreement on the tough issues relies on access to accurate, reliable water information that is freely available and of the highest standards. Key to making these decisions and arriving at sound policy is a definitive water data source that stands above reproach.
<i>Australian Government response</i>	Aligned with this need, the Australian Government assigned the Bureau of Meteorology (the Bureau) responsibilities under the <i>Water Act 2007</i> to compile and deliver comprehensive water information for the country. As part of the Australian Government's long term framework for water security, Water for the Future, \$450 million was allocated to the Bureau over 10 years to deliver the Improving Water Information Program. This program includes development and maintenance of an integrated, national water information system which will be freely accessible to the public. Details of the full suite of Bureau objectives and deliverables can be found at <a href="http://www.bom.gov.au/water">www.bom.gov.au/water</a> .
<i>A partnership model...</i>	Vital to the success of the Bureau's mission is the partnership and cooperation of all State and Territory Governments and all water data collecting organisations in each jurisdiction. One of the vehicles for effective collaboration is the Jurisdictional Reference Group for Water Information (JRGWI), established to provide regular input to the Bureau's activities, and bringing to the table the experience and wisdom of respected senior officials from across the water sector.
<i>...and putting it into practice</i>	The Modernisation and Extension of Hydrologic Monitoring Systems Program (the M&E Program) is an \$80 million fund administered by the Bureau and available to organisations named under the Water Regulations 2008. The M&E Program is aimed at improving technologies employed by those who collect water information, and enabling better approaches to data transfer and standardisation. Coordination activities are also supported through the M&E Program via funding for Strategic Water Information Coordinators (SWICs) in each State and Territory. SWICs have been tasked with bringing together key stakeholders in their jurisdiction to distil State/Territory priorities in water data collection, and to set these out in a series of Strategic Water Information and Monitoring Plans (SWIMPs).

- Strategic plans...* The SWIMPs provide a framework for describing where we are going and how we will get there. Each SWIMP has been produced with a whole of jurisdiction focus to encapsulate the current state of play in water information and monitoring, describe the gaps, issues and opportunities that exist, and articulate a series of priorities, strategies and actions that will bring us closer to the end vision of better water information for all.
- ...and how they contribute to the solution* Through the M&E Program the Bureau is able to assist the States and Territories to get closer to our agreed view of what constitutes a fit-for-purpose hydrologic observing system in each jurisdiction. The Bureau looks to the SWIMPs to provide guidance on how best to invest M&E Program funds to achieve this goal. In this regard, the SWIMPs are a vital product.
- The future* In closing, the Bureau appreciates the energy and expertise that has been applied in the preparation of this SWIMP, and thanks all of the officers that have participated in its development and review. Our special thanks go to the lead author of the SWIMP, the Department of Sustainability and Environment.



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## Executive Summary

In 2007 the new federal *Water Act 2007* and associated *Water Regulations 2008* gave the Bureau of Meteorology (the Bureau) new functions, including the collection and collation of water information across Australia. In conjunction with these functions the Bureau was given the responsibility to administer a competitive funding program of \$80m over five years, the Modernisation and Extension of Hydrologic Systems Fund (MEHS). The objective of the MEHS is to assist water information collectors to modernise and extend their water monitoring systems in order to enhance the accuracy and transfer of data to the Bureau.

As part of the MEHS program the Bureau commissioned a Strategic Water Information and Monitoring Plan (SWIMP) from each jurisdiction, to be developed in consultation with organisations that had legal obligations to deliver water information to the Bureau.

A key function of the SWIMP is to provide background to:

- A. the jurisdictional business drivers for collecting the types of data and information described in the *Water Regulations 2008*,
- B. the existing jurisdictional water monitoring infrastructure and networks,
- C. opportunities for improving jurisdictional water data and information in relation to the Bureau's requirements, and
- D. strategic investment priorities across Victoria for the Bureau's MEHS funding decisions.

Victoria's water allocation regime and environmental water management is dependent on accurate and reliable resource information for its effective operation. Victoria's water information is collected by a wide range of businesses that require this information for their specific business needs. With the advent of the Commonwealth *Water Act 2007* these businesses are now required to deliver this information to the Bureau. The MEHS funding program provides an opportunity for Victoria's water information collectors to seek assistance as they fulfil their new obligations under the Act.

This SWIMP describes Victoria's water information and monitoring in the context of the State's water allocation and environmental water management program. At the Statewide level, water information and monitoring needs of different organisations are dependent on their role in the Victorian Water Allocation Framework and associated key legislation and policies, such as the Victorian *Water Act 1989*, the Sustainable Water Strategies, the *Our Water Our Future* White Paper, and the Victorian River Health Strategy.

In order to support the Bureau in its new functions under the federal *Water Act 2007* the structure of the SWIMP reflects the Bureau's data delivery requirements by focusing on the data categories and subcategories identified in the federal *Water Regulations 2008* (the Regulations). The SWIMP brings together the water monitoring needs of Victorian water agencies, catchment management authorities, state government departments, and private sector organisations in a single document. It was developed over two years. The 2009 version focused on surface water and groundwater quantity and quality (the Regulations Categories 1, 2, 3 and 9). In 2010 the scope was expanded to include data categories related to jurisdictional water management (the Regulations Categories 5, 6 and 7) and an expansion of meteorological information (Category 4).

The federal Regulations individually name 53 organisations in Victoria ('named persons') who are required to give the Bureau specified water information that is in their possession,

custody or control at specified frequencies (Water Regulations 2008, Schedule 2). However, given the differences in jurisdictional approaches to water resource and environmental water management in Australia, some organisations currently named in the Act do not hold any of the water information categories defined.

A strong consultative approach was adopted in the development of the SWIMP to ensure that all organisations participating in the process were given multiple opportunities to provide input. All key organisations collecting water information in Victoria participated in the development of the SWIMP and their input was reflected in earlier drafts of the SWIMP submitted to the Bureau in order to assist with their funding decisions for upcoming rounds of the competitive MEHS fund and future funding opportunities.

The Victorian SWIMP:

- documents the key drivers for the monitoring of water in Victoria,
- identifies the existing water monitoring infrastructure and water monitoring networks in Victoria,
- highlights the gaps within and across water monitoring networks throughout Victoria, with emphasis on gaps that relate to the Bureau's requirements, and
- provides recommendations for improvement through targeted and strategic investment across the State.

The Victorian SWIMP emphasises the prioritisation of critical infrastructure and networks that deliver the broadest State needs for monitoring information. The infrastructure and networks documented in this SWIMP service the bulk of the Victorian monitoring needs of the key organisations at local, state and national levels. They also provide the foundation stone for delivering on the information requirements for the Bureau as it delivers its new functions under the federal *Water Act 2007*.

## 1 Introduction

In 2007 the new federal *Water Act 2007* (the Act) came into effect. The Act gives the Bureau of Meteorology (the Bureau) water information functions and powers that are significant additions to its existing functions under the *Meteorology Act 1955*.

Section 120 of the Act defines additional functions of the Bureau to include (amongst others):

- collecting, holding, managing, interpreting and disseminating Australia's water information
- providing regular reports on the status of Australia's water resources and patterns of usage of those resources
- providing regular forecasts on the future availability of Australia's water resources
- compiling and maintaining water accounts for Australia, including a set of water accounts to be known as the National Water Account.

The administration of the Act is governed by new Water Regulations 2008 (the Regulations) that commenced on Monday 30 June 2008.

The development of this document and its structure was guided by the Bureau's Framework Guidance Document V 1.0, issued to all jurisdictions on the 15 January 2009 (Bureau of Meteorology 2009) and revised in November 2009. The key purpose of the Framework Guidance Document was to align jurisdictional documents, allowing the Bureau to use these documents to support their funding decisions under the MEHS program.

This SWIMP was prepared in stages, including extensive consultations with the relevant organisations named in the Act and multiple submissions of drafts to the Bureau.

Over the life of this SWIMP (commencing 2007) the lead agency (DSE) engaged in extensive discussions with organisations named in the Act, to identify the gaps, issues and opportunities for water information monitoring across all data categories as defined in the National *Water Act 2007*.

Organisations named in the Act were offered additional opportunities to provide input to the Victorian SWIMP through participation in workshops held for most of the Water Information Categories identified in the Regulations. The workshop schedules were organised around key data providers to the Bureau, however, all Victorian organisations named in the Act were contacted and invited to participate. Some named persons elected not to participate in the workshops. Other organisations requested invitations to attend workshops for data categories they were not required to deliver to the Bureau. All such requests were accommodated. Relevant representation of lead agency staff occurred at all workshops in order to ensure that all scales of water management in Victoria, from regional to state to the Murray Darling Basin Authority, were considered.

The outcomes of the workshops were used to prepare draft Mini SWIMPs for each Water Information Category. Each Mini SWIMP aimed to represent the water information needs and priorities of the organisations that attended each workshop.

One of the main purposes of the Mini SWIMPs was to identify the water information priorities for each of the organisations named in the Act that collect and use water information throughout Victoria. These priorities do not necessarily align with or reflect the Bureau's priorities or those of other organisations, such as the Commonwealth Government and the Murray Darling Basin Authority. The draft Mini SWIMPs were presented to all workshop participants for comment before being finalised. The main findings of each Mini SWIMP have been incorporated into the Victorian SWIMP. Therefore the information presented in the Victorian SWIMP represents the business drivers and information requirements of the organisations that participated in the workshops and consultation process.

### 1.1 Format for the jurisdictional SWIMPs

The Victorian SWIMP aligns with the Bureau's Framework Guidance Document with four main sections that address the following themes:

1. The main business drivers for collecting and using water information in Victoria;
2. The monitoring networks, technologies and data management systems that are currently used to collect, store and report water information throughout Victoria;
3. An assessment of the gaps, issues and opportunities related to water information collection and reporting throughout Victoria; and
4. A description of the investment priorities to address current gaps and issues associated with each Water Information Category.

An overview of the information presented in each section is provided below.

#### 1.1.1 Section A – A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information

Section A of the Victorian SWIMP summarises Victoria's water information questions/drivers and the fundamental reasons why different organisations collect and use water information. Water resource management in Victoria is guided by State and intergovernmental legislation, agreements and policies. These drivers operate at specific state, regional and/or local scales with obligations for the collection of water information and monitoring being dependent on the role of a given Victorian entity in water and environmental resource management. State agencies (e.g. DSE and DPI), Water Corporations, Catchment Management Authorities and other local and regional entities have additional needs for water data to inform policy, planning and research, and inform specific decisions in their businesses. Examples of specific business decisions that rely on water information include the management of allocations and entitlements, management of the Environmental Water Reserve (EWR) and flood warning management. The length of record of water information required by named persons differs depending on their specific obligations within Victoria's water resource management framework.

#### 1.1.2 Section B – A description of monitoring networks and technologies and data management systems in place in Victoria

Section B of the Victorian SWIMP describes the water monitoring networks and technologies, and data management systems in place within Victoria. Much of the information presented in Section B, such as the description of Victoria's Regional Water Monitoring Partnerships (RWMPs) and the Groundwater Management System (GMS), has been carried forward from earlier drafts of the Victorian SWIMP, which addressed four out of the seven water information categories considered in the current SWIMP. Those earlier SWIMPs used a combination of emails, targeted phone-calls and face-to-face meetings with representatives from relevant named organisations and existing stakeholder networks to collect the relevant inputs. New information collected through the Mini SWIMP workshops (**Error! Reference source not found.**) has been incorporated into the final Victorian SWIMP where relevant.

Information on data management systems is presented separately for Statewide and regional water resource management in Victoria. Systems and processes that are used to collate and record data at the Statewide level are described in detail. Brief summaries are provided for data management systems that are used only at a regional level.

#### **1.1.3 Section C – An assessment and statement of gaps, issues and opportunities in existing Victorian water information and monitoring investment and systems - gap identification**

Section C provides an assessment and statement of gaps, issues and opportunities in existing Victorian water information and monitoring investment and systems.

Information from current monitoring network reviews, such as a recently completed *Statewide Groundwater Monitoring – Network Requirements – Guideline Document*, and discussions about recent developments in surface water monitoring under the Regional Water Monitoring Partnerships are used to assess the data collection and reporting systems described in Section B.

In addition to the physical components of a monitoring network, Section C describes the strategic direction Victoria has adopted in the management, analysis and reporting of water information. Critical gaps are identified in relation to data set management and linkages between key water data collectors in Victoria.

#### **1.1.4 Section D – A description of priorities, strategies and recommended actions – strategic vision and resulting prioritisation**

Section D directly targets the Bureau's requirement to use the Victorian SWIMP to guide investment decisions under the Commonwealth Modernisation and Extension of Hydrologic Monitoring Systems Program Fund.

In 2011 the funding themes for the M&E program are:

- Theme 1: Data Collection and Telemetry
- Theme 2: Coordination Activities
- Theme 3: Collating and Reporting water information
- Theme 4: Spatial Data
- Theme 5: Developing the National Groundwater Information System
- Theme 6: Data management, processing and transfer

Section D brings together specific information gaps and issues described in Section C and provides an overview of their overall importance in relation to the business users of the information at regional, state and federal levels. All of the recommendations were discussed at each of the information sub-category workshops and represent the requirements of the organisations named in the federal legislation who participated in those workshops. Workshop participants rated the importance of each action according to the broad criteria. Not all actions were required by all participants, but there was broad agreement on the relative priorities for each information category.

## **2 Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.**

### **2.1 Background**

Victoria is located in the south east corner of Australia. It is the second smallest state, but is the second most densely populated state or territory (after the Australian Capital Territory) and caters for the second highest population of any state (ABS, 2008).

Victoria's northern border is the southern bank of the River Murray. It is bordered by South Australia to the west, by the Tasman Sea to the east and by Bass Strait and the Indian Ocean to the South. The Great Dividing Range separates Victoria into a southern part which primarily drains to the sea and a northern part which drains to the River Murray. Victoria contains many topographically, geologically and climatically diverse areas, ranging from the wet, temperate climate of Gippsland in the southeast to the snow-covered Victorian alpine areas in the east, which rise to almost 2,000 metres. In the west and northwest there are extensive semi-arid plains.

There is an extensive series of river systems in Victoria. The River Murray System is the most notable. Sixty percent of Victoria is within the Murray Darling Basin which makes up approximately 12% of the total Murray Darling Basin area (MBDC, 2006). Including sub-basins within the River Murray system, 29 river basins exist in Victoria as shown in Figure 1. Surface water is managed within these basin boundaries.



Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

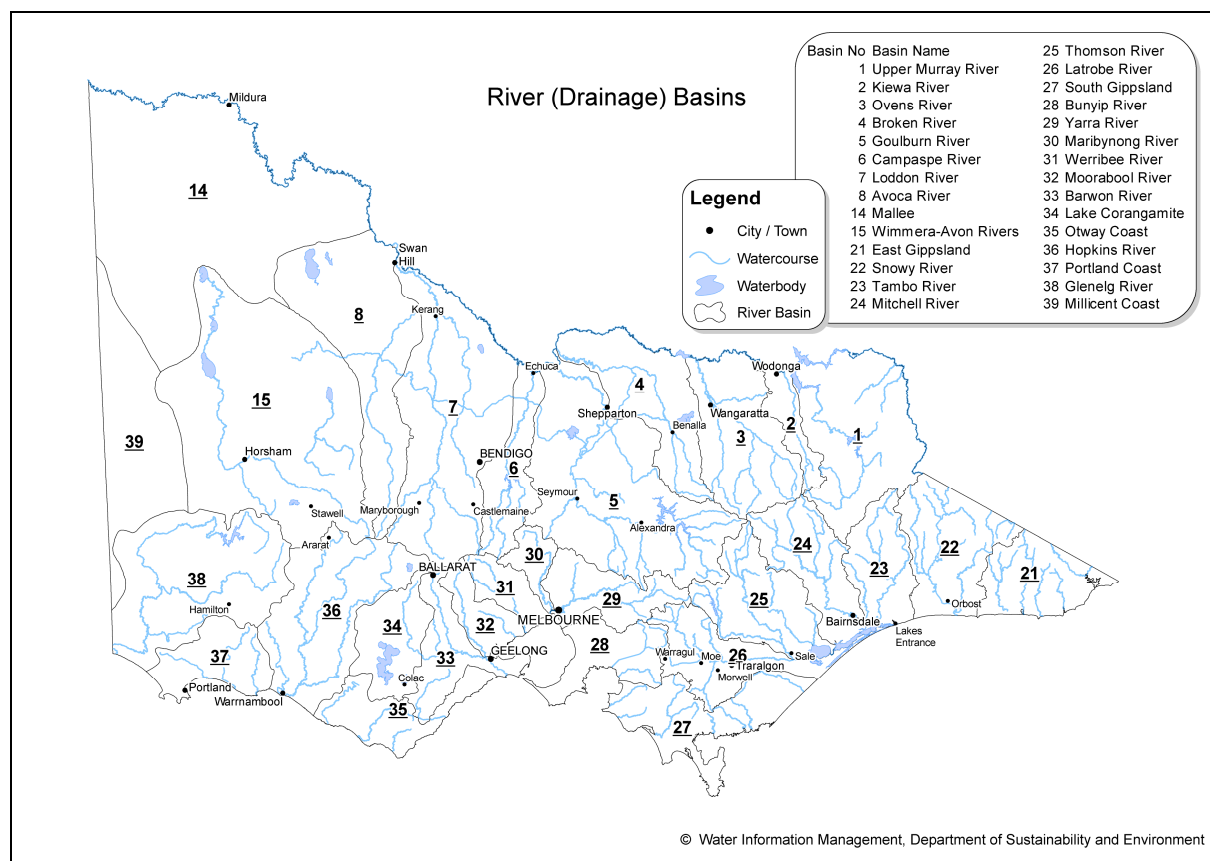


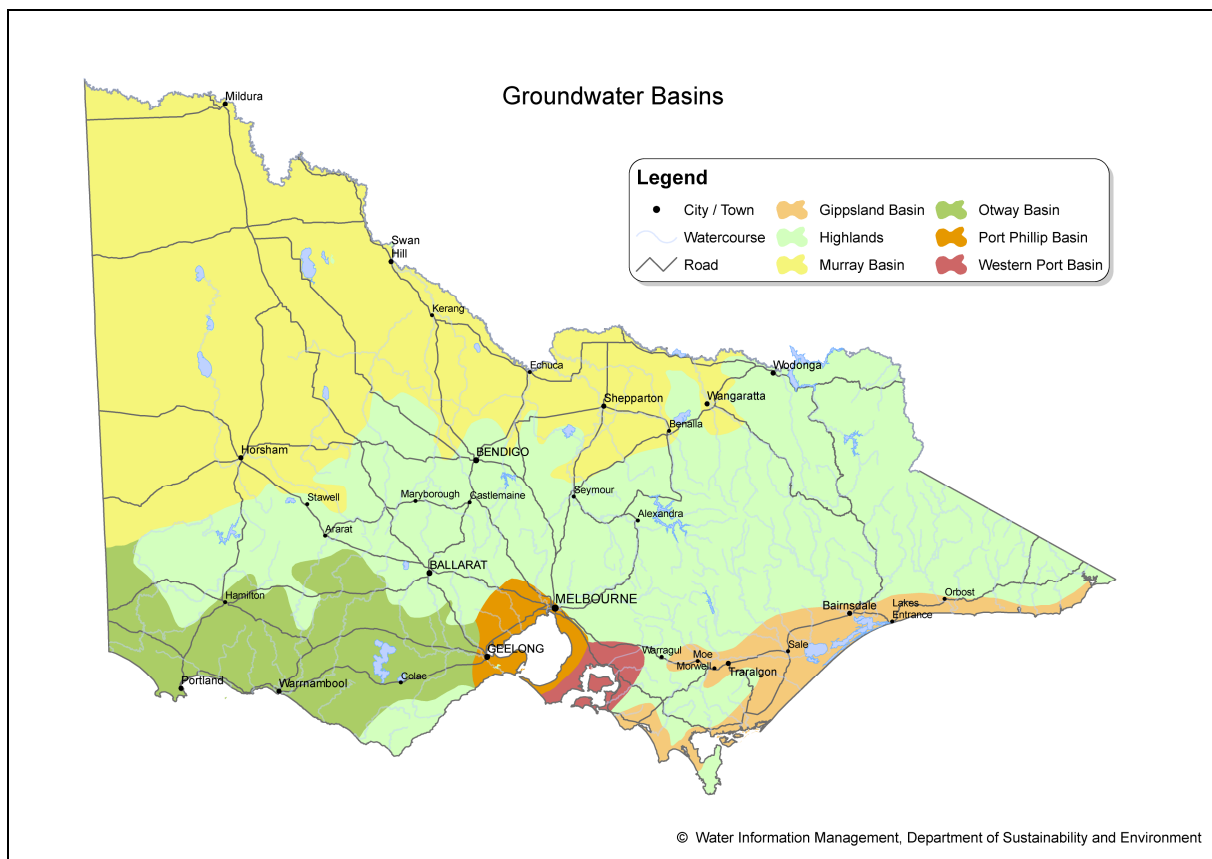
Figure 1. River basins in Victoria.

Groundwater aquifers in Victoria do not align with surface water catchments and some aquifers are interconnected to surface water resources across six basins. Groundwater basins are shown in Figure 2. Groundwater is managed under the *Water Act 1989* and within geographical areas defined as groundwater management units (GMUs).

In Victoria, groundwater resources are used for a variety of purposes and total groundwater use equals approximately 15% of surface water use. In some areas, groundwater supplements surface water. In others, whole communities are dependent on groundwater for all purposes including town supply.

Victoria is progressively determining Permissible Consumptive Volumes (PCVs) to cap groundwater extraction and stabilise use in all Groundwater Management Areas (GMAs). PCVs define the maximum volume that can be allocated in each area. Generally annual extraction is about half of the licensed volume, however, groundwater use has increased during the recent drought (DSE, 2008a). Under existing licences approximately 1,010 billion litres of groundwater could be extracted in 2008-2009, with 400 billion litres actually extracted (DSE, 2010).

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.



**Figure 2. Groundwater basins in Victoria**

The management of Victoria's water resources is governed by the State's water allocation framework, as described in the *Water Act 1989* and subsequent amendments to that Act.

Water is allocated in Victoria based on a three tiered system:

Tier 1 – The Government effectively retains the overall right to the use, flow and control of all surface water and groundwater on behalf of all Victorians.

Tier 2 – The Water Minister sets bulk allocations for consumption and the environment for both individual catchments and aquifers.

Tier 3 – The rights that are allocated to private individuals for consumption. These include water rights, licences and private rights and allocations for households and for rural domestic and stock use.

The Department of Sustainability and Environment (DSE) is Victoria's lead government agency for sustainable management of water resources. However, several other bodies including the Essential Services Commission (ESC), Department of Health and the Environment Protection Authority (EPA) Victoria play a role in setting the policy and/or regulatory environment for the State's water industry. The Victorian Environmental Water Holder (Water Holder) will be a new independent body that oversees the best use of Victoria's environmental water entitlements and co-ordinates watering programs with the Commonwealth Environmental Water Holder.

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

Monitoring of the quantity and quality of the resource supports the allocation framework and associated decision making and policy development. Organisations across all three levels of Victoria's water allocation framework strategically collaborate to maximise the value of the investment in Victoria's monitoring framework with water information from a given monitoring location typically being used for more than one specific purpose. For example, information from a site used for monitoring compliance with Bulk Entitlements will also be used in analysing long-term trends and in the calculation of the Index of Stream Condition (Figure 3). Similarly, DSE monitors groundwater in the State Observation Bore Network at three-monthly intervals, and key water corporations monitor the same bores at monthly intervals with all data being shared and hence duplication of effort is avoided.

Specific business drivers for requiring water information focus on the management of consumptive and environmental water, and require the collection of information relating to resource availability, distribution and use. In general, information needs arise from operational local management requirements, from local to Statewide policy requirements, and from obligations under state and intergovernmental legislation and agreements (Figure 3).

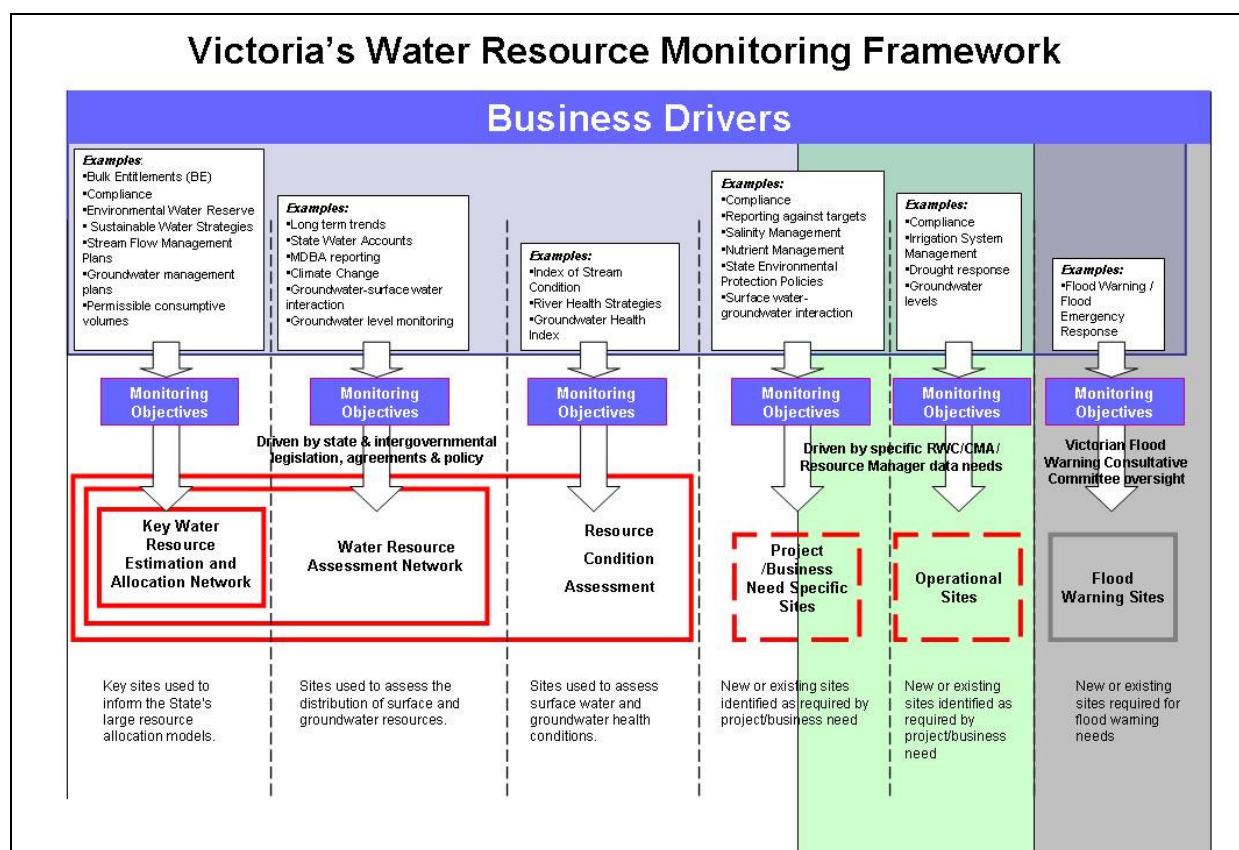


Figure 3. Victoria's water information drivers and the fundamental reasons for requiring water information.

At the Statewide level the Victorian surface and groundwater monitoring program is driven out of the need for the Minister for Water to deliver a Water Resources Assessment Program

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

(WRAP) under Section 22(1) and (2) and (2A) and (26) of the Victorian *Water Act 1989*. Section 22 of Victoria's *Water Act 1989* requires that the Minister delivers a continuous program of assessment of the water resources of the State and that a long-term water resources assessment is undertaken. Specifically the WRAP needs to provide for the collection, collation, analysis and publication of information about (a) the availability of water; and (b) water quality (including salinity).

The WRAP data is available through the Victorian Water Resources Data Warehouse, the Groundwater Management System and the Monthly Water Report. A brief report on the Water Resources Assessment Program is also included in each Annual Report of DSE. Finally, information about the Water Resources Assessment Program is published every five years, with the most recent five-yearly trend report covering the period to 2005.

Surface water monitoring by Victorian water businesses is also guided by the State Environmental Protection Policy Waters of Victoria (SEPP (WoV)). At an operational level the implementation of SEPP (WoV) is the shared responsibility of protection agencies, businesses and communities. Groundwater quality is guided by SEPP (Groundwaters of Victoria). The objective of the State Environment Protection Policy *Groundwaters of Victoria* is to improve groundwater quality to protect existing and beneficial uses of groundwater.

Surface water and groundwater monitoring is an essential tool for assessing and reporting progress in achieving both the SEPP (WoV) and SEPP (Groundwaters of Victoria) objectives.

## **2.2 Business drivers for relevant organisations**

In Victoria, the organisations that regularly collect and use water information can be grouped into three broad categories in broad alignment with the allocation framework.

The Department of Sustainability and Environment (DSE) has an overarching role in Victoria's sustainable water management and supply, and in sustainable catchment management. At a regional level Water Corporations and Catchment Management Authorities (CMAs) are responsible for the operational management of the State's water resources and for meeting the requirements of State priorities, and interstate obligations. Rural and urban water corporations are responsible for allocating and delivering water to relevant users and the environment. Other organisations such as power generation companies and various industries collect and use water information for their ongoing operational needs and to measure compliance against environmental protection legislation. The specific business drivers for these groups of organisations are described below and summarised in Figure 3 and Table 1.

### **2.2.1 Department of Sustainability and Environment, Catchment Management Authorities and the Department of Primary Industries**

The Victorian DSE is responsible for managing the State's water resources and meeting the requirements of State priorities, and interstate and national obligations.

DSE uses groundwater information to support management actions and improve the understanding of groundwater resources. Examples include the development and continued review of conceptual models for aquifer definition and behaviour, and the development of local management plans and regulations. It uses groundwater monitoring data to understand and manage the quality of groundwater resources,

including aspects such as salinisation and groundwater-surface water interactions and impacts of climate change.

DSE relies on meteorological data when assessing catchment yield and the impacts of climate change and land use on catchment health and funds some rainfall monitoring sites for inclusion in flood forecast modelling.

DSE uses information about Rights, Allocations and Trades in setting allocations under Bulk Entitlements and limits (caps) for licensed diverters in individual catchments. It relies on Water Use information to model and forecast current and future demands, allocations and availability under a range of land-use, climate change and population scenarios and uses such information to determine future planning needs. An emerging issue in the water use area is the extent to which farm dams, and non-metered and/or unlicensed extractions influence available water resources, run-off and yield in particular areas.

CMAs are responsible for sustainable catchment and water management in alignment with the Victorian River Health Strategy (2004). Information on water quality and water quantity, including daily and seasonal flow regimes, is used to assist in the development and implementation of regional targets for water quality and in the management of the Environmental Water Reserve.

Waterwatch Victoria is a community engagement program that connects local communities with river health and sustainable water management issues. Through Waterwatch, groups are supported and encouraged to become actively involved in local water quality monitoring and on-ground action. A network of Waterwatch co-ordinators supports local communities across Victoria and each CMA has a representative. Waterwatch is not a named person for the purposes of reporting to the Bureau and is not required to provide any data.

DSE also uses water quantity monitoring data collected by Government agencies and other relevant organisations to assist in its compilation of Victoria's annual water accounts. These Victorian Water Accounts provide an annual statewide overview of the state of Victoria's water resources.

The State's Water Resources Assessment Program and the Victorian Water Accounts provide information that supports long-term planning and policy development, such as Victoria's four regional Sustainable Water Strategies (the Central Region SWS, Northern Region SWS, Western Region SWS and Gippsland Region SWS). Each regional SWS outlines the regional water resource management issues and establishes a 50 year plan to secure water to sustain current regional towns, industries and businesses and water for local growth, while safeguarding the future of Victoria's rivers and other natural water sources.

The strategies are being developed by the DSE in partnership with rural and urban water corporations, catchment management authorities, other key regional stakeholders, interest groups and communities. They will:

- identify and manage arising threats to supply and quality of water for cities and towns or industry or rivers and aquifers
- exploit emerging opportunities to improve water security and/or the health of rivers and aquifers

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

- communicate to regional communities what their water situation looks like over the long-term, and actions they can take to improve it.

The Northern Region Sustainable Water Strategy is the result of 18 months of consultation in northern Victoria and was released on 9 December 2009. DSE is in partnership with its delivery partners to implement the key actions and policies from the Strategy.

The Gippsland submission period for the Draft Gippsland Region Sustainable Water Strategy has ended. The submissions are currently being considered as part of preparing the Final Gippsland Region Sustainable Water Strategy, which is expected to be released in mid 2011.

It was recommended that the Government defer finalising the Western Region SWS until the public consultation phase of the Murray Darling Basin Plan is complete, this will allow an opportunity for alignment of both plans.

The Central Region Sustainable Water Strategy was released in 2006 following an 18 month preparation period which included lengthy community input, and ultimately guided both the Draft and Final versions of the Strategy

Catchment Management Authorities (CMAs) are responsible for co-ordinating the ecological sustainable development and use of catchments, floodplains and waterways. Their role includes protecting and rehabilitating environmental values, water quality and river flows. CMAs require information on water volumes to plan environmental watering events, as well as manage and monitor environmental water at local scales. CMAs use water quality information (and biological assessments) to report on the condition of waterways. The Index of Stream Condition, for example, uses water quality and hydrological information collected across the state for the calculation of two of five sub-indices.

Groundwater information, in particular levels and conductivity, is used by some CMAs to:

- assess salinity threats to regional assets;
- determine how groundwater levels respond to climate change and different harvesting regimes;
- evaluate the effect of groundwater use on surface water flows; and in some cases
- support salt balance modelling for the Murray Darling Basin Authority (MDBA).

Meteorological data is used by CMAs as inputs to model water balances for wetlands and water courses, to monitor land-use impacts on run-off, for salinity models and for water quality modelling in waterways.

The Victorian Department of Primary Industries (DPI) facilitates the development of Victoria's primary industries to achieve strong economic activity and a high quality natural resource base. DPI uses groundwater level and electrical conductivity of groundwater to investigate, report and manage salinity in areas where saline groundwater is close to the surface and has the potential to affect agriculture. In particular, DPI uses groundwater information to facilitate changes in agricultural

practice where needed and help regional Natural Resource Management (NRM) groups design, refine, deliver and review their regional investment strategies and natural resource management plans.

DPI uses meteorological data, mostly sourced from the Bureau, to advise farmers on irrigation scheduling or to meet requirements of specific research. They use wind speed, dry bulb air temperature, relative humidity and global solar radiation to estimate crop specific evapo-transpiration rates at farm-to-regional scales. Current research is developing models based on meteorological data to simulate plant available soil water. Bureau data are used to investigate the effects of elevated carbon dioxide levels in the atmosphere and climate change on phenology, growth and yield of agricultural crops. Indices are under development for on-farm management response to predicted extreme weather events. Occasionally, DPI will collect additional meteorological data to assist small-scale research projects such as pest and disease modelling.

### **2.2.2 Rural and urban water corporations**

Rural Water Corporations (RWCs) are responsible for delivering allocated water to relevant users and the environment and predominantly use groundwater and surface water information to assist with operational activities.

RWCs are responsible for issuing groundwater licences in accordance with Permissible Consumptive Volumes (PCVs) that are set by the Minister for Water for all groundwater harvesting areas throughout the State. Southern Rural Water (SRW), Goulburn Murray Water (G-MW) and Grampians Wimmera Mallee Water (GWMWater) use groundwater information to determine the extent of the groundwater resource, determine Sustainable Diversion Limits (SDLs) and investigate how changes in storage level in one aquifer can affect another aquifer or surface water reserve. They use this information as inputs to Groundwater Management Plans and monitor the effectiveness of specific management actions that are implemented through those plans.

RWCs manage many of Victoria's major and minor storages and use information on storage level, volume, releases, water use, rights, allocations and trades to manage supply to their customers over annual, seasonal and daily time-scales. They may also use information on major and minor storages to manage bulk water processes such as adjustments to bulk water allocations, to manipulate levels for flood control purposes and to manage restrictions when required.

RWCs typically use meteorological data to manage resource operations and availability. For example, rainfall is an important indicator of inflows to storages (which determines the size of the available resource and flood risk) and short-term water demand (e.g. irrigation demand is likely to be low during and immediately after a heavy rain event). Longer-term climate data are important for developing drought strategies and comprehensive water management strategies.

Conductivity, as a surrogate for salinity, is the most important water quality variable for RWCs which use that data to set triggers for harvesting and to ensure that they meet their obligations under Salinity Management Strategies.

Urban Water Authorities are responsible for delivering allocated water to the relevant users, which may include the environment in some cases (e.g. Melbourne Water provides environmental flows to the Yarra River as the bulk water supplier). These authorities rely on various types of water information to inform resource planning and

management, assess usage against bulk entitlements and impose restrictions when required.

Demand management is becoming an increasingly important driver for urban water managers, hence more accurate information on day to day usage and demand is required. Specific information requirements include real-time inflows to storages, volumes held in storage, stream-flow at strategic locations, bulk-offtakes and volumes supplied to other utilities and customers.

Meteorological information, particularly rainfall, is vital for determining short-term inflows to storages. Long-term climate data are used to develop drought strategies and management plans.

Victoria's Drinking Water Quality Regulatory Framework is governed by Victoria's *Safe Drinking Water Act 2003* (the Act) and *Safe Drinking Water Regulations 2005* (the Regulations). The four main elements of the regulatory framework for drinking water are the:

- Development and implementation of the catchment-to-tap risk management plans for the supply of drinking water;
- Independent audit of these risk management plans to ensure that they comply with the requirements of the Act and Regulations;
- Setting of mandatory water quality standards; and
- Disclosure of drinking water quality information to the public.

Water quality information is critical to urban water corporations to manage their supply and treatment operations. For example, urban water corporations may cease harvesting from a particular source, if the quality is below a threshold that can be efficiently treated. Organisations that include groundwater in potable supply use groundwater level data to comply with their pumping licence requirements and monitor the extent of the available reserve. They also use groundwater quality data to ensure that the resource is suitable for potable use. Victoria's Department of Health provides oversight over Victoria's drinking water supply and requires monthly reporting of drinking water quality.

### **2.2.3 Other organisations**

Various individuals and organisations collect groundwater and/or surface water data for a range of other business needs, including compliance with licence requirements, investigations of surface water-groundwater interactions and flood emergency responses (Figure 3).

The EPA has a responsibility to protect water quality in Victoria by employing a range of measures consistent with its obligations under the *Environmental Protection Act 1970*). Specific examples include monitoring obligations associated with issuing licenses around landfill sites and waste water treatment plants to ensure that waste material is not contaminating underlying groundwater or receiving surface waterways.

The State Environment Protection Policy (SEPP) Waters of Victoria (WoV) under the *Environmental Protection Act* outlines the legal framework for State and local government agencies, businesses and communities to work together to protect and rehabilitate Victoria's surface water environments. In carrying out these



responsibilities, the EPA supports communities, businesses and agencies to implement the policy and ensure the protection of beneficial uses of water and water quality throughout the State. Water quality monitoring in these instances occurs in response to a pollution event and therefore differs from routine water quality monitoring.

Hydro-electricity generators that have major or minor storages use water information for operational purposes. AGL Hydro Partnership own and operate weather stations to monitor rainfall, wind and temperature at various locations upstream of their power generation plant at Mount Beauty. These data are used in real-time to manage dam releases and control flooding.

Various shire councils record rainfall and river flows for flood warning purposes. Similarly, Catchment Management Authorities and Water Corporations also use surface water data in their roles under Victoria's emergency management associated with flood events.

The Bureau of Meteorology is the main collector of meteorological data in Victoria. It is responsible for weather forecasting, weather and flood warnings, climate analysis and modelling rainfall run-off events. Many of these outputs as well as raw meteorological data are used for operational purposes and investigations conducted by the other organisations that have already been described in this SWIMP.

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

**Table 1: Summary of business drivers for collecting and or using various categories of water information throughout Victoria.**

Organisation	Information Drivers by Data Category defined in the federal <i>Water Act 2007</i> and <i>Water Regulations 2008</i>						
	Surface Water & Groundwater (categories 1&2)	Major and Minor Water Storages (category 3)	Meteorology (category 4)	Water Use Information (category 5)	Rights, Allocations and Trade (category 6)	Urban Water Management (category 7)	Water Quality (category 9)
<b>Department of Sustainability and Environment</b>	<p>Long-term resource management planning &amp; resource condition assessment</p> <p>Resource impact on environmental and agricultural values</p> <p>Understand groundwater resources including aquifer definition and extent, salinisation, groundwater-surface water interactions and impacts of climate change and landuse change</p>	<p>Water resources modelling and management</p> <p>Water accounting</p>	<p>Floodplain management</p> <p>Catchment yield</p> <p>Climate change impact assessment</p> <p>Drought monitoring and development of strategies</p>	<p>Assessment and prediction of potential long-term changes in resource availability</p> <p>Future planning needs determination</p> <p>Forecasting allocations</p> <p>Understanding the impact of farm dams and non-metered and/or unlicensed extractions on resource availability</p> <p>Managing and monitoring environmental deliveries at regional scales</p>	<p>Development of Bulk Entitlements</p> <p>Setting and forecasting allocations under bulk entitlements</p> <p>Setting caps (limits) for licensed diverters</p> <p>Predicting potential future (long-term) changes in water availability</p> <p>Future planning needs identification</p>	<p>The role of DSE in urban water management does not require DSE to hold information in this category</p>	<p>Resource condition assessment</p> <p>Development and implementation of regional water quality targets</p> <p>Victorian Water Quality Monitoring Network</p>

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

Organisation	Information Drivers by Data Category defined in the federal <i>Water Act 2007</i> and <i>Water Regulations 2008</i>						
	Surface Water & Groundwater (categories 1&2)	Major and Minor Water Storages (category 3)	Meteorology (category 4)	Water Use Information (category 5)	Rights, Allocations and Trade (category 6)	Urban Water Management (category 7)	Water Quality (category 9)
<b>Catchment Management Authorities</b>	<p>Assessment of salinity threats to regional assets</p> <p>Evaluation of impacts of groundwater use on surface water flows</p> <p>Salt balance modelling for the MDBA</p>	<p>Resource modelling and assessment</p> <p>Water resources management including assessment of availability of Environmental Water and capacity to deliver that water</p>	Resource modelling and assessment	Management and monitoring of environmental deliveries at a local scale	Not required to hold information in this category	Not required to hold information in this category	Reporting on water body/water course condition
<b>Department of Primary Industries</b>	Investigation, reporting and management of salinity in designated salinity provinces	No significant role	<p>Providing advice to farmers (e.g. irrigation scheduling)</p> <p>As needed use for specific investigations (i.e. pest and disease modelling)</p>	Not required to hold information in this category	Not required to hold information in this category	Not required to hold information in this category	Use of water quality of groundwater data to develop new processes, tools and frameworks to facilitate agricultural practice change

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

Organisation	Information Drivers by Data Category defined in the federal <i>Water Act 2007</i> and <i>Water Regulations 2008</i>						
	Surface Water & Groundwater (categories 1&2)	Major and Minor Water Storages (category 3)	Meteorology (category 4)	Water Use Information (category 5)	Rights, Allocations and Trade (category 6)	Urban Water Management (category 7)	Water Quality (category 9)
<b>Rural Water Corporations (i.e. SRW, G-MW, GWMWater)</b>	<p>Determining extent of groundwater resources</p> <p>Determining sustainable diversion limits</p> <p>Informing groundwater management plans and setting Permissible Consumptive Volumes</p> <p>Issuing and monitoring licences in accordance with PCVs</p> <p>Monitoring groundwater use and reporting on quality</p> <p>Assessing interactions between aquifers and between aquifers and surface water</p>	<p>Operational purposes including demand management, restriction requirements, flood impact mitigation and bulk water delivery</p> <p>Water accounting and Bulk Entitlement compliance</p> <p>Resource modelling and assessment</p> <p>Dam safety and flood warning</p>	<p>Operational purposes including inflow predictions, loss estimates, short and long-term demand</p> <p>Forecasting for operations and public information</p> <p>Drought monitoring and development of strategies</p> <p>Flood forecasting and warning</p>	<p>Setting and managing (updating) allocations and/or restrictions</p> <p>Assessing demand and managing supply and delivery</p> <p>Monitoring customer use and assessing against allocations</p> <p>Assessing water delivery efficiency</p> <p>Assessing compliance with customer delivery requirements</p>	<p>Assess, set and update allocations against Bulk Entitlements and water shares</p> <p>Assess demand and available resources</p> <p>Manage supply to customers</p> <p>Monitor customer use against allocations</p>	<p>Not required to hold information in this category</p>	<p>Planning operations and releases for irrigation and environmental purposes (e.g. salinity triggers)</p> <p>Monitoring obligations under Salinity Management Strategies</p> <p>Monitoring salinity credits</p>

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

Organisation	Information Drivers by Data Category defined in the federal <i>Water Act 2007</i> and <i>Water Regulations 2008</i>						
	Surface Water & Groundwater (categories 1&2)	Major and Minor Water Storages (category 3)	Meteorology (category 4)	Water Use Information (category 5)	Rights, Allocations and Trade (category 6)	Urban Water Management (category 7)	Water Quality (category 9)
<b>Urban Water Authorities (e.g. Melbourne Water, Coliban Water)</b>	Operational purposes: monitoring availability and quality for town water supply  Compliance with pumping licence reporting requirements	Operational purposes including demand management, restriction requirements, flood impact mitigation and bulk water delivery  Water accounting and Bulk Entitlement compliance  Resource modelling and assessment  Dam safety and flood warning	Operational purposes including inflow predictions, loss estimates, short and long-term demand  Forecasting for operations and public information  Drought monitoring and development of strategies  Flood forecasting and warning	Setting and managing (updating) allocations and/or restrictions  Assessing demand and managing supply and delivery  Monitoring customer use and assessing against allocations  Assessing water delivery efficiency  Assessing compliance with customer delivery requirements	Not required to hold information in this category	Monitoring and management of demand and supply (to organisation and onto customers)  Setting restrictions and/or allocations  Informing resource planning and management  Assessing use against bulk entitlements  Assessing use of, and determining potential for, alternative water sources	Managing supply and treatment operations

Section A: A summary of Victoria's water information questions/drivers and the fundamental reasons for requiring water information.

Organisation	Information Drivers by Data Category defined in the federal <i>Water Act 2007</i> and <i>Water Regulations 2008</i>						
	Surface Water & Groundwater (categories 1&2)	Major and Minor Water Storages (category 3)	Meteorology (category 4)	Water Use Information (category 5)	Rights, Allocations and Trade (category 6)	Urban Water Management (category 7)	Water Quality (category 9)
<b>Other individuals and organisations</b>	Comply with EPA licence requirements	Operational water accounting for organisations such as power generators that rely on water held in storages.	Manage storage releases and control flooding	Not required to hold information in this category	Not required to hold information in this category	Not required to hold information in this category	Comply with EPA licence requirements  Monitor responses to pollution events
<b>Bureau of Meteorology</b>	Develop national water accounts and aquifer balances	Not required to hold information in this category	Weather forecasting and warning  Flood warning  Climate analysis and forecasting  Calibrate radar estimates of rainfall accumulation  model rainfall-runoff events  Provision of data to other organisations	Not required to hold information in this category	Not required to hold information in this category	Not required to hold information in this category	No significant role

### **3 Section B: A description of monitoring networks and technologies and data management systems in place in Victoria.**

This section of the SWIMP provides a brief history of surface water and groundwater monitoring in Victoria, describes the main statewide data management systems used in Victoria and then describes the specific monitoring networks that are used to collect, record and manage information for each of the relevant information sub-categories. Much of the information presented here was provided by representatives from the organisations who attended each information category workshop.

#### **3.1 A History of surface water and groundwater monitoring in Victoria**

##### **3.1.1 Surface water**

Victoria's surface water monitoring program has a long history that started with the *Irrigation Act of 1886*, which signalled the commencement of organised stream gauging in Victoria. A requirement for the collection of streamflow data was formally included in legislation in 1890. In 1905, a statutory body, the State Rivers and Water Supply Commission (SR&WSC) of Victoria was established to take control of the development of Victoria's water resource supply under the *Water Act 1905*.

The *Water Act 1958* gave the SR&WSC responsibility "to systematically gauge, record and publish the volume of flows of rivers and streams and to carry out surveys necessary to ascertain the nature and extent of the water supply and water storage resources in the State". By 1960, the SR&WSC maintained around 265 gauging stations. The allocation of responsibility to the SR&WSC, together with the stimulation provided by establishment of Australian Water Resources Council (AWRC) in 1961 and the provision of Commonwealth grants for extended gauging programmes, led to an expansion aimed at providing statewide surface water monitoring for development purposes.

The Australian Water Resources Council initiated a Victorian Water Quality Assessment Programme (WQAP) in 1975 as part of its National Water Quality Assessment Programme. The Victorian Water Quality Monitoring Network (VWQMN) was established in 1975 to collect water quality data from all major streams and their tributaries in Victoria. (Bowels *et al.* 1988 cited in Scanlon, 2006). By 1981 the State Rivers & Water Supply Commission (SR&WSC) was operating approximately 530 stream gauging stations and was collecting water quality data at around 300 of those sites for the VWQMN.

In 1981, following AWRC recommendations, the first steps towards adopting a network approach to water resources data collection were taken. The Victorian Water Industry was restructured in several ways. The SR&WSC was changed to the Rural Water Commission in 1984 and Commonwealth funding for primary water resource assessment gauging stations discontinued in 1986. Both of these changes led to a rationalisation of the water monitoring network. Discussion papers, status reports and network reviews were produced in 1986, 1987 and 1988, which ultimately led to a decrease in the number of stream gauging stations.

In 1992 the Rural Water Commission was changed to the Rural Water Corporation and a Hydrographic Network Review was undertaken, which provided the basis for the formulation of a Government Service Contract for Surface Water Resources Assessment

(a responsibility of the Minister for Water under the *Water Act 1989*). The review identified a number of activities requiring water data and sorted them into two groups:

- Direct government responsibilities; and
- Planning and operational activities undertaken by a range of autonomous agencies and private businesses (mainly the new Rural Water Authorities).

In the next two years after 1992 the Rural Water Corporation's service divisions were re-structured into business units which were ultimately sold. The hydrology unit, operating as Hydro Technology, was purchased by Sinclair Knight Merz (SKM), the major structures group by Snowy Mountains Engineering Corporation (SMEC), the State Water Laboratory eventually became part of Australian Water Technologies, and the hydrographic services unit was purchased by Thiess Environmental Services. By 1994, the remnants of the RWC had been divided into five regional Rural Water Authorities, now Rural Water Corporations. Further amalgamations have occurred since 1994 and there are now four Rural Water Corporations in Victoria: Gippsland and Southern Rural Water, Goulburn-Murray Water, Grampians Wimmera Mallee Water and Lower Murray Urban and Rural Water.

In 2002, the Department of Sustainability and Environment and a number of key Gippsland water resources agencies established a Gippsland Regional Water Monitoring Partnership (GRWMP) to provide a co-ordinated and cost effective approach to water monitoring across the Gippsland Region. This partnership approach was extended across the rest of the State with the establishment of the North East, North West and South West Regional Water Monitoring Partnerships (RWMPs). These partnerships collectively manage water quantity (hydrographic) monitoring, field collection of water samples and in-situ water quality parameters, and laboratory analyses of water quality samples. The Partnerships provide Statewide consistency in the collection of water information and increased access to more information for each individual organisation.

DSE manages service provider contracts for the collection of water information on behalf of Victoria's RWMPs. DSE is also a participating member of each of the RWMP and surface water monitoring sites of relevance to State questions and drivers are included in the partnership networks.

### **3.1.2 Groundwater**

During the 19<sup>th</sup> Century and first half of the 20<sup>th</sup> Century groundwater was mainly used in mines for mineral processing, sluicing and dewatering. As such it was administered as a mineral. The State Chemist attached to the Mines Department conducted the first analyses of groundwater chemistry in the 1850s and the Drilling Branch of the Mines Department initiated the first groundwater level monitoring in the 1870s.

Organised groundwater monitoring of level or quality at bore sites was not initiated until the mid to late 1960s by the Mines Department and groundwater remained classified as a mineral until the introduction of the *Groundwater Act 1969*. That Act split the roles of the Mines Department and State River and Water Supply Commission (SRWSC). Diversion and licensing of irrigation and industrial water were carried out by the SRWSC, while the investigation function and drilling function remained at the Mines Department. The Mines Department role in groundwater exploration was coordinated with the drilling of the deep coastal sedimentary basins. Many of these exploratory holes became monitoring bores and were later incorporated into monitoring networks. Gradually around 2000 "deep"



bores around the State were brought into a monitoring network. A small component of these included the pollution investigation bores, which were jointly funded by the new EPA.

Several Government Agencies including the Agriculture Department, State Rivers and Water Supply Commission and Melbourne Water constructed arrays of shallow (15 – 20 m deep) monitoring bores in irrigation areas and around water treatment facilities. In the early 1980s salinity funding initiatives resulted in the profusion of monitoring bores in high watertable irrigation and dryland areas by the then Soil Conservation Authority (later to become the Centre for Land Protection Research). In more recent years DSE, some of the Catchment Management Authorities and Rural Water Corporations have added to the monitoring arrays.

The current State Observation Bore Network consists of bores across the State from a variety of sources and programs including the EPA, the then Mines Department, the State Rivers and Water Supply Commission (and successor bodies), the Rural Water Corporations and the Catchment Management Authorities. DSE, in partnership with the Rural Water Corporations has progressively reviewed the distribution and monitoring frequency of the State Observation Bore network to provide the groundwater data necessary to manage the groundwater resources around the State. These reviews have recommended numerous new monitoring bores especially in areas where resource sustainability is threatened or the impact of pumping is highest. DSE and the Rural Water Corporations are currently implementing some of the recommendations of these reviews with a systematic drilling program of new bores occurring across the State. Although there has been some infill drilling over the last few years, the current program of installing new monitoring bores is the biggest of its kind for at least a decade.

## **3.2 Data Management Systems**

### **3.2.1 Statewide level**

There are currently four main repositories for water information that is collected at a Statewide level:

Basic spatial data are managed through Victoria's VicMap products. The data layer VicMap Hydro currently carries information on Victoria's water infrastructure and blue line network. However, recent work has demonstrated that the underlying data needs to be revised in order to more accurately identify features, such as supply line networks.

Surface water monitoring information is currently managed by a private company, Rubicon, on behalf of DSE in the Victorian Water Resource Data Warehouse (VWRDW) (<http://www.vicwaterdata.net/vicwaterdata/home.aspx>), which is a central online database that provides comprehensive community access to water quality and quantity data throughout Victoria. The VWRDW is used by many organisations to access monitoring data.

All groundwater bore construction and groundwater monitoring information collected in Victoria is currently stored in the Groundwater Management System (GMS), which is owned by DSE and managed by Rubicon. The GMS contains a wide range of information on approximately 135,000 boreholes throughout Victoria and acts as a record of authorised drilling activities. It stores information primarily of interest for groundwater

management and groundwater investigations, and is a useful resource for all environmental studies (e.g. salinity) where groundwater or catchment condition is a focus.

The quality of data on the GMS is variable. Information collected through routine monitoring programs such as the State Observation Bore Network and Dryland Salinity Bore Network is generally of a high quality, but the GMS also includes one-off data that are collected when new bores are drilled for private licence holders. DSE recently commenced a review of all the SOBN data held in the GMS to improve the accuracy of stored data. To date, all location and water level data have been reviewed and identified errors have been rectified. A review of elevation data is continuing.

The Victorian Water Resources Data Warehouse and the Groundwater Management System are both based on old technology. DSE are currently in the process of planning a new Water Management Information System (WMIS) which will house all routine groundwater and surface water monitoring data and related information. It is expected that the WMIS will replace the VWRDW and the GMS over time and will provide the ability to automate the data transfer of Victoria's surface water and groundwater data to the Bureau of Meteorology in the required data format.

Finally, Victoria's State Water Register provides information on water entitlements, allocation and trades. The State Water Register is a public register of all water related entitlements (including Bulk Entitlements) in Victoria. It was designed pursuant to part 5A of the *Water Act 1989* to facilitate the responsible, transparent and sustainable use of the State's water. The functionality of the State Water Register is continuing to be enhanced to allow for streamlined reporting on the State of Victoria's water entitlements, use and trade. The water register is accessed via the DSE website at:

[http://www.ourwater.vic.gov.au/allocation/victorian\\_water\\_register](http://www.ourwater.vic.gov.au/allocation/victorian_water_register)

### **3.2.2 Regional level**

While some Victorian water businesses provide information that is uploaded to the VWRDW and the GMS, most have their own databases and data management systems that enable them to manage their water information according to their specific business needs. These databases are likely to use different types of technology, store information in different formats, use different naming conventions and may contain data of varying quality. All of these issues potentially limit the extent to which data can be shared between organisations and mean that data are not necessarily provided to the Bureau in the required format.

The requirement for all organisations named in the Water Regulations to deliver water information to the Bureau increases the need to collect and record data in a more standardised way so that information can be more readily shared. Collating data from different databases within organisations will probably require engagement and co-operation across multiple levels within organisations and is likely to be time consuming. In some cases, collaborating with the software producers is required to sort the data, also a costly and timely process. Some of the organisations have expressed that they intend to engage a consultant to assist in collation of the data.

Many organisations across Australia are now working collaboratively to develop suitable software and systems for ingesting data that can then be exported to the Bureau in the adopted WDT Format.

### **3.3 Specific monitoring networks and technologies used for each information sub-category**

#### **3.3.1 Category 1 – Surface Water (including information for flood forecasting and warning)**

It is estimated that, outside of Melbourne Water's management area, 80% of all surface water monitoring sites are included in one of the four Regional Water Monitoring Partnerships (RWMPs) described in Section 3.1. All data collected through the partnerships are stored in DSE's Hydstra database and are loaded onto the Victorian Water Resources Data Warehouse.

Some partners have indicated that they monitor surface water sites outside the RWMP. All information provided by these organisation on sites outside of the partnerships were summarised in an inventory associated with the 2009 draft version of Victoria's Jurisdictional SWIMP.

Current systems and technologies for the collection of water information at individual surface water sites vary from paper based strip chart recorders requiring regular field visits for retrieval of data to Internet Programmable (IP) telemetered loggers providing remote access to data. Paper based records are later converted to digital format and stored electronically (generally in Hydstra) in accordance with the operating agency's procedure. Electronic records are checked for accuracy and quality coding of data before storing.

All data collected on behalf of the four RWMPs is verified, quality-coded and delivered to DSE's database from which it is extracted and delivered to the Bureau as required under the Regulations.

Data collected outside the RWMP network is processed through a variety of management systems primarily meeting the needs of each collection agency. Water information transferred to the Bureau by several of the organisations required to deliver these data is currently provided in a number of data formats. These include spreadsheets, WDTF, and XML. The systems used to facilitate the data transfer include Kyster (Hydstra) and Time Studio. Some agencies are working collaboratively and others individually to develop systems that will enable transfer of data in the WDT Format.

#### **3.3.2 Category 2 – Groundwater**

##### **3.3.2.1 Metering of licensed bores**

Of Victoria's total groundwater entitlements, the amount actually used in any year varies depending on summer rainfall, restrictions in some areas and other factors (DSE, 2010). In 2006/07, 60 Victorian urban communities used groundwater as town water supply, around 50,000 landholders used groundwater for stock and domestic purposes and 5,500 business/landholders used groundwater for irrigation purposes (DSE, 2008b). The total amount of groundwater used in 2007/08 dropped by 11% compared to 2006/07, but the proportion of groundwater used for stock and domestic purposes increased by 2% (DSE, 2010).

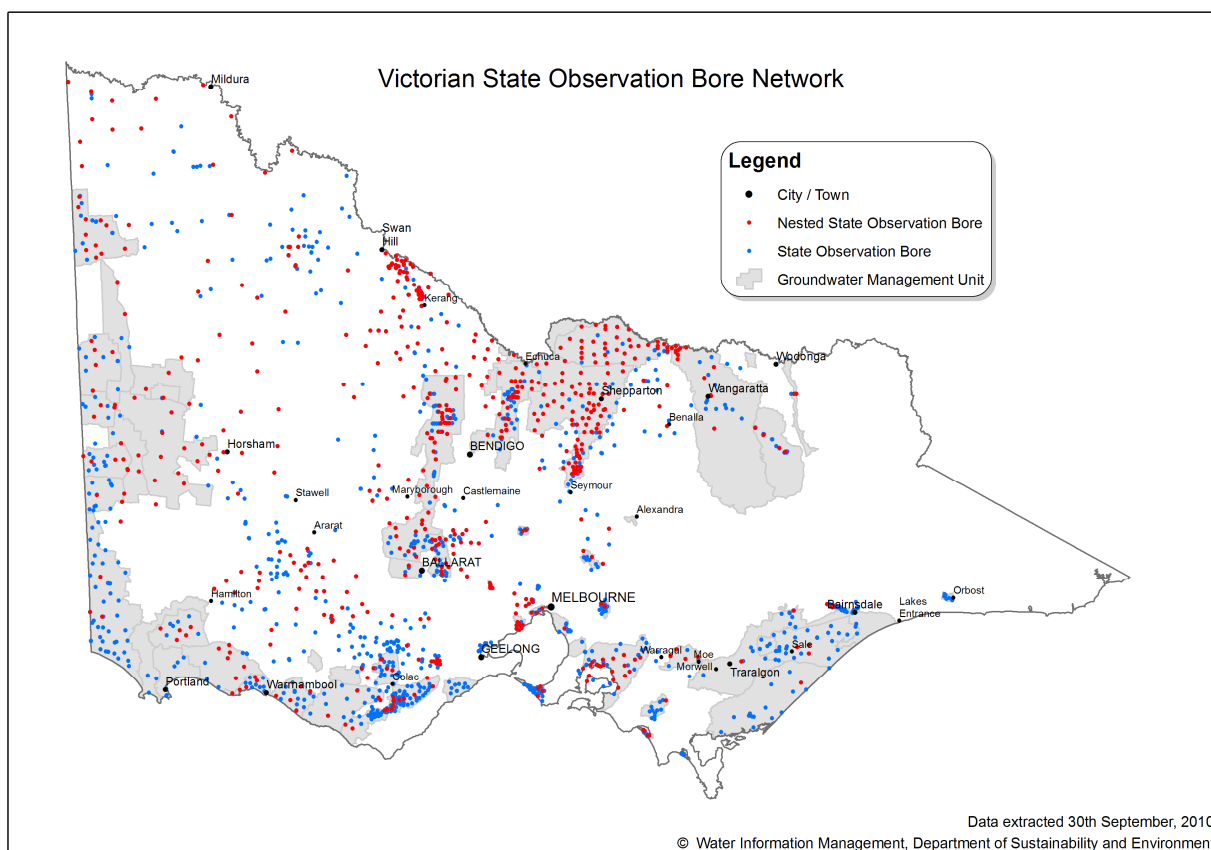
### 3.3.2.2 Groundwater monitoring networks

#### **The State Observation Bore Network**

DSE manage the State Observation Bore Network (SOBN) which consists of approximately 2,500 observation bores across the State. The depth of bores in the SOBN ranges from 2 m – 2000 m, with the majority between 50 m – 200 m. The monitoring bores are concentrated in areas of highest actual or potential groundwater use (Figure 4). The number of SOBN bores monitored in each region is shown in Table 2. Water level monitoring is generally undertaken on a quarterly basis by DSE with some Rural Corporations funding infill monthly monitoring of 500 observation bores within fully allocated Groundwater Management Areas. Water quality monitoring (usually electrical conductivity) also occurs in some of the (shallower) bores and is mainly aimed at determining the risk of seawater intrusion or the impacts of pumping on the local groundwater quality. All data collected from the SOBN is stored on the GMS (See Section 3.2.1).

DSE has drafted the Statewide Groundwater Monitoring Network Requirements Guideline Document (DSE, 2008c). That document focuses on monitoring to characterise and report on groundwater as a resource across the State and how the resource changes over time. The draft guidelines separate resource monitoring bores into two tiers, namely:

- Tier 1 – State Observation Bore Network – monitoring bores that provide data that broadly represent the groundwater level and chemistry of the monitored aquifer and are used to report on the condition of the resource for the Groundwater Management Unit.
- Tier 2 – Intensive resource monitoring and investigation – monitoring bores that augment Tier 1 bores for monitoring in priority areas and are not part of the active SOBN. They are monitored more frequently than the SOBN bores by water corporations or Catchment Management Authorities as part of regional legislative obligations, such as additional monitoring prescribed by groundwater management plans.



**Figure 4. Victoria's State Observation Bore Network. (Note: Nested bores occur where multiple bore casings are located close together to monitor groundwater at varying depths or aquifers)**

**Table 2: The number of SOBN bores currently monitored in each Victorian region. (Source: DSE, 2008c)**

SOBN monitored (Current monitoring contract)			
Region	WSPA / GMA	Other areas	Total
North	759	671	1430
South West	325	363	688
South East	328	51	379
Total			2497

### The Dryland Salinity Bore Network

The Victorian Department of Primary Industries own and manage approximately 4,900 bores that are used to monitor water levels in agricultural areas. These bores are generally shallow (usually less than 3 m deep) and most of them are in the North-East, Goulburn-Broken, North-Central, Wimmera, Mallee, Glenelg-Hopkins and Corangamite

salinity provinces. The main purpose of these bores is to monitor groundwater levels in agricultural areas that are at risk from saline groundwater and where management actions may be implemented to ensure groundwater levels remain at least 2 m below the surface. Levels are monitored at least once a year, but most bores are monitored quarterly, bi-monthly or monthly. Electrical conductivity and other water quality parameters are measured less frequently. Data collected from this network are recorded both in the Department of Primary Industries' database, as well as the GMS.

The network had its origins in the late 1970s with the early dryland salinity investigations undertaken by the former Soil Conservation Authority. The network's primary purpose is for salinity assessment and salinity management and policy guidance. However, the large number, broad distribution and excellent quality of time series groundwater record from these bores (comparable to the SOBN) means that it provides invaluable information about groundwater conditions, trends and other groundwater attributes for most of Victoria's different geologies. It also provides valuable data about climate and land use impacts on groundwater across the State, including some GMAs and other groundwater resource areas. As such, this network provides an excellent complement to the SOBN.

### **Monitoring undertaken by the Catchment Management Authorities**

Some of the Victorian Catchment Management Authorities manage groundwater monitoring within their catchments. The Mallee CMA annually monitors groundwater levels and electrical conductivity in approximately 647 shallow and deep bores, some of which are part of the SOBN. The Corangamite CMA has a network of shallow bores which are regularly monitored to aid in salinity management. The West Gippsland CMA also manages approximately 300 bores in the Macalister Irrigation District to monitor the impacts of irrigation on salinity.

### **Other groundwater monitoring data**

Southern Rural Water (SRW) and Goulburn Murray Water (G-MW) request groundwater licence holders in GMAs and WSPAs to provide a water sample once a year. However, response rates are generally only about 25%. SRW and the Urban Water Authorities that harvest groundwater regularly monitor level and water quality in their production bores, especially when they are in use. Standing level and drawdown levels in these production bores are often measured using in-situ pressure loggers and are linked to SCADA (Supervisory Control and Data Acquisition) systems. This means that data can be collected and reported in real time. However, levels in production bores vary over short time intervals and are therefore a less reliable measure of groundwater level than the SOBN and salinity monitoring bores. In addition to regular monitoring of production bores, Wannon Water monitor 2-3 bores to assess their use against their Bulk Entitlement (BE). Data from these BE assessment bores are also delivered to the Bureau of Meteorology as required under the Commonwealth *Water Act 2007*.

Power stations in the Latrobe Valley are big users of groundwater and are licensed by SRW to pump groundwater to dewater their mines. The extraction amounts are read manually and the data periodically provided to SRW for assessment.

### **3.3.3 Category 3 – Major and minor storages**

Victoria's water corporations are responsible for collecting level and storage volume information from the major and minor (< 1,000 ML) storages they maintain and operate. These level and storage data are collected manually and/or automatically and stored in

hard copy and/or electronic format depending on the level of sophistication and resources available to the individual Water Corporation. Some data are accessible in near real-time whilst some are collected as required (and hence can be at random intervals). Data are accessed through a variety of communication media such as dedicated wireless systems or commercial telecommunications (e.g. Next G and landlines). Data are managed through proprietary and commercial software and stored in a variety of formats that best suit or match the individual water corporation's systems and needs.

Information on storages and their water levels is provided to the Bureau daily by some water businesses. Over longer time scales the water businesses collaborate with DSE to provide annual summaries on a storage by storage basis that are then presented in Victoria's annual Water Accounts (e.g. DSE 2008b).

At the time of the workshops, leading up to round 4 of the Modernisation and Extension of Hydrologic Monitoring Systems program (refer to Section 1), The participating organisations provided the following advice on their information management for inclusion in this report:

- Goulburn-Murray Water uses a combination of manual and automated monitoring systems to record level and volume at their storages. Manual readings are taken weekly and automated readings are taken daily. Manual readings at un-manned storages can occur at irregular intervals. Data that are recorded on automated SCADA systems are stored at the site and then transferred to an internal database at G-MW on a daily basis. G-MW send data from their central database to the Bureau in Water Data Transfer Format (WDTF), via File Transfer Protocol (FTP).
- Coliban Water records water level manually at its three major storages every day and at its minor storages once per week. The three major storages also have data loggers, but representatives from Coliban Water indicated that manual readings are considered to be more accurate and more reliable. Wannon Water also measures storage levels manually.
- Both Coliban Water and Wannon Water record storage level information in paper form and/or manually enter it into Excel spreadsheets. Coliban Water reports the level and volume of their major storages to the Bureau daily. Wannon Water publishes its storage data on the "Save Water" website every week.
- Gippsland Water use SCADA telemetry to collect data from all of their storages. The level of the storage is recorded every 15 seconds. These level data are used to calculate volume, which is reported as daily average. Data transfers are completed automatically to the Bureau.
- South Gippsland Water, Barwon Water and AGL Hydro Partnership also collect storage level information on SCADA. South Gippsland Water reports most of the data specified in the regulations to the Bureau through the FTP weekly. It reports data on the volume of water released to the Bureau annually. Barwon Water transfers storage data to an internal system daily via Hydstra and automatically sends data from the internal system to the Bureau.
- International Power monitors the level of its storages twice weekly by manual observations. A data logger, which is downstream of the cooling pond, also collects level information which is converted to a storage volume. The data are converted to a CSV file and then zipped into a FTP file which is sent monthly to the Bureau

- Melbourne Water monitors the level of their storages manually at 8.00 am each day to check against the automatic readings that are recorded through a SCADA system at one minute intervals. Daily data are stored in an internal spreadsheet/electronic data warehouse called WaterWorks. The volumes of the storages are calculated using capacity tables for volume/level conversion.

### **3.3.4 Category 4 – Meteorological and Climate**

#### **Bureau operated sites**

The Bureau is the key agency responsible for collecting, storing and reporting meteorological data in Victoria and operates well over 1,000 sites across the State. Meteorological observation stations, such as rain gauges and evaporation pans, are established in Victoria by the Bureau in consultation with DSE and other agencies. Rainfall, wind speed and temperature data are collected at least daily from these sites. The Bureau also manages some World Meteorological Sites, which are used for global assessments.

The Bureau is involved in the operation of 1247 precipitation sites (at the time of the workshops), which have automated Tipping Bucket Rain Gauges (TBRG) or are manually read. The automated sites may have push telemetry, where data are sent to a central database as they are collected, or poll telemetry where data are requested from the site at regular intervals or when required. There are currently 195 push telemetry sites in Victoria that use Event Reporting Radio Telemetry System (ERTS) radio equipment as their primary reporting system. Polled telemetry is the primary reporting system at 68 rain gauge sites. The poll telemetry sites generally use Campbell or Mindata loggers. Of those sites with Campbell loggers, 27 sites have an IP-capable telemetry system, but currently do not use the push telemetry capability. There is only one rain gauge site in Victoria which uses the File Transfer Protocol (FTP) as the primary telemetry. The Bureau has approximately 79 automated weather stations, with rain gauges, that report data in real time. These sites have a data resolution of at least 30 minutes. There are 31 sites that have one minute data resolution, with more expected to be introduced in future. The remainder of the sites have a rain gauge owned by an external agency, or have cooperative observers (this includes 700 manual rainfall observation sites, 100 synoptic sites and 25 cooperative observation sites).

The Bureau has 50 sites across Victoria with Class A evaporation pans. There are 112 sites that are used for surface observation of wind speed and direction; 37 of these sites have a specific wind run anemometer. Melbourne Airport is the only place in Victoria where global solar exposure or irradiance is measured. Generally, solar irradiance quantities are calculated based on data from satellites. The Bureau has 103 sites with a measure of dry bulb air temperature, and 38 that measure wet bulb air temperature. Relative humidity is measured at 66 sites. Vapour pressure deficit is calculated from the dew point temperature rather than measured directly.

There are approximately 500 private rain gauges located around Melbourne. The Bureau requests data from these private rain gauges, and records it when provided, however, these data are not quality assured. Daily readings are sent annually by individuals and then scanned and entered into a database held by Bureau.

The Bureau identified 15 sites in 1991 that represent a network of benchmark stream flow gauging stations in Victoria from which data would be collected to monitor the impacts of



climate on water resources. These stations were thought to be in stable or protected catchments in which long term variations could be attributed to climate alone (Bureau of Meteorology, 1991).

### **Flood warning sites**

Flood warning data collection networks in Victoria have been developed over time and are currently managed cooperatively by various agencies (VFWCC, 2001). Generally, municipal councils are involved in the development, installation, management and maintenance of flood warning systems. The Bureau is responsible for monitoring situations likely to lead to flooding and for the prediction of flooding in rural Victoria (VFWCC, 2001).

Monitoring for flood warning, overseen by the Bureau of Meteorology, is conducted at a total of 585 surface water sites, of which 283 are part of the Water Monitoring Partnerships network. Some additional sites are used to provide flash flooding information and are operated by other organisations named in the regulations, e.g. City of Greater Geelong (5 sites), Melbourne Water and Goulburn Murray Water.

The Bureau manages 350-400 flood warning sites and all of these sites have telemetry, telephone, mobile, satellite or ERTS. The Bureau has FTP data transfer agreements with the following agencies: Goulburn Murray Water (GMW), MDBA (River Murray Water), Southern Rural Water and East Gippsland Water and is developing a FTP set up with Melbourne Water and Grampians Wimmera Mallee Water. FTP enables two way data transfer between agencies.

### **Melbourne Water managed sites**

Melbourne Water owns, manages and operates 250-300 sites in its catchments to measure precipitation, evaporation, temperature, humidity and vapour pressure. Melbourne Water provides these data to the Bureau and they are saved in the Waterworks database. Melbourne Water also operates meteorological stations at St Kilda Marina and Patterson Lakes (Whalers Cove). These stations record atmospheric pressure, wind speed, wind direction and temperature data for internal operational purposes. The St Kilda Marina site also collects rainfall. Melbourne Water recently installed precipitation sites above the snowline as part of a study funded through Round 3 of the MEHS program.

### **Sites managed by other agencies**

Several agencies in Victoria operate meteorologic observation sites to meet their specific business and/or project needs. Coliban Water and Barwon Water have a number of rainfall and evaporation stations associated with their storages and catchment areas. In the case of Coliban Water, data are all manually read and provided on paper to the Bureau. Barwon Water's rainfall stations are monitored through a telemetry system, while evaporation data are provided manually to Bureau. Barwon Water also has a number of rainfall monitoring sites at its treatment plants.

Goulburn Murray Water collects rainfall data at approximately 15 storages (at the time of the workshops). Class A evaporation pans are located at 12 of these storages. These stations are read daily and reported to the Bureau. Tipping Bucket Rain Gauges are located upstream of storages. These have been upgraded to Campbell loggers with the intention to connect them to Supervisory Control and Data (SCADA soon to provide real

time data. In addition, GMW establishes small scale weather stations for individual projects as needed.

Goulburn Valley Water has 13 weather stations at wastewater treatment plants and other sites to provide additional information for operational purposes. AGL Hydro Partnership manage a number of small weather stations that are connected to SCADA to record precipitation. There is also a weather station at Rocky Valley that is read manually on week days.

Latrobe City Council records rainfall and flow as partners in the flood warning network. Historical data are available in hard copy however; Latrobe City Council is interested in transferring these data to electronic format. DPI primarily uses data from Bureau's established network of meteorological observation stations; however they do establish weather stations for project specific purposes where required.

### **3.3.5 Category 5 – Water Use Information**

Rural water corporations are one of the agencies that collect water use data in Victoria. Different types of data are collected at different frequencies. Some information is collected by manual spot readings, other information is collected by automated SCADA systems. Spot readings that are used to calculate total daily volumes of water use are of limited value because they do not capture flow changes and variability throughout the day. There is an increasing need to measure flow at bulk off-take locations, channel outfalls and farm gates in real time to ensure the water supply systems are being operated as efficiently as possible. Southern Rural Water and Goulburn Murray Water use proprietary software systems developed by Rubicon Systems to capture some of these data. Both water corporations use IPM software (also developed by Rubicon) to plan and record the distribution of water to customers.

### **3.3.6 Category 6 – Rights, allocations and trades.**

All information related to water rights, allocations and trades in Victoria is maintained on the Victorian Water Register (see Section 3.2.1). The Victorian Water Register contains information relating to the location and maximum permissible storage volume for major and minor storages, although reliable information for minor storages has only been collected for new and recently re-newed licences. The State Water Register also includes information about Section 51 Licences (as defined under the Victorian *Water Act 1989*), which permit the extraction and use of water from a waterway. As for minor storages, some of the older records are incomplete. Permits to self extract water from a bore in Victoria are recorded on the State Water Register and the Groundwater Management system (GMS). These records generally consist of just the location of the bore and may not include permissible extraction volumes.

The State Water Register records entitlements with integrity, enables water accounting, keeps track of the water market and produces information for managing the State's water resources. The register is shared between an independent Victorian Water Registrar, the Office of Water in the Department of Sustainability and Environment, and rural water corporations.

Formal announcements of allocations made against Victorian water entitlements are currently issued as media releases, which are emailed or faxed from the relevant water resource manager or corporation after consultation with all of the affected named persons.

The scheduling of the allocation announcements is location-specific, with allocations for northern Victorian water systems made on the 1st and 15th business day of each month. Other Victorian regions may have monthly announcements only. The Bureau is sent a copy of these announcements in the current format and the announcements come directly from the relevant organisation to the Bureau.

### **3.3.7 Category 7 – Urban water management.**

The specific information required to inform supply and demand management and resource planning are real time inflows to storages and volumes held in storage, stream flow at strategic locations, flows through bulk off-takes and volumes supplied to other utilities (e.g. retail water authorities) and to customers. Urban water corporations in Victoria use their own metering and monitoring systems to inform their own specific business and operational needs. Most of the information is collected by manual readings or by Supervisory Control and Data Acquisition (SCADA) systems, but the frequency of readings will often vary between organisations and may differ from that requested by the Bureau under the Water Regulations (2008).

### **3.3.8 Category 8 – Information about water restrictions.**

Stakeholders are notified about restrictions to their water supply through a variety of media which may include radio, television, authority web-sites, direct mailing or direct contact. The authority that issues the restriction selects the media channels that they consider will best convey the necessary information to the broadest number of stakeholders. These decisions are made on a case by case basis.

### **3.3.9 Category 9 – Water Quality**

Most of the routine water quality monitoring used for environmental purposes that occurs in Victoria is conducted through one of the four Regional Water Monitoring Partnerships described in Section 3.1. The range of water quality variables measured at each site varies, but most sites are monitored at least monthly. Some variables such as temperature, electrical conductivity and dissolved oxygen are measured continuously at some sites using automated data loggers. Water quality information collected under the partnerships is made available on the Victorian Water Resources Data Warehouse, which is maintained by DSE (see Section 3.2.1).

Melbourne Water has its own network of water quality monitoring sites and data from these sites are reported to the EPA. Melbourne Water's long-term water quality data network comprises 136 sites, which are sampled monthly. Melbourne Water collect all the data required under the regulations except for electrical conductivity of a groundwater sample. The data are stored in excel spreadsheets (at the time of the workshops) with plans to make them available on the Hydstra system at some time in the future.

Catchment Management Authorities (CMAs) predominantly use the water quality data that are collected under the RWMP's. However, some CMAs conduct additional water quality monitoring as required for specific projects. The Mallee CMA collects electrical conductivity of surface water samples, which are delivered to the Bureau as part of the data delivery from DSE of all data collected under the partnership contracts. The Wimmera CMA collects and reports all the water quality variables listed in the regulations except electrical conductivity of a ground water sample. These data are collected and

sent to Bureau monthly except for electrical conductivity which is logged hourly and sent to Bureau monthly.

In Victoria the water corporations generally collect all of the water quality variables listed in the Regulations. South Gippsland Water measures all listed variables (except for electrical conductivity of a groundwater sample) three times per month. Lower Murray Water collect electrical conductivity of a water sample, turbidity, temperature and pH readings and record them on an excel spreadsheet. Data are collected at various frequencies at water treatment plants in the Lower Murray Water area and are reported annually to the Bureau. Southern Rural Water (SRW) has a database that is currently being built to deliver all the required data to the Bureau in the Water Data Transfer format, in an automated fashion.

Waterwatch Victoria is a community engagement program with volunteers across the state also collecting water information, including water quality and macroinvertebrate information. Waterwatch coordinators, hosted in each of the CMAs, coordinate the Waterwatch water quality monitoring programs, with data contributing to smaller projects and the statewide Index of Stream condition assessment. The Waterwatch databases contain 15 years of data, though none of this exists in a publicly available place.

#### **3.3.9.1 Quality of groundwater**

The 2007 Victorian Groundwater snapshot collected baseline groundwater quality data from selected bores across the State, including samples from 141 bores in 18 Groundwater Management Units (GMUs) in southern Victoria and samples from 187 bores in 12 GMUs in northern Victoria. The snapshot measured groundwater quality in relation to potential hazards and landuse impacts. These baseline data will be used as a benchmark for future sampling.

The Victorian Department of Primary Industries routinely measure electrical conductivity in groundwater to assess risks to agriculture. These data are recorded from bores in the Dryland Salinity Bore Network and at specific research sites. Data are maintained in an access database and are regularly uploaded to the GMS. The Mallee Catchment Management Authority monitors groundwater levels and electrical conductivity in approximately 600 shallow bores, which are not part of the SOBNS. These bores are sampled quarterly and the data are used to account for salinity impacts from irrigation and other actions as required under the Basin Salinity Management Strategy.

## **4 Section C: An assessment and statement of gaps, issues and opportunities in existing Victorian water information and monitoring investment and systems.**

Victoria's water resource management has undergone significant reforms over the last two decades following the establishment of new legislation in the *Water Act 1989* and significant amendments to this Act in 2005. Water information is collected to inform each tier of the water resource management system, with data from the same monitoring points potentially being used at the State, regional and local level. Because water information is shared between, or used by, many different organisations, gaps or limitations in the current data collection and reporting systems often affect more than one organisation. Similarly, actions to address identified gaps are likely to benefit multiple organisations.

Victoria's surface water monitoring program matches relevant business needs. However data improvements can be realised through further investment. This section describes the gaps issues and opportunities that organisations with data delivery obligations under the federal water legislation identified in the Mini SWIMP workshops as being relevant to each information category. It is a critical assessment of the water monitoring networks and water information systems outlined in Section B. The monitoring networks and data management systems have also been examined in terms of data delivery to the Bureau. The assessment has been undertaken as a data gap review by comparing what is available to what is needed. The context for this comparison is Section A: Water Information Drivers. These drivers characterise the challenges and issues facing water managers and planners in Victoria.

### **4.1 Category 1 – Surface water**

#### **4.1.1 Regional Water Monitoring Partnerships**

An inventory of Victoria's surface water monitoring sites within the Regional Water Monitoring Partnerships demonstrated a general need to upgrade instrumentation and associated monitoring infrastructure. This inventory was followed by a comprehensive data needs analysis to inform the importance of data from a given site relative to Victoria's draft monitoring framework. Sites which are monitored by multiple users and are required for flood warning were given the highest priority for upgrades, with sites established for short-term, single project needs given the lowest priority.

In addition, a number of sites were identified as critical for climate change analysis and/or for Statewide Resource Allocation Models (REALM models) that have data collected from significant periods of time prior to electronic records. These old paper records are currently kept in storage and need to be digitised in order to ensure data accessibility.

#### **4.1.2 Flood Warning**

The Department of Sustainability and Environment (DSE) continues to examine all aspects of flood risk management, including intelligence and warning functions. It is anticipated that many of the gaps within the current flood warning networks will be identified and addressed through the Comrie review arising from the January 2011 floods experienced throughout Victoria.

The Flood Recovery initiative implemented by the State Government, following those floods, has also provided additional resources to improve the currency and accuracy of Flood Warning information.

## 4.2 Category 2 – Groundwater

The water regulations require named organisations to supply groundwater levels and groundwater pressure for this information category. The utility of these two information sub-categories, the extent to which they are currently monitored, and the potential need for other information sub-categories, was discussed by officers of these organisations at the Mini SWIMP workshops. The agreed outcomes of these discussions, including specific gaps and issues, are described below.

### Distribution and condition of bores

Victoria's State Observation Bore Network (SOBN) has expanded over time due to the inclusion of additional bores. However, that expansion has generally occurred without a strategic assessment of need. Recent reviews of the network have shown that the location of the bores, the type of data collected and the frequency of data collection do not meet all Victoria's current groundwater monitoring needs. Reconfiguration activities have commenced to ensure the SOBN is better equipped to meet present day demands for more accurate water resources information, but the reconfiguration program needs to continue to ensure the SOBN provides the data necessary to monitor the State's major groundwater resources.

In addition to location issues, the SOBN presents a legacy of aging infrastructure. Many of the government bores were constructed using mild steel casings, which over time have deteriorated. The effective life of SOBN bores ranges from 5 years to 40 years, and depends on the construction materials, the bore location and depth. The median age of bores in the current SOBN is approximately 20 years, and 21 bores are over 40 years old (Table 3). Some bores have collapsed and pose no risk whilst others may pose a contamination risk or contribute to wastage of a valuable resource. Some bores have been inappropriately abandoned.

**Table 3: The current age of SOBN bores in years. (Source: DSE, 2008c)**

Bore age (years)	Number of bores (Current monitoring contract)
<10	233
10 < 20	1068
20 < 30	765
30 < 40	410
>40	21
	2497

DSE is currently funding the first phase of the SOBN Refurbishment Project, which is being run in partnership with Goulburn-Murray Water, Grampians Wimmera Mallee Water and Southern Rural Water. The aim of the SOBN Refurbishment Project is to upgrade ageing infrastructure, address problems associated with failed or blocked bores, improve the distribution of bores in high priority areas and improve data collection. The project is expected to ultimately set priorities for the location of new bores and will also identify current bores that are in the wrong place or are not required.

Reconfiguration activities have commenced and more than 170 new wells have been added to the SOBN in the last two years, which has increased the knowledge of local aquifers where previously it had been poor. The Refurbishment Program needs to continue to ensure the SOBN provides the data necessary to monitor the State's major groundwater resources.

DPI is conducting a separate review of its salinity management monitoring sites to identify areas where groundwater flow is poorly understood. The review mainly focuses on the North East, Goulburn-Broken, North Central, Wimmera, Glenelg-Hopkins and Corangamite salinity provinces. Higher elevations are not well represented and an extension of the review across the state and broadening of focus to include groundwater dependent ecosystems and issues other than salinity would further enhance Victoria's groundwater information.

A potential limitation of the existing bore monitoring network is the lack of information on private extractors who harvest less than 20 ML/year. Programs are in place to assess areas with limited monitoring coverage and to make recommendations regarding future monitoring programs.

#### **4.2.1 Frequency of groundwater monitoring**

Groundwater monitoring is labour intensive and is expensive. As a result, monitoring is less frequent than many organisations would like. Monitoring once per year or once every quarter is sufficient in areas where there is limited harvesting and groundwater levels are not likely to change. However, in areas that have high extraction rates, more frequent monitoring would be useful to better assess groundwater responses to pumping, impacts on streamflow and responses to specific management. Bores in Water Supply Protection Areas are currently monitored monthly, and it may be necessary to introduce similarly frequent groundwater monitoring in other areas on a case by case basis.

Most water corporations have pressure loggers in some of their larger production bores. These loggers are often linked to telemetry systems and SCADA to provide information in real time. The cost of installing pressure loggers in every groundwater bore throughout Victoria is obviously prohibitive, but installing loggers in selected routine monitoring bores does help to increase our understanding of groundwater variation. DSE has installed loggers also in approximately 70 bores where the requirement for more frequent monitoring has been identified. Another 70 loggers are scheduled for installation at selected bores in the near future, but it may be worth increasing the number of loggers further if the review of groundwater monitoring (described earlier) identifies extra areas where more frequent monitoring is required.

#### **4.2.2 Groundwater water quality**

Although not identified as a priority information sub-category, some of the representatives of the named organisations who attended the project workshops felt that a lack of water quality data from aquifers was a major limitation of the current groundwater monitoring programs. Electrical conductivity is routinely measured at various bores throughout Victoria, including most of the salinity monitoring program bores that are managed by the Department of Primary Industries and the Catchment Management Authorities. However, other water quality parameters such as nutrients, metals, major ions and isotopes are not routinely monitored at most bores. The main exceptions are where bores are specifically used to supply water for human consumption and where monitoring is needed to comply with EPA licences for wastewater treatment plants and other activities that have the potential to pollute groundwater. The lack of water quality data is primarily due to the high costs associated with collecting samples and conducting analyses in the laboratory.

Water quality is useful for determining the age of water in an aquifer, its source and the direction of flow. Water quality samples are most likely to be collected and analysed when a bore is drilled, but the lack of ongoing monitoring means there is very little understanding of how water quality changes over time. Such information is particularly important for assessing responses to climate change and potential impacts associated with increased groundwater harvesting in dry years. Water quality information would be useful also to determine whether actions implemented through groundwater management plans are delivering benefits.

In the past two years DSE has measured water quality in approximately 700 bores to provide some baseline information. The monitoring was a one-off effort and the selected bores did not necessarily provide a comprehensive indication of groundwater conditions in all parts of the State. Workshop participants agreed that a review should be undertaken to identify areas where water quality information is most critical and that routine water quality monitoring should commence in these identified areas. Given the high cost of monitoring water quality in groundwater, the selection of these bores should be very rigorous and be linked to clear research questions and analyses. Workshop participants also agreed that any water quality data that are currently collected and any new data should be provided to the Bureau so that it can be used by any interested parties.

#### **4.2.3 Inconsistent bore numbering and a lack of standard measuring protocols**

Many bores throughout Victoria are used by multiple agencies for different purposes and projects. The same bore may have multiple identification numbers and data from the same bore may be recorded against any one of these numbers depending on who has collected the information and what it is being used for. New bores that are drilled for specific monitoring such as to comply with EPA discharge licence requirements also do not need to adopt the Statewide numbering protocols. Inconsistent bore numbering becomes a significant problem when data from different monitoring programs are combined. Temporal changes in groundwater may not be detected because although the same bore, or bores in the same aquifer, are monitored over a long period, the record associated with any given identification number could be relatively short. Inconsistent bore monitoring protocols are an artefact of the haphazard approach to groundwater monitoring in the past, but should be relatively easy to address going forward. If more rigorous numbering protocols are implemented then it would be useful to audit existing data and where possible make the relevant links between different data sets.



There is also an issue with regard to standard groundwater monitoring protocols throughout Victoria. Workshop participants highlighted the potential for field staff from different organisations, and even different staff within the same organisation, to use a different reference when measuring groundwater levels. Some staff measure groundwater level relative to the ground surface, others measure it relative to the top of the bore casing and others report level to the Australian Height Datum (AHD). Unless accurate meta-data are recorded with the field measurements it can be difficult to determine what a particular groundwater level reading relates to. The problem is exacerbated when data are reported and used outside the organisation that collected it, as will be the case for all groundwater data published by the Bureau. Ideally all groundwater level data will be reported to AHD, but this won't be practical in all situations and therefore a national standard protocol for measuring level is required. It is also important to include meta-data with any groundwater measurements.

There is also a lack of consistency around the collection and analysis of water quality data. The same water quality parameters can be measured using different laboratory techniques, which may produce slightly different results. It is important to know which techniques have been used to analyse individual groundwater samples and the specific tolerances of the equipment. Ideally consistent groundwater sampling and analysis standards will be developed across Australia. These standards should reflect what is most commonly used at present. If that is not done then a stronger requirement to include meta-data to describe the sampling and analysis techniques that were used would add significant value to the groundwater data available.

#### **4.2.4 Hydrogeological information**

DSE see the benefit in investigating the integration of the hydrogeological databases developed by Southern Rural Water and Goulburn-Murray Water to support a Statewide hydrological database consistent with the National Groundwater Information System. Such a tool would improve the understanding of the State's groundwater resource characteristics thus providing a more informed platform for the decision on how they should be managed. Such an integrated product needs to be populated with all borehole data including information from the GMS managed by DSE, the Geological Exploration and Development Information System (GEDIS) database managed by DPI and the salinity bore database managed by DPI.

#### **4.2.5 Emerging issues**

Workshop participants identified several emerging issues related to groundwater monitoring and groundwater use. The first issue relates to the impact of groundwater on stream health. This has become a particular issue during the drought because the relative proportion of groundwater in natural river channels has increased. In some cases, such as parts of the Wimmera River catchment, groundwater intrusions have caused rivers to become more saline than the sea. Another drought related issue is the extent to which increased groundwater extraction and naturally declining water tables have affected groundwater dependent ecosystems such as wetlands. The drying up of wetlands and remnant pools that have previously received saline groundwater is contributing to the occurrence of Acid Sulfate Soils (ASS) in some parts of inland Australia. More groundwater monitoring in targeted locations would improve our understanding of

groundwater and surface water interactions in various systems and allow all of these impacts to be better assessed and managed.

The other two emerging issues relate specifically to engineering solutions for future water management. If Aquifer Storage and Recovery (ASR) is going to be trialled or implemented in Victoria then targeted groundwater investigations will be needed to identify suitable aquifers and to monitor changes to water level and water quality.

#### **4.3 Category 3 – Major and minor water storages**

The water regulations describe six information sub-categories that relate to major and minor storages data parameters such as level and volume of a storage. The utility of each sub-category and the extent to which each sub-category is currently monitored was discussed by named persons at the project workshops. The agreed outcomes of these discussions, including specific gaps and issues, are described below.

##### **4.3.1 Improved tools for data collection**

Major and Minor storage operators throughout Victoria collect storage level and storage volume information in a variety of ways. Some organisations take manual readings, because they consider it to be more accurate than automated measurements or they do not have the resources to automate their monitoring infrastructure. Manual readings may be very accurate, but a spot measurement that may be biased by conditions at the exact time the record was taken may not provide a reliable estimate of daily storage level or volume on a given day. Manual readings are often stored on paper or in stand-alone spreadsheets and there is the potential for transcription errors.

Some named persons believe that implementing SCADA on all storages across the jurisdiction will improve long-term records, because collected data will be stored on a database rather than held in separate excel spreadsheets that might be lost. SCADA also provides real time reporting and less data handling that reduces errors at the site and in transcription. However, other named persons feel the cost of implementing SCADA on all the storages in their region is potentially prohibitive.

##### **4.3.2 Inaccurate or out of date bathymetric data**

Named persons raised concerns over the accuracy and reliability of bathymetric data and associated storage capacity tables for both major and minor storages. These issues have been exacerbated during the drought, because errors in bathymetric data and storage capacity tables are most pronounced when water levels are low. Bathymetric errors may be due to inaccuracies in the initial survey or physical changes to the storage due to sedimentation or erosion since the initial surveys were conducted. The current low storage levels in many of the major and minor storages throughout Victoria provide an opportunity to update bathymetric data and storage capacity tables using the latest survey techniques.

##### **4.3.3 Survey storage gauges to AHD**

In Victoria most gauge boards that are used to measure storage levels have been referenced to Australian Height Datum (AHD). However, there are still some storages

where this is not the case. It is not a major problem for named persons because they know which of their own storages are and are not referenced to AHD and take this into account when using the data. However, once the information has been provided to the Bureau and is available to third parties, the lack of consistent reference points becomes an issue. End users of the information may not know which storages have been referenced to AHD therefore it may be difficult or misleading to compare data from different storages. An obvious way to overcome this is to ensure all storage gauges are referenced to AHD.

#### **4.3.4 Water Information Standards**

In Victoria, there is confusion around the type of information that needs to be forwarded to the Bureau. The named persons feel that some standards around specific data delivery would be helpful to allow them to assess what to forward to the Bureau. For example; information that is forwarded to the Bureau about the transfer of volumes of water between storages, can be reported as either the delivered or received value, or both. Standard rules for these types of situations would be useful.

There is some confusion regarding the reporting of dead storage. Some named persons in Victoria include dead storage in their reports for total storage, others only report active storage. An inconsistent approach may lead to problems for any third party that accesses the records supplied from the Bureau. The named persons for the Major and Minor Storages information category expressed a desire for the Bureau to specify uniform standards for reporting.

The Bureau has advised that storage data published through the Australian Water Resources Information System (AWRIS) product will be adjusted to reflect a similar approach to defining “dead storage” across all named persons. The MDBA also intends to use a direct feed from the Bureau AWRIS product as a single point of truth. However, there is still the potential for confusion among third party users if they compare data supplied direct from named persons with data published on the Bureau’s or MDBA’s websites.

Named persons indicated that they were uncertain about which water transfers needed to be reported to the Bureau under the Major and Minor Storages information category. For example, the three Major Storages that Coliban Water operates and manages are on the same river and are separated by very short distances. Coliban Water can release water from the two most upstream storages to aggregate volumes in the most downstream storage. South Gippsland Water also transfers water short distances between connected storages on the same system and then release a passing flow from a reservoir that is too small to qualify as a minor storage. Coliban Water and South Gippsland Water requested clarification from the Bureau regarding the type of information they are required to provide for individual storages in connected systems.

#### **4.3.5 Data coverage of minor storages**

Currently in Victoria there is a good coverage of data on the major storages. However, many of Victoria’s smaller storages are on private land and their level and volume are not recorded or reported systematically. The lack of information on minor storages has implications for estimating water yield, particularly in catchments where minor storages and farm dams have the potential to collect a significant proportion of local run-off.

There is no immediate business driver for the Victorian water corporations to increase monitoring at privately owned minor storages. However, DSE and other agencies responsible for assessing changes in yield and overseeing water accounts at a catchment or State-wide level would benefit from more frequent monitoring of all storage volumes throughout the State.

#### **4.4 Category 4 – Meteorology**

The water regulations describe nine information sub-categories that relate to meteorology data parameters. The utility of each sub-category and the extent to which each sub-category is currently monitored was discussed by named persons at the project workshops. The agreed outcomes of these discussions including specific gaps and issues are described below.

##### **4.4.1 Standard and automated approach to data transfer**

Currently in Victoria, there are a variety of different recording systems for monitoring meteorological data. Manual readings, data loggers with telephone telemetry, ERTS and SCADA systems are used at various locations throughout Victoria. There are also different SCADA systems, each built to meet the specific business needs of individual named persons. Multiple systems are used at some locations, which leads to double or triple handling of data. There is also no standard format for data used in flood warning and non-flood warning systems.

Named persons identified a need to streamline and or standardise the approach to data transfer both within organisations and for the data transfer to the Bureau. A standard approach would allow different systems to talk to each other and reduce duplication. The named persons agreed that a uniform data format system that can be used on the SCADA systems would be useful. The standard data format would enable the data to be sent automatically to the Bureau and provide an efficient way to monitor data.

##### **4.4.2 Increase coverage of operational sites (including flood warning sites)**

In Victoria, there is a need to increase the current coverage of meteorological operational sites, including those which are used as flood warning sites. More rain gauges, for the purpose of flood warning, are required in the headwaters and mid-catchment areas of some catchments that currently lack sites due to low population density or poor radio and telephone networks. In addition, access to current site information by multiple organisations, for various needs, often creates a situation where, multiple systems are used at the same site. Network upgrades would reduce the duplication at such sites.

An automated system of data retrieval from sites would be beneficial, although poor transmission is likely to be a problem in areas that have limited radio and telephone network coverage. Victoria's regional Bureau of Meteorology Hydrology group liaises with relevant organisations in identifying the best locations for meteorological sites and the automation of data transfer.

#### **4.4.3 Change from polling to event reporting**

In some cases the named persons would like to change their meteorological reporting systems from polled reporting systems to event reporting systems if the telemetry system is compatible. Polled reporting systems require named persons to contact the gauge (usually by telephone) to obtain data. Polling systems can become overloaded when many users call for data at the same time, which can happen during heavy rain events. Event based reporting, on the other hand, automatically sends the data to subscribers when an event occurs. The current Internet Protocol enabled Campbell loggers that are connected to the NextG network have the capability for event reporting and could be used for that purpose where required and feasible.

#### **4.4.4 Review of the number and spatial distribution of rainfall gauges**

A review of the number and spatial distribution of the rainfall gauges within Victoria was identified as an important improvement required in Victoria's flood warning network. Many areas including the upper catchments and alpine regions of the Upper Mitta, Upper Goulburn, Upper Mitchell, Upper Glenelg and also the Murray region, have limited numbers of rainfall gauges. Historically, the lack of gauges in these regions is related to their low population levels. With increasing urban growth in these areas, the network of rain gauges to assist in determining rainfall events and subsequent size of flows and flood events will need to increase.

The spatial resolution of rainfall data influence flood forecasting. Participants at the Mini WIMP workshop for this data category agreed that a greater number of meteorological sites including rain gauges would be useful at and above major storages, with the greatest benefit realised from telemetered sites. Strategic placement of rainfall/repeater stations could strengthen existing ERTS telemetry systems as the repeater stations improve data transfer to the Bureau.

Workshop participants recommended an initial scoping study to review the current locations and gaps in the rainfall gauge network with the priority being rainfall monitoring sites for operational purposes (flood warning, headworks/reservoirs) rather than pure meteorological weather forecasting reasons. The scoping study should identify the optimal density and distribution of rainfall gauges. Recommendations from the study should include recommendations for locations for new monitoring sites, as well as upgrading of redundant telemetry equipment to polling and/or event based stations.

#### **4.4.5 Increase number of Class A evaporation pans**

Named persons at the workshop for this information category agreed there on the benefits of increasing the number of Class A evaporation pans throughout Victoria to better estimate evaporation from water storages. In particular, Class A evaporation pans close to storages that are not served by the existing monitoring sites, would significantly enhance the existing network.

#### **4.4.6 Real time estimates of reference crop evapotranspiration (ET<sub>o</sub>)**

Reliable real-time estimates of reference crop evapotranspiration (ET<sub>o</sub>) as defined by the Food and Agriculture Organisation, are needed for farmers to improve their irrigation

management. Currently, the Bureau provides forecast reference crop ETo but not real-time estimates. The Bureau's SILO database provides historical ETo, which is based on an assumed wind speed of 2 m/s. With improvements in ETo estimates farmers can calculate crop specific water use and hence, irrigation requirements. ETo should be calculated from data collected at automatic weather sites and provided as cumulative daily ETo (updated at hourly intervals).

## **4.5 Category 5 – Water use**

A number of gaps and issues were identified relating to the collection and reporting of water use information throughout Victoria. The water regulations describe nine information sub-categories that relate to irrigation water use. The utility of each sub-category and the extent to which each sub-category is currently monitored was discussed by representatives of the organisations named in the legislation at the Mini SWIMP workshop. The agreed outcomes of these discussions, including specific gaps, are described below.

### **4.5.1 Lack of uniform standards**

Data delivered to the Bureau by the Victorian organisations named in the federal legislation is likely to be collected to different standards for the individual water use information subcategories. Standards differ between and within organisations in terms of the frequency of measurement, the accuracy and resolution of measurement and the approaches to quality assurance and quality control methodologies. This lack of consistency may pose a problem for third parties attempting to use, analyse or compare data available from the Bureau's national database.

During the project workshop participants indicated inconsistent standards in data collected throughout the headworks system, especially with measuring daily volumes at the bulk off-takes. The participants suggested that it would be useful if the Bureau set an agreed standard for data accuracy, method of collection and data interpretation.

Workshop participants indicated that national standards should take account of what is most commonly recorded in different jurisdictions. Once national standards have been established, organisations named in the legislation could review their own monitoring systems and identify sites where upgrades are necessary. Upgrades should be conducted in a priority order and workshop participants agreed that the highest priority would be to ensure that measurements at all bulk off-take sites throughout Victoria would be comparable, which would be facilitated by adopting a uniform standard.

### **4.5.2 Confusing terminology in the Water Regulations 2008**

Participants in the workshops identified an issue surrounding some of the terminology within the subcategories as listed by the Bureau in Category 5. The Water Regulations do not clearly reflect the way that data are collected in Victoria. For example, if the term 'irrigation network' in the subcategory 5b water regulation was taken literally, then any measure of water use for stock and domestic or other consumptive purposes would be excluded. Some of the largest and most complicated water distribution networks in Victoria are used for stock and domestic supply rather than irrigation. This particularly applies to the Wimmera Mallee Supply System that Grampians Wimmera Mallee Water

operates in western Victoria. Workshop participants suggested that the term 'irrigation network' should be replaced by 'distribution network'. Similarly, organisations have customers that self-extract directly from waterways or groundwater, which is outside the scope of the regulations.

Collecting data on the total daily volume of water returned to a water storage seems unnecessary in relation to data collection in Victoria. The named persons in this category could think of very few instances in Victoria where irrigation water is returned to a water storage from an irrigation network. The irrigation water in Victoria generally goes back into a watercourse and then into a storage. It is felt that it is unnecessary to provide these data separately, because 'water storages' as defined in the Water Regulations 2008 are included in the broader term 'water course'. There is no business need for Victorian organisations named in the federal legislation to report on the volume of water returned to a water storage from an irrigation network and so no actions or strategies to improve the delivery of these data to the Bureau were identified.

#### **4.5.3 Adequacy of monitoring locations and links to in-house computer systems**

The total daily volume of water diverted from a watercourse to a distribution network is a critical piece of information for the participating organisations in Victoria listed in this information category. All participants indicated that the collection of this information is generally adequate for their own business needs, with the data being managed in their Supervisory Control and Data Acquisition (SCADA) systems.

The main areas for improvement would be re-locating some monitoring sites that are not in optimal locations, installing new monitoring sites that would provide a better measure of water diversions, and increasing the number of monitoring sites connected to the SCADA systems. Workshop participants suggested there were probably not many instances where monitoring sites are not in optimal locations for this information sub-category, but any instances where that is not the case should be rectified. Increasing the number of monitoring sites on the SCADA system would increase the frequency of readings (this would mean that daily volumes could be accurately measured, rather than estimated from a spot reading) and increase the capacity to upload data in real time. Automating data collection and reporting functions would reduce costs and errors associated with manually transcribed data.

#### **4.5.4 Lack of channel outfall monitoring**

In Victoria, only a small proportion of channel outfalls are monitored. This monitoring is generally less frequent than monitoring at other locations within the water supply system. Where outfall monitoring does occur it is often upstream of other extraction points and therefore does not necessarily provide a true measure of the volume of water that discharges from the water supply system to a natural water course. Historically, the measurement of outfalls has not been as important to organisations named in the federal legislation as the monitoring of water diverted from a water course. However, outfall data are being used more frequently to increase the efficiency of system operations. Reliable measures of channel outfalls, particularly the volume of water that is being discharged from water delivery systems to wetlands and natural river channels, are becoming more important due to the recognition of the environment as a legitimate water user.

Most channel outfalls in Victoria are modelled or estimated, rather than directly measured. Improvement in measurements (i.e. more locations and more accurate measurements) could improve the quality of models. The Northern Victorian Irrigation Renewal Project (NVIRP) is taking steps to improve estimates of channel outfalls, as one of its aims is to reduce channel outfalls. Workshop participants agreed that direct measurement or improved modelling could also be used to improve estimates of channel outfalls in other parts of Victoria. It was suggested that the highest priority for new channel outfall monitoring locations and improved modelling would be areas where the water supply system discharges to high value wetlands and natural river channels.

#### **4.5.5 Unmetered and unlicensed water use**

There is a gap in the data coverage of water use at unlicensed and unmetered locations, such as farm dams, in Victoria. The lack of understanding over how much water is used and when it is used is a particular problem in catchments where unmetered and unlicensed water use accounts for a large proportion of the total water use or available water reserve. DSE are interested in determining the influence that farm dams have on total yield in various catchments throughout the State. Workshop participants agreed that improved monitoring and estimation of unmetered and unlicensed water use was a high priority in catchments where these types of extractions were likely to represent a substantial proportion of the total water use.

#### **4.5.6 Self extraction from bores and waterways**

Data collection of groundwater and surface water self extraction is limited in Victoria. Data are generally collected yearly, rather than monthly, and hence organisations named in the legislation are not able to report these data at the frequency specified in the legislation.

Workshop participants acknowledged that these data would be useful in some business contexts. For example, one of the main limitations of annual reporting is that there is no indication of when self extractors harvest water and what effect this has on water resources. It is likely that self extractors will harvest during drier periods and, if they take most of their annual allocation at that time, the impacts on the water reserve will be most pronounced.

Environmental managers use these data for water resource modelling and more frequent reporting may improve the reliability of these models. More frequent reporting could be achieved by increasing resources to physically read meters or by installing telemetry infrastructure. However, the number and location of potential bores and surface water pumps is likely to make both of these options prohibitively expensive in most areas and should only be considered in areas where self extraction is likely to represent a large proportion of the total water use in the region.

#### **4.5.7 Privacy issues**

It was evident to the named persons that some of the data requested under the legislation in category 5 could raise some privacy issues. For example, supplying information on the total monthly volume of water supplied to individual irrigators could contravene



requirements of privacy legislation. Participants at the workshops were keen to further explore the use of this information, in particular in relation to its availability via the internet.

## **4.6 Category 6 – Rights, allocations and trades**

### **4.6.1 Lack of information on the share sale price**

In Victoria, the information that is obtained on permanent Australian water access entitlement trades is stored on the State Water Register. However, the supply of the gross and net share sale price of the water access entitlement trade is voluntary and hence is generally not on the water register. Workshop participants for this category suggested that there is no Victorian business need for action or strategies to include this information in the register.

### **4.6.2 Limited information on permits to operate minor storages**

In Victoria, the information on permits to operate minor storages is stored on the State Water Register. At present, this information is incomplete. The information is generally collected for new and renewal applications, for which good electronic records are available. However, historical records are very limited and are largely paper based. This is especially the case for storages that are less than 200 ML and have a dam wall that is less than 5 m high and are therefore not classified as hazardous. In Victoria, if a minor storage is licensed, it will generally be recorded, but the details of the storage location and volume may be lacking.

Information on minor storages will become more important if the current drought persists because the data can help inform water resource models and estimates of inflows into catchments. Looking forward, it will be essential to implement projects to increase information on minor storages. An action to address this could be to initially identify where information gaps are, e.g. where the location and volume is missing on the permits. Secondly, it will be important to upgrade the historical and paper based data into electronic formats.

### **4.6.3 Delivery of formal announcements of water allocations**

Currently in Victoria, all formal announcements of water allocations made to water access entitlements are delivered by email or fax to the persons who require the information. These emails usually consist of a media release. Workshop participants agreed that it would be practical, and form the most appropriate information delivery format, for the Bureau to receive the same email announcement. This would streamline the process of the delivery of the formal water allocation announcements and would reduce the resource effort for the organisations named in the legislation.

### **4.6.4 Water access entitlements**

Section 8 of Victoria's *Water Act 1989* relates to the continuation of private access to water. In Victoria, there is a need to improve the national water account by obtaining better estimates on how much water is used and how much water could potentially be used under the Victorian Section 8 rights. For example, there is a knowledge gap on how much water is used and how much water could potentially be used from unlicensed farm

dams and/or watercourses associated with properties that have Section 8 rights. Currently, there is some estimation on a few dams though more work is needed. A suggested action from the workshop participants was to implement projects to estimate how much water is used and how much could potentially be used from unlicensed farm dams and from unmetered extraction from other watercourses.

#### **4.6.5 Inadequate coverage of information in permits for groundwater bores that are used to self extract**

Section 51 of Victoria's *Water Act 1989* relates to licences to take and use water. Information about Victoria's Section 51 licences for groundwater bores are available on the State Water Register and in the Groundwater Management System (GMS) administered by DSE. The information in the Register and the GMS often lack some relevant data, e.g. Information on which aquifers are being accessed and the location, coverage and spatial extent of the ground water network would improve Victoria's information on groundwater extractions. Addressing this data gap was identified as a priority at the workshops, as it would support both the Bureau and the operations of the organisations named in the federal legislation.

#### **4.6.6 Lack of information on licences to self extract from a watercourse**

Throughout Victoria there is a lack of information on the licences to self extract from a watercourse. Currently self extraction licences under Section 51 of Victoria's *Water Act 1989* do not always contain the location, the maximum permissible extraction volume and other conditions of use. Often these licences are allocated to a whole property, but the exact location of that extraction point on that property is unknown. Obtaining more detailed information about the locations of the extraction points would be useful to better understand which sustainable diversion limit area the extraction is in for trading purposes.

### **4.7 Category 7 – Urban water management**

A number of gaps were identified in relation to the collection and reporting of information on urban water management throughout Victoria. The Commonwealth Water Regulations 2008 describe 15 information sub-categories under Category 7, Urban Water management. The interpretation of the description provided for each sub-category in the Water Regulations 2008 generated extensive discussion at the workshops, even in light of the Bureau's subsequent publication attempting to further clarify these sub-category descriptions ([http://www.bom.gov.au/water/about/publications/document/Water\\_Information\\_Bulletin\\_Issue\\_4\\_22\\_December\\_2008.pdf](http://www.bom.gov.au/water/about/publications/document/Water_Information_Bulletin_Issue_4_22_December_2008.pdf)). The agreed outcomes of these discussions, including specific gaps, are described below.

#### **4.7.1 Lack of uniform standards**

Data collected by the Victorian organisations listed in the legislation relies on different standards for some of the Category 7 sub-categories. Standards differ between and within organisations in terms of the frequency of measurement, the accuracy and resolution of measurement and the quality assurance and control approaches around managing the data. There is also a lack of uniform standards for describing sampling

locations (e.g. location co-ordinates and written descriptions). Organisations who take water from surface sources (subcategory 7a) measure take at various frequencies from daily to once every four months through meter readings (combination of manual readings and flow meters linked to SCADA) and they do not always log the time that the reading was taken. Data are typically held in electronic spreadsheets or SCADA systems.

The lack of uniform standards for data collection presents issues with comparing or contrasting data collected with different levels of accuracy and reliability. Biases and uncertainty associated with the use of different data management methods means that some of the data which are currently sent to the Bureau may be misinterpreted. A lack of consistency is likely to pose a problem for any third parties that wish to use those data.

Workshop participants suggested that it would be useful if the Bureau set an agreed standard for data accuracy, method of collection and data interpretation. Named persons could then determine whether they met the standard and identify implications if they did not. For example, some organisations may choose to modify their infrastructure or data collection methods where needed, even though the legislative requirements to deliver data to the Bureau only apply to the data currently collected and explicitly excludes any requirements of organisations to change their data collection approaches.

Workshop participants indicated that any national standard should take account of what is being most commonly applied in different jurisdictions and include explicit involvement of the Victorian Water Industry in considering potential impacts of implementing such a standard. Once national standards have been established, organisations could review their own monitoring systems and identify sites where upgrades are necessary.

#### **4.7.2 Adequacy of monitoring locations and better automation of data collection and transfer**

Organisations named in the legislation in relation to this data category are interested in upgrading their monitoring systems to SCADA for operational reasons. This would also increase the accuracy and frequency of data delivered to the Bureau and hence provide benefits to both the data provider and the Bureau.

Monitoring locations and configurations at water treatment plants affect data accuracy. Workshop participants suggested that most monitoring sites would already be in optimal locations for this information sub-category. However, if improvements in the monitoring configuration in treatment plants were required, this would provide operational benefits and would improve data accuracy. Automating data collection and reporting functions would also reduce costs and errors associated with manually transcribing data. Some participants expressed interest in converting these data into the Water Data Transfer Format (WDTF).

Some sub-categories were identified in the workshop as not being relevant in Victoria at this stage (e.g. subcategory 7c – volume taken from desalination). As these new water sources are developed appropriate monitoring would be implemented. However, some emerging areas of interest, related to alternative water sources, were raised. Examples included managed aquifer storage and stormwater and rainwater harvesting. Current networks do not adequately monitor the use of these alternative sources (e.g. subcategory 7o – volume of stormwater discharged to a watercourse is not routinely monitored by any of the organisations participating in the workshops) and improvements in monitoring

networks to cover these alternative sources were considered to be an emerging priority for those present at the workshop.

#### **4.7.3 Frequency of monitoring**

Recording frequency across various subcategories of Category 7 differ from daily to quarterly and use a combination of manual meter readings and SCADA. Organisations collect and report on data at the frequencies that suit their individual business needs, but often differ from those in the federal legislation.

Furthermore, categorisation according to customer type (i.e. residential, industrial, commercial and municipal) can only occur as frequently as the relevant meters are read. As not all meters are read on the same day it is not possible to allocate water use by different customer types to specific periods.

Organisations represented at the workshops indicated that business needs for improved metering technologies would continue to evolve and agreed that, as demand management becomes more of an issue, the need for more frequent and accurate measurements would become stronger and implementing smart meter programs would become a higher priority.

#### **4.7.4 Need for clarity around accounting and reporting requirements**

There is a need for clear standards with respect to who reports on water use under the federal legislation when there is a volume of water provided to a third party via an organisation's infrastructure. For example, Southern Rural Water has a bulk entitlement share in Thomson Reservoir. As a bulk supplier, they can supply water from the Thomson dam to irrigators in the Werribee area via infrastructure owned by some of the metropolitan water retailers (South East Water and City West Water). In a second example, North East Water delivers water via their supply system to a golf course that has purchased that water (via trade) from an irrigator supplied by the bulk supplier Goulburn Murray Water. In both examples, the water is not purchased by the second party and then on sold to the third party, it is just transferred via their infrastructure. However, it is unclear who would need to report the amount of water received from the bulk supplier.

### **4.8 Category 9 – Water quality**

A number of gaps were identified relating to the collection and reporting of water quality information throughout Victoria. The Commonwealth Water Regulations 2008 describe eight information sub-categories that relate to water quality parameters. The utility of each sub-category and the extent to which each sub-category is currently monitored was discussed at the project workshops. The agreed outcomes of these discussions including specific gaps and issues are described below.

#### **4.8.1 Standard tool for data storage and reporting**

There are currently inconsistencies with regard to the format that named persons use to record water quality data throughout Victoria. The Bureau require the data in the .xml format or the preferred Water Data Transfer Format (WDTF). Most of the surface water quality data collected under Victoria's Regional Water Monitoring Partnerships (RWMPs)

is stored on the Victorian Water Resources Data Warehouse, to which it is supplied as a CSV file. Melbourne Water save their water quality data to their Hydstra system. Southern Rural Water is building a database which will deliver all the data to the Bureau in the required WDTF. The Southern Rural Water system is being built such that other named persons could easily provide data in a Microsoft Excel or CSV format and the system would convert it into WDTF. A standard database made available to all named persons would streamline internal data handling procedures and make it easier to deliver data to the Bureau.

A potential issue for Victorian organisations receiving surface water information collected under the RWMPs is the duplication associated with different parties effectively providing the same data to the Bureau. Organisations that are required to provide these data are implementing section 7.11 of the Water Regulations 2008, which allows them to inform the Bureau in writing that they believe this information is already in the Bureau's possession. Therefore, a key need is to undertake an appropriate level of data mapping to ensure that the authoritative source of unedited and edited data is clearly identified at the Statewide level, and a streamlined plan for data provision is agreed between the Bureau and the Victorian organisations that are also members of the RWMPs.

Appropriate development of data quality management plans and guidelines for data provision would ensure that any improvements to the core data would be accessible to all parties. Development of appropriate standards for identification/naming of sites would also ensure that data provided by various parties to the Bureau, from what may be the same site, may be more easily identified.

#### **4.8.2 Review of water quality site locations in the RWMPs**

Many of the water quality sites monitored under Victoria's Regional Water Monitoring Partnerships were established as part of the Victorian Water Quality Monitoring Network (VWQMN) in the 1970s and 1980s. Both water quality and water volume data is collected from these sites, allowing the calculation of water quality concentrations and loads. Given the advances in technology for the collection of information on both water quality and quantity, and possible changes in business needs for water quality information, a review of the VWQMN is recommended. The review needs to confirm the business needs for water quality information for organisations collecting these data, determine if the sites are in the best locations, if the appropriate water quality variables are being measured at each site and whether the monitoring frequency is adequate. The analysis must assess the benefits of maintaining existing locations to continue long-term data records against retiring or moving sites to ensure optimal spatial coverage. A similar review for the Port Phillip and Westernport Regions was part of the "Better Bays and Waterways" project by the Victorian EPA and Melbourne Water in 2007. Workshop participants felt that this could possibly be extended across the whole of Victoria.

#### **4.8.3 Rescue of strategic data**

Currently, in Victoria there are poor electronic records for water quality data collected before 1980. Workshop participants felt there would be value in converting water quality data contained in reports, paper based records and small project databases into a usable electronic database. Rescuing these water quality data would improve long term trend

analyses and assist in predicting potential future water quality issues. This action would be very labour intensive as it would require collating and collecting old project data from relevant organisations and manually entering them into a common storage database.

#### **4.8.4 Response monitoring equipment**

Participants in the workshops related to the collection of water quality information in Victoria discussed the concept of emergency response monitoring equipment that could be used after major bushfires or in the event of a sudden algal bloom or pollution event. The response monitoring equipment would consist of a pool of temporary water quality monitoring probes and instruments capable of monitoring a variety of water quality parameters. Currently, there is not enough equipment to monitor water quality when a large scale and urgent need arises. Some organisations have better access to response monitoring equipment than others, but there are no formal mechanisms to facilitate the sharing of this equipment or its transfer across areas of need. Workshop participants suggested that it would be useful to establish a movement register of equipment that is available to all CMA's, water utilities and other relevant organisations. The movement register would record who is using the equipment, where they are using and for what purpose. Individual needs could be ranked and equipment allocated in a triage type arrangement when demand is high.

#### **4.8.5 Increase in turbidity monitoring at strategic locations**

Urban water corporations identified the need for more frequent turbidity monitoring at raw water off takes. Water treatment facilities do not cope well with very turbid water and as a result water utilities rely on accurate turbidity measurements to determine when and how much water they take from particular locations. The urban water corporations who participated in the workshops indicated that more frequent and more accurate monitoring, and perhaps increased monitoring sites, particularly in smaller water catchments, would enable them to manage their water harvesting operations more efficiently. These data could then be made available to the Bureau.

#### **4.8.6 Waterwatch data**

The Waterwatch program has collected stand-alone water quality data from more than 1,000 sites in Victoria over the last 15 years. These data are not currently stored in a central database and are not readily accessible to third parties. While there may be some issues regarding the lack of associated water volume data, data quality control and data accuracy collected under the Waterwatch program, the sheer amount of data and length of the monitoring record make it a potentially useful dataset. Transferring these data to a central database that can be accessed by organisations and individuals is therefore considered a worthwhile action.

#### **4.8.7 Groundwater water quality sites**

Workshop participants highlighted the need for more extensive monitoring of water quality in groundwater. These issues have already been described in the groundwater section of this SWIMP (see Section 4.2).

## 4.9 Gaps analysis.

In 2010 a review was commissioned to identify the Gaps remaining within Victoria's hydrologic systems. All named persons within Victoria were invited (and encouraged) to participate in a survey targeted at determining the extent to which the Bureau of Meteorology's Modernisation and Extension (M&E) of Hydrologic Systems Programme to enhance the accuracy and transfer of real-time data to the internet had progressed. Only eleven of the Victorian named persons responded.

The reports outputs are a compilation of named persons responses to the survey, assessment of funding allocations and applications for Rounds 1 to 4 of the M & E program and consideration of the gaps identified through the 2010 Victorian SWIMP.

The objective of the Gap report is to;

- Link M&E funded projects undertaken in rounds 1, 2 and 3, and those projects currently being undertaken in round 4, with **themes** as defined in the round 4 funding guidelines and **gaps** as defined in the 2010 Victorian SWIMP
- Report on the extent to which gaps have been addressed **for individual organisations** through completion of specific M&E projects.
- Allow Victoria to take stock of data, network and system gaps and review the extent to which they have been addressed through M&E investment;
- Provide a structured, quantifiable way of highlighting areas where further investment is required to address outstanding gaps to assist individual organisations within Victoria when presenting their case for future funding programs, including Round 5 M&E; and
- Provide the Bureau with a means of demonstrating the value of the M&E program, consistent across jurisdictions.

### 4.9.1 M & E Program outcomes

To date the M & E Program has extended across 4 years and is anticipated to continue for one more year. In Victoria awareness of the intent and purpose of the program was poor in the early rounds of funding but as the Named Persons became aware of the programs value and benefits engagement in it increased. The program has now reached a level of maturity whereby the outcomes and value are clearly identifiable.

One example of this is the results from a study into the benefits of Acoustic Doppler instrumentation (including velocity meters and current profilers) purchased through the M & E Funding. That study has identified substantial improvements in both the accuracy of flow measurements and confidence in the data derived. Concurrently Operator safety has been substantially enhanced. Additionally the introduction of Acoustic Doppler Velocity Meters leads to substantial reductions in the cost of obtaining flow measurements, (particularly at high flow,) This is but one example of the benefits of the program but, unfortunately, the funding initiatives are achieving substantial benefits at a time when funding is coming to an end.

The Gap analysis presented herein indicates many more opportunities exist in Victoria to further enhance the accuracy and efficient transfer of real-time data to the internet, but, further funding would be required.

The following summarises the benefits to Victoria arising from funding during the first four years of the program;

- Project applications have exceeded 115
- 14 out of Victoria's 52 named persons organisations have received funding (Note: Victoria's Regional Water Monitoring Partners, comprised of 43 individual agencies, have also participated in bids lead by the Department of Sustainability and Environment)
- Approximately 70 bids have been funded (22 were DSE lead)
- \$9.7 Million have been provided to Victoria through the M & E program
- 51 gaps were identified in the 2010 Victorian SWIMP. These spanned 6 of the water information categories.

#### 4.9.2 Funding Theme Allocations.

The major portion (82%) of the Victorian agencies bids focused on the two Themes numbers 1 (Improving the accuracy of existing water information) & 4 (Improving water data management procedures.) This suggests that the major focus in Victoria has been on upgrading capital equipment to improve the accuracy and currency of water information and to ensure that the data derived is efficiently and effectively transferred to the Bureau in useable formats.

Similarly the survey indicates that, although funding has provided valuable improvements to the Victorian Hydrologic systems, there are still many gaps to be addressed. Analysis of Theme 1 and 4 gaps indicated that they are only 58% closed.

Figure 5. M & E Project funding

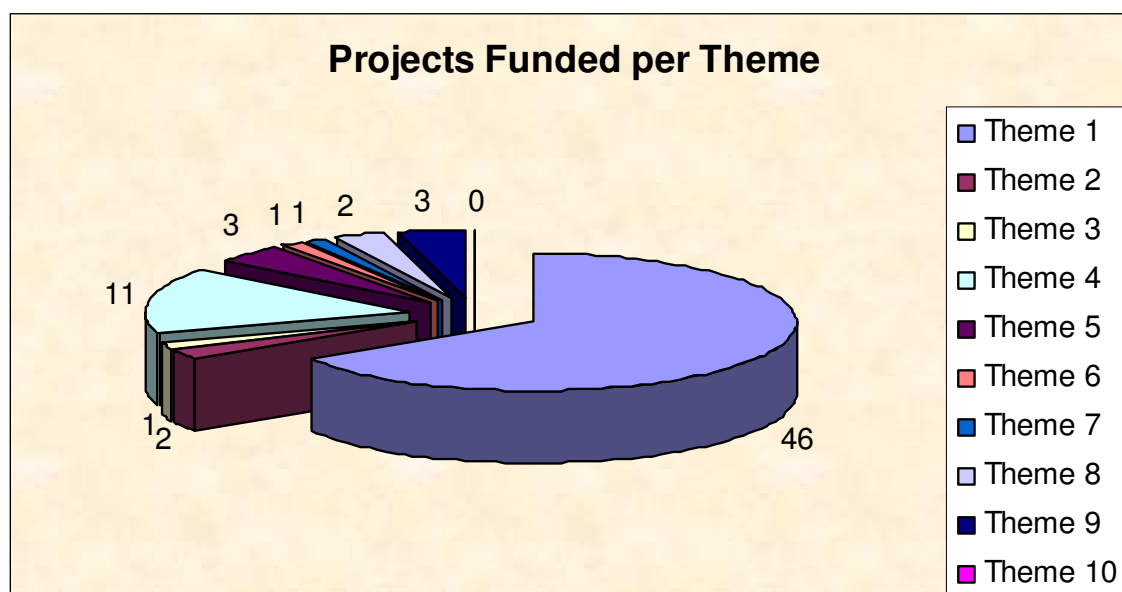




Table 4 sets out the number of gaps addressed through M & E Funding program and the funded organisations estimation of the closure of that gap. The organisational name highlighted in yellow indicates those who responded to the survey and the figure highlighted in blue in the “Total Number funded” column indicates those organisations that have received funding but did not provide any feedback about their funding outcomes.

[illegible]

#### 4.9.4 Networks and Systems Gaps closures

In Victoria, 51 Gaps were identified in the effective collection of high quality fit for purpose water information. A number of those gaps have been addressed through the M & E funding program but many others have not yet been addressed.

Table 6 to Table 13 list the gaps and provide a broad subjective overview of the effectiveness of individual funding programs. Where numbers in the right hand column are highlighted in blue it indicates no response was received from the successful proponent and hence analysis of those benefits were not possible

**Table 5. M & E funding for Theme 1,Gaps 1-7**

Theme 1. Improving the accuracy of existing water storage measurement, stream flow, groundwater, meteorological, and water quality networks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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**Table 6 M & E funding for Theme 2,Gaps 9-11**

Theme 2. Installation of telemetry									
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects					
				Number of projects which fully addressed gap for the funded organisation(s), >75% closed	Number of projects which part addressed gap for the funded organisation(s), 50-75% closed	Number of projects which part addressed gap for the funded organisation(s), 25-50% closed	Number of projects which part addressed gap for the funded organisation(s), <25% closed		
9	Category 1- Surface Water. Inadequate Telemetry coverage to provide the necessary operational information	0	0						
10	Category 2-Groundwater. Inadequate Telemetry coverage to provide the necessary operational information	2	2						
11	Category 4 Meteorology. Existing telemetry systems are unsuitable for new IP instrumentation.	0	0						

**Table 7. M & E funding for Theme 4, Gaps 36-39**

Theme 4. Installation of software, upgrading of existing data management systems or purchase and installation of new data management systems to improve water data (and metadata) management procedures within organisations.																																													
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects																																									
				Number of projects which fully addressed gap for the funded organisation(s), >75% closed										Number of projects which part addressed gap for the funded organisation(s), 50-75% closed										Number of projects which part addressed gap for the funded organisation(s), 25-50% closed										Number of projects which part addressed gap for the funded organisation(s), <25% closed											
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		
	Category -All. Lack of standard approaches to data transfer amongst named persons																																												
36		8	16																																										
37	Category 5- Water Use Information. Inadequate SCADA network coverage	0	0																																										
38	Category 6- Rights, Allocations and Trades. Lack of an effective method for delivery of formal announcements of water allocations to the Bureau.	0	0																																										
39	Category 7- Urban Water Management. Inefficient data handling and transfer processes are impinging named persons ability to meet the Bureau delivery requirements.	3	9																																										

Section C: An assessment and statement of gaps, issues and opportunities in existing Victorian water information and monitoring investment and systems.

**Table 8. M & E funding for Theme 5, Gaps 40 & 41**

Theme 5. Recovery or rescue of water information, including metadata, of demonstrated strategic value to the Bureau's purposes that is at risk of imminent loss due to its condition, storage status and/or the future lack of staff to interpret it or undertake its recovery.																																													
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects																																									
				Number of projects which fully addressed gap for the funded organisation(s), >75% closed										Number of projects which part addressed gap for the funded organisation(s), 50-75% closed										Number of projects which part addressed gap for the funded organisation(s), 25-50% closed										Number of projects which part addressed gap for the funded organisation(s), <25% closed											
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		
40	Category 2-Groundwater. Preservation of old (particularly paper based) groundwater data.																																												
		2	5																																										
41	Category 9- Water Quality. Preservation of old (particularly paper based) water quality data	1	2																																										

**Table 9. M & E funding for Theme 6, Gaps 43**

Theme 6. Improving the Australian Hydrologic Geospatial Fabric's (AHGF) national surface water foundation data set by the population of compatible geo-databases.																																															
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects																																											
				Number of projects which fully addressed gap for the funded organisation(s), >75% closed										Number of projects which part addressed gap for the funded organisation(s), 50-75% closed										Number of projects which part addressed gap for the funded organisation(s), 25-50% closed										Number of projects which part addressed gap for the funded organisation(s), <25% closed													
	Category 1- Surface Water.			1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10				
43	Inadequate geospatial definition of Surface Water points	1	1																																												

**Table 10. M & E funding for Theme 7, Gaps 44**

Theme 7. Improving the Australian Hydrologic Geospatial Fabric's (AHGF) national foundation groundwater data set.																																															
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects																																											
				Number of projects which fully addressed gap for the funded organisation(s), >75% closed										Number of projects which part addressed gap for the funded organisation(s), 50-75% closed										Number of projects which part addressed gap for the funded organisation(s), 25-50% closed										Number of projects which part addressed gap for the funded organisation(s), <25% closed													
	Category 2-Groundwater. Inadequate geospatial definition of Groundwater points			1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10				
44		1	1																																												

**Table 11. M & E funding for Theme 8, Gaps 42**

Theme 8. Participating in the cooperative planning and production of the National Water Account (NWA).																																															
				Number of M&E funded projects																																											
		Total Number of funded projects	Total number of project applications submitted	Number of projects which fully addressed gap for the funded organisation(s), >75% closed										Number of projects which part addressed gap for the funded organisation(s), 50-75% closed										Number of projects which part addressed gap for the funded organisation(s), 25-50% closed										Number of projects which part addressed gap for the funded organisation(s), <25% closed													
Gap ref. #	Gap			1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10				
	Categories 1, 2,3,4,5 & 9 Misalignment of data published in Victorias annual Water Accounts and the Bureaus National Water Account																																														
42		2	2																																												

**Table 12. M & E funding for Theme 9**

Theme 9. Engagement of Strategic Water Information Coordinators.																																															
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects																																											
				Number of projects which fully addressed gap for the funded organisation(s), >75% closed										Number of projects which part addressed gap for the funded organisation(s), 50-75% closed										Number of projects which part addressed gap for the funded organisation(s), 25-50% closed										Number of projects which part addressed gap for the funded organisation(s), <25% closed													
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10				
	Ongoing Strategic Water Information Coordination between Bureau and Victorian water agencies	3	3																																												

Section C: An assessment and statement of gaps, issues and opportunities in existing Victorian water information and monitoring investment and systems.

**Table 13. M & E funding for Theme 10, Gaps 45-51**

[illegible]

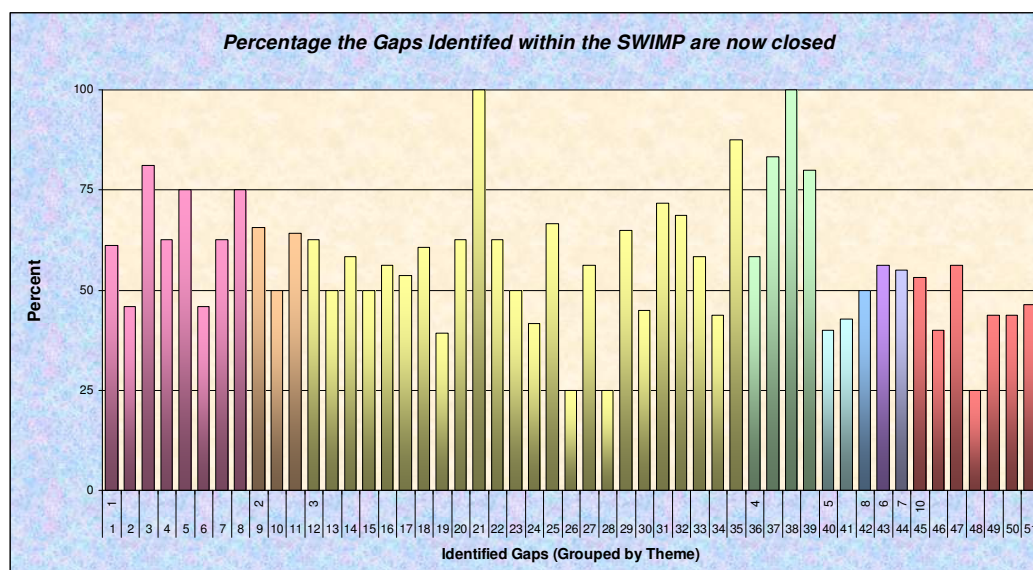
#### 4.9.5 Further investment needs

Whilst the following graph indicates the percentage by which the Victorian water monitoring agencies believe the gaps have been closed it also indicates that more investment is required. A further infusion of funds across all Themes would improve the currency, accuracy and confidence levels for all data being forwarded to the Bureau and ensure the provision of high quality, fit for purpose data.

Ideally, a targeted gap closure exceeding 75% for each of the high and moderate priority gaps identified within the Victorian SWIMP 2010 should be the target.

Gaps 1, 2, 4, 5, 7, 9, 19, 11, 12, 13, 14, 17, 18, 20, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50 and 51 are currently below that target. This identifies 66% of the gaps identified within the 2010 Victorian SWIMP require further investment.

### Figure 6. Gaps closure in Victoria



#### 4.9.6 Benefits derived from the M & E Funding

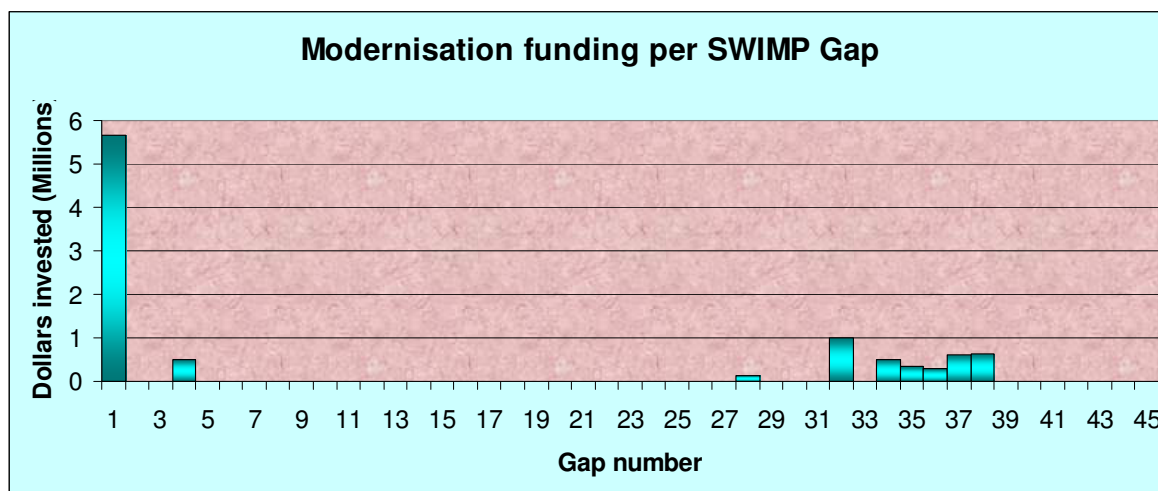
The M & E program has been invaluable in ensuring that Victoria can better meet its obligations in collecting high quality, fit for purpose water information. All agencies within Victoria gratefully acknowledge the Federal Governments financial support and the Bureau of Meteorology's administration of the Modernisation and Extension of Hydrologic Services Programme.

The following tables provide insight into the patterns of funding sought and received across the ten funding themes and fifty-one gaps identified by Victorian agencies.

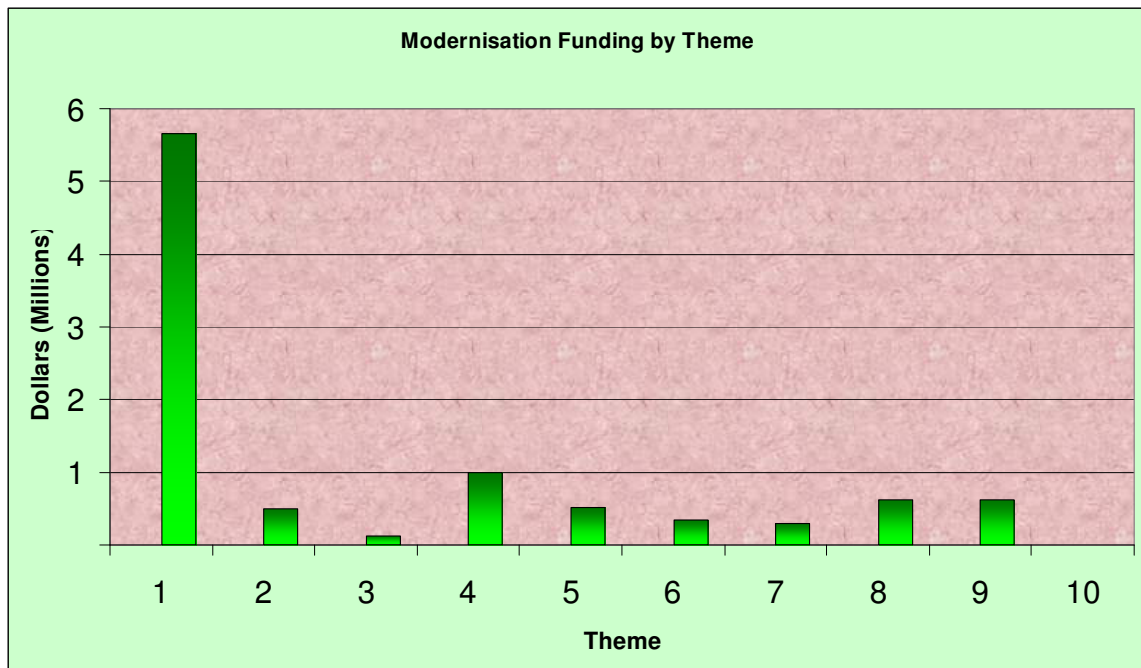
The major component of funding was sought within, and provided through Theme 1 which encompassed gaps 1 to 8 and Theme 4 which encompassed gaps 36 to 39 within the 2010 Victorian SWIMP.

Only one gap now remains to be adequately closed within Theme 4 (i.e. 36. Standardised methodologies for data transfer to the Bureau are not available). Following a Bureau request, this will be addressed through a DSE Round 5 bid targeted at ensuring data is provided to the Bureau in Water Data Transfer Format. However the remaining Themes all require substantial investment to ensure their acceptable closure.

Figure 7. Victorian M & E Funding allocation per SWIMP gap.



**Figure 8. M & E Funding per Theme.**



## 5 Section D: A description of priorities, strategies and recommended actions

### 5.1 Key Priorities for Investment in the 2011 – 2012 Monitoring and Extension of Hydrologic Systems Program

This version of the Victorian SWIMP represents the completion of a two year project targeted at informing the Bureau's investment through the administration of the federal, competitive Modernisation and Extension of Hydrologic Systems Program (M&E fund). A comprehensive list of gaps, issues and opportunities in water information and monitoring investment and systems has been established through consultation with all organisations required to deliver water information under the federal *Water Act 2007*. The recommended actions presented in this section of the SWIMP aim to address the specific information gaps and issues described in Section C. All of the recommendations were discussed at each of the information sub-category workshops and represent the requirements of the organisations named in the federal legislation who participated in those workshops. Workshop participants rated the importance of each action according to the broad criteria outlined in Table 14. Not all actions were required by all participants, but there was broad agreement on the relative priorities for each information category.

**Table 14: Priority rating table for actions discussed in information category workshops**

	High – Necessary to ensure continued provision of data required by the Bureau or substantially improves the quality/certainty of data that serves significant business drivers for multiple organisations.
	Moderate – Improves the quality/certainty or extent of data collected and delivered to the Bureau, but only addresses business drivers for a small proportion of named persons.
	Low – Improves quality/certainty of data for some named persons, but likely to be expensive and should only be implemented if higher priority actions have been addressed.

The funding themes for the M&E Funds in 2011 are:

Theme 1: Data collection & Telemetry

Theme 2: Coordination Activities

Theme 3: Collating and Reporting water information

Theme 4: Spatial data

Theme 5: Developing the National Groundwater Information System

Theme 6: Data management, processing and transfer.

Recommended actions identified during the SWIMP workshops that align with one or more of these M&E funding themes for 2011 – 2012 are presented in Table 15 along with a suggested timeline for implementation. Those actions constitute a program that is realistic, structured and achievable within the resourcing and scheduling limitations of the Victorian jurisdiction.

It is expected that targeted M&E investment in the areas outlined in Table 15 will lead to:

- Improvements in data mapping to allow for streamlined data provision to the Bureau from Victorian organisations named in the Regulations;
- Updated water resource accounting rules to reflect the reconfiguration and expansion of Victoria's water supply network;
- Availability of data extract tools to allow for streamlined and customised water entitlement information to be extracted from Victoria's Water Register as part of development of the National Account;
- Improvements in data collection and reduction in uncertainty around data through upgrades in monitoring infrastructure, in particular instrumentation and data transfer from sites, and long-term, sustainable network design.
- Improvements to the underlying hydrological spatial layer for Victoria to allow for improved reporting and spatial presentation of water resources;
- More effective and responsive compliance with obligations arising from Victoria's water resources assessment program and arising from the Act regarding provision of water information;
- Improved information provision to the Bureau of Meteorology as a result of improved search and retrieval functionality to existing information sources;
- Continued capability in the water monitoring, accounting and reporting field to support improved reporting on the state of Victoria's water resources.



Section D: A description of priorities, strategies and recommended actions

Table 15 Victorian Jurisdictional Water Information Indicative Investment Priorities for the Modernisation and Extension of Hydrologic Systems Program 2011 – 2012.									
Information Category	Gap/issue	Strategic action	Bureau Theme Number	Priority	Timing (Years 2010 – 2014)				
					2010	2011	2012	2013	2014
Theme 1 – Improving the accuracy of water monitoring									
Category 1 – Surface water	1. Obsolete monitoring equipment or infrastructure can impact on the data accuracy at monitoring sites.	Action 1: Identify aged or obsolete equipment and infrastructure affecting data accuracy.  Action 2: Implement a program for instrument and infrastructure upgrade.	1	High	X	X	X		
Category 2 – Groundwater	2. Obsolete monitoring equipment or infrastructure can impact on data accuracy at monitoring sites.	Action 1: Identify aged or obsolete equipment and infrastructure affecting data accuracy.  Action 2: Implement a program for instrument and infrastructure upgrade.	1	High	X	X	X	X	X

Section D: A description of priorities, strategies and recommended actions

<b>Table 15 Victorian Jurisdictional Water Information Indicative Investment Priorities for the Modernisation and Extension of Hydrologic Systems Program 2011 – 2012.</b>									
<b>Information Category</b>	<b>Gap/issue</b>	<b>Strategic action</b>	<b>Bureau Theme Number</b>	<b>Priority</b>	<b>Timing (Years 2010 – 2014)</b>				
					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 3 – Major and minor storages	3. Current data capture and data delivery processes are unable to meet the frequencies required by the Bureau.	Action 1: Increase the number of storages where level and volume information is recorded on a SCADA system.  Action 2: Upgrade and automate the data collection and transfer systems.  Action 3: Improve the accuracy, precision and reliability of automated monitoring equipment at some sites.	1	High	X	X			
	4. Storage capacity tables must be reviewed to ensure they are accurate.	Action 1: Upgrade Bathymetric surveys and storage capacity curves at any storage not surveyed in the last 30 years and for any other storage where storage capacity curves are suspected of being inaccurate.	1	High	X	X			
	5. Level datum at storages require standardising.	Action 1: Convert all storage references to an AHD standard.	1	High	X	X	X		

Section D: A description of priorities, strategies and recommended actions

<b>Table 15 Victorian Jurisdictional Water Information Indicative Investment Priorities for the Modernisation and Extension of Hydrologic Systems Program 2011 – 2012.</b>									
<b>Information Category</b>	<b>Gap/issue</b>	<b>Strategic action</b>	<b>Bureau Theme Number</b>	<b>Priority</b>	<b>Timing (Years 2010 – 2014)</b>				
					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 4 – Meteorology	6. Evapotranspiration (ETo) data is required in real-time to improve irrigation management.	Action 1: Develop automated data transfer from weather stations at strategic locations to provide cumulative daily ETo (updated at hourly intervals).	1	Low		X	X	X	X
Category 6 – Rights, allocations and trades	7. Improved monitoring of water held in or harvestable from small storages is required.	Action 1: Review the information gaps in permits to operate minor storages.  Action 2: Identify where there are large gaps in the information such as the location and the maximum permissible volume of the storage, and then implement a project to obtain this data.	1	High		X	X	X	X
Category 7 – Urban water management	8. The locations of current inflow and outflow monitoring points for urban water diversions require reviewing and resiting to improve the accuracy of the flow data obtained.	Action 1: Install new meters or relocate meters to appropriate locations.	1	Moderate		X	X	X	

Section D: A description of priorities, strategies and recommended actions

Table 15 Victorian Jurisdictional Water Information Indicative Investment Priorities for the Modernisation and Extension of Hydrologic Systems Program 2011 – 2012.									
Information Category	Gap/issue	Strategic action	Bureau Theme Number	Priority	Timing (Years 2010 – 2014)				
					2010	2011	2012	2013	2014
Theme 2: Installation of Telemetry									
Category 1 – Surface water	9. Telemetry coverage may fail to provide the necessary operational information.	Action 1: Review the existing telemetry coverage in Victoria and identify gaps within the networks.  Action 2: Install additional telemetry at locations identified through the review.	2	Moderate		X	X	X	
Category 2 – Groundwater	10. Telemetry coverage may fail to provide the necessary operational information.	Action 1: Review the existing telemetry coverage in Victoria and identify gaps within the networks.  Action 2: Install additional telemetry at locations identified through the review	2	Moderate		X	X	X	

Section D: A description of priorities, strategies and recommended actions

<b>Table 15 Victorian Jurisdictional Water Information Indicative Investment Priorities for the Modernisation and Extension of Hydrologic Systems Program 2011 – 2012.</b>									
<b>Information Category</b>	<b>Gap/issue</b>	<b>Strategic action</b>	<b>Bureau Theme Number</b>	<b>Priority</b>	<b>Timing (Years 2010 – 2014)</b>				
					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 4 – Meteorology	11. Existing telemetry systems are incompatible with IP instrumentation.	Action 1: Review all sites and determine where optimal reporting technologies are not installed.  Action 2: Replace telemetry where identified.	2	Moderate		X	X		
<b>Theme 3: Extending the coverage of monitoring networks</b>									
Category 2 – Groundwater	12. The Victorian Groundwater network is inadequate.	Action 1: Identify areas where new bores are required or existing bores need to be repaired or retired.  Action 2: Commence a prioritised program of upgrading bores as identified in action 1.	3	High	X	X	X	X	X

Section D: A description of priorities, strategies and recommended actions

<b>Table 15 Victorian Jurisdictional Water Information Indicative Investment Priorities for the Modernisation and Extension of Hydrologic Systems Program 2011 – 2012.</b>									
<b>Information Category</b>	<b>Gap/issue</b>	<b>Strategic action</b>	<b>Bureau Theme Number</b>	<b>Priority</b>	<b>Timing (Years 2010 – 2014)</b>				
					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
	13. The Victorian Groundwater water quality monitoring requires upgrading	Action 1: Increase monitoring of nutrients, pH, ions and isotopes at strategic locations (to be determined) throughout the State to provide a baseline against which future changes can be assessed.	3	High	X	X	X	X	
	14. Groundwater extraction places environmental assets at risk through inadequate monitoring	Action 1: Assess where the potential for increased groundwater extraction to adversely impact high value environmental assets, such as wetlands and other groundwater dependent ecosystems, exists.	3	Moderate			X	X	
	15. Gaps in the State operated groundwater monitoring require data input from private bore owners	Action 1: Identify private bore owners who are prepared to measure levels in their bores, in addition to the extraction volumes they currently measure, and provide that data.	3	Low				X	X

Section D: A description of priorities, strategies and recommended actions

<b>Table 15 Victorian Jurisdictional Water Information Indicative Investment Priorities for the Modernisation and Extension of Hydrologic Systems Program 2011 – 2012.</b>									
<b>Information Category</b>	<b>Gap/issue</b>	<b>Strategic action</b>	<b>Bureau Theme Number</b>	<b>Priority</b>	<b>Timing (Years 2010 – 2014)</b>				
					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 3 – Major and minor storages	16. Inadequate information is available on small storages (less than 100 ML capacity) and their impact on catchment yield.	Action 1: Identify those minor or small storages for which level and/or volume data are not recorded.  Action 2: Introduce monitoring at small storages which are located within catchments that have many small storages that are not currently monitored.	3	Low				X	X
Category 4 – Meteorology	17. The current number of meteorologic operational sites, (including those which are used as flood warning sites) are inadequate.	Action 1: Review the current coverage and determine where additional sites are required to establish a comprehensive Statewide network.  Action 2: Automate and telemeter the existing and upgraded network where practicable.	3	High		X	X		

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
	18. Insufficient rain gauges exist to meet the flood warning and meteorologic needs of Victoria.	<p>Action 1: Review the number and spatial distribution of rainfall gauge sites to determine the optimal requirements to meet state needs.</p> <p>Action 2: Identify the best locations for new monitoring sites, or the need to upgrade existing rain gauge monitoring sites to either polled, event based or repeater sites.</p> <p>Action 3: Install new monitoring sites, or upgrade existing rain gauge monitoring sites to either polled, event based or repeater stations as identified through reviews.</p>	3	High	X	X	X		
	19. Evaporation pan coverage is inadequate	Action 1: Install Class A evaporation pans where there is a need to increase numbers particularly at or near storages.	3	Low			X	X	



Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 5 – Water use information	20. There is inadequate data available to define the implications for changes in catchment yields as a consequence of unmetered farms dams	<p>Action 1: Investigate the impact of farm dams in catchments where they have the potential to account for a significant proportion of the total water used.</p> <p>Action 2: Determine the number and volume of farm dams in each sub-catchment and their harvest capacity at different times of the year.</p> <p>Action 3: Develop an inventory of these and other unlicensed and unmetered dams to determine the potential impact they have on water resources.</p>	3	High	X	X	X		

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
	21. The number of existing monitoring points within the Water Use Information category are inadequate.	Action 1: Review the location of existing monitoring points to determine optimal locations.  Action 2: Establish a prioritised monitoring point upgrade program.  Action 3: Increase the coverage of water monitoring at channel outfalls.	3	High	X	X			
	22. Self extraction from Groundwater and Surface water sources requires improved monitoring.	Action 1: Improve the collection and collation of water information from Groundwater and Surface Water self extraction points.	3	Low			X	X	X
Category 6 – Rights, allocations and trades	23. Knowledge about how much water is used or potentially used from farm dams and the impact this may have on catchment yields for major storages needs improving.	Action 1: Obtain better estimates on how much water is used and how much water could potentially be used from unlicensed farm dams.	3	Low		X	X	X	X

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
	24. There is currently inadequate information and metadata about private extraction groundwater bores.	<p>Action 1: Collect improved information about groundwater use in Victoria to assist with identifying which aquifers are being accessed and the location, coverage and spatial extent of the groundwater network.</p> <p>Action 2: Prioritise permit areas and identify the gaps in coverage of groundwater bore location, permitted depth, and the maximum permissible extraction volume.</p> <p>Action 3: Assess data entry priorities based on the latest information and progressively make data and metadata available electronically to the national water database (with guidance from the Bureau).</p>	3	Low			X	X	X

Section D: A description of priorities, strategies and recommended actions

<b>Table 15 Victorian Jurisdictional Water Information Indicative Investment Priorities for the Modernisation and Extension of Hydrologic Systems Program 2011 – 2012.</b>									
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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
	25. Improved metadata and data is required from private extractions points along watercourses.	Action 1: Identify the location of current self extraction points for each licence.  Action 2: Obtain more detailed information about the locations of the extraction points to understand better which sustainable diversion limit area the extraction is in for trading purposes.	3	Low			X	X	X
Category 7 – Urban water management	Water Management  26. Stormwater discharges are not adequately monitored.	Action 1: Identify strategic locations for installing stormwater discharge monitoring.  Action 2: Develop and implement plans for the installation of new monitoring equipment.	3	Moderate		X	X		

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
	27. Monitoring points require reviewing to ensure high quality water information is obtained.	Action 1: Undertake strategic reviews of the effectiveness of existing monitoring points.  Action 2: Develop and implement plans for the installation of new monitoring equipment.	3	Moderate		X	X		
	28. Current monitoring does not cover artificial recharge of groundwater. This is an emerging issue.	Action 1: Identify strategic locations for installing recharge monitoring.	3	Moderate		X	X		
	29. There is inadequate monitoring of alternate sources of non-potable water supply.	Action 1: Monitor critical alternative non-potable discharges to watercourses or marine environments.	3	Moderate			X	X	
	30. Current monitoring does not adequately capture use of alternative water sources (e.g. rainwater tanks, grey water recycling.)	Action 1: Undertake a scoping study of ways to gain a better understanding of alternative water use and develop systems for monitoring this use.	3	Moderate			X	X	

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 9 – Water quality	31. The network coverage of water quality monitoring sites does not capture sufficient data.	<p>Action 1: Determine the criteria to be used to decide which sites are retained and where new sites are needed.</p> <p>Action 2: Complete a review on the suitability of locations of current VWQMN monitoring points.</p> <p>Action 3: Develop and implement plans for the installation of new monitoring points.</p>	3	High	X	X			
	32. Useful Water Quality data available from alternate sources has been overlooked by the existing Water Act.	Action 1: Migrate all Waterwatch data into a centralised Database.	3	Moderate		X	X		

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
	33. The network coverage of Groundwater water quality monitoring sites does not capture sufficient data	Action 1: Increase the frequency of monitoring of nutrients, pH, ions and isotopes at strategic groundwater locations (to be determined) throughout the State and provide a baseline against which future changes can be assessed.  Action 2: Identify the required spatial coverage, of groundwater water quality monitoring and upgrade or add additional sites in priority areas.	3	High	X	X	X		
	34. There is insufficient monitoring equipment available to meet short-term event based monitoring.	Action 1: Purchase a pool of water monitoring equipment that can be made available to any named person for event based (short term) monitoring.	3	High		X	X		
	35. Adequate monitoring of water quality at raw water off-take points to water treatment plants is unavailable.	Action 1: Increase the extent and frequency of turbidity monitoring at raw water off takes to water treatment plants.	3	Moderate		X	X		

Section D: A description of priorities, strategies and recommended actions

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Information Category	Gap/issue	Strategic action	Bureau Theme Number	Priority	Timing (Years 2010 – 2014)				
					2010	2011	2012	2013	2014
Theme 4: Improving data management and transfer									
Category 4 – Meteorology	36. Standardised methodologies for data transfer to the Bureau are not available	Action 1: Standardise the approach to data transfer.  Action 2: Develop a uniform data format system that can be used on different SCADA systems.	4	High	X	X			
Category 5 – Water use information	37. Water Use information Inadequate SCADA network coverage.	Action 1: Increase the number of water use and flow measurement sites on SCADA systems to increase the frequency of data collection and increase the accuracy of daily flow measurements.  Action 2: Develop systems for direct transmission of data to the Bureau at frequencies that meet or exceed those required under the Water Act.	4	High	X	X	X		



Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 6 – Rights, allocations and trades	38. The agreed method for delivery of formal announcements of water allocations to the Bureau requires refining.	Action 1: Seek approval from the Bureau for the named persons recommended action of dual delivery of the information when it is available by email or fax.	4	High	X	X			
Category 7 – Urban water management	39. Existing data handling and transfer processes impede the timely delivery of data to the Bureau.	Action 1: Develop common data handling and transfer protocols.	4	High	X	X			
<b>Theme 5: Rescue of Strategic data</b>									
Category 2 – Groundwater	40. Old records (particularly those on paper) require conversion to digital format.	Action 1: Convert paper based groundwater records to electronic format in the GMS.  Action 2: Capture and save data from obsolete Databases into a single database.	5	Low			X	X	X

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 9 – Water quality data	41. Old records (particularly those on paper) require conversion to digital format.	Action 1: Data from small projects in paper based databases and spreadsheets must be converted to electronic formats and into a common storage database.  Action 2: Recover old project data and convert to electronic format and store it in a common database	5	High		X	X		
<b>Theme 6: Improving the Australian Geospatial Fabric (surface water)</b>									
Category 1 – Surface water monitoring	42. Geospatial definition of Surface Water points require improvement.	Action 1: Assist the Bureau with its development of Geofabric.	6	High	X	X	X	X	X
<b>Theme 7: Improving the Australian Geospatial Fabric (groundwater)</b>									
Category 2 – Groundwater	43. Geospatial definition of Groundwater points require improvement.	Action 1: Develop a Victorian hydrogeological mapping database consistent with the NGIS.	7	High	X	X	X	X	X

Section D: A description of priorities, strategies and recommended actions

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Information Category	Gap/issue	Strategic action	Bureau Theme Number	Priority	Timing (Years 2010 – 2014)				
					2010	2011	2012	2013	2014
Theme 8: Improving the National Water Account									
Category 3 – Major and minor storages	44. Data published in Victoria's annual Water Accounts, the Bureau's National Water Account and the emerging National Water Accounting Standards can be misaligned and confusing.	Action 1: Liaise with the Bureau in an endeavour to align the reporting information.	8	Moderate		X			
Theme 9: Strategic Water Information Coordination									
All Categories	45. Lack of a coordinated approach to liaison between the Bureau and Named persons organisations may potentially impact on the flow of water information and testing of Bureau “products”	Action 1: Submit a funding bid in compliance with the identified requirements of the SWIC roles and tasks.	9	High	X	X	X	X	X
Theme 10: Water information standards									
Category 2 – Groundwater	46. A national standard is required for bore numbering and naming conventions and data collection	Action 1: Consult with other jurisdictions or the Bureau about the standards to be adopted.	10	High		X	X	X	X

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Category 3 – Major and minor storages	47. Collection and reporting of storage data requires a standardised process.	Action 1: Data reporting standards must be developed for the collection of major storage data on the transfer of water between major storages and reporting of dead storage.	10	Moderate		X	X	X	X
Category 5 – Water use information	48. Inconsistencies in National Metering standards create inconsistencies across data providers	Action 1: Assist the Bureau with developing a national set of standards.  Action 2: Upgrade monitoring points to comply with the adopted metering standards.	10	High	X	X			
Category 7 – Urban water management	49. Lack of a common language and definitions in water information have the potential to create confusion.	Action 1: Advocate the Bureau to take a lead role in coordination of the development of a common language and set of definitions.  Action 2: Support the Bureau development of a Water Information Dictionary.	10	High	X	X			

Section D: A description of priorities, strategies and recommended actions

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					<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
	50. Standard naming conventions and standards around data collection are required.	Action 1: Advocate the Bureau to take a lead role in coordination of the standards.	10	High	X	X			
Category 9 – Water quality	51. There is no standard tool for data storage and reporting.	Action1: Research and scope the most suitable platform (including quality assurance) for all named persons.  Action 2: Develop a standard tool for data storage for use across a number of named person organisations.	10	High	X	X	X		

## Appendix A – Acronym List

ABS	Australian Bureau of Statistics
ANRA	Australian Natural Resources Atlas
AWRC	Australian Water Resources Council
BE	Bulk Entitlement
CMA	Catchment Management Authority
DCNR	Department of Conservation and Natural Resources
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
DSBN	Dryland Salinity Bore Network (managed by DPI)
EWR	Environmental Water Reserve
FTP	File Transfer Protocol
GMA	Groundwater Management Area
GMID	Goulburn-Murray Irrigation District
GMU	Groundwater Management Unit
G-MW	Goulburn-Murray Water
GWMWater	Grampians Wimmera Mallee Water
M&E guidelines	Modernisation and Extension of Hydrologic Monitoring Systems Program guidelines
MDBA	Murray Darling Basin Authority
MDBC	Murray Darling Basin Commission
OWOF	Our Water Our Future
Named persons	Organisation named in the Water Regulations 2008
RWMP	Regional Water Monitoring Partnership
SFMP	Stream Flow Management Plan
SGMS	State Groundwater Monitoring Strategy
SKM	Sinclair Knight Merz
SOBN	State Observation Bore Network
SR&WSC	State Rivers and Water Supply Commission
SRW	Gippsland and Southern Rural Water Corporation
SWIMP	Strategic Water Information and Monitoring Plan
SWRA	Surface Water Resources Assessment
SWS	Sustainable Water Strategy

the Act	Commonwealth <i>Water Act 2007</i>
the Bureau	The Bureau of Meteorology
the Regulations	Water Regulations 2008
UA	Unincorporated Area (Groundwater)
VFWCC	Victorian Flood Warning Consultative Committee
VWQMN	Victorian Water Quality Monitoring Network
VWRDW	Victorian Water Resources Data Warehouse
WRAP	Water Resources Assessment Program
WSPA	Water Supply Protection Area

## Appendix B – References

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## Appendix C – ‘Named persons’ under the Commonwealth Water Act 2007

Section 126 of the Commonwealth Water Act (2007) requires organisations named in the accompanying regulations (Part 7, Division 7.2) to give the water information that they hold in their possession, custody or control to the Bureau within prescribed time periods from obtaining this information. The named persons are further grouped into categories, as identified below, with different delivery requirements of water information being relevant to different categories of ‘persons’.

1. AGL Hydro Partnership, VIC (Category C, Category H)
2. Alpine Shire Council, VIC (Category H)
3. Barwon Region Water Corporation (Barwon Water), VIC (Category D, Category F, Category H)
4. Benalla Rural City, VIC (Category H)
5. Central Gippsland Region Water Corporation (Gippsland Water), VIC (Category D, Category F, Category H)
6. Central Highlands Water, VIC (Category D, Category F, Category H)
7. City of Greater Geelong, VIC (Category H)
8. City West Water Limited, VIC (Category F)
9. Colac-Otway Shire Council, VIC (Category H)
10. Coliban Region Water Corporation (Coliban Water), VIC (Category D, Category F, Category H)
11. Corangamite Catchment Management Authority, VIC (Category G, Category H)
12. Department of Primary Industries, VIC (Category B)
13. Department of Sustainability and Environment, VIC (Category A, Category B, Category D, Category H)
14. East Gippsland Catchment Management Authority, VIC (Category G, Category H)
15. East Gippsland Region Water Corporation (East Gippsland Water), VIC (Category F, Category H)
16. East Gippsland Shire Council, VIC (Category H)
17. Environment Protection Authority, VIC (Category B, Category D)
18. Gippsland and Southern Rural Water Corporation (Southern Rural Water), VIC (Category D, Category E, Category H)
19. Glenelg Hopkins Catchment Management Authority, VIC (Category G, Category H)
20. Golden Plains Shire Council, VIC (Category H)
21. Goulburn Broken Catchment Management Authority, VIC (Category G, Category H)
22. Goulburn-Murray Rural Water Corporation (Goulburn-Murray Water), VIC (Category D, Category E, Category H)

23. Goulburn Valley Region Water Corporation (Goulburn Valley Water), VIC (Category D, Category F, Category H)
24. Grampians Wimmera Mallee Water Corporation (GWMWater), VIC (Category D, Category E, Category F, Category H)
25. Greater Shepparton City Council, VIC (Category H)
26. Hindmarsh Shire Council, VIC (Category H)
27. Horsham Rural City Council, VIC (Category H)
28. International Power (Australia) Pty Ltd, VIC (Category D)
29. Latrobe City Council, VIC (Category H)
30. Lower Murray Urban and Rural Water Corporation (Lower Murray Water), VIC (Category E, Category F, Category H)
31. Loy Yang Power, VIC (Category D)
32. Mallee Catchment Management Authority, VIC (Category G, Category H)
33. Melbourne Water Corporation (Melbourne Water), VIC (Category D, Category F, Category H)
34. Mitchell Shire Council, VIC (Category H)
35. Murrindindi Shire Council, VIC (Category H)
36. North Central Catchment Management Authority, VIC (Category G, Category H)
37. North East Catchment Management Authority, VIC (Category G, Category H)
38. North East Region Water Corporation (North East Water), VIC (Category D, Category F, Category H)
39. Parks Victoria, VIC (Category H)
40. Port Phillip and Westernport Catchment Management Authority, VIC (Category G)
41. Rural City of Wangaratta, VIC (Category H)
42. South East Water Limited, VIC (Category F)
43. South Gippsland Region Water Corporation (South Gippsland Water), VIC (Category D, Category F)
44. Strathbogie Shire Council, VIC (Category H)
45. Surf Coast Shire Council, VIC (Category H)
46. Wannon Region Water Corporation (Wannon Water), VIC (Category D, Category F)
47. Wellington Shire Council, VIC (Category H)
48. Westernport Water, VIC (Category F)
49. Western Water, VIC (Category F)
50. West Gippsland Catchment Management Authority, VIC (Category G, Category H)
51. Wimmera Catchment Management Authority, VIC (Category G, Category H)

- 52. Yarra Valley Water Limited, VIC (Category F)
- 53. Yarriambiack Shire Council, VIC (Category H)

Once the Act and Regulations came into effect, further communications between 'named persons' and the Bureau took place through an exchange of "Letters of Understanding", which identified the actual categories and sub-categories of water information held, and hence required to be delivered by each organisation.

Given the differences in water resource management between jurisdictions in Australia, it was not surprising that some organisations identified in the Act did not hold any of the required water information and hence the SWIMP and the M&E program were not of relevance to their business.

## **Appendix D – Organisations that are partners in Victoria’s four Regional Water Monitoring Partnerships**

- Alpine Shire
- Barwon Water
- Benalla Rural City
- Bureau of Meteorology
- City of Greater Shepparton
- Coliban Water
- Corangamite Catchment Management Authority
- Department of Primary Industries, VIC
- Department of Sustainability and Environment, VIC
- East Gippsland Catchment Management Authority, VIC
- East Gippsland Shire Council
- East Gippsland Water
- Environment Protection Authority
- Gippsland Water
- Glenelg Hopkins Catchment Management Authority
- Goulburn-Broken Catchment Management Authority
- Goulburn-Murray Water
- Goulburn-Murray Water for and on behalf of the Murray Darling Basin Commission
- Grampians Wimmera Mallee Water
- International Power (Australia) Pty Ltd, VIC
- Latrobe City
- Lower Murray Water
- Loy Yang Power, VIC
- Mallee Catchment Management Authority
- Melbourne Water
- Mitchell Shire
- Murrindindi Shire
- North Central Catchment Management Authority
- North East Catchment Management Authority
- North East Water

- Parks Victoria
- Rural City of Wangaratta
- Shire of Strathbogie
- South Gippsland Water
- Southern Rural Water
- TRUenergy
- Wannon Region Water Corporation
- Wellington Shire
- Westernport Water, VIC
- West Gippsland Catchment Management Authority
- Wimmera Catchment Management Authority

## **Appendix E – Key state-wide groundwater monitoring networks**

### **State Observation Bore Network**

- Department of Sustainability and Environment
- Grampians Wimmera Mallee Water Corporation
- Goulburn Murray Water Corporation
- Southern Rural Water

### **Dryland Salinity Bore Network**

- Department of Primary Industries