

INDEPENDENT AUDIT OF QUEENSLAND NON-URBAN WATER MEASUREMENT AND COMPLIANCE

FINAL REPORT

Prepared by the Independent Expert Panel

23 March 2018

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23rd March 2017

Hon Dr Anthony Lynham MP
Queensland Minister for Natural Resources, Mines and Energy
1 William Street
BRISBANE QLD 4000

Dear Minister

Independent Audit of Queensland Non-Urban Water Measurement and Compliance

We are the Independent Expert Panel appointed to investigate and report on issues related to Queensland Non-Urban Water Measurement and Compliance.

We are pleased to attach for your consideration our report in response to the terms of reference. Based on a strategic audit, our report recommends actions by Queensland Government to alter and improve many aspects of Queensland's non-urban water management.

Amongst other findings, our report points out:

1. The excellent work being done in developing and establishing Water Plans for Queensland;
2. A series of deficiencies in current arrangements for measuring the take of water from supplemented and unsupplemented waters, and from overland flows;
3. An absence of appropriate water accounting and management control systems;
4. A deteriorating situation in relation to water metering and measurement including understaffing in technical and operational areas;
5. A weak enforcement and compliance culture leading to ineffective water management; and
6. The opportunity to tap into new technology to support real-time reporting of the take of water and proposes methods for identification and implementation of other appropriate scientific and technical advances.

The report makes a series of recommendations related to each aspect of improving governance and management of Queensland's non-urban water.

We would be pleased to make ourselves available to brief you further on the matters in the report Minister, and assist you in any way, should you so desire.

The Independent Expert Panel consider that it is worthy of special mention to you Minister, that we have received maximum cooperation from the DNRME staff and have been highly impressed by their efforts to assist our review.

Yours sincerely



Tim Waldron (Chair)



Prof Poh-Ling Tan



Ian Johnson

EXECUTIVE SUMMARY

The Queensland Government appointed an Independent Expert Panel (the Panel) to audit non-urban water measurement and compliance. Under the Terms of Reference the independent audit was to undertake a strategic review of Queensland's current non-urban water measurement and compliance framework including the regulatory arrangements which support water measurement and compliance.

IMPORTANCE OF WATER TO QUEENSLAND

Queenslanders who live in a greatly variable climate understand perhaps more than any other Australians that good management of water underpins key sectors in the economy and a sustainable environment. Water is valued for its ability to sustain ecosystems and for ecosystem services; its cultural and spiritual significance especially for Indigenous peoples; and for consumption in a range of urban and rural uses, including being a production factor in industry and agriculture. Many countries in the world extract more water annually than is recharged through their natural water cycles. This places extreme stress on water users and ecosystems. Over two decades ago, Australia's national water reform sought to avoid a water crisis by addressing sustainable water use.

It is timely to examine how Queensland's water reform has been implemented. Further to this, following investigative journalism that alleged serious water compliance issues in northern New South Wales, it was important that the Queensland Government initiated an independent review of non-urban water management for the whole of this state.

THREE CRITICAL AREAS

The Panel audited all aspects covered in the Terms of Reference. However, the Panel highlights three critical areas of importance that need to be addressed in a timely and integrated manner by the Queensland Government as part of a program of reform for water measurement and compliance. These issues are detailed later in the recommendations and in the body of the report. The recommendations' overall objective is to give Queenslanders the needed confidence that non-urban water is being measured and managed to a level commensurate with how highly we value water.

1. Introduce robust measurement and compliance governance

While overall governance for measurement and compliance requires improvement, this Audit notes that governance aspects relating to obligations, rules and limits are well developed within the water planning process and are significant strengths in the current arrangements.

The Audit identified areas with room for improvement including developing compliance objectives, determining measurement and implementing measurement. Areas with weakness and gaps included poor transparency, monitoring and enforcement functions.

Historically when water was a common resource, and its supply abundant, compliance was not an issue. However, in an age of increased competition for water, all water users need to clearly understand their rights and responsibilities under the law, and bear the consequences of breaching their obligations.

The Panel bears in mind that governance, risk assessment and compliance are interrelated and finds that the Department of Natural Resources, Mines and Energy (DNRME) as an organisation has not yet developed a culture across the whole of the organisation to ensure adherence to standards found in water plans. This is a common feature worldwide but it requires change. The current

compliance programme operates in a complex, uncertain environment, is greatly challenged from a capacity and resourcing standpoint, and lacks organisational uniformity.

The lack of reviews of enforcement and fragmented approach between resource operators and DNRME leads to a high level of discretion and inefficiency. Management focus on water compliance objectives is not given any priority at present. Compliance is not referred to explicitly within the corporate plan, nor is it explicitly identified in personal performance plans of senior executives or their periodic reviews.

Leadership of DNRME is required to develop and drive a stronger culture towards enforcement, and empower the organisation and staff to achieve water management and compliance objectives. This is considered so serious that the Panel recommends the establishment of a Compliance Management and Review Group to review and report regularly to senior management. Additionally, it is considered important to have a separation of duties between operational and compliance activities in order for the group to have clear focus on their responsibilities.

2. Implement a new policy for water metering

Introduced under the *Water Act 2000*, Queensland has one of the best water planning processes in Australia. Yet implementation of water plans, monitoring and measurement of water extractions from watercourses, lakes, aquifers and overland flow is not as accurate and reliable as it should be.

Stakeholders and the community recognise that measurement must be effective to ensure that water use accords with the conditions in water plans. Current standards (the Australian Standard AS4747 Meters for Non-Urban Water Supply) (AS4747) along with Queensland Guidelines for installing non-urban water meters exist, but installation and validation of these meters are not adhered to in practice, nor is there verification that meters have an acceptable degree of accuracy. Other inconsistencies exist with water metering standards and practices differing between supplemented and unsupplemented water.

The government decision in 2013 to change ownership of irrigation meters to farmers appears to have been short sighted and failed to foresee all consequences. This resulted in poor water measurement from many privately-owned meters; suppliers offering low cost inferior meters; and the opportunity for deceptive practices. These problems are exacerbated by the reduction of DNRME technical staff with meter expertise, and by the inadequate validation system.

The Panel vigorously debated as to whether alterations in stronger government control can be successful without government taking over ownership. The Panel is also aware that any change to the ownership model is disruptive and costly therefore any move away from the water entitlement holder ownership model must be well considered.

The Panel recommends a Queensland appropriate standard for meters, independent meter validation, checks on meter maintenance, and a uniform policy for metering for both supplemented and unsupplemented water. Further, the Panel proposes a 24 month plan to resolve the issue of ownership of meters, based on detailed examination of costs and benefits of various options, including public-private partnerships, and extensive community consultation.

3. Systems and Resourcing require urgent attention

The Panel finds that the above inadequacies of the current metering and compliance arrangements are principally due to outdated water information management systems and inadequate resourcing. Water use information is currently kept by regional staff in spreadsheets which are not consistently

managed throughout the state, and have limited head office oversight. Similarly, metering records are not efficiently kept. This is not an effective water accounting system.

Systems and resourcing investment are foundational to the implementation of the recommendations of this Audit. The investment in management systems and information systems needs to be a top priority for DNRME. Good performance and efficiency of delivering metering and compliance arrangements is dependent on addressing these systemic issues.

DNRME has a significant opportunity to improve the efficiency of metering and compliance activities to support Queensland's water management framework. Seizing this opportunity requires investment in management and information systems, and adjustment to the allocation of resources within DNRME.

AUDIT APPROACH

The Panel worked with DNRME to conduct a metering workshop, and held field inspections in the following six catchments and sub-catchment areas:

- Barron;
- Burnett;
- Condamine Balonne;
- Gowrie Oakey Creek;
- Logan; and
- Wet Tropics.

During field visits, the Panel took the opportunity to meet a range of stakeholders to gather further evidence and to discuss any relevant issues. The Panel acknowledges that stakeholder consultation was not extensive given time constraints and the scope of the Terms of Reference.

The Panel also received support from an independent research team to gather information from DNRME and undertake preliminary analysis.

REPORT CARD

The Panel used a report card with a traffic light system to illustrate findings of areas of strength (green), those which need some improvement (amber) and that which have major weakness and gaps (red). Based on this, the diagram below assesses key components relating to water measurement and compliance.



KEY FINDINGS

The key findings of the Audit are summarised below. The body of this report expands on the issues identified and provides further discussion.

Governance, culture and transparency need improvement

The Audit identified that well-developed water planning arrangements are in place, based on best available science, community engagement and clear processes. However, the governance arrangements associated with water measurement, monitoring and compliance of non-urban water use in Queensland lack robustness, completeness and transparency.

The issues identified include a lack of management systems and documentation, some inconsistencies in practices across the regions and water user groups, inadequate review processes and lack of transparency. Different practices apply to supplemented and unsupplemented water extractions.

A lack of transparency hinders information sharing and the development of a strong compliance culture, both within DNRME and with water entitlement holders. Greater transparency leads to stronger accountability as the actions of stakeholders are more visible and placed under stronger

scrutiny. A better-informed community including water entitlement holders leads to stronger awareness and self-compliance.

Measurement and reporting requires significant improvement

Queensland's use of technology in non-urban water measurement and monitoring activities is immature. DNRME should consider the best available technological solutions to assist in measurement and compliance arrangements. Significant opportunities exist to modernise systems and the meter fleet and to introduce more frequent and reliable gathering of data.

DNRME manages its hydrometric network to the international standard ISO 9001 Quality Management Standard. Consultation with stakeholders identified that more gauging stations should be installed. The Panel suggest that the good work started with developing ISO standards for measurement should now be extended to the much larger issue of meter installation, validation, testing and reporting.

The Panel found issues with record keeping and poor capability of data systems to report fundamental information. Doubt emerged whether all water entitlements that required metering under the law, did have a meter installed. This may have been a problem with the data provided by DNRME or related to the poor availability of information. More importantly, water use information was recorded using separate spreadsheet systems kept by each region and core data was often not available at a state level.

The availability of this information can lead to holistic water balance reporting which shows the total water available and how it is allocated across the different water user groups including the environment. Currently water balance reporting is not available and it would be valuable for water planning and investment purposes and to inform the community and industry of the availability of water to maximise its economic value.

Water harvesting and overland flow measurement

Queensland has made strong progress in the measurement of overland flow in the Lower Balonne area. However, in other areas of the state such as the Border Rivers area, it is not possible at the moment to accurately and reliably measure overland flow and water harvesting.

Improvement opportunities exist in the measurement of water harvesting and overland flow by utilising either technology, such as satellite imagery and drones, as well as well researched measurement methodologies for overland flow. Large volumes are associated with this type of water extraction and it is important to improve measurement.

Required investment

The indicative analysis of the resourcing requirement suggests that an additional \$17 million per year in annualised cost would be required to implement the recommendations made for the unsupplemented meter fleet and to gain the assurance and compliance changes needed. Five alternative cases to bring about changes needed are documented in the report, and all have an increased annualised cost. The final costs would depend on the standard and extent of metering and assurance adopted and whether supplemented water extractions are included. No assumptions have been made about whether these costs are to be recovered from entitlement holders.

Recognition of staff dedication

Throughout this report the Panel has identified systemic issues which have developed over a long period of time. They are not just pertinent to Queensland but are intrinsic problems facing the water

industry throughout Australia. While this could be misinterpreted as being the consequence of DNRME officers failing in their responsibilities, this is not the case.

The Panel met with staff who have shown diligence in difficult circumstances and are aware of and have helped identify these issues. Some DNRME officers demonstrated an outstanding commitment in helping to achieve the objectives of their work and the objectives of this Audit.

It will take decisive leadership to invest in a change of institutional culture and address the issues of concern. The Panel believe the staff are generally dedicated and capable people who will respond well to such a leadership drive.

KEY RECOMMENDATIONS

The following eight recommendations are a summary of the full recommendations of the Audit. The full recommendations of the Audit can be found in Appendix A. Successful implementation of the recommendations will provide all stakeholders with confidence that arrangements are in place and that information is available to effectively and efficiently manage non-urban water in Queensland.

1. Establish a Compliance Management and Review Group with separation from operational activities to review and report regularly to senior management of the Department on the implementation of water measurement and compliance programs. An independent audit must be conducted within two years of this Audit and report on all measurement and compliance programs including the performance of the Compliance Management and Review Group.
2. Develop a stronger culture towards compliance enforcement and empower the organisation and staff to achieve compliance objectives.
3. Introduce a standard metering policy for both supplemented and unsupplemented water extractions which includes developing a Queensland metering standard, DNRME validation of meter installations, and verification of meter accuracy through testing.
4. Invest additional resourcing to build capacity including sound, modern management and information systems to deliver metering and compliance arrangements, and enhancing staff meter knowledge, lost through earlier policy change.
5. Take a series of actions over the next 18 months to gather required information for a long term decision on meter ownership and management. This issue is to be resolved within 24 months and should include consideration of the risks, and benefits and costs of outsourcing metering services to a third party provider(s).
6. Improve transparency by making publicly available online information relating to water resource management, water use and compliance. This should include the development and publication of state-wide and catchment level compliance objectives and management strategies aligned with risks and issues.
7. Undertake a review of existing legislation and regulatory instruments in relation to water planning and implementation to ensure greater consistency between obligations, objectives, and management and compliance practices.
8. Improve the reliability and accuracy of water harvesting and overland flow measurement and monitoring.

1 BACKGROUND

1.1 Establishment of the independent audit

On 14 August 2017, the Honourable Dr Anthony Lynham, Minister for Natural Resources and Mines (Minister) announced an independent review into rural water metering.

The Department of Natural Resources, Mines and Environment (DNRME) issued Terms of Reference for the independent audit (the Audit) in September 2017 (See Appendix B).

The purpose of this Audit is to undertake a strategic review of Queensland's current non-urban water measurement and metering framework including the regulatory arrangements which support water measurement and compliance.

The outcomes of the Audit will provide the Government with an independent health check on the current arrangements and make recommendations or identify options to improve on any limitations in the current arrangements. Appendix C includes the recommendations made and how they relate to the Terms of Reference.

1.2 Terms of reference

The key objective of the Audit is to determine the level of effectiveness of the current regulatory framework and provide advice and options to further improve Queensland's non-urban water measurement and compliance framework. The Audit will consider the full spectrum of the framework, including implementation, compliance, reporting, systems and technology adaptation.

The terms of reference of the Audit includes the following:

1. adequacy of Queensland's rural water measurement and monitoring governance arrangements, for all forms of take (including metered and un-metered take) and consider the regulatory framework/model, including responsibility for installation, reading, maintenance of water meters and measurement infrastructure (ownership models)
2. how the metering and measurement framework ensures consistency with water plans and the Water Regulation 2016 including take of unsupplemented water (water harvesting and overland flow rights), Resource Operations Licence Holder obligations (for supplemented schemes), and the actions that have been taken by the state to support compliance
 - a. further explore water harvesting and overland flow take in the Border Rivers and provide options and advice on how the metering and measurement framework can provide consistency with water plans, the Water Regulation 2016 and the extent that it is consistent with the Basin Plan developed by the Murray Darling Basin Authority.
3. appraising compliance arrangements including complaint and investigation management practices and how they are applied and the operational efficiency of the framework to support compliance and penalties
4. the adequacy, sufficiency/capability of Queensland's water measurement and monitoring technology, including identifying opportunities presented by new technologies and a review of Queensland interim metering standard and Queensland's progress to transitioning to meet Australian Standard 4747 and other appropriate National performance measures for non-urban water metering; and
5. examining the ongoing resourcing requirements (including CAPEX and OPEX) to deliver sustainable metering and compliance arrangements to support Queensland's water management framework state-wide but with particularly references to ensuring

Queensland's accreditation under the Basin Plan, including consideration of alternative provider models.

1.3 Role of Independent Expert Panel

An Independent Expert Panel (the Panel) was formed in October 2017 to conduct an audit and to provide advice and options for consideration by DNRME and the Minister.

The Panel consists of:

- Mr Tim Waldron (Chair);
- Mr Ian Johnson; and
- Professor Poh-Ling Tan.

The role of the Panel was to provide professional advice based upon their individual expertise, knowledge and experience. The Panel formulated options and advice for consideration by the government from the information collated and received during the Audit.

The Panel was supported by an independent research team which assisted in the formulation of the Panel's options and advice and to produce the key reporting deliverables.

1.4 Related national enquiries

There are two national enquiries, which have recently been completed or are underway, to investigate water related issues in the Murray Darling Basin.

The Commonwealth Government requested the Murray-Darling Basin Authority (MDBA) to provide an independent, basin-wide strategic review into compliance with state and territory based regulations governing water use in the Murray-Darling Basin. The Murray-Darling Basin Water Compliance Review was completed in November 2017.

That review included reports by the Murray Darling Basin Authority and the Independent Review Panel. That review made 12 recommendations and identified 9 actions with most of the recommendations and actions having application to Queensland. Section 11 of the report provides some further commentary of the recommendations and actions made by the Murray-Darling Basin Water Compliance Review.

The Panel has completed its review to address the terms of reference issued by DNRME. The Panel has formed its independent views with no major inconsistencies with the actions and recommendations made by the Murray-Darling Basin Water Compliance Review.

On the 16th August 2017, the Senate announced an inquiry into the integrity of the water market in the Murray-Darling Basin. The Senate Rural and Regional Affairs and Transport References Committee will report by 28 March 2018.

1.5 Final report

The Panel delivered an Initial Report to DNRME in November 2017. Although the Audit is a broader review into water measurement and compliance across all of Queensland, the Initial Report focused on the progress of investigations made to date in relation to the Murray-Darling Basin located within Queensland. Any observations made were preliminary in nature as not all the information requested was received from DNRME nor had the Panel had sufficient time to fully consider the information received at that stage of the review.

The Final Report encompasses the full review of non-urban water measurement and compliance across all of Queensland in accordance with the terms of reference. The Final Report has benefited from further analysis conducted by the independent research team and from the Panel visiting the sample catchments agreed with DNRME as being the focus areas for the review.

2 AUDIT PROCESS AND RESEARCH UNDERTAKEN

2.1 Background

The Review required the Panel to develop an understanding of Queensland's current rural water measurement and monitoring arrangements and in particular the:

- governance arrangements for all forms of take (metered and un-metered);
- water planning and regulation framework for supplemented and unsupplemented take;
- compliance and enforcement arrangements; and
- water measurement and monitoring technology.

The Panel's methodology included:

- tasking the research team to gather information from DNRME and undertake analysis;
- meeting with DNRME to gather information and to clarify our understanding of current practices and issues;
- meeting with the research team to review evidence and discuss issues;
- visiting some of the main focus areas to view how the current arrangement are working;
- consulting with stakeholders to obtain their views; and
- holding Panel workshops to discuss the issues and to form recommendations.

The Panel worked with the research team to identify issues for further investigation and to form our independent views on the key findings and recommendations.

2.2 Research and evidence gathering

The research and gathering of evidence was undertaken by the Panel as well as the independent research team. A number of information requests were made to DNRME and Appendix D contains a list of the key documents which the Audit relied upon. The information requested included policy and planning documents, reporting on compliance activities, and a sample of compliance case studies, data relating to meter and water allocation information and any supporting information relating to the information requests made.

The research team interviewed a number of DNRME staff based in the Brisbane and regional offices.

A Glossary of Terms is provided in Appendix E to assist with the definition of technical concepts and to ensure that definitions of terms used in this report are transparent.

2.2.1 Independent research team

The independent research team undertook the detailed analysis to test the governance arrangements and the key elements associated with the non-urban water measurement and compliance activities. The Panel met regularly with the independent research team to discuss the evidence gathered and the issues identified. The independent research team made a number of information requests to DNRME and interviewed a number of DNRME staff in the Brisbane and regional offices.

2.2.2 Meetings with DNRME

The Panel met with DNRME officers to gain an understanding of current practices and issues and requested both background information and more detailed information. This assisted the Panel to develop an understanding of current practices and issues as well as identifying which areas would require more detailed analysis.

2.2.3 Focus areas

The Panel agreed with DNRME to focus on the following six catchments and sub-catchment areas identified to cover the breadth of issues in measurement and compliance across the state:

- Barron;
- Burnett;
- Condamine Balonne;
- Gowrie Oakey Creek;
- Logan; and
- Wet Tropics.

2.2.4 Field visits

The Panel initiated field visits to the six catchments and sub-catchment areas outlined above. These field visits enabled the Panel to experience at first-hand how the governance framework worked in practice in the DNRME regional offices and to observe elements of the non-urban water measurement and monitoring activities. The Panel visited pump and meter installations sites and spoke to irrigators on their experiences with meters.

Please refer to Field Visit Reports in Appendix F.

2.2.5 Stakeholder meetings

During the field visits, the Panel took the opportunity to hold a number of stakeholder meetings to gather further evidence and to discuss any issues which may be of relevance to the Audit. The stakeholders included:

- land care group;
- Resource Operations Licence holders;
- industry groups;
- entitlement holders;
- certified meter validators; and
- peak environmental group.

The Panel acknowledges that this stakeholder consultation was not extensive given the constraints of time and the scope of the terms of reference.

3 GOVERNANCE FRAMEWORK

3.1 What is governance?

Governance is widely referred to as the range of legal and administrative rules, mechanisms and processes relating to how decisions are taken, how stakeholders may articulate their interests and have their concerns considered, and how decision makers are held accountable. This Audit focuses on the rural water governance framework, by which we mean the overall structure through which key objectives, responsibilities and activities are formulated, implemented, monitored and enforced for non-urban water.

Governance mechanisms include:

- policies and practices;
- assigning accountabilities;
- decision making; and
- monitoring the outcomes and impacts on stakeholders.

A good governance framework has three main elements – efficiency, effectiveness and building trust and engagement. The Organisation for Economic Co-operation and Development (OECD) has established a framework for good water governance, refer to Figure 3-1 below. As the diagram shows, there are many elements in a water governance framework. Monitoring and evaluation is an important feedback loop to identify and address gaps or weaknesses.

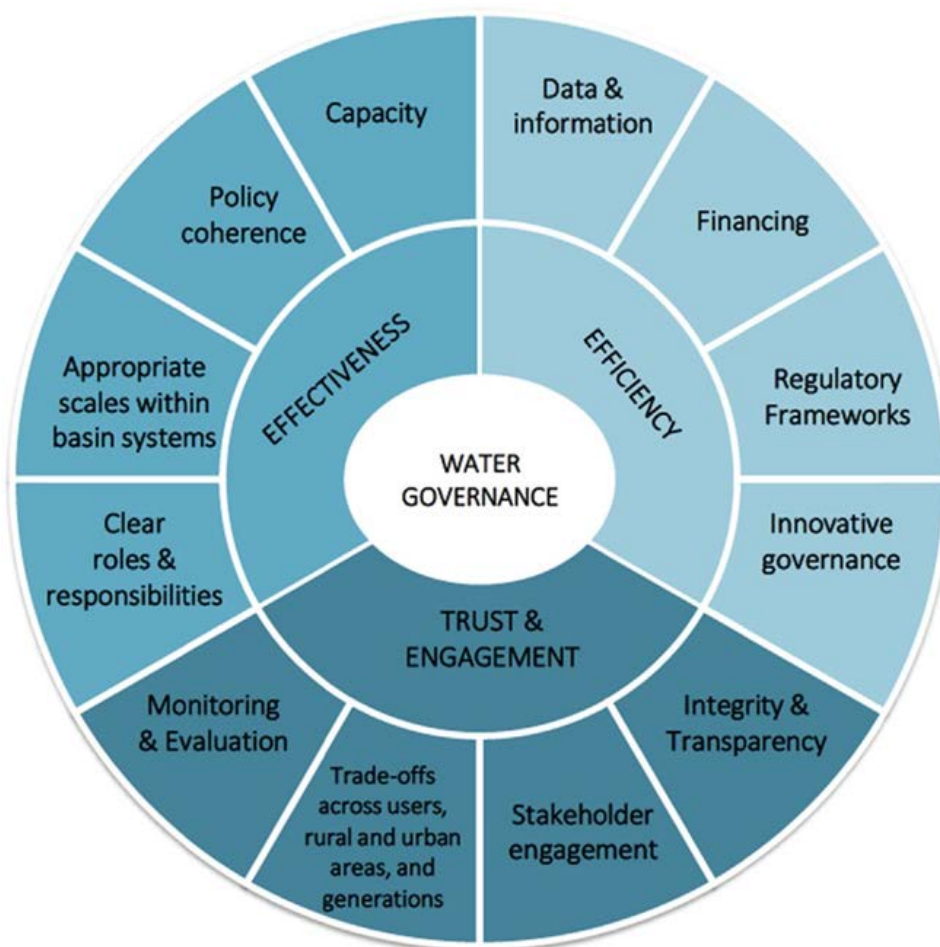


Figure 3-1 – OECD Water Governance Framework

3.2 Assessing the governance framework

The Panel's approach to the review of the governance framework focused on assessing the following relevant elements:

1. Understand objectives – legislation, policy, intergovernmental agreements for water management and compliance activities;
2. Establish rules and limits – management rules and limits to deliver natural resource outcomes;
3. Develop compliance objectives – establishing the outcomes being sought and documenting those
4. Determine measurement – to support delivery of objectives and compliance with rules;
5. Implement measurement – methods, standards, financing, ownership, installation, validation, maintenance, replacement;
6. Monitor performance – assessments, meter readings, recording and storage of data;
7. Enforce standards and obligations – compliance and investigation processes; and
8. Review, resource and capacity – checks and balances to test how effective the framework is, assess compliance, assess effectiveness of management, assigning resources and capacity.

Appendix G of the report provides an outline of the current governance arrangements.

This section of the report has reviewed the governance framework to identify the strengths and weaknesses of the current arrangements including highlighting improvements required.

As governance touches across all aspects of the measurement and compliance framework, more specific findings and recommendations relating to the particular elements of the governance framework are discussed in more depth in subsequent sections of the report.

3.3 Report card

A report card was developed based on a traffic light system to provide a simple but effective method to assess each element of the governance framework. Figure 3-2 below shows the report card which also illustrates how the different elements of the governance framework interact.

The following describes what each traffic lights represents:

- green represents strong aspects with minor improvements required;
- amber means some good aspects however improvements still required; and
- red denotes significant weaknesses and gaps.

The rating for the governance framework overall was amber as there are many elements in place, however there are also significant improvements required. The report card outcomes included 4 of the 8 governance elements as red, with 2 greens and 2 ambers. The Panel considers that the first two elements are foundational to governance and provide the state a good position to improve the subsequent elements.



Figure 3-2 – Governance Report Card

As the rest of this chapter explains, several performance measures were deficient, and although there are some well-performing areas, the overall assessment notes the absence of systematic documentation and orderly management of water measurement and metering, specifically:

- how measurement and metering objectives are set;
- how metering decisions are made;
- who is responsible for the various enforcement activities;
- how the enforcement activities are resourced;
- reporting on performance against the said objectives; and
- the process of checks and balances to review the effectiveness of the system.

3.4 Understand Obligations

This aspect of the governance framework was rated green with strong aspects and minor improvements required.

Understand Obligations

The understanding obligations element of the governance framework involves identifying the obligations of DNRME with regards to water measurement and compliance. This

includes legislation, policy, and intergovernmental agreements for water management and compliance activities.

The Panel examined whether there was clear articulation of what outcomes are being sought and recording those so that all stakeholders involved and the broader community can see and understand what they are.

Clear statements of outcomes guide the organisation and its people to work towards achieving these outcomes. Conversely, if the obligations are not understood or obscure, they will become difficult to achieve.

In Queensland, water planning is the key process to understanding the water monitoring and measurement objectives. Water plans identify the water available in each basin for environmental and consumptive use and allocates the resource across the various user groups. Planning is carried out by well-resourced and experienced planners, engagement with communities is generally of a high standard although recent legislative changes have made elements of this discretionary. Plans formulate firm environmental flow objectives and water security objectives under legislation and regulations.

As a consequence, obligations are generally well understood when they are examined through water planning processes, principally because these processes are highly structured, well resourced, and have a number of check points including external review.

National audits of the water planning process conducted by the former National Water Commission and now by the Productivity Commission as well as the assessment of this Panel confirm that this is a sound and well documented legislative process with:

- clear criteria for plans;
- provision of best available science to inform decisions;
- opportunity for stakeholder and community input;
- reporting back on all issues; and
- examination of any decisions affecting individuals by an advisory panel.

3.4.1 Improvements required

The improvements identified relate to establishing stronger links with the objectives in the water plans to the objectives associated with water measurement and monitoring.

It is unclear how DNRME ensures that new or changed obligations are incorporated into business as usual activities and day to day management decisions outside of the water planning process.

There does not appear to be a central registry of the applicable obligations under Intergovernmental Agreements. There is no central register of Murray Darling Basin obligations. There is a risk that obligations may be missed or misinterpreted.

3.5 Establish rules and limits

A green rating was given to this aspect of the governance framework as strong aspects were observed with minor improvements required.

**Establish rules
and limits**

The establishment of rules and limits creates measureable and verifiable metrics to enable objectives to be achieved. These are the management rules and limits to deliver natural resource outcomes. The rules and limits cascade down from the objectives to determine

what is to be achieved and how it is achieved. The rules and limits guides all the stakeholders in the process to achieve the objectives set.

Again, the water plan process including the Water Regulation 2016 and Resource Operations Licences (ROL) including water allocations, licences and permits provides a strong framework to establish rules and limits. These documents clearly articulate the rules and limits for all stakeholders to follow.

3.5.1 Improvements required

The Audit identified a number of improvements which would further strengthen this area of the governance framework.

The meter roll out program is now within the Water Regulation 2016 and this change has resulted in a reduction in the information previously provided in the Resource Operations Plans (ROPs). This level of information availability and transparency should be restored to ensure stakeholders are provided with this information.

A number of other recommendations have been made to regularly review the various documents which establish limits and rules and for this process to be transparent and to involve stakeholder input.

**Developing
compliance
objectives**

3.6 Develop compliance objectives

This part of the governance framework was rated amber with some good aspects however improvements are required.

The development of the compliance objectives is establishing the outcomes being sought and documenting those. There are state-wide and regional based natural resource management compliance plans with targets. These plans do not explicitly identify key risks and rationale to support targets. These plans cover vegetation, water and land issues.

There is considerable discretion at the regional level with respect to the establishment of regional compliance plan objectives. These are intended to be risk based, although the process for their development is not consistently or rigorously applied.

The approach to the establishment of compliance objectives is not formalised. Discussions with regional staff indicate that the objectives are developed regionally and moderated through discussions at the Natural Resources Compliance Committee (NRCC) to develop the state-wide objectives.

The NRCC was established in March 2016 and its objective is to process, facilitate, obtain and provide legal advice relating to natural resource compliance. The NRCC aims to ensure that DNRME's natural resources management compliance approach is strategic and consistent across the broader legislative, geographic and community context and to ensure resources are aligned to the greatest departmental priority and area of regulatory risk. The NRCC is scheduled to meet every month or as required depending on when an urgent matter is received.

The compliance objectives are not included in DNRME's corporate plan or in the performance plans of key officers. This does not create strong accountabilities across the organisation to achieve compliance objectives.

3.6.1 Improvements required

A robust planning process would see a cascading of plans from the corporate plan level to the regional level, down to the catchment level. This would enable the state level corporate objectives to be translated to catchment specific objectives and targets and vice-versa. It ensures consistency across all levels of the organisation and provides a line of sight from state level objectives down to the catchment level.

A series of recommendations have been made to improve transparency and create greater accountabilities. This includes the compliance objectives being included in DNRME's corporate plan and the performance plans of key officers. Details of this appear in section 5 of this report.

3.7 Determine measurement

An amber rating was given to this element of the governance framework as some good aspects were observed with improvements required.

**Determining
measurement**

Determining measurement supports the delivery of objectives and compliance with rules. This is achieved with the development of policies and standards relating to what water is measured and monitored and how this is actually done.

3.7.1 Improvements required

Policies and standards are in place however these do not apply consistently to unsupplemented and supplemented water users. This can create equity issues as a higher cost of compliance could be imposed on one group over the other. The metering policy is not effective due to limitations in the application of the Australian Standard AS4747 Meters for Non-Urban Water Supply (AS4747).

Section 6 of this report provides more detail on the findings and recommendations related to the metering policy.

3.8 Implement measurement

This part of the governance framework was rated red with significant improvements required.

**Implementing
measurement**

Implementing measurement includes establishing the methods, standards, financing, ownership, installation, validation, maintenance and replacement of the meters and measurement devices.

The state's water monitoring network of groundwater and stream measurement, or hydrometric network, is managed to the International Standard ISO 9001 Quality Management Standard. Improvement opportunities were identified as consultation with stakeholders discovered that more gauging stations should be installed especially where there are nodes which are based only on theoretical models. DNRME advised that the number of stations was reduced significantly a number of years ago and suggested that this decision needs to be reviewed. The configuration of the network should be reviewed to assess whether the current network is fit for purpose and if it can be improved. Alternative technologies may be available to enhance the network such as satellite imagery and drones.

The Panel believes this component of the governance framework results in poor outcomes due to weaknesses in the metering policy and the meter validation and maintenance regime. The accuracy of meters is not tested and is an unknown. Some forms of water take like water harvesting and overland flow are not reliably measured.

Overall, the measurement and monitoring environment for water taken is weak with significant discretion provided to meter owners and validators on how the meter policy and meter standards are interpreted and applied. This severely compromises the quality of the meters and how they are installed with the reliability of meter measurements becoming highly questionable.

3.8.1 Improvements required

A standard metering policy should apply to both supplemented and unsupplemented water to remove any discrepancies across extraction types and to simplify administrative arrangements.

Weaknesses in the application of AS4747 provides an opportunity for Queensland to develop its own metering standard which is consistent with AS4747 and to address the particular issues in Queensland with the reliability of meter measurement.

The metering policy needs to be further strengthened by introducing a stronger and more independent meter validation and maintenance oversight regime.

The specific findings and recommendations are explained in more detail in Section 6.

3.9 Monitor Measurement

A red rating was given to this element of the governance framework as significant improvements are required.

**Monitoring
measurement**

Meter assessments, meter readings, recording and storage of data are the key elements to this aspect of the governance arrangements.

The investment in information systems has been poor which reflects in the quality and efficiency of extracting vital data from information systems. Telemetry has limited use with many meters installed with data loggers however the information is only captured in a few areas. The meter reading data is stored in spreadsheets, which is very labour intensive and introduces data integrity issues. The Water Management System (WMS) either lacks functionality or is not fully utilised as it is unable to capture and report on the core information required to monitor measurement.

Some doubt emerged during the Audit that all water entitlements that should be metered have a meter installed. It is unclear if this is a real problem or related to the poor availability of information. DNRME had difficulty providing the requested information to identify the meter fleet against water entitlements to enable more detailed analysis to be completed. Further issues emerged with record keeping as not all the requested meter validation certificates could be provided.

Overall, the control environment for measurement of water take is relatively weak. There is significant scope for fraudulent activity to occur, and limited oversight and review by DNRME.

3.9.1 Improvements required

The use of telemetry and remote read technology needs to be pursued which is supported by fit for purpose information systems to capture and report data.

A significant increase in resourcing is urgently required to improve management systems, information systems and the number of people dedicated to measurement and metering activities. This investment is critical if improvements are to be achieved.

Sections 7 and 10 of the report provide further details on the findings and recommendations made to address the monitoring aspects.

3.10 Enforcement

This part of the governance framework was rated red with significant improvements required.

Enforcement

Compliance and investigation processes are the key activities associated with enforcement.

DNRME's culture toward compliance is weak and management practices, including the level of resourcing available and the limitations with information systems, makes the compliance effort very challenging. The lack of separation of compliance activities from operational activities contributes to this weak compliance culture.

Low level of enforcement is reflected in 75% of compliance cases resulting in no action with only seven Penalty Infringement Notices (PINs) being issued since 2003. However these figures cannot be verified due to limitations in record keeping.

A strength is the broad range of actions and penalties available so that an appropriate penalty can be applied.

Education and deterrence is a critical aspect of any compliance approach and the current arrangements are lacking in both. Most people tend to follow the rules if they know they are being watched and will be punished if they break the rules.

The NRCC brings together operational experts with in-house legal experts to obtain legal advice on compliance matters pertaining to land, water and vegetation legislation. Although the Audit did not include an extensive review of the NRCC, the Panel observed that it has a strong focus on vegetation matters and the focus and progress of water compliance activities has been poor.

3.10.1 Improvements required

Senior management need to make compliance a key focus area and improve the culture to make it core business. The compliance objectives must be included in DNRME's corporate plan to raise its profile and importance across the organisation. This step will create greater accountability and put DNRME's enforcement performance under the spot light.

Compliance activities need to be separated from operational activities to provide compliance with free air to effectively resource and tackle the enforcement task. Operational activities will take precedence over compliance which is a day to day conflict that needs to be removed.

The enforcement task needs to be appropriately resourced rather than matching the enforcement effort to the staff available.

Enforcement needs to be supported with fit for purpose information systems so that data can be efficiently and reliably captured, stored and assessed with strong checks and balances. This is important for legal cases as the evidence captured needs to stand up in court.

Section 4 of the report provides further details on the findings and recommendations made in relation to enforcement and compliance.

3.11 Review, resourcing and capacity

A red rating was given to this element of the governance framework as significant improvements are required.

**Review,
resourcing and
capacity**

The review, resourcing and capacity element includes checks and balances to test how effective the framework is, including how resources and capacity are assigned.

This is poorly done as a formal management system approach is not adopted. This Audit is a form of review however it would be expected that management would be undertaking regular internal reviews to test the effectiveness of the framework. We have not seen any evidence that suggests this is occurring.

The resourcing and capacity is poorly undertaken which is evident across most aspects of the governance framework. The current arrangements have many weaknesses, principally due to inadequate resourcing, and the situation will continue to deteriorate unless action is taken. This adversely impacts on the performance and efficiency of delivering metering and compliance arrangements.

3.11.1 Improvements required

DNRME has a significant opportunity to improve the sustainability and efficiency of metering and compliance activities to support Queensland's water management framework. This opportunity involves investing additional resourcing in management systems, information systems and people. This investment is critical if improvements are to be achieved.

Section 7 of the report has further details on the finding and recommendations made in relation to resourcing.

3.12 Recommendations

The Audit identified that sound water planning arrangements are in place however the governance arrangements associated with water measurement and compliance of non-urban water use in Queensland lacked robustness, completeness and transparency. A number of weaknesses and gaps were identified which created ambiguities and inconsistencies across different types of water entitlements and water user groups.

The issues identified included a lack of a management system and documentation, some inconsistencies in practices across the regions and water user groups, inadequate review processes and lack of transparency. It is not always clear who does what and how it is done.

The current governance framework does not adequately and consistently apply to all non-urban water users in Queensland. There are separate policies, rules, procedures, and governance mechanisms for supplemented and unsupplemented water.

Other issues identified by the Audit include:

- conflicts of interest which weaken the governance framework
 - within DNRME there are overlaps between operational/service delivery function and monitoring or compliance functions
 - within ROL areas there are conflicts of objectives for operators to control and report non-compliance by customers.
- deficiencies in assurance practices or programs at all levels. (DNRME, ROL holders, entitlement holders, meter validators).

The Audit found that limited checks and balances exist on how cases are managed across the state. This function is not fully performed by the NRCC which meets monthly where the prime focus is on legal advice and sanctions with the agenda dominated by vegetation matters.

Recommendations

1. A Compliance Management and Review Group is established within the Department to review and report regularly to senior management on:
 - a. Implementation of a formalised management system to manage and monitor the water metering and measurement activities including compliance and new or changed obligations arising from legislation and Intergovernmental Agreements.
 - b. Implementation of a documented, formalised and systematic approach to water compliance to apply across all regions to ensure a consistent and robust conduct of investigations and compliance actions.

The Group must allow performance assessment to be conducted separately from operational activities to provide oversight and consistency across the state. An independent audit must be conducted within two years of all water measurement and compliance programs including the performance of the Compliance Management and Review Group.

2. The future role and structure of the Natural Resource Compliance Committee should be reviewed in light of the revised governance and management arrangements.
3. Implement a documented, formalised and systematic catchment risk assessment process and apply the outcomes to decision making on water measurement and monitoring. The risk assessment process must be consistent with any relevant Intergovernmental Agreements and the community and stakeholders must be consulted in undertaking these risk assessments.

4 COMPLIANCE FRAMEWORK

4.1 Importance of robust compliance

Measurement of water needs the support of robust compliance arrangements to address any offences. These arrangements need to ensure that all water users have a clear understanding of their rights and obligations and the consequences of breaching their obligations. For a compliance program to be effective, the following is required:

- organisational leadership and enabling culture;
- education to encourage self-compliance;
- management practices that utilise existing compliance components;
- relevant use of deterrence messages; and
- appropriate penalties for offences.

4.2 Organisational leadership and culture

The Panel bears in mind that governance, risk and compliance are interrelated. In the previous section the Audit found governance arrangements associated with water measurement and monitoring of non-urban water use in Queensland lacked robustness, completeness and transparency. The panel has found that this arises from the historical origins of an organisation that has its roots in water delivery and supply, which then evolved to planning for the allocation of water in a sustainable, equitable manner based on good science and community input. DNRME as an organisation has not yet developed a culture across the whole of the organisation to ensure adherence to standards found in water plans. This is a common feature worldwide which is why regulatory roles have been separated from service delivery functions, as implemented in Queensland and other parts of Australia under the National Water Initiative.

However we find that the next step, which is creating a coherent compliance program, has yet to be taken. The current compliance program operates in a complex, uncertain environment, is greatly challenged from a capacity and resourcing standpoint, and lacks organisational uniformity. The lack of reviews of enforcement and fragmented approach between resource operators and DNRME leads to a high level of discretion and inefficiency.

It is apparent that the implementation of Recommendation 1 provides for a more systematic approach to a compliance program, and strong leadership is needed to prioritise enforcement.

4.3 Management focus on compliance objectives

Management focus on water compliance objectives is poor and not given sufficient priority. It is not referred to explicitly within the corporate plan. Senior executives have advised that compliance is not explicitly identified in personal performance plans or periodic reviews.

4.4 Education

DNRME did not demonstrate that its compliance arrangements include formal education programs to educate water entitlement holders of their rights and obligations. The approach is ad-hoc and opportunistic and involves providing presentations at various industry and rural forums. The Panel were not made aware of any standard presentations or information materials provided at such forums.

A stronger compliance framework emerges when it is supported by a formalised education program that includes standard messaging to prevent violation of laws and regulations. These messages could be tailored to the compliance risks that are emerging or which are being targeted as part of the compliance plan.

The Queensland Police are very good at this and run various road safety campaigns which target speeding, seat belt wearing and mobile phone use to make drivers aware that compliance is being taken seriously. The aim of this is to educate and encourage self-compliance. Similar education programs would be beneficial to the water compliance outcomes.

4.5 Management practices

The Audit identified a number of weaknesses in management practices which leads to unsatisfactory compliance outcomes. The key issues identified included:

- reluctance to use the stronger enforcement actions;
- cases not being pursued in a timely manner;
- focus on persuasion rather than using enforcement action; and
- regions having discretion which may not result in consistency across the state.

Figure 4-1 below includes DNRME descriptions of what each compliance action entails and the Panel's report card assessment against them.

| Compliance Action | Description | Report Card Assessment |
|-----------------------------|--|------------------------|
| Prosecution | Taking legal proceedings to seek a court order to impose a period of suspension or cancellation of the water licence, allocation or permit or seeking restoration/rectification of the natural resource. | RED |
| Penalty Infringement Notice | Issuing a fine to impose a financial penalty. | RED |
| Statutory Notice | Issuing a Compliance Notice under the <i>Water Act 2000</i> to cease the taking or interfering of water | RED |
| Directive | Under the <i>Water Act 2000</i> , certain circumstances permit the amendment, cancellation or forfeiture of a water licence, allocation or permit. | RED |
| Negotiated Solution | A negotiated outcome is achieved as an alternative to prosecution. | RED |
| Formal Warning | A non-statutory response that involves a letter advising that an alleged non-compliance has occurred to educate the recipient and advise that a sanction may be applied in the future. | RED |
| Letter | Sending of a letter such as a reminder notice to read a meter. | RED |
| No action | No action is taken. | RED |
| Notification expired | The statute of limitation period has expired and no further action can be taken. | RED |

Figure 4-1 – Water compliance actions since 2003

A strength is the broad range of actions and sanctions available so that an appropriate penalty can be applied. The problem is in the execution and the lack of compliance action taken.

The statistical data on compliance actions provided by DNRME has its limitations. DNRME advises that reporting on compliance activities is impacted by not all records being available and reduced confidence levels in relation to accuracy. An example of this limitation emerges in the reporting of the number of PINs issued. DNRME believes 7 PINs have been issued however DNRME's Compliance Information Register and Management system (CIRaM) reports that 3 PINs have been issued.

Figure 4-2 below shows the water compliance action data provided by DNRME and, acknowledging the limitations with the data, provides some strong themes on what compliance tools are used. The data covers the period from 2003 to February 2018 and shows that the predominant compliance action is no action as 76% of cases involve no compliance follow up. Almost 1% of cases are not progressed due to the expiry of the statute of limitation. This indicates that compliance arrangements require restructuring.

Of the cases that involve action being taken, the dominant activities are low scale enforcement with letters issued (6%) or a formal warning given (10%). Stronger enforcement has been limited to about 8% of actions via statutory actions (4.3%) and prosecutions (3.3%).

This data raises serious concerns about the limited compliance effort and the weak culture currently in place.

| Compliance Action | Number | % |
|--|--------------|-------------|
| Prosecution | 146 | 3.3% |
| Penalty Infringement Notice ¹ | 3 | 0.1% |
| Statutory Notice | 192 | 4.3% |
| Directive | 2 | 0.0% |
| Negotiated Solution | 9 | 0.2% |
| Formal Warning | 438 | 9.9% |
| Letter | 247 | 5.6% |
| No action | 3,349 | 75.8% |
| Notification expired | 31 | 0.7% |
| TOTAL | 4,417 | 100% |

Figure 4-2 – Water compliance actions since 2003 (as at 28 February 2018)

The timeliness of managing compliance cases raises further concerns as Figure 4-3 shows. It is surprising to find that almost 24% or 198 cases have been open for greater than a year and a significant number of cases, 136 in total or almost 17%, have been open for 2 or more years. This demonstrates that the culture towards compliance is poor and reflects a lack of management focus. The priority given to compliance is low with insufficient resourcing to manage the workload. Timely responses to compliance cases is imperative to send a message that offences will not be tolerated.

¹ CIRaM reports that 3 PINS have been issued however DNRME believes that 7 PINs have been issued.

Compliance outcomes are impacted by the low numbers of staff in regions across Queensland, and the staff's responsibilities over a wide range of tasks. The Panel met with officers who organised for a range of views to be voiced, including those critical of DNRME. Officers appeared hard working and in an environment that had many calls on their time. They work in difficult circumstances and the Panel have recognised that it is a management issue to ensure resources meet the needs of good compliance.

| Period case open | Number | % |
|------------------|------------|-------------|
| 0 to 3 months | 111 | 13.2% |
| 4 to 6 months | 469 | 55.7% |
| 7 to 12 months | 64 | 7.6% |
| 1 year | 62 | 7.4% |
| 2 years | 16 | 1.9% |
| 3 years | 37 | 4.4% |
| 4 years | 81 | 9.6% |
| 5+ years | 2 | 0.2% |
| TOTAL | 842 | 100% |

Figure 4-3 – Period current water compliance cases open as at January 2018

4.6 Compliance case studies

The Audit reviewed a sample of compliance cases to assess the actions taken. These cases confirmed that the compliance approach lacks sufficient teeth to make a significant change to behaviour. Three examples appear below.

Case 1 - This involved seven consecutive years of take above entitlement before a PIN was issued. For seven years DNRME initiated a number of educational and compliance strategies with the individual before taking more forceful action. A more appropriate approach would have been to provide the individual with one warning before issuing a fine. Further breaches would have involved suspension of water take. The weak approach resulted in seven consecutive years of overuse and significant administrative effort over a seven year period to manage the individual. This case sends the wrong message to users – that they can flout the rules and breaches go unpunished.

Case 2 - The situation involved three issues, the taking water during a ban, non-approved meters installed and the meters not working. The action taken was a warning letter and a remedy request to install approved meters. A warning letter in this situation was lenient and a more severe penalty was warranted to send a much firmer deterrence message.

Group of cases - A number of compliance cases assessed involved no action taken due to the Statue of Limitations period expiring. DNRME has 1 year from when the offence occurred or when the offence came to DNRME's attention. It is unacceptable that delays result in no action being taken. This significantly weakens the compliance response and the effectiveness of the arrangements. Offenders will re-offend if they are not punished.

Of further concern was the level of discretion provide to each region to manage compliance cases which lends itself to inconsistencies across the state. Regions have significant management discretion with respect to investigations despite the oversight role played by the NRCC. The Panel

does not consider that the NRCC would be capable to provide this oversight when it meets monthly and has responsibility for vegetation, land and water.

4.7 Resourcing

The Audit found that the current management of compliance is driven by available resourcing rather than by need, which leads to a reduction in the compliance effort and slow response times. The regions prepare their compliance plans based on the expected resources to be available rather than developing a plan with appropriate actions which best matches the compliance risks identified.

Resourcing needs to be available to meet the required compliance effort otherwise the compliance effort is piecemeal and ineffective. For compliance to be effective, the effort must be driven by the need and not the availability of staff.

4.8 Compliance management information system

DNRME officers are concerned about the functionality and efficiency of CIRaM and if it remains fit for purpose. The Audit has not investigated this issue in depth as DNRME advised that a review of the system is taking place. The Audit did observe the reporting limitations and lack of confidence with the system when compliance data was requested.

There are poor mechanisms to ascertain whether all identified compliance issues are entered into CIRaM by regional staff. The Audit did observe that the level of information entered for cases varies greatly. The system is highly dependent on an individual officer's diligence in performing their roles.

DNRME officers raised concerns with the level of confidence with current process and information systems standing up in court and meeting requirements that the evidence is available, reliable and admissible. This is a serious issue and can hinder compliance actions being progressed by officers. Systems and processes need to be strengthened to address this issue.

The Audit identified that documentation and guidance materials are in place to guide staff on compliance decisions (Natural Resource Compliance Response Guidelines May 2017). These guidelines could be further supported by more prescriptive business rules which make it clearer what course of action is most suitable for particular cases. This would remove the level of discretion currently in place and reduce the risk of inconsistencies.

4.9 Penalties

The penalties for breaches may not provide sufficient deterrence against offences occurring i.e. the penalty not fitting the crime. DNRME commented that some water users may see the fines as a cost of doing business rather than as a cost that should be avoided. The size of financial penalties needs to be reviewed and to ensure that sufficient flexibility is available to match the size of the financial penalty to the severity of the breach.

4.10 Statute of Limitations

As discussed earlier, the Audit identified a number of compliance cases which did not result in enforcement actions due to the period of the Statute of Limitation expiring. The Audit did not ascertain the reasons why insufficient time was available. It could be due to a number of factors such as compliance cases not being processed efficiently, that cases involve complexities in gathering evidence or insufficient resources are available to process compliance cases.

Section 931 of the *Water Act 2000* provides for the following Statute of Limitations period:

A proceeding for an offence by way of a summary proceeding under the Justices Act 1886 must start within

(a) 1 year after the commission of the offence; or

(b) 1 year after the offence comes to the complainant's knowledge, but not later than 2 years after the commission of the offence.

It is important that compliance cases are processed as quickly as possible with a timely response to any alleged offences to maximise the deterrence factor. However, it is important that DNRME is provided sufficient time to manage the cases on hand and is provided a reasonable period of time to progress cases along the escalation path. The length of the Statute of Limitations period needs to take all these factors into consideration.

The Statute of Limitation period needs to be reviewed in light of a stronger compliance culture, which will likely result in an initial increase in cases. DNRME needs to be provided sufficient time to manage the cases to ensure that any alleged offences are appropriately resolved.

4.11 ROL holder reporting

A reporting gap arises under the current arrangements with ROL holders being responsible for metering of supplemented water entitlements. DNRME is notified of any breaches against volumetric limits well after the end of the water year. The ROL holders are taking actions to manage water entitlement holder's compliance against their volume limits.

The Panel notes that water entitlement holders are using temporary transfers when water usage exceeds their nominal water entitlement in a particular water year. However, on occasions this transfer is being made after the ROL holder identified that the water entitlement holder has exceeded their nominal water allocation, which is a breach of their water entitlement conditions. DNRME is not being made aware when this is occurring.

This issue has emerged at both SunWater and Seqwater and DNRME is currently developing a protocol to manage the situation.

As ROL holders do not have any powers under the *Water Act 2000* to prosecute, they are unable to take compliance action in cases of deliberate overuse or recurring non-compliance. Instead, the ROL holder notifies DNRME of the non-compliance. The reporting of the overuse does not always include the water entitlement holder's details as the reporting is based on the offtake node².

SunWater and Seqwater have recently become more proactive in their approach to compliance, advising entitlement holders of their usage during the year. SunWater has a documented policy and Seqwater is yet to document its approach. The ability to monitor water trading as a means to manage an individual's use against their water entitlement is reliant upon having a system to monitor water trading. SunWater has capability to monitor water transfers and trading whereas Seqwater does not currently have this capability.

SunWater and Seqwater notify the entitlement holder at the end of the third quarter if they have used more than three quarters of their allocation. SunWater has noticed an improved compliance performance under this approach and at this stage Seqwater was unable to comment if improvements have been made.

² Nodes are established by the Water Plan and are a key measurement and reporting point on the water course in the plan area or in a groundwater management area.

4.12 Recommendations

The Audit identified some major weaknesses in the compliance arrangements with limited and weak enforcement action taken. DNRME's culture toward compliance is weak and management practices, including the level of resourcing available and the limitations with the information systems, makes the compliance effort well below standard.

A formal education program is lacking and deterrence is weak. Most people tend to follow the rules if they know they are being watched and will be punished if they break the rules. This aspect needs immediate attention so that water entitlement holders understand and feel the consequences of breaking the rules.

Recommendations

4. The leadership of DNRME establish a stronger culture towards compliance enforcement and empower the organisation to achieve the compliance objectives through:
 - a. Ensuring that the Compliance Management and Review Group has adequate levels of well-trained regional staff to complete the activities required in the compliance plan.
 - b. Having compliance targets included in the performance plans of responsible officers.
 - c. Establishing systems to ensure that the standard of evidence meets judiciary scrutiny.
 - d. Implementing action plans to address the timely closure of compliance cases.
 - e. Placing a greater focus on ensuring that the recording and monitoring of compliance cases are maintained in a timely, consistent and accurate basis.
 - f. Ensuring a compliance officer who is familiar with the region makes regular on ground inspections/audits.
5. Steps are taken to address the following elements of the compliance arrangements:
 - a. Develop a strategy to educate and raise awareness of entitlement holder's rights and obligations and the penalties associated with any breaches and send stronger deterrence messages to the community.
 - b. Review the penalties and sanctions available for breaches to ensure that adequate deterrence is achieved.
 - c. Review the Statue of Limitation period to ensure the timeframe is appropriate and sufficient time is available to complete all the steps required to prepare cases i.e. complete investigations, gather facts/evidence and prepare briefs.
 - d. Place an obligation on the ROL holder to report any take above entitlement and provide details of recurring non-compliance to allow prosecution. Require ROL holders to undertake pro-active management of compliance against volumetric limits.
 - e. Prohibit water users from forward drawing on water accounts that are overdrawn at the end of the water year.

5 TRANSPARENCY

5.1 Importance of transparency

A fundamental characteristic of a robust compliance system is ensuring that entitlement holders understand their rights and obligations and have access to all the information they need to comply voluntarily.

DNRME does not publish its compliance plan or its guidelines on how it manages and enforces compliance (*Natural Resources Compliance Response Guidelines, May 2017*). This does not inform the community and entitlement holders of the consequences of breaching compliance requirements.

Queensland entitlement holders have limited visibility of actual water use during the year and during and after water events. The community lacks this information at the catchment level to understand the availability of water and current water usage trends.

Greater transparency of water availability and water use information will have benefits to the Queensland economy. It will provide valuable information to stakeholders on where water is available to maximise its economic value. This will lead to economic growth and contribute jobs and other benefits to the community.

Greater transparency promotes awareness, voluntary compliance and stronger deterrence and places a stronger accountability on DNRME to take the appropriate actions. It also promotes greater confidence to all stakeholders that compliance is treated seriously and performed well.

5.2 Water balance

The Audit identified that there was a void related to information about a holistic water balance. Many aspects of water volumes available or used cannot be totally accounted for, and this is not unusual in the water industry. Often in times of crisis, such as droughts and industry unrest, better information is needed in relation to water volumes as a whole.

The International Water Association (IWA) identified this as an issue approximately fifteen years ago and developed a water accounting balance sheet that has been advanced in the urban side of the water industry. This is shown in Figure 5-1 below.

This is now used by many countries specifically for water distribution systems. It allows governments and boards of directors in water businesses to identify what is important and where capital investments are essential. One of the important aspects of these balance sheets is to demonstrate where there is poor knowledge. The urban water industry utilised the IWA document and eventually focussed sufficient effort to be able to account for all water to a 95% confidence level, obviating the need for the term “Unaccounted for Water”.

The New South Wales Department of Primary Industries Office of Water produces General Purpose Water Accounting reports for all major regulated inland catchments on an annual basis. This reporting has been undertaken as a result of agreements reached under the National Water Initiative to implement a standardised and comparable approach to water accounting nationwide. The structure of these reports is in accordance with an ‘Exposure Draft of Australian Water Accounting Standards 1 (ED AWAS 1)’ which is available on the Bureau of Meteorology website. This draft standard could be used as a review document for Queensland to help develop an appropriate water balance picture, and as a basis for accounting for all water in Queensland.

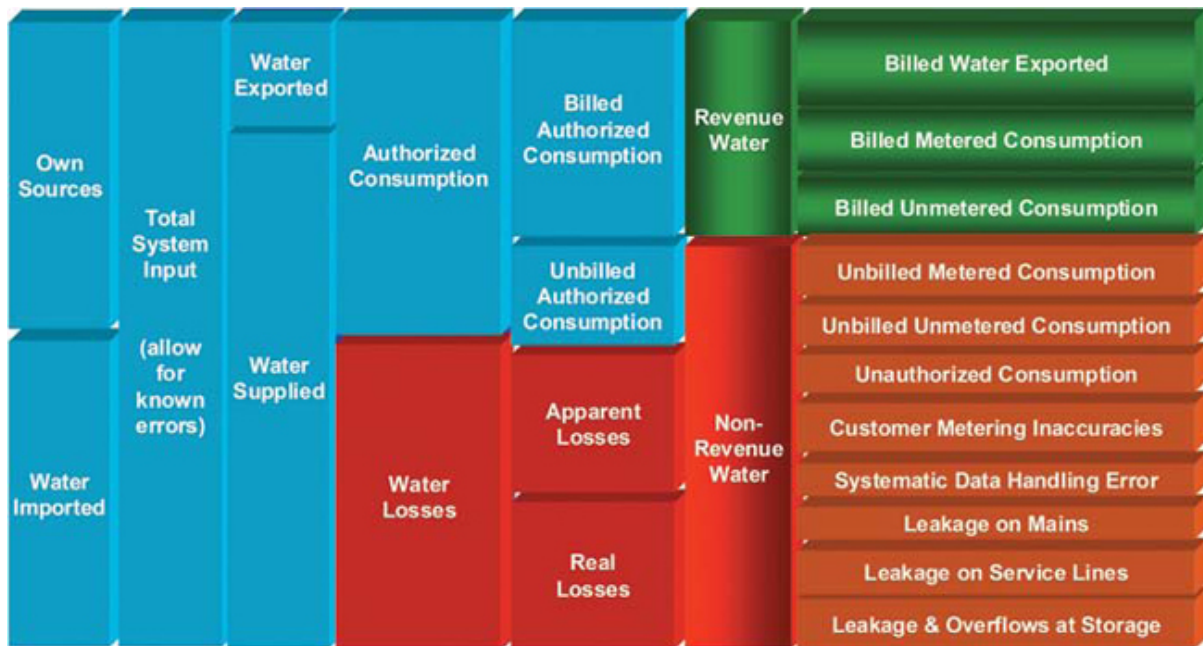


Figure 5-1 – IWA Urban Water Balance Framework

The Panel has produced a water balance document, similar to the IWA urban document, which provides a foundation for further development to make it appropriate for Queensland. This is shown in Figure 5-2.

The Panel's view is that it is important for Queensland to commence this type of water balance approach to gain knowledge needed both state-wide and in regional catchments, or in managed areas, for making strategic decisions and for gaining knowledge that the public would expect to be available, as well as for identifying capital and operating cost investments.

| QUEENSLAND WATER BALANCE | | | | | | | | | | |
|--|--|--------------------------------|---|--|--|-------------------------------|--|---|---|----------------------|
| TOTAL WATER AVAILABLE IN QUEENSLAND FOR EXTRACTION AND THE ENVIRONMENT | SOURCED FROM: RIVER FLOW OVERLAND FLOW DAMS GROUND WATER LAKES STREAMS | FOR CONSUMPTIVE PURPOSES | Urban - own source | Store and treat to potable standard | To Supply System Reservoirs and Distribution | IWA URBAN WATER BALANCE | WATER ACCOUNTED FOR AND DELIVERED | | | |
| | | | Urban - extractions | | | TOTAL WATER | | | | |
| | | | UNSUPPLEMENTED Watercourse extractions | LICENCE - AREA (ha) | | | | IN TRANSIT FOR CONSUMPTION OR INDUSTRY NEEDS | UNACCOUNTED FOR WATER INCLUDING : 1 Evaporation 2 Meter errors 3 Data transfer error 4 Unauthorised take 5 Leaks from Infrastructure 6 Unmetered Water | |
| | | | | LICENCE - VOLUME | | | | | | |
| | | | | LICENCE - NO VOLUME | | | | | | |
| | | | | Water Allocations - volumetric | | | | | | |
| | | | | STATUTORY RIGHT TO TAKE** | | | | | | |
| | | | | UNACCOUNTED FOR WATER | | | | | | |
| | | | SUPPLEMENTED Watercourses Pipe channel Open Channel Groundwater | Water Allocations - volumetric | | | | UNACCOUNTED FOR WATER | | |
| | | | | UNACCOUNTED FOR WATER | | | | | | |
| | | | | OVERLAND FLOW WATER | LICENCED NOTIFIED | | | | | |
| | | | | | Not managed | | | | | |
| | | | | | NOT LICENCED or NOTIFIED | | | | | |
| | | | | GROUNDWATER | LICENCED - VOLUME | | | | | |
| | | | LICENCE - AREA (ha) | | | | | | | |
| | | | STOCK AND DOMESTIC Not managed GAINED ASSOCIATED WATER | | | | | | | |
| | | | UNSUPPLEMENTED | MINING | | | | | | |
| | | | UNALLOCATED WATER - Reserved for future consumptive use | | | | | | Available to Supplement Consumption | RESIDUAL FLOW |
| | | | FOR THE ENVIRONMENT | TO MEET ENVIRONMENTAL FLOW OBJECTIVES | | | | Nature's Needs | | |
| | | | | QUEENSLAND MURRAY DARLING BASIN only - COMMONWEALTH ENVIRONMENTAL WATER OFFICE (supplemented and unsupplemented water - surface and groundwater) | | | | | | |
| | | | | Planned and Held Entitlements | | | | | | |
| | | | | Unaccounted for Take | | | | | | |

Figure 5-2 –Proposed Queensland Holistic Water Balance – Accounting for Water

5.3 Recommendations

A lack of transparency hinders information sharing and the development of a strong compliance culture, both within DNRME and with water entitlement holders. Greater transparency leads to stronger accountability as the actions of stakeholders are more visible and placed under stronger scrutiny. A better informed community including water entitlement holders leads to stronger awareness and self-compliance.

The publishing of water availability and water use information will have benefits to the Queensland economy. The economic value of water can be maximised as stakeholders will have better information to make investment decisions. This will lead to economic growth and contribute jobs and other benefits to the community.

Recommendations

6. More information is made publicly available by DNRME relating to water resource management, water use and compliance to improve transparency. This should include the development and publication of a state-wide and catchment level compliance objectives and management strategies aligned with risks and issues. In particular:
 - a. DNRME makes an accountable commitment to achieving its compliance objectives and targets within its corporate plan. DNRME to report annually on performance.
 - b. DNRME publish its compliance plan or its guidelines on how it manages and enforces compliance (*Natural Resources Compliance Response Guidelines*, (May 2017)).
 - c. Make available to each water user their water entitlement, water used to date and any restrictions on taking water.
 - d. Release information on a catchment basis on water availability, water use and water traded to increase transparency and information available to the community and stakeholders.
 - e. A holistic water balance is developed for Queensland that is suitable for reporting all water in Queensland and the regions and for separately water managed areas.

6 METERING POLICY

6.1 Importance of the metering policy

The accurate and reliable monitoring and measurement of water extractions from watercourses, lakes, aquifers and overland flow is essential for the sustainable and equitable sharing of Queensland's water resources. The information relating to water use is fundamental to improving water planning and management practices.

Effective metering, measurement and compliance of water use is a fundamental plank to provide confidence and assurance to all stakeholders that water use is sustainable.

Measuring water extractions with the use of meters allows for accurate measurement of water use and this benefits the community and water users by:

- improving the planning and sustainable management of the water resource;
- reducing the risk of environmental damage or water depletion;
- providing greater protection and security of water entitlements;
- establishing more equitable water sharing arrangements;
- supporting on-farm water use efficiencies; and
- enabling water trading.

6.2 Current policy framework

All new and replacement meters installed by an entitlement holder must be an "approved meter" as defined under the Water Regulation 2016 and comply with the *Queensland Interim Metering Standard*.

Entitlement holder owned meters must comply with the requirements of the *Queensland Interim Metering Standard*, the *Guide to Queensland Non-urban Water Metering for Unsupplemented Water Extractions* or the Australian Standard AS4747.

As there are only a limited number of pattern approved meters available in Australia for the type and size of meters commonly used for non-urban water metering, the installation and use of contemporary meters is permitted until the end of the meter's life or lesser period if the meter cannot be revalidated by a meter validator.

DNRME released the *Queensland State Implementation Plan for Non-Urban Water Metering 2014* in response to the National Metering Framework to provide all stakeholders with a clear understanding of the implementation of the National Framework for Non-Urban Metering in Queensland.

The National Metering Framework was released by the Commonwealth Department of Environment in 2010. It provides a nationally consistent basis for water metering. The National Metering Framework aims to deliver the primary objective agreed by Australian, state and territory governments to provide an acceptable level of confidence that measurement performance in the field is within maximum permissible limits of error of $\pm 5\%$.

The National Metering Framework outlines:

- implementation of national standards for meter construction, installation and maintenance;
- use of certified installers, maintainers and validators; and
- requirements for compliance, auditing and reporting.

The National Metering Framework also specifies that:

- all non-urban meters shall comply with the national metering standards by 1 July 2020, unless otherwise exempted by the relevant jurisdictional government department;
- any meter installed after 30 June 2010 must comply with the national metering standards; and
- any meter installed prior to 1 July 2010 shall be replaced with a compliant meter by 1 July 2020. Replacement shall be undertaken at the earliest opportunity, such as when major maintenance is required on the non-compliant meter. This was the 'grandfather' rule to assist with the transition to the new framework.

The state government's implementation plan clearly set out the state's position at the time as follows:

Given the considerable cost to fully comply with the National Framework and with no offer from the Commonwealth for funding assistance for the upgrade of existing meters, the Queensland Government does not intend to mandate full compliance with the National Framework.

The interim metering standard was last reviewed in April 2017 and applies to unsupplemented water extractions and excludes supplemented water extractions.

The interim standard is intended as a guide for the purchase and installation of compliant meters under AS4747 and supports the primary objective of the National Metering Framework i.e. that on site meter measurement performance is within maximum permissible limits of error of +/- 5%. The National Framework for non-urban metering includes a "grandfather" rule for all existing meters, however all meters must comply by 1 July 2020, and any existing meter replaced prior to, must be a compliant meter.

The Panel identified that the majority of pattern approved meters on the Australian market are of the electromagnetic type (5 manufacturers) with 1 mechanical type. This limited range of pattern approved meter types and sizes available, continues to cause problems for the irrigation industry, and is one of the reasons for the high occurrence of failure to comply with existing standards. Appendix H has a list of meters types commonly used in Queensland since 2005.

The key issues identified by the Audit in relation to the current metering policy arrangements include:

- inconsistent policies apply to meters for supplemented and unsupplemented extractions;
- majority of meters installed are not AS4747 compliant;
- accuracy of meters is not tested and is unknown;
- meter validation/maintenance process is flawed;
- frequency of meter reads leads to poor information availability; and
- meter roll out strategy is reactionary.

6.3 Unsupplemented v Supplemented water extractions

The current policy, outlined in the *Queensland State Implementation Plan for Non-Urban Water Metering 2014*, places the metering responsibility with the entitlement holder for unsupplemented water use, whereas the metering responsibility rests with the ROL holder for supplemented water use. In the situation that both supplemented and unsupplemented water pass through the same meter, the ROL holder has the metering responsibility. The metering responsibility includes ownership, installation, validation, maintenance, and reading of the meter.

This has resulted in differences with unsupplemented water extractions having a requirement to comply with AS4747 whereas ROL holders for supplemented water extractions are not mandated to meet AS4747 but rather, are only encouraged to do so.

This is a flawed policy position and creates inconsistencies and equity issues.

The service providers of supplemented water extractions have the flexibility to make decisions about the installation of new meters which best meet their operational and business requirements. The adoption of any particular standard is not mandated for supplemented water extractions. Should the service provider have valid reasons for not adopting AS4747 for new installations, DNRME expects the service provider to communicate their reasons to its customers and DNRME.

The current arrangement results in administrative complexity with the same standard not applying to all water extractions. It is not equitable to all water users as a higher standard may apply to a particular user group resulting in higher costs.

A standard metering policy should apply to both supplemented and unsupplemented water to remove any discrepancies across extraction types and to simplify the administrative arrangements. A stronger and more equitable framework would apply the same standards to all types of non-urban water extractions.

6.4 AS4747

The Audit identified a number of significant deficiencies in relation to the metering standards with meters in place that are not AS4747 compliant, or the installation characteristics are not consistent with AS4747. The AS4747 standard does not adequately deal with the use of meters in a non-urban environment. This results in meters that may provide measurement accuracy consistent with the principles of AS4747 being excluded.

The Audit identified that just 12 meter installations of the 360 independently validated since 2012 are compliant with AS4747 specifications.

The Panel has been advised that more suitable high quality meters are available for non-urban use which may not be pattern approved however would meet the AS4747 meter measure performance criteria of maximum permissible limits of error within +/-5%. The Panel has been informed from the National Measurement Institute³ that the cost of achieving a pattern approval for non-urban water meters is in the range \$100,000 to \$200,000. This is cost prohibitive given the potential sales volumes to Australian meter manufacturers, and is one of the main reasons why the strict adoption AS4747 is causing problems.

A three-tiered specification approach for meters will improve meter reliability and accuracy as the meter type is matched to volumes of water passing through the meter. This allows the strengths of each meter type to be matched to the operating conditions.

Under such an approach, the following size of delivery pipe specifies the most appropriate meter type:

- up to 200 mm – any type that is suitable for the purpose;
- 200 mm to 350 mm - electromagnetic meters; and
- above 350 mm - Ultrasonic meters (Doppler).

³ Assistant Manager for Policy, Pattern Approval, National Measurement Institute.

The Audit considered how Queensland can improve the accuracy of meter measurement and still utilise the strengths of AS4747 and create a system that supports the principles of the standard to achieve high quality outcomes. The Australian *National Framework for Non-Urban Water Metering* contains the following provision that allows states to develop their own standard:

Non-urban meters shall comply with the following key requirements of the Metrological Assurance Framework to ensure an acceptable level of confidence in meter performance. All non-urban meters shall be:

- *pattern approved by the National Measurement Institute (NMI) where available*
- *where pattern approval is not available for meters or measuring devices (see section 3.6.5, Limitations of Pattern Approval), a contemporary meter or metering system approved by the relevant jurisdictional department or agency would be acceptable. Use of an approved meter must still provide an acceptable level of confidence that it will perform within the maximum permissible limits of error in field conditions ($\pm 5\%$).*

In order to overcome the problems of the limited number of pattern approved meters, there is a need to develop an improved Queensland Metering Standard. This standard would specify the meters that are suitable for non-urban use in Queensland conditions and meet the AS4747 meter measure performance criteria of maximum permissible limits of error within $\pm 5\%$.

Developing a Queensland Metering Standard would also be consistent with the *Queensland State Implementation Plan for Non-Urban Water Metering 2014* mentioned previously.

6.5 Meter accuracy

A qualitative assessment of meter accuracy by meter owner and by meter size was undertaken by the Audit to determine the confidence level of meter accuracy.

The results of this analysis are presented in Figure 6-1 with Figure 6-2 explaining the colour coding for the various confidence levels of meter accuracy. It is illustrated that despite adopting AS4747, the Panel's confidence in privately owned meter installations is very low when compared to service provider owned and managed meters.

| | METER OWNER | METER SIZE | CONFIDENCE LEVEL OF ACCURACY |
|--|-----------------|------------------------------|--|
| QUEENSLAND'S NON-URBAN METERS INSTALLED | SEQW | 450mm and above | Reports no meters above 300 mm |
| | | Above 300 mm and below 450mm | Reports no meters above 300 mm |
| | | Above 150mm up to 300 mm | No written policy , meter types vary Good construction designs |
| | | 150 mm and below | Report all meter inserts changed every 5 years |
| | SUNWATER | 450mm and above | Good construction Reports of difficulties in verifying |
| | | Above 300 mm and below 450mm | Those recently replaced are mostly a good standard |
| | | Above 150mm and up to 300 mm | Those recently replaced are mostly a good standard, others ageing |
| | | 150 mm and below | Good installations with some maintenance issues with ageing meters |
| | PRIVATELY OWNED | 450mm and above | Struggle with technical knowledge Poor manufacturers support |
| | | Above 300mm and below 450mm | Struggle with technical knowledge Heavily reliant on pump installer |
| | | Above 150mm and up to 300mm | Struggle with technical knowledge Heavily reliant on advice |
| | | 150 mm and below | Less complex Construction reasonable in some cases |

Figure 6-1 – Confidence levels of meter accuracy

| | |
|--|--|
| | High level of confidence the meter reading will be correct. |
| | Very good installations and reasonable maintenance. |
| | Generally good. All new meters of good standard. |
| | Recently replaced meters are of a good standard with some exceptions. |
| | Generally good construction. Reports difficulties in proving accuracy. |
| | Good construction but often working outside of meters capability. |
| | Reasonable construction but many issues relating to meter accuracy. |
| | Little confidence that the meter is measuring accurately. |

Figure 6-2 – Colour code for confidence levels of meter accuracy

Appendix I includes details of the unsupplemented meter fleet based on the data provided by DNRME. The accuracy of this data cannot be assured due to the limitations in DNRME information systems.

The assessment was completed after gathering evidence and views from:

- field visits to irrigation regions of Queensland which included inspections of meters;
- interviewing management and technical representatives of SunWater and Seqwater;
- discussions with many farmers;
- interviewing SunWater and Seqwater technical representatives onsite;
- conclusions from a workshop with DNRME meter technical and operational management staff;
- review of completed validation documents; and
- interviews with external validators recognised by DNRME staff as very experienced technicians.

The key observation from this analysis are:

- Seqwater owned meters have a good to high level of confidence of meter accuracy;
- SunWater owned meters have a good to high level of confidence of meter accuracy but with some concern related to the larger meters, and concern related to their apparent ageing meter fleet; and
- privately owned meters either have difficulties in proving accuracy or meters are working outside of meter capability. The larger privately owned meters have many issues with meter accuracy, giving little confidence that the meter is measuring accurately.

This analysis has identified that major issues exist with the privately owned meters and the accuracy and performance of those meters. These issues include:

- meters not fit for purpose;
- installation configuration not compliant with standards;
- validation process is weak, and interviews suggested there are integrity issues; and
- poor controls to maintain meters.

A contributing factor to this issue is that the meter ownership policy has been introduced without strong oversight and checks on the standards of implementation.

6.6 Meter validations and maintenance

Water entitlement holders are responsible for ensuring that existing meters for unsupplemented water extractions are revalidated and if necessary replaced and/or upgraded to comply with the approved meter definition under the Water Regulation 2016. The revalidation of meters is to occur at least once every 5 years at the cost of the water entitlement holder.

The Water Regulation 2016 shows the date by which each meter will need to be revalidated by a validator to continue to be an approved meter.

Persons undertaking meter validations activities are required to:

- hold certification under the national scheme developed by Irrigation Australia Limited on behalf of the Commonwealth Government; or
- be appointed by the Director General of DNRME as an authorised meter validator.

Validations are conducted by accredited persons engaged by the meter owner. Where a water entitlement holder is also a validator, they may self-validate the installation of the meter or measuring system. This introduces significant conflict of interest issues. There is no guidance provided to accredited persons with respect to acceptable practices in areas such as conflict of interest.

The water entitlement holder is responsible for the up keep of the meter and the associated cost. Any maintenance undertaken must be in accordance with the Guide to Queensland Non-urban Water Metering for Unsupplemented Water Extractions and AS4747.

All maintenance is to be validated by a person certified under the national certification scheme or trained with nationally approved training.

The Panel identified that there is no explicit requirement to have an approved meter maintenance program or an obligation on the owner to confirm functionality of the meter on a periodic basis.

The meter validation process is flawed, with no pre-requisite requirement for a validator to have meter experience or knowledge, inadequate training provided to validators and no ongoing regulation or monitoring of validation practices and standards. The meter validation process does not include a verification or meter testing process to ensure that the meter is working according to design standards. Validation certificates show no details of what has been done while validating i.e. no check list is shown in the validator's guide.

There are no sanctions available against validators for poor performance. The meter validation process will continue to deteriorate under the current arrangements and lead to poorly performing meters and significantly compromise DNRME's water management.

Despite DNRME's non-urban water metering implementation plan prepared in 2014 defining a meter validation as including volumetric meter testing, the Panel's view is that AS4747 has been interpreted to only require the testing of the pipework construction on either side of the meter. Experience shows that well designed pipework gives the opportunity to measure well, but meters need frequent maintenance or repairs, as they are rarely protected from stones, mud, weeds, and while appearing to work, their measuring capability suffers significantly. This also happens with urban water meters, where there is far less possibility of ingress.

Consideration needs to be given to in-situ verification testing procedures, and although this task is far more difficult with large diameter meters, appropriate methodology needs to be determined. Considerations should include:

- where possible, meters tested by directing water into known storage holdings;
- use of wrap-around test meters;
- mobile certified test meters connected via testing points;
- temporary insertion meters suitable for the velocity range; and
- other site-specific flow testing arrangements.

A further weakness arises as DNRME has no power to compel the repair or replacement of a meter that has been found to be not working or inaccurate. The framework is further compromised as documentation of meter maintenance and audits by ROL holders or meter owners is not required.

Weaknesses in the application of AS4747 provides an opportunity for Queensland to develop its own metering standard which is consistent with AS4747 however addresses the issues in Queensland with the reliability of meter measurement.

6.7 Meter reading

Meters are read by the entitlement owner for unsupplemented water extractions or the ROL holder for supplemented water extractions. Readings are required to be provided to the DNRME either once or twice per year for unsupplemented water extractions and annually for supplemented water extractions. Readings are generally not available in a timely manner i.e. adjacent to the flow event or time of diversion, at the water user level or DNRME needs to follow up entitlement holders.

The Audit identified a number of weaknesses associated with measuring and monitoring activities. For example, quarterly and annual take is measured in the Mareeba Dimbulah Scheme and annual take is measured for unsupplemented surface water allocations across the Barron water plan area. This frequency of measurement makes it difficult for DNRME to assess overuse of surface water on a daily or weekly basis particularly in the low flow periods where demand for water escalates and water sharing rules are likely to be in place. This level of measurement does not provide an adequate assessment of the achievement of environmental flow objectives for the Barron catchment (see Appendix F).

Also, only annual take is measured from groundwater licences in the Atherton Groundwater Management Area. Regular measurement is required to manage the use of groundwater during low percentage announcement periods where overuse is likely to impact on highly connected surface water flows.

There is limited if any remote monitoring or use of other technologies to assist the data collection effort. Many meters have been installed with data loggers, however DNRME does not have the communication and information system to read the information with the exception of one or two areas.

The Gowrie Oakey Creek field visit identified the need to complement the upgraded gauging station network with frequent reading of meters to confirm stream pumping and water harvesting take. This demonstrates the value that telemetry can provide.

Queensland's use of technology in non-urban water measurement and monitoring activities is immature. DNRME has not adopted the best available technological solutions to assist in compliance arrangements. Significant opportunities exist to modernise systems and the meter fleet to introduce more frequent and reliable data recording.

6.8 Meter roll out strategy

The application of the metering policy to roll out metering is not systematic and is largely reactive. There is no consistent process whereby DNRME monitors or undertakes a periodic risk assessment for each catchment area and makes a conscious decision to meter or not to meter. There is limited transparency about periodic reviews of catchments, and no information available publicly about decisions taken not to meter.

6.9 Other matters

Desktop audits are undertaken for all meter readings. This is completed using spreadsheets to compare current and prior readings to identify anomalies. There are limited if any controls in place to ensure integrity of data.

There are no verification of meter readings 'in field' during or after events. There is a limited ability to reconcile water use against entitlement conditions, there is an annual reconciliation only.

Introduction of remote reading of meters will assist in addressing measurement issues of this nature by providing greater integrity and accuracy of meter reading data.

The analysis of the metering data was hindered by the quality of the data and the functionality of the central WMS database. The Audit identified a large number of areas where entitlements are not metered and a large number of entitlements in metered areas which are not metered. DNRME is investigating further to better understand the issue and the number of entitlements and the volume of water.

The issues identified above will be addressed with the implementation of a fit for purpose water accounting system.

The Panel was made aware during its stakeholder consultation of a number of meter sites which are health and safety risks. The Panel was concerned about this and finds this unacceptable. It is a further example of weakness in compliance arrangements. The *Queensland Interim Water Meter Standard for Non-urban Metering* includes specific health and safety requirements for meter sites. The meter owner has a responsibility to ensure that the meter site meets health and safety requirements. DNRME has a process for its officers to assess the risks when undertaking field visits which prohibits the officer entering a site if it presents any health and safety risks.

The Panel notes that Seqwater have implemented a program of site installation improvements to address health and safety issues at some of their sites.

6.10 Recommendations

The following recommendations are made to address the issues identified in relation to the metering policy:

Recommendations

7. Introduce a metering policy that applies to supplemented and unsupplemented water extractions, which includes a stronger validation, verification and maintenance oversight regime and an assessment system to ensure the meter chosen and installed is fit for purpose. It should be consistent with the principles of AS4747, and allow a transition period for grandfathering arrangements of the existing meter fleet.
8. Specify and introduce a stronger meter validation and maintenance oversight regime which includes auditing of meters, DNRME validation and verification of meters. DNRME should engage the accredited meter validators directly to ensure consistent practices and to remove any potential conflicts of interests. A pre-requisite knowledge and experience of water meters, or appropriate training should be required for validators.
9. The appropriate powers or polices should be provided to DNRME:
 - a. To compel the repair of a faulty water meter owned by the land holder (not working or inaccurate).
 - b. For ROL holders and meter owners to be required to keep systematic records of meter maintenance and of audits completed.
 - c. For penalties/sanctions to be introduced for validators providing certificates that are inconsistent with the Queensland meter standard.
 - d. Such that the application of the metering standard forms part of a quality management system.
10. DNRME investigate further to identify why a large number of entitlements are not metered. If any of the entitlements should be metered, an action plan should be established to have meters installed.

7 INFORMATION SYSTEMS AND RESOURCING

7.1 Current arrangements

The Panels' view is that the current metering and compliance arrangements are not sustainable and additional resourcing is urgently required. The current arrangements have many weaknesses, principally due to inadequate resourcing, and the situation will continue to deteriorate unless action is taken. The investment in management systems and information systems is not a priority for DNRME and this adversely impacts on the performance and efficiency of delivering metering and compliance arrangements.

DNRME has a significant opportunity to improve the sustainability and efficiency of metering and compliance activities to support Queensland's water management framework. This opportunity involves investing additional resourcing in management systems, information systems and people. This investment is critical if improvements are to be achieved.

7.2 Water information management system

The Audit identified that information management systems supporting DNRME's water measurement and monitoring role are not fully utilised and lacks functionality. DNRME's WMS does not store comprehensive information to enable an efficient reconciliation of usage to entitlement volumes. Regions have developed local spreadsheets or access databases to support operations. There does not appear to be any central oversight or review of locally developed systems. Furthermore, a lack of data integrity is an impediment to compliance actions as staff do not have the necessary confidence that it will stand up to judiciary scrutiny.

Access to meter records in DNRME's information systems is difficult. Insufficient data is kept of meter installation details with limited data captured for meter size, type, serial number and installation date. No details of installation configuration or photographic records are kept.

Inadequacies in the water information systems and the associated reporting results in inefficiencies as the process is time consuming, unreliable or erroneous. There is no transparency nor consistency of information across business systems to support monitoring or reporting. It is not possible to conduct reconciliations in a timely manner centrally or regionally using these official information systems.

The lack of integrity and poor quality of the information systems pose high levels of risk for DNRME in relation to the burden of proof and chain of evidence tests for compliance actions. This undermines the compliance framework and may limit DNRME's compliance options.

Implementation of a fit for purpose water accounting system is a critical step to ensure both water users and DNRME have access to relevant water use information on a timely basis. It is expected that the development of such a system would have a capital cost of between \$10 - 20 million depending on the system scope adopted. Without this system it will not be possible to provide the community with the necessary assurance about the management of Queensland water entitlements.

7.3 Groundwater and stream measurement

DNRME operates and maintains the state's water monitoring networks that are capable of producing reliable water quantity and quality data. It is important that this network is adequately configured and resourced. The delivery of timely and reliable data from these networks is critical to the sustainable management of the state's water resources, including informing flood warning.

DNRME adopted a quality management system, certified under ISO 9001:2015, to ensure that the State's water monitoring data is fit-for-purpose, meets DNRME's customer needs and is publically available. By providing a framework that aims to continually measure the performance of DNRME's water monitoring networks, the department has the ability to identify risks to reliability and opportunities for improvement. This provides public and stakeholder confidence that the water monitoring activities are being conducted in a way that is consistent, repeatable, credible and defensible across the state.

The state's water monitoring network of groundwater and stream measurement provides information about water flows. This network can also be referred to as a hydrometric network and provides important data for water resource management purposes to declare events and measure any return flows into the system. Data gathered from the hydrometric network can provide information about extractions and assist compliance and enforcement.

The configuration of the network should be reviewed to assess whether the current network is fit for purpose and if it can be improved. Alternative technologies may be available to enhance the network such as satellite imagery and drones.

Consultation with stakeholders identified that more gauging stations should be installed especially where there are nodes which are based only on theoretical models. DNRME advised that the number of stations was reduced significantly a number of years ago and suggested that this decision needs to be reviewed.

The Panel was advised that the Daintree sub-catchment monitoring node in the Wet Tropics uses theoretical modelling not actual flow measurement. As a result, it is difficult for DNRME to assess whether water management strategies are meeting the water plan objectives.

While DNRME manages its hydrometric network according to the international standard quality management standard ISO 9001, DNRME has no evidence that the groundwater and stream measurement devices owned by ROL holders are being managed to a similar standard.

Any groundwater and stream measurement devices which are required for water resource management and compliance should be owned, maintained and operated by DNRME and not the ROL holders. DNRME should seek a transfer of any devices in the ROL holder's ownership that are required for water resource management and compliance functions. The ROL holders should have ownership and responsibility for groundwater and stream measurement devices that solely serve operational purposes.

7.4 Technical expertise

DNRME has lost staff with technical expertise and experience relating to metering. The value of water is important to the Queensland economy and the investment in the skill base for water measurement and monitoring is fundamental for DNRME for this activity to be appropriately resourced.

The Panel was alarmed by the small number of people remaining on the DNRME staff who have experience and technical knowledge of water metering. The policy in 2013 to change meter ownership from government to landholders resulted in nearly all meter technicians being made redundant or leaving, and the few remaining technicians were reassigned to other priorities.

These few individuals presently deliver an indispensable value to DNRME and show an impressive dedication and willingness to help with any meter issues, despite being reassigned. They offer the only help available in this knowledge gap, and the Panel was highly impressed with their outstanding depth of commitment.

DNRME needs to invest in its work force to increase the technical expertise by way of recruitment and training and development. More sustainable and efficient metering and compliance arrangements would be achieved with the support of a well-resourced and well-trained technical team. Many of the issues to be faced by DNRME in implementing the recommendations are technical in nature and require the use of technology. This will require staff with the technical knowledge to implement the solutions and to manage them into the future.

The Panel believes a scientific and technical committee would provide focus on researching and advising on water measurement standards, policies and technologies. The committee would consist of technical experts from within and outside DNRME and would report to the appropriate DNRME senior manager responsible for water policy. The committee's principal role would be to inform water policy relating to water measurement standards and the adoption of new technologies by providing scientific and expert opinion.

The Panel has reviewed the qualities of people needed to be on such a committee for it to be successful.

The ideal profile of the scientific and technical committee would include the following skills:

- management and project planning and implementation;
- technical knowledge and expertise with meters including their workings and accuracy, comparative technical merits and suitability for measurement for different conditions and environments;
- scientific expertise in testing and implementing new technologies such as satellite technology, data transformation systems, and gathering the required intelligence for water business decision making. The capability of implementing collaborations and partnerships with universities and research institutions and the international water research centres would also be important; and
- experience in DNRME's system and protocols both in Brisbane and in the regions to assist with successful implementation of new systems within DNRME.

7.5 Ongoing resourcing requirements

To assist in the identification of ongoing resourcing requirements, the Panel has undertaken an analysis of the current resources engaged by DNRME (base case) and developed an estimate of resources required for five other scenarios.

7.5.1 Cost Model

The analysis of the ongoing resourcing requirements was undertaken by the research team who developed a costing model to estimate the capital and operating costs.

The costing model uses a bottom-up estimating approach utilising unit costs for key activities needed to support improved management.

The model has been developed to estimate the costs associated with delivering the following cost elements:

- implement measurement;

- measure water;
- monitor – assurance;
- monitor – accounting; and,
- compliance.

Figure 7-1 below outlines these cost elements and what is included within each element.

The model groups each of the cost elements by who (DNRME, Landholder, Provider) incurs the costs for each scenario, for both operating and capital costs.

The costs are based on unit rate estimates for each function. The total costs are then calculated by applying the unit rate by either the number of:

- individual entitlements;
- individual meters; or
- management areas.

Appendix J includes further details on the assumptions made in the cost model.

| Cost Element | Inclusions |
|-----------------------|---|
| Implement measurement | <ul style="list-style-type: none"> • capital cost of installing AS4747 compliant meters and data loggers • meter validation • catchment risk assessments • meter policy review |
| Measure water | <ul style="list-style-type: none"> • communication equipment • communication costs (annual) • meter maintenance • meter reading • maintenance of communication equipment • checking receipt and follow up of meter readings |
| Monitor – assurance | <ul style="list-style-type: none"> • meter site and desktop audits • in field meter testing (5 yearly) |
| Monitor – accounting | <ul style="list-style-type: none"> • reconciliation of use to entitlement • management reporting of use • water information dashboard • water accounting system |
| Compliance | <ul style="list-style-type: none"> • development of management area base Compliance plans (every 10 years) • annual review of Compliance plans • development and delivery of education programs • staff competency training • operational performance review • quality audits of compliance with metering policy and management framework |

Figure 7-1 –Cost elements

7.5.2 Model Scenarios

Six scenarios have been modelled for the purposes of providing DNRME with a potential range of cost outcomes associated with different cost inclusions. The six scenarios, including the base case, are described in more detail below:

1. base case – current arrangements as understood by the Panel;
2. existing unsupplemented meter fleet with improved assurance;
3. all existing meters, including supplemented meters, with improved assurance;
4. meter all entitlements greater than 20ML using low technology metering with improved assurance;
5. meter all entitlements greater than 20ML using high technology metering with improved assurance; and
6. meter all entitlements greater than 20ML using high technology with improved assurance, using an outsourced delivery model.

The scenarios apply a simplifying assumption that all meters immediately comply with the AS4747 standard. This would involve all meters to be replaced without any grandfathering provisions.

Case 1- Base Case

The base case considers the existing fleet of meters for unsupplemented entitlements (excluding the Great Artesian Basin) and an assessment of the level of effort currently applied to the functions in the range of activities shown in section 7.5.1. The base case includes an estimate of the capital cost to install AS4747 compliant meters. The number of meters is assumed to be 4,997 based on data provided by DNRME.

The level of effort assumed within the model is based on the responses provided by DNRME staff during the Audit in interviews, and based on reviews of current documentation. This estimate has not been cross checked against DNRME's financial records.

Case 2 - Existing unsupplemented meter fleet with improved assurance

This case has kept all things constant in the base case, but has significantly increased the level of effort applied to the assurance and compliance functions in accordance with the recommendations of this report.

Case 3 – All existing meters (incl. supplemented meters) with improved assurance

This case is Case 2 plus the existing fleet of supplemented water extraction meters, which is assumed to be 7,827 based on information supplied by SunWater and Seqwater. The number of supplemented water bulk meters for irrigation developments are included however meters within distribution networks are excluded.

The meter ownership is based on existing arrangements with unsupplemented meters owned by the water entitlement holder and supplemented meters owned by the ROL holder. This case applies the same level of management and assurance to all meters. The department would assume all responsibility for measurement and compliance for supplemented and unsupplemented metering.

Case 4 - Meter all entitlements >20ML (low tech) with improved assurance

This case assumes that all volumetric entitlements greater than 20ML will be metered (as per the MDBA Review recommendation) and all the recommendations of this report are applied. This case assumes a total 36,484 meters are installed or an additional 23,660 meters above the current meters installed for unsupplemented and supplemented water extractions.

Under the low technology case, meters would not have back to base communication, and are owned by the landholder for unsupplemented entitlements or ROL holder for supplemented entitlements.

The meter ownership is based on existing arrangements with unsupplemented meters owned by the water entitlement holder and supplemented meters owned by the ROL holder.

Case 5 - Meter all entitlements >20ML (high tech) with improved assurance

Case 4 with back to base communications technology applied to all meters. The level of assurance activities would also reduce as the communications technology provides an additional level of assurance such as that the meter is reading water take.

No change is assumed to the current meter ownership arrangements with unsupplemented meters owned by the water entitlement holder and supplemented meters owned by the ROL holder.

Case 6 - Meter all entitlements >20ML (high tech) with improved assurance, using an outsourced delivery model.

This case is Case 5, however all new and replacement meters would be managed by a third party provider who would purchase, install, maintain, validate, test and read meters. The third party provider would be responsible for all capital costs and recover capital through an annual service fee under a long term performance based contract.

Under this scenario, the meter ownership transfers to the third party provider.

7.5.3 Model results

Figure 7-2 below shows the results of the costing model for the six cases assessed. Appendix K includes more details on the estimated costs.

The chart shows a breakdown of the costs based on the key cost elements described earlier. The estimated costs increase due to the enhancements to the assurance and validation framework, the implementation of technology and information systems and the growth in the number of meters.

A significant cost item (Implement measurement) for all cases represents the annualised cost⁴ associated with installing AS4747 compliant meters. The capital expenditure on metering ranges from \$51.4 million in case 1 through to \$300 million in cases 5 and 6 (including communications network capital costs of \$5 million). These costs are then annualised and presented in Figure 7-2.

⁴ The annualised costs is calculated by converting capital costs to an annuity at a discount rate of 6% and adding annual operating costs.

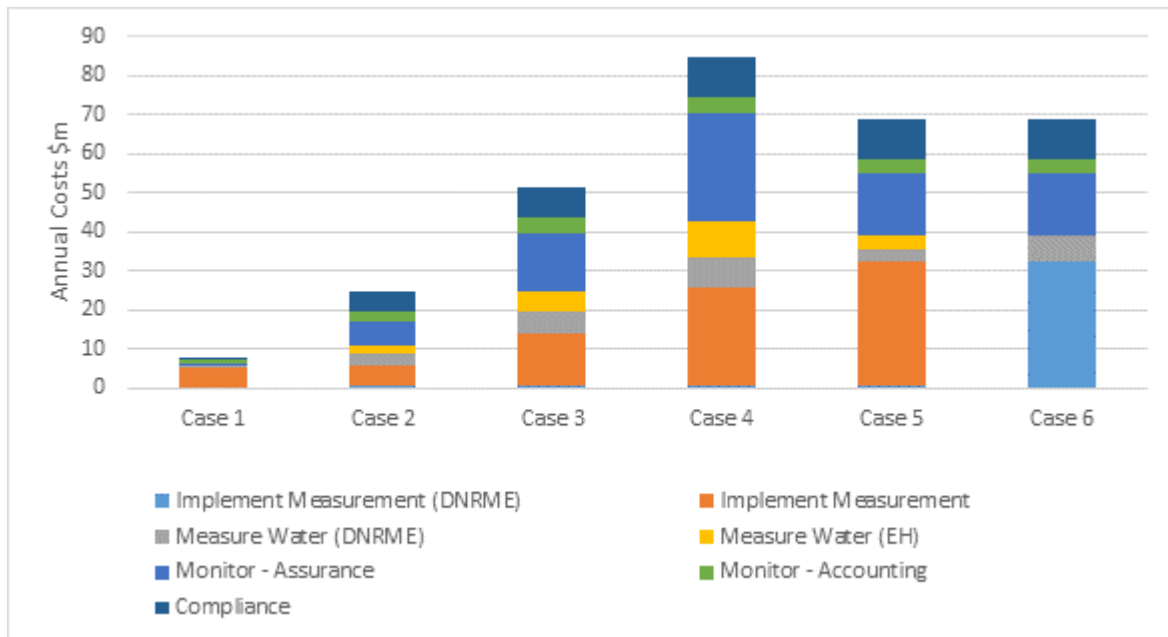


Figure 7-2 –Estimated annualised costs for scenarios modelled (\$ millions)

Figure 7-3 below includes a table which compares the annualised costs for the six cases assessed and how the costs are shared between DNRME and the water entitlement holders. The table also shows the number of meters assumed to be installed under each scenario, which changes as supplemented water extractions are included (Case 3) and the number of water entitlements that are metered is expanded (Case 4).

The analysis does not make any assumptions regarding the recovery of any costs from water entitlement holders. The costs are based on who owns the meter to assign the costs associated with installation, reading, and maintenance of the meter.

It is estimated that under the current arrangements (base case), the total annualised cost of the activities described in section 7.5.1 is \$7.8m. Of this amount, DNRME incurs 39% of the cost (\$2.2 million) and the water entitlement holders incur the remaining 61% or \$5.6 million. DNRME's costs are all operating costs with the water entitlement holder incurring a combination of capital and operating costs.

| Scenario | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Case 6 |
|---|--------|---------|---------|---------|---------|---------|
| Total annualised costs | \$7.8m | \$24.6m | \$51.2m | \$84.9m | \$69.0m | \$69.0m |
| DNRME annualised cost | \$2.2m | \$17.4m | \$32.7m | \$50.8m | \$33.7m | \$69.0m |
| Water entitlement holder annualise cost | \$5.6m | \$7.2m | \$18.5m | \$34.1m | \$35.3m | - |
| Meters within compliance framework | 4,997 | 4,997 | 12,824 | 36,484 | 36,484 | 36,484 |
| Increase in total annualised costs compared to base case (Case 1) | - | \$16.8m | \$43.4m | \$77.1m | \$61.2 | \$61.2m |

Figure 7-3 –Comparison of estimated annualised costs for scenarios modelled

Case 2, which involves the existing unsupplemented meter fleet with improved assurance, has an estimated annualised cost of \$24.6 million, a significant increase over the current resourcing levels. The additional cost of implementing the improved assurance on the existing unsupplemented fleet is \$16.8 million with:

- \$5.9 million is associated with increased auditing and verification of meter installations and meter accuracy
- \$4.5 million in additional compliance costs; and
- \$2.9 million in additional meter reading costs.

DNRME would incur \$15 million of the additional cost and the water entitlement holder would incur \$1.6 million of additional costs.

Case 3, which is expanding the improved assurance to the entire existing meter fleet, which includes supplemented take, has a total annualised cost of \$51.2 million. This involves an additional 7,827 supplemented meters included in the assurance framework.

Expanding the improved assurance to supplemented take involves additional annualised costs of \$26.6 million, of which:

- \$9.3 million is associated with increased meter auditing and verification activities;
- \$2.8m in additional compliance costs; and
- \$2.4 million in additional meter reading costs.

The estimated annualised costs for Case 4, which involves metering all entitlements greater than 20ML using low tech metering and implementing improved assurance, is \$84.9 million. This policy position would require the installation and management of an additional 23,660 meters across the state. DNRME would be responsible for \$50.8 million and the water entitlement holder \$34.1 million. This implies that the expansion of metering to all entitlements greater than 20ML under an improved assurance framework involves additional annualised costs of \$33.7 million.

Case 5 utilises high technology metering for all entitlements greater than 20ML and implementing improved assurance. The estimated total annualised cost is \$69.0 million with DNRME incurring \$33.7 million and the water entitlement holder \$35.3 million. The use of high technology metering is estimated to save \$15.9 million based on all entitlements greater than 20ML metered with improved assurance. The level of assurance activities is assumed to reduce as the technology provides assurance for activities such as meter functionality, as noted earlier.

Case 6 involves an outsourced delivery model of Case 5. This case is based on a third party provider owning and operating the meter fleet for all entitlements greater than 20ML with improved assurance implemented. The estimated annualised cost is \$69.0 million based on a simplifying assumption that no efficiency savings are made by outsourcing the arrangement. It would be expected that moving to an outsourced provider would result in significant cost savings and it is recommended that this be tested through a market based expression of interest process.

The current estimated spend on metering and compliance is \$7.8 million in annualised terms. The modelling suggests that this spend should be between \$24.6 million and \$69.0 million, depending on the standard and extent of metering and assurance adopted, and whether supplemented water extractions are included.

The estimated costs indicate that the current level of resourcing is inadequate and DNRME will be required to increase its investment on metering and compliance arrangements to support

Queensland's water management framework. The current level of resourcing will not enable sustainable and efficient metering and compliance arrangements to be in place.

The model does not address whether any additional costs incurred by DNRME or the third party provider should be recovered via a charge to water entitlement holders. This is a separate policy matter for the Queensland Government to consider.

7.5.4 Confidence levels

It should be noted that the following confidence levels apply to the cost estimates:

- uncertainty around the cost estimates is 30% to 50% due to the high level nature of the analysis and the level of confidence that can be reasonably expected; and
- cost of a water accounting system has a higher degree of uncertainty at around 100% due to unknown scope and functionality required.

7.6 Recommendations

DNRME should review the resourcing requirements to meet the revised arrangements expected to be implemented as a result of this Audit. The Panel's recommendations, and in particular the establishment of a Compliance Management and Review Group, will involve additional resources being focused on compliance activities. DNRME will need to ensure that this Group is appropriately resourced to achieve the outcomes in the compliance plans.

This approach has the advantage that is Group will be comprised of staff that have knowledge and experience and may reduce the incremental costs impacts by re-assessing existing resourcing to the compliance effort.

The following recommendations are made to address the issues identified in relation to the metering policy:

Recommendations

11. DNRME invests additional resourcing in management systems, information systems and people to deliver sustainable metering and compliance arrangements to support Queensland's water management framework state-wide. In particular:
 - a. Increase the investment in its staff with knowledge and skill capacity in water measurement and monitoring fields.
 - b. Invest in fit for purpose information systems and technologies to provide a water accounting system for supplemented and unsupplemented water which stores the information required to manage and monitor; and a compliance information reporting and a management system (Review if the existing system (CIRaM) remains the most appropriate and efficient system) and, remote read technology and supporting systems to improve timeliness and accuracy of meter reading data.
 - c. Review the existing hydrometric network and investigate alternative technologies that may be available to enhance the network such as satellite imagery and drones.
 - d. Review the ownership of groundwater and stream measurement devices to transfer those gauges which are required for resource management or compliance purposes to DNRME from ROL holders. The remaining groundwater and stream measurement devices, which serve an operational role to ROL holders, would remain in ROL holder ownership and be managed to a standard determined by the ROL holder.
 - e. Establish a scientific and technical committee with appropriate technical experts within and outside DNRME to focus on researching and advising on water measurement standards, policies and technologies. The committee would report to the senior DNRME officer responsible for water policy.
12. DNRME should review the indicative resourcing requirements and costings for modelled scenarios provided in this report to produce more detailed financial assessments that can be used as a basis for development of investment programs for defined periods to implement the recommendations of the Audit.

8 METER OWNERSHIP

8.1 Is ownership important?

Meter ownership is a key issue which the Audit has considered.

The Panel is aware that any change to the ownership model is disruptive and costly and any move away from the water entitlement holder ownership model needs to be well considered.

The Panel considered many issues in developing its view on who should own the water meters. The many issues considered are outlined in Figure 8-1 below.

| For Government Ownership | Against Government Ownership |
|--|---|
| More certainty of consistency in meter fleet and quality of meters | Disruption and costs associated with change of ownership |
| Ensures compatibility with logging and telemetry technologies | Stronger government oversight on validation and verification can be introduced |
| The present situation has not been well managed and is likely to deteriorate over time | Not core business for government, repeating culture mistakes, however this can be managed with a third party provider |
| Well maintained meters are more likely | Government would need to employ people or contract for maintenance and would involve a metering charge to recover these costs |
| Present system of validation has integrity issues that would be removed | MBDA Compliance Review came to the view that neither ownership model is inherently superior |
| Would assist DNRME keep technical staff and knowledge of meter issues in-house | Part government owned and part private owned during transition may cause issues with water entitlement holders |

Figure 8-1 – Meter ownership analysis

The previous government decision to change ownership of irrigation meters to farmers appears to have been short sighted and failed to take into account all the resulting consequences. The decision has brought about a series of events that has resulted in poor water measurement from many of the privately-owned meters. The Panel heard evidence of low cost inferior meters being offered by suppliers, of validation integrity issues, and witnessed situations where farmers could not calibrate new meters correctly and struggled to get technical support.

These problems are exacerbated by the significant reduction of DNRME staff who have technical meter expertise, and by the poor validation situation.

One of the key issues under consideration was whether a stronger government oversight under the current ownership model can adequately address the issues that have emerged. Would stronger government oversight with a new meter policy, new meter specifications and government-controlled validation and verification supported by audits address the weakness in the current arrangements?

The answer is unknown. The Panel vigorously debated whether the alterations in stronger government control can be successful without taking over ownership. It is not possible to know at this moment. The Panel believes this is a key issue and strongly support such controls being immediately implemented. These improvements, if successful, may also reduce the worries and concerns of staff having to deal with pendulum policy changes.

Alternatively, Government ownership may bring about an immediate energetic and motivated change. However, at some time in the future this may result in the tasks being given lower attention than core business. Changes can easily occur to priorities of work whenever there are staff shortages or urgent issues of the day to be dealt with. During those times of difficulties the organisational cultural values will emerge to dictate that core business must be maintained at the expense of all other work. Although a change to Government ownership of meters appears to help stop a deteriorating situation, it is not core business for Government and therefore has all the risks inherently associated with such issues.

The Panel also considered the potential of a third-party provider offering the metering services to DNRME, plus the length of time required to discover the benefits and costs of changing the meter owner model to a private provider.

The involvement of a third party has a strong benefit of locking down the ownership issue but the cost is also unknown. More details are needed for such an important decision.

8.2 Recommendations

The Panel has decided that ownership of meters should not immediately be changed.

It is a complex issue that should be informed with better cost information for options. Additionally the influence of recommendation number 4 (stronger government oversight) should be monitored closely to be able to review the impact of those changes, along with ownership cost options. During this process the views of the stakeholders involved should be gathered.

The Panel has recommended a series of actions to gather the required information and views of the stakeholders involved before a decision can be made. It would be important to understand the costs, benefits and risks of the alternatives to inform the decision-making process.

Recommendations

13. A series of actions take place over the next 18 months to assist DNRME gather the required information to make a long-term decision on meter ownership:
 - a. Seek Expressions of Interest from third party providers to explore the potential of a delivery option model including supply, maintain and read meters, and identify any necessary meter charges required under such a model.
 - b. Within 18 months start a review to compare the success of whether the stronger oversight has had desired impacts, against the merits of changing the meter ownership model with either the government or a third party provider owning the meters and taking into account stakeholder views.
 - c. Resolve the meter ownership model within 24 months.

9 WATER PLANS AND WATER REGULATION 2016

9.1 Water Plans and Water Regulation 2016

The water planning process establishes very clear management objectives and targets for water management and for the environment. DNRME has a strong natural resource assessment focus which is a key strength. The water planning framework is very strong at the development stage, there are a lot of resources applied to understanding the risks and issues, and to developing operating rules and conditions to deliver the objectives and planning outcomes.

However, the water planning process can be described as a “set and forget” compliance regime particularly with respect to the implementation of operational rules.

The overall approach to the implementation of metering and measurement of non-urban water should be defined within the water planning process to address the requirements of the water plans and now the water management protocols which have replaced the ROPs. The inclusion of the meter roll-out program in the Water Regulation 2016 fails to address this important connection. Prior to this change, the information on the meter roll-out was provided in the ROPs and was more detailed and informative. The Panel is concerned that this shift has reduced the transparency of information to the community and stakeholders such as water entitlement holders.

The Panel confirmed in their field visit to the Wet Tropics that the shift of metering programming from the Water Plan to the Water Regulation 2016 did not adequately provide for the completion of a defined metering program for unsupplemented water allocations. Also DNRME advised that there is no defined program for the metering of unsupplemented water licences in other parts of the Wet Tropics sub-catchments due to resourcing constraints and other departmental priorities.

DNRME indicated that the timeframes associated with the Water Regulation 2016 can result in a 2 year timeframe from when the decision is made to meter an area to when the requirement to install a meter is effective. Figure 9-1 shows the DNRME metering implementation process and the metering decision making path starting from the risk assessment phase to the meter roll out phase.

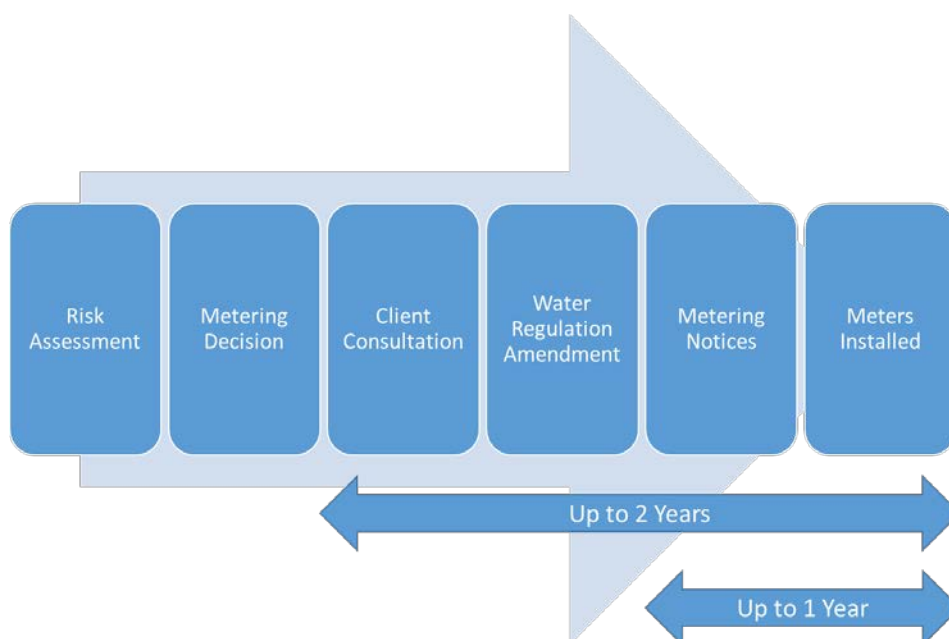


Figure 9-1 – DNRME Metering Implementation Process

The Panel believes that this timeframe needs to be shortened so that the benefits from metering can be realised much sooner.

The principles for implementing metering are documented in the current metering policy however any decisions made by DNRME to meter or not meter is not formalised or transparent. There is a lack of a systematic process and documentation for metering decisions and it is not always transparent to the community and stakeholders why a decision to meter or not to meter has been made.

The initial Great Artesian Basin plan was completed in 2006 and was recently fully reviewed however the implementation of metering is to occur over the period to the next review. However, there is no process to define when and where metering is to be rolled out across the extensive Great Artesian Basin.

9.2 Catchment risk assessments

Although risk assessments are completed as part of the water planning process, there does not appear to be a formalised or systematic catchment risk assessment process conducted on a periodic basis. This did occur when the National Water Compliance Framework funding package was in place because it was a requirement for all water resources to be rated into risk categories and reviewed every 5 years. The resourcing that was available by the Australian Government under the National Water Compliance Framework no longer exists.

9.3 Stock and domestic

Stock and domestic water use is poorly monitored. The water take by stock and domestic holders, whether riparian or non-riparian, needs to be carefully managed in areas of high water stress.

If the catchment risk assessment process identifies that the water use from the exercise of stock and domestic and other riparian rights is placing significant stress on water use in an area, steps should be taken to measure and monitor this form of take.

The field trip inspections in the Wet Tropics and Gowrie Oakey Creeks identified potential problems with excessive take from stock and domestic use and low risk use that cannot be measured unless it goes through the same meter as water taken under a water entitlement.

9.4 Review and roll-over of Water Plans

The Panel acknowledges that the 10 year review of a water plan is a significant undertaking and reviews and rollovers are likely to be driven by resourcing issues. Our stakeholder consultation during the Audit identified that DNRME has effective engagement with stakeholders during the review process however less transparency was evident when a decision was being made about whether to rollover, amend or replace a plan.

9.5 ROL holder obligations

Each supplemented water supply scheme has a ROL and SunWater and Seqwater are required to report against its requirements annually on matters relating to water quality monitoring, water taken, releases, and environmental releases.

ROL holders are required to self-declare any non-compliance, for example, any instances when environmental releases could not be made for any reason. The ROL holder is required to report on when, why and what compensatory actions will be taken.

Where a ROL holder knows they cannot meet their ROL requirements, an interim program is negotiated. For example, an interim program was developed for the Burdekin to accommodate the impact of proposed upgrades to outlets in the scheme. A further example arose with the storm damage to Paradise Dam.

The Audit found that these negotiated outcomes relating to environmental flow obligations are not publicly released. This is not acceptable and DNRME should either release the information or place an obligation on the ROL holder to make the information public. Transparency is a fundamental requirement to keep the community and stakeholders informed.

9.6 Recommendations

The Audit identified a number of gaps and inconsistencies between the metering and measurement framework and how it interacts with the water plans and the Water Regulation 2016.

An opportunity exists to review the current arrangements to ensure that the decision making frameworks remain relevant and are consistent across the various planning and regulatory instruments.

Recommendations

14. Ensure greater consistency across the various water planning and regulatory instruments and increase transparency by:
 - a. As part of reviews required under legislation, a greater focus is given to water plan operational rules and implementation plans to ensure rules and limits remain relevant and consistent with overall water management objectives and compliance outcomes. The community and stakeholders should be consulted about these reviews.
 - b. Regular reviews of DNRME's decision framework for metering to ensure it remains relevant and appropriate. DNRME also investigate making metering programs more transparent by including them in the Water Management Protocols for each catchment rather than the Water Regulation 2016. DNRME publicly releases the metering programs.
 - c. Catchment based risk assessment to include assessments for stock and domestic use. If there is increased competition for water in an area which includes impacts of increased stock and domestic use further controls on stock and domestic water use should be imposed.
 - d. Review of overland flow is completed to ensure take is consistent with the relevant water plans.
 - e. Review the timeframes associated with the meter roll out program and shorten the 2 year timeframe from when a decision is made to meter an area to when meters are actually installed.
 - f. Timely reports are released publicly by DNRME on the status of water plans and the decisions made whether to rollover, amend or replace a plan. The community and stakeholders are consulted during this process and the performance assessments of water plans are publicly released.
 - g. ROL compliance with respect to environmental flow obligations is made transparent with reports by ROL holders to be made publicly available.

10 MEASUREMENT OF OVERLAND FLOW AND WATER HARVESTING

10.1 Importance of overland flow and water harvesting

The measurement and monitoring of overland flow and water harvesting is critical to obtain a full picture of water use in Queensland. The volumes involved can be significant and in areas of water stress the measurement and monitoring becomes more important to water planning objectives.

Overland flow is water that runs across the land after rainfall, either before it enters a watercourse, after it leaves a watercourse as floodwater, or after it rises to the surface naturally from underground.

It does not include:

- water that has naturally infiltrated the soil in normal farming operations;
- irrigation tail water if its recycling meets best practice requirements; and
- water collected from roofs for rainwater tanks.

Water harvesting is the taking of unsupplemented water during high flow events. Water harvesting generally involves extraction of water when set flow thresholds are exceeded and pumping and storing the water off-stream for later use.

The Border Rivers areas is located with the MDB Basin Plan (Basin Plan) area and the measurement of overland flow and water harvesting takes on greater significance due to the obligations under the Basin Plan. Queensland will be required to demonstrate by June 2019 that the water take within the Basin Plan area is within the sustainable diversion limits.

10.2 Water harvesting in Border Rivers

DNRME has established water entitlements to authorise water harvesting in the Border Rivers catchment. The water harvesting entitlements include water licences, but the majority have been converted to tradeable water allocations that are specified with:

- access to water defined by flow conditions that must prevail for water to be taken or, for the majority of water harvesting water allocations in the Border Rivers, by the chief executive announcing that water harvesting can commence;
- the rate at which water may be taken;
- the nominal volume which defines the share of water available; and
- the volumetric limit of water that may be taken over a given period.

The monitoring and measurement of water harvesting events on the Border Rivers is based on an informal ring around for the entitlement holder to notify DNRME of meter readings prior to and after the announced water harvesting event. Data loggers and remote read technology is not utilised in the Border Rivers which is similar to other areas of Queensland where water harvesting is available.

The measurement of water harvesting is a labour intensive process and does not include a verification process. The measurement readings provided are based on the honesty of the water entitlement holder. The process is prone to errors as the data provided over a phone call can be incorrectly recorded in DNRME systems. DNRME systems are spreadsheet based, which introduces further assurance issues, as errors can occur and the integrity of the data is not protected as data can be changed, either unintentionally or deliberately. DNRME has no ability to verify that the meter was functional during the entire period of diversion. There is no photographic or other evidence of meter readings to record the time of reading.

Reliable measurement of water harvesting extractions is critical to achieve a major reduction in the uncertainty of the total water take. DNRME will need to address this issue by June 2019 when the Basin Plan sustainable diversion limits apply.

10.3 Overland flow in the Border Rivers

Overland flow in the Border Rivers is not currently measured. Estimates are made through an informal ring around. DNRME acknowledges that there is significant uncertainty in the estimate. This creates major uncertainty on the total water take against the Basin Plan sustainable diversion limits. This issue will be critical for DNRME to resolve prior to the June 2019 application of the sustainable diversion limits.

DNRME has established volumetric entitlements for overland flow in the Lower Balonne. There does not appear to be a strong linkage between the information gathering of overland flow in other areas such as the Border Rivers and the quantification of the resource in the water plan. The overland flow works notifications have not been systemised nor converted to volumetric entitlements except in a limited number of cases where there has been trading of surface water.

DNRME has established a satisfactory measurement methodology of overland flow in the Lower Balonne after undertaking research to identify a workable methodology. The research carried out by DNRME found many of the difficulties with measuring occurred in times of high flows and in keeping the equipment in good condition. These issues have now been resolved, and the staff doing this work deserve praise for their dedication to research all the issues which has resulted in some successful results. This approach should be extended to the Border Rivers area.

Overland flow is not adequately measured in other areas of the state due to measurement reliability issues. There are numerous uncertainties in the assessment methods for overland flow including inconsistencies across areas in the state.

The main control strategy for overland flow is works authorisations. DNRME has records of "existing works" and landholders are not authorised to modify these works. The data associated with works authorisation is not stored in an information management system. If a landholder wants to modify the works they must be certified by a survey.

The Panel considers that the following approach is appropriate for the measuring the take of overland flow water:

- develop an estimation approach for smaller storages that are not surveyed;
- in the short term, recommend use of buoys to measure water volumes in surveyed storages; and
- in the long term, recommend research into satellite technology.

The Panel notes that other factors impact on overland flow such as levees and these have not been considered by the Audit. These other factors need to be evaluated to obtain a complete picture of water take.

The Panel believes that DNRME can introduce measurement methodologies to better estimate overland flow extractions. This, with the improvement possible with water harvesting measurement, would achieve a significant reduction in the uncertainty of the total water take.

10.4 Sustainable diversion limits

The Audit identified that the sustainable diversion limits in the Basin Plan area may conflict with some water licence conditions with respect to carry over rules. DNRME indicated that they do not expect any problems to emerge however did not provide sufficient evidence to demonstrate that this is not an issue.

Our enquiries to DNRME could not verify if this applied to other parts of the state. A risk emerges that carry over allowance could conflict with the sustainable diversion limits.

The interaction of carry over rules with sustainable diversion limits needs to be reviewed to ensure that no compliance issues emerge against the Basin Plan in June 2019.

10.5 Recommendations

There is considerable uncertainty about the volume of overland flow and water harvesting taken in the MDB and in other areas of the state. Queensland is unable at the moment to accurately and reliably measure water harvesting and overland flow volumes.

Improvement opportunities exist in the measurement of water harvesting and over land flow by utilising either technology such as telemetry, satellite imagery and drones and well researched measurement methodologies for overland flow.

Recommendations

15. The reliability and accuracy of water harvesting and overland flow measurement and monitoring is improved by:
 - a. Adopting data logger and remote read technology.
 - b. Establishing an overland flow measurement methodology for inclusion in the meter policy which extends to the Border Rivers and other parts of the state and takes into account the methodology for measurement of overland flow in the Lower Balonne. The technical and scientific committee (see recommendation 12) should develop the proposed methodology. DNRME should publicly release the overland flow assessment methods to the community and stakeholders.
 - c. Reviewing the water licence conditions in the Queensland Murray Darling Basin catchments against the sustainable diversion limits to identify if any conflicts arise, particularly in relation to carry over rules and assess how best any conflicts can be resolved or managed. The community and stakeholders should be consulted during this process.
 - d. Establishing a system to manage overland flow works authorisations including the conversion of these authorisations to volumetric entitlements. DNRME publicly release the authorisation conversion information to the community and stakeholders. A risk based audit program should involve site visits to confirm that all works are authorised.
 - e. Implementing a fit for purpose water accounting system linked to information management systems that provides all the information required to perform the water measurement and monitoring of water harvesting and the take of overland flow.

11 MURRAY-DARLING BASIN WATER COMPLIANCE REVIEW

The Commonwealth Government requested the MDBA to provide an independent, basin-wide strategic review into compliance with state and territory based regulations governing water use in the MDB. The MDB Water Compliance Review was completed in November 2017. That review included reports by the MDBA and their Independent Review Panel. That review identified 12 recommendations and 9 actions with most of the recommendations and actions having application to Queensland.

This Panel's findings are separate to and developed independently of the MDBA Water Compliance Review. However, the Panel is in broad agreement with the recommendations and actions made by that Review. The Panel's recommendations are for the whole of the state and not just the MDB.

The Panel has not made any comments on the timings for the implementation of recommendations in the MDB Water Compliance Review. This is because the Queensland Government will need to decide its priorities and how it will resource the implementation of the recommendations it agrees with.

The Panel suggests that the Queensland Government considers the recommendations made in this independent audit when responding to the MDB Water Compliance Review's recommendations and actions.

11.1 Recommendations and actions

This section of the report provides some commentary on the MDB Water Compliance Review recommendations and actions which are directly applicable to Queensland and how they interact with the recommendations made by the Audit.

The MDB Water Compliance Review recommendations and action of relevance to Queensland are recommendations 1 to 3, 5 and 6 and actions 1 and 3 to 7.

Recommendation 1: To deliver a 'no meter, no pump' policy, it is recommended that governments:

- a) mandate that all new meters on sale in Australia must meet AS4747 from 30 September 2018*
- b) require that 95% of meterable take in each water resource area is metered using AS4747 compliant meters by 31 December 2022*
- c) require the installation of telemetry for all entities with an average annual take of more than 100ML by 31 December 2022. For all others the requirement to install telemetry would be subject to a published risk assessment*
- d) publish a mandatory protocol to be followed in the event of meter failure*
- e) require installed meters to be validated by the compliance agency and then checked every five years*
- f) require that all meters be easily identifiable by a unique reference number, and entitlement and pump details must be publicly accessible*
- g) release a meter improvement plan by 1 July 2018 with annual reports on progress*
- h) audit water take by stock and domestic and other rights holders to identify areas of stress on water resources from the exercise of these rights, and put in place measures to monitor compliance.*

The Panel recommends that the Queensland approach to metering is based on catchment risk assessment which determines the requirement to measure and monitor take based on the policy triggers and does not support a sweeping 'no meter, no pump' policy.

These triggers are designed to identify catchments with high risks associated with the use of water and provide a check that the benefits of metering outweigh the costs. The Queensland water planning framework protects the allocation of water to the environment as this is determined before the allocation of water to other users. The environmental flows are measured independently of meters at each offtake point.

The Panel has identified some issues with AS4747 and its applicability to non-urban water. The Panel has recommended that Queensland develop its own metering standard to broaden the list of meters suitable to the Queensland environment. These are meters which would comply with AS4747 however do not seek AS4747 accreditation due to the high costs (Recommendation 7).

The Panel supports the installation of remote read technologies (Recommendation 11b).

The Panel has recommended that the appropriate legislative powers are provided to enforce the repair of a faulty water meter (Recommendation 9a)

The Panel has recommended a more robust meter validation process to improve the consistency and quality of meter validation and the introduction of a meter validation process to improve the quality and measuring accuracy of meters (Recommendation 8). A recommendation has been made for DNRME to engage its own meter validators to ensure consistent practices and remove any potential conflicts of interest with the water entitlement holder, who is the meter owner, engaging the validator (Recommendation 8).

The Panel has recommended that the collection and storage of meter data is improved (Recommendation 11b).

In terms of stock and domestic use, the Panel has recommended that the catchment based risk assessment should assess the need to meter stock and domestic use. Where it is determined that there is increased competition for water and stock and domestic use is impacting on the availability of water, further controls on stock and domestic water use should be imposed in these areas (Recommendation 14c).

Recommendation 2: To improve confidence in the measurement of take by floodplain harvesting in the northern Basin, it is recommended that NSW and Queensland:

- a) include an updated assessment of water take by floodplain harvesting in their annual water accounts commencing immediately*
- b) require that 95% of take by non-metered floodplain harvesting is accurately measured, for example, by calibrated storage level recorders by 30 June 2022 and publish annual milestones towards this objective.*

A number of recommendations have been made by the Panel to improve the measurement of overland flow including the adoption of remote read technologies to improve the timeliness of measurement (Recommendation 15a to 15e).

Recommendation 3: To achieve the coverage required to generate river flow data for compliance and enforcement purposes, it is recommended that each state

review its hydrometric network to identify any gaps and maintenance backlogs and publish by 30 June 2019 a program for addressing any issues.

Action 1. The MDBA will:

- a) publish guidelines drawing on relevant standards for the requirements of hydrometric networks and hydrologic models for compliance and enforcement by 30 June 2018*
- b) publish annually from 2018 a report on the data quality and assurance processes for hydrometric data for Basin Plan reporting and river operations in the River Murray System.*

The Panel supports recommendation 3 and action 1 and has made a similar recommendation to review the Queensland hydrometric network to ensure it is fit for purpose (Recommendation 11c).

Recommendation 5: It is recommended that by 30 June 2018 each state review its arrangements for compliance and governance to ensure they take account of the following principles:

- a) encouraging a strong culture of compliance that is led 'from the top'*
- b) clear assignment of decision making responsibilities at appropriate levels, with decisions made on the grounds set out in published compliance strategies*
- c) a commitment to transparency*
- d) compliance functions should preferably be undertaken by a single agency (with appropriate separation of enforcement and operational functions) or where this is not the case, the agencies should be well-aligned.*

The Panel has made a range of similar recommendations to ensure a more proactive and stronger focus on compliance and enforcement:

- the leadership of the DNRME establish a stronger culture towards compliance enforcement (Recommendation 4);
- improved governance arrangements to clearly assign roles and responsibilities (Recommendation 4b);
- a commitment to transparency (Recommendation 6); and
- establishment of a Compliance Management and Review Group to review and report regularly to senior management (Recommendation 1).

Recommendation 6: It is recommended that by 30 June 2018 each state publish compliance strategies that include:

- a) a risk-based strategy for guiding compliance monitoring effort*
- b) annual audit priorities*
- c) an escalation pathway to apply once non-compliance is detected*
- d) a mandatory protocol for entitlement holders to follow in the event of meter failure*
- e) a statement of the penalties and sanctions regime, and any improvements required*
- f) annual reporting of data on compliance activities by location including the timeliness with which allegations are addressed*
- g) provisions to ensure compliance staff are adequately trained*

- h) a program of community awareness and education including a program to ensure that water plans, licences and management rules are expressed as simply as possible and guides for these instruments are published*
- i) a program to ensure information about entitlements, allocations, licence conditions, meter readings, account balances and so on are easily accessible to the public in real-time*
- j) a program to ensure meters are identified by a unique reference number, and entitlement and pump details are publically accessible*
- k) a commitment to effectiveness and efficiency, including the adoption of new technologies*
- l) adequate resourcing based on a cost recovery pathway, with compliance budgets protected from the normal exigencies of government budgets.*

Action 3. The MDBA will also review its arrangements as per Recommendation 5 and will prepare guidelines for consistent reporting of compliance activities by 31 March 2018.

The Panel is in broad agreement with this recommendation and action. The Panel has made the following recommendations which are consistent with the above.

- Queensland water measurement and monitoring compliance strategy and annual plan is publicly released (Recommendation 6b). This would include the annual risk based compliance audit program;
- review and publicly release the water measurement and monitoring policy and guidelines which includes the escalation pathway for non-compliance (Recommendation 6b)
- appropriate powers are provided to DNRME to compel the repair of a faulty water meter (Recommendation 9a);
- review of the penalties and sanctions available to ensure that adequate deterrence is achieved (Recommendation 5b) and a review of the Statue of Limitation period to ensure that the timeframe is appropriate and sufficient to complete compliance cases (Recommendation 5c);
- annual reporting of compliance activities against the annual compliance plan (including the audit program) to improve assurance and transparency of compliance activities (Recommendation 6a);
- increase its investment in staff with knowledge and skill capacity in water measurement and monitoring fields (Recommendation 11a);
- an education and awareness program is developed and implemented to increase information available to entitlement holders and the community and to promote self-compliance (Recommendation 5a);
- make available more information to entitlement holders and the community on water allocations, water use and water availability (Recommendations 6c and 6d);
- improve the capture and storage of water entitlement and meter information (Recommendation 11b);
- a number of recommendations have been made to adopt new technologies and to modernise systems to improve efficiencies such as the water accounting system (Recommendation 11b), compliance case management system (Recommendation 11b) and remote read technologies (Recommendation 11c); and
- establishment of a Compliance Management and Review Group to review and report regularly to senior management which is separated from operational and policy roles (Recommendation 1). This Group is appropriately resourced to achieve the outcomes in the compliance plans (Recommendation 1).

Action 4. The MDBA will take a more proactive approach to compliance and enforcement by:

- a) immediately adopting the revised protocol for handling and escalating allegations of non-compliance at Attachment B*
- b) seeking a change to the Water Regulations 2008 to ensure uniform application of its compliance powers during the transition period to 30 June 2019.*

The Panel has made a range of similar recommendations to ensure a more proactive and stronger focus on compliance and enforcement (Recommendations 4 and 5).

The Panel has recommended a review of the penalties and sanctions available to ensure that adequate deterrence is achieved (Recommendation 5b) and a review of the Statute of Limitation period to ensure that the timeframe is appropriate and sufficient to complete compliance cases (Recommendation 5c).

Action 5. By 30 June 2018 the MDBA will revise and publish its compliance and enforcement strategy to ensure compliance with the Basin Plan. The strategy will include:

- a) a clear statement of the MDBA's expectations that compliance and enforcement is undertaken effectively by states, in line with best practice*
- b) a risk-based audit program to check that Basin Plan obligations are being met, including state compliance arrangements*
- c) guidelines or standards relevant to water measurement and compliance*
- d) improvements to the system of assurance statements made by states and Australian Government agencies in meeting their Basin Plan obligations*
- e) improved communication of the MBDA's compliance activities.*

The Panel agrees with this recommendation and has made similar recommendations in its Audit:

- the Queensland water measurement and monitoring compliance strategy and annual plan is publicly released (Recommendation 6). This would include the annual risk based compliance audit program;
- review and publicly release the water measurement and monitoring policy and guidelines (Recommendation 6); and
- annual reporting of compliance activities against the annual compliance plan (including the audit program) to improve assurance and transparency of compliance activities (Recommendation 6).

Action 6. The MDBA will establish a dedicated compliance and enforcement branch, as well as an independent assurance committee to advise on the MDBA's compliance and enforcement work.

The Panel has made a similar recommendation to apply to Queensland with the establishment of a Compliance Management and Review Group to review and report regularly to senior management which is separated from operational and policy roles (Recommendation 1).

The Panel has recommended the review of a committee to undertake an assurance and monitoring role over compliance activities to ensure appropriate, timely and consistent compliance enforcement actions are undertaken (Recommendation 2).

APPENDIX A – FULL RECOMMENDATIONS

Governance

1. A Compliance Management and Review Group is established to review and report regularly to senior management on the:
 - a. Implementation of a formalised management system to manage and monitor the water metering and measurement activities including compliance and new or changed obligations arising from legislation and Intergovernmental Agreements.
 - b. Implementation of a documented, formalised and systematic approach to water compliance to apply across all regions to ensure a consistent and robust conduct of investigations and compliance actions.

The Group must allow performance assessment to be conducted separately from operational activities to provide oversight and consistency across the state. An independent audit must be conducted within two years of all water measurement and compliance programs including the performance of the Compliance Management and Review Group.

2. The future role and structure of the Natural Resource Compliance Committee should be reviewed in light of the revised governance and management arrangements.
3. Implement a documented, formalised and systematic catchment risk assessment process and apply the outcomes to decision making on water measurement and monitoring. The risk assessment process must be consistent with any relevant Intergovernmental Agreements and the community and stakeholders must be consulted in undertaking these risk assessments.

Compliance Actions and Culture

4. The leadership of DNRME establish a stronger culture towards compliance enforcement and empower the organisation to achieve the compliance objectives through:
 - a. Ensuring that the Compliance Management and Review Group has adequate levels of well-trained regional staff to complete the activities required in the compliance plan.
 - b. Having compliance targets included in the performance plans of responsible officers.
 - c. Establishing systems to ensure that the standard of evidence meets judiciary scrutiny.
 - d. Implementing action plans to address the timely closure of compliance cases.
 - e. Placing a greater focus on ensuring that the recording and monitoring of compliance cases are maintained in a timely, consistent and accurate basis.
 - f. Ensuring a compliance officer who is familiar with the region makes regular on ground inspections/audits.
5. Steps are taken to address the following elements of the compliance arrangements:
 - a. Develop a strategy to educate and raise awareness of entitlement holder's rights and obligations and the penalties associated with any breaches and send stronger deterrence messages to the community.
 - b. Review the penalties and sanctions available for breaches to ensure that adequate deterrence is achieved.
 - c. Review the Statue of Limitation period to ensure the timeframe is appropriate and sufficient time is available to complete all the steps required to prepare cases i.e. complete investigations, gather facts/evidence and prepare briefs.
 - d. Place an obligation on the ROL holder to report any take above entitlement and provide details of recurring non-compliance to allow prosecution. Require ROL holders to undertake pro-active management of compliance against volumetric limits.

- e. Prohibit water users from forward drawing on water accounts that are overdrawn at the end of the water year.

Transparency

- 6. More information is made publicly available by DNRME relating to water resource management, water use and compliance to improve transparency. This should include the development and publication of a state-wide and catchment level compliance objectives and management strategies aligned with risks and issues. In particular:
 - a. DNRME makes an accountable commitment to achieving its compliance objectives and targets within its corporate plan. DNRME to report annually on performance.
 - b. DNRME publish its compliance plan or its guidelines on how it manages and enforces compliance (*Natural Resources Compliance Response Guidelines*, (May 2017)).
 - c. Make available to each water user their water entitlement, water used to date and any restrictions on taking water.
 - d. Release information on a catchment basis on water availability, water use and water traded to increase transparency and information available to the community and stakeholders.
 - e. A holistic water balance is developed for Queensland that is suitable for reporting all water in Queensland and the regions and for separately water managed areas.

Metering Policy

- 7. Introduce a metering policy that applies to supplemented and unsupplemented water extractions, which includes a stronger validation, verification and maintenance oversight regime and an assessment system to ensure the meter chosen and installed is fit for purpose. It should be consistent with the principles of AS4747, and allow a transition period for grand-fathering arrangements of the existing meter fleet.
- 8. Specify and introduce a stronger meter validation and maintenance oversight regime which includes auditing of meters, DNRME validation and verification of meters. DNRME should engage the accredited meter validators directly to ensure consistent practices and to remove any potential conflicts of interests. A pre-requisite knowledge and experience of water meters, or appropriate training should be required for validators.
- 9. The appropriate powers or polices should be provided to DNRME:
 - a. To compel the repair of a faulty water meter owned by the land holder (not working or inaccurate).
 - b. For ROL holders and meter owners to be required to keep systematic records of meter maintenance and of audits completed.
 - c. For penalties/sanctions to be introduced for validators providing certificates that are inconsistent with the Queensland meter standard.
 - d. Such that the application of the metering standard forms part of a quality management system.
- 10. DNRME investigate further to identify why a large number of entitlements are not metered. If any of the entitlements should be metered, an action plan should be established to have meters installed.

Information Systems and Resourcing

11. DNRME invests additional resourcing in management systems, information systems and people to deliver sustainable metering and compliance arrangements to support Queensland's water management framework state-wide. In particular:
 - a. Increase the investment in its staff with knowledge and skill capacity in water measurement and monitoring fields.
 - b. Invest in fit for purpose information systems and technologies to provide a water accounting system for supplemented and unsupplemented water which stores the information required to manage and monitor; and a compliance information reporting and a management system (Review if the existing system (CIRaM) remains the most appropriate and efficient system) and, remote read technology and supporting systems to improve timeliness and accuracy of meter reading data.
 - c. Review the existing hydrometric network and investigate alternative technologies that may be available to enhance the network such as satellite imagery and drones.
 - d. Review the ownership of groundwater and stream measurement devices to transfer those gauges which are required for resource management or compliance purposes to DNRME from ROL holders. The remaining groundwater and stream measurement devices, which serve an operational role to ROL holders, would remain in ROL holder ownership and be managed to a standard determined by the ROL holder.
 - e. Establish a scientific and technical committee with appropriate technical experts within and outside DNRME to focus on researching and advising on water measurement standards, policies and technologies. The committee would report to the senior DNRME officer responsible for water policy.
12. DNRME should review the indicative resourcing requirements and costings for modelled scenarios provided in this report to produce more detailed financial assessments that can be used as a basis for development of investment programs for defined periods to implement the recommendations of the Audit.

Meter Ownership

13. A series of actions take place over the next 18 months to assist DNRME gather the required information to make a long-term decision on meter ownership:
 - a. Seek Expressions of Interest from third party providers to explore the potential of a delivery option model including supply, maintain and read meters, and identify any necessary meter charges required under such a model.
 - b. Within 18 months start a review to compare the success of whether the stronger oversight has had desired impacts, against the merits of changing the meter ownership model with either the government or a third party provider owning the meters and taking into account stakeholder views.
 - c. Resolve the meter ownership model within 24 months.

Water Plans and Water Regulation 2016

14. Ensure greater consistency across the various water planning and regulatory instruments and increase transparency by:
- a. As part of reviews required under legislation, a greater focus is given to water plan operational rules and implementation plans to ensure rules and limits remain relevant and consistent with overall water management objectives and compliance outcomes. The community and stakeholders should be consulted about these reviews.
 - b. Regular reviews of DNRME's decision framework for metering to ensure it remains relevant and appropriate. DNRME also investigate making metering programs more transparent by including them in the Water Management Protocols for each catchment rather than the Water Regulation 2016. DNRME publicly releases the metering programs.
 - c. Catchment based risk assessment to include assessments for stock and domestic use. If there is increased competition for water in an area which includes impacts of increased stock and domestic use further controls on stock and domestic water use should be imposed.
 - d. Review of overland flow is completed to ensure take is consistent with the relevant water plans.
 - e. Review the timeframes associated with the meter roll out program and shorten the 2 year timeframe from when a decision is made to meter an area to when meters are actually installed.
 - f. Timely reports are released publicly by DNRME on the status of water plans and the decisions made whether to rollover, amend or replace a plan. The community and stakeholders are consulted during this process and the performance assessments of water plans are publicly released.
 - g. ROL compliance with respect to environmental flow obligations is made transparent with reports by ROL holders to be made publicly available.

Measurement of overland flow and water harvesting

15. The reliability and accuracy of water harvesting and overland flow measurement and monitoring is improved by:
- a. Adopting data logger and remote read technology.
 - b. Establishing an overland flow measurement methodology for inclusion in the meter policy which extends to the Border Rivers and other parts of the State and takes into account the methodology for measurement of overland flow in the Lower Balonne. The technical and scientific committee (see recommendation 12) should develop the proposed methodology. DNRME should publicly release the overland flow assessment methods to the community and stakeholders.
 - c. Reviewing the water licence conditions in the Queensland Murray Darling Basin catchments against the sustainable diversion limits to identify if any conflicts arise, particularly in relation to carry over rules and assess how best any conflicts can be resolved or managed. The community and stakeholders should be consulted during this process.

- d. Establishing a system to manage overland flow works authorisations including the conversion of these authorisations to volumetric entitlements. DNRME publicly release the authorisation conversion information to the community and stakeholders. A risk based audit program should involve site visits to confirm that all works are authorised.
- e. Implementing a fit for purpose water accounting system linked to information management systems that provides all the information required to perform the water measurement and monitoring of water harvesting and the take of overland flow.

APPENDIX B – TERMS OF REFERENCE

Project Overview – Terms of Reference

Independent Audit of Queensland Non-Urban Water Measurement and Compliance

Purpose

Water measurement, metering and compliance is crucial to the integrity of water planning and governance. It provides a core building block which gives confidence to all stakeholders about water planning, sustainable water use and the integrity of these frameworks.

The purpose of this independent audit is to undertake a strategic review of Queensland's current measurement, framework and regulatory arrangements (including legislation, systems and procedures to support water measurement and compliance) for rural water.

The Audit will:

- identify limitations with the existing framework for the measurement and management of water use in the Queensland.
- provide options and advice to improve the current framework, including resource implications (CAPEX and OPEX) and opportunities for adopting improved technology.
- contribute to the Commonwealth Government's independent review in response to the ABC Four Corners program of 24 July 2017 instigated by the Prime Minister which is due to report to COAG in December 2017
- consider the measurement framework for overland flow (and associated structures including levees and roads), utilising the *Water Resource (Border Rivers) Plan 2004* (the Plan) area as an example, to provide options and advice on how the metering and measurement framework can provide consistency with the Plan, the Water Regulation 2016 and to the extent that it is consistent with the Basin Plan developed by the Murray Darling Basin Authority.

Project Drivers

1. The previous LNP Government made substantial changes to metering arrangements in Queensland. These changes including the handover of responsibility from the state to landholders for metering equipment and accountability for metering activities. Completed in 2014, the ownership of these meters has been transferred to the water authorisation holders, who are now fully responsible for the ongoing maintenance and validation of the installed meter. It is timely to consider the effectiveness of this policy shift as part of this wider review.
2. The ABC Four Corners program episode titled 'Pumped: Who is benefitting from the billions spent on the Murray-Darling?' raised issues in relation to water recovery and implementation of the Murray Darling Basin Plan (Basin Plan) including:
 - alleged water theft by a number of cotton irrigators in the NSW Barwon Darling river reaches, including in times when pumping was not allowed to ensure that flows reach the Menindee Lakes for Broken Hill water supply
 - alleged lack of compliance and metering of water use in the Barwon darling by the NSW government; and
 - alleged collusion between senior officers of the NSW government and irrigators leading to changes in the relevant NSW water regulations to allow irrigators to access low flows and therefore flows consisting of tax payer funded environmental water entitlements

3. The Commonwealth Government has requested the Murray Darling Basin Authority (MDBA) to provide an independent, Basin-wide strategic review into compliance with state and territory based regulations governing water use in the Murray Darling Basin.
4. The ABC Lateline program, 31 August 2017, that raised issues in relation to the take of overland flow and associated structures (e.g. levees or roads) in the Border Rivers catchment in the Queensland Murray Darling Basin.

Scope

The Queensland Government audit will consider:

1. adequacy of Queensland's rural water measurement and monitoring governance arrangements, for all forms of take (including metered and un-metered take) and consider the regulatory framework/model, including responsibility for installation, reading, maintenance of water meters and measurement infrastructure (ownership models)
2. how the metering and measurement framework ensures consistency with water plans and the Water Regulation 2016 including take of unsupplemented water (water harvesting and overland flow rights), Resource Operations Licence Holder obligations (for supplemented schemes), and the actions that have been taken by the state to support compliance
3. reviewing compliance arrangements including complaint and investigation management practices and how they are applied in QMDB catchments and the operational efficiency of the framework to support compliance and penalties
4. the adequacy, sufficiency/capability of Queensland's water measurement and monitoring technology, including identifying opportunities presented by new technologies and a review of Queensland interim metering standard and Queensland's progress to transitioning to meet Australian Standard 4747 and other appropriate National performance measures for non-urban water metering;
5. examining the ongoing resourcing requirements (including CAPEX and OPEX) to deliver sustainable metering and compliance arrangements to support Queensland's water management framework state wide but with particular references to ensuring Queensland's accreditation under the Basin Plan, including consideration of alternative provider models.

Out of Scope

- Comparison with other jurisdictions will not be examined.
- The review will not include public consultation and submission processes.

Guiding Principles

- This Audit is to provide a health check on status of water measurement and metering in Queensland and to support the current Commonwealth review being conducted by the MDBA.
- This review will involve active engagement with relevant stakeholders using DNRME's Water Engagement Forum (see appendix 1 for membership list)
- The findings of the report should focus on enhancing water management outcomes in Queensland and support the rigorous science which is at the heart of the water planning framework.
- The deliberations of the independent expert panel and supporting work conducted by consultants will be independent of Queensland Government agencies.

Independent Expert Panel

A three-person Independent Expert Panel will be convened to provide options and advice. The Panel will be chaired by Mr Tim Waldron. Tim serves as Chair of the International Water Association Specialist Group on Water Loss Management. He has provided advice about water measurement and management to water companies and Governments across the world including; USA, Africa, South America, Asia and Europe.

Deliverables and Timeframes

1. Project Initialisation Meeting and Processes (September 2017)
2. Independent Expert Panel Project Scoping Meeting (October 2017)
3. Draft Initial Report presented to DNRME Steering Committee/Board (November 2017)
4. Preliminary findings fed into the Commonwealth MDBA review and formally provided to Commonwealth (November/December 2017)
5. Final Report to DNRME Steering Committee/Board (February 2018)
6. Report tabled by the Minister (March 2018).

APPENDIX C – RECOMMENDATIONS RELEVANT TO TERMS OF REFERENCE

| RECOMMENDATION | RELEVANT TERMS OF REFERENCE |
|---|-----------------------------|
| GOVERNANCE | |
| 1. A Compliance Management and Review Group is established within the Department to review and report regularly to senior management on the: | 1, 2, 2a, 3 |
| a. Implementation of a formalised management system to manage and monitor the water metering and measurement activities including compliance and new or changed obligations arising from legislation and Intergovernmental Agreements. | 1, 2, 2a, 3 |
| b. Implementation of a documented, formalised and systematic approach to water compliance to apply across all regions to ensure a consistent and robust conduct of investigations and compliance actions. | 1, 2, 2a, 3 |
| 2. The future role and structure of the Natural Resource Compliance Committee should be reviewed in light of the revised governance and management arrangements. | 1, 3 |
| 3. Implement a documented, formalised and systematic catchment risk assessment process and apply the outcomes to decision making on water measurement and monitoring. The risk assessment process must be consistent with any relevant Intergovernmental Agreements and the community and stakeholders must be consulted in undertaking these risk assessments. | 1, 2, 2a |
| COMPLIANCE ACTIONS AND CULTURE | |
| 4. The leadership of DNRME establish a stronger culture towards compliance enforcement and empower the organisation to achieve the compliance objectives through: | 1, 2, 3, 4, 5 |
| a. Ensuring that the Compliance Management and Review Group has adequate levels of well-trained regional staff to complete the activities required in the compliance plan. | 1, 2, 3, 4, 5 |
| b. Having compliance targets included in the performance plans of responsible officers. | 1, 2, 3, 4, 5 |
| c. Establishing systems to ensure that the standard of evidence meets judiciary scrutiny. | 1, 2, 3, 4, 5 |
| d. Implementing action plans to address the timely closure of compliance cases. | 1, 2, 3, 4, 5 |
| e. Placing a greater focus on ensuring that the recording and monitoring of compliance cases are maintained in a timely, consistent and accurate basis. | 1, 2, 3, 4, 5 |
| f. Ensuring a compliance officer who is familiar with the region makes regular on ground inspections/audits. | 1, 2, 3, 4, 5 |

| RECOMMENDATION | RELEVANT TERMS OF REFERENCE |
|--|-----------------------------|
| 5. Steps are taken to address the following elements of the compliance arrangements: | 3 |
| a. Develop a strategy to educate and raise awareness of entitlement holder's rights and obligations and the penalties associated with any breaches and send stronger deterrence messages to the community. | 3 |
| b. Review the penalties and sanctions available for breaches to ensure that adequate deterrence is achieved. | 3 |
| c. Review the Statue of Limitation period to ensure the timeframe is appropriate and sufficient time is available to complete all the steps required to prepare cases i.e. complete investigations, gather facts/evidence and prepare briefs. | 3 |
| d. Place an obligation on the ROL holder to report any take above entitlement and provide details of recurring non-compliance to allow prosecution. Require ROL holders to undertake pro-active management of compliance against volumetric limits. | 3 |
| e. Prohibit water users from forward drawing on water accounts that are overdrawn at the end of the water year. | 3 |
| TRANSPARENCY | |
| 6. More information is made publicly available by DNRME relating to water resource management, water use and compliance to improve transparency. This should include the development and publication of a state-wide and catchment level compliance objectives and management strategies aligned with risks and issues. In particular: | 1, 2, 3, 4 |
| a. DNRME makes an accountable commitment to achieving its compliance objectives and targets within its corporate plan. DNRME to report annually on performance. | 1, 2, 3, 4 |
| b. DNRME publish its compliance plan or its guidelines on how it manages and enforces compliance (<i>Natural Resources Compliance Response Guidelines</i> , (May 2017)). | 1, 2, 3, 4 |
| c. Make available to each water user their water entitlement, water used to date and any restrictions on taking water. | 1, 2, 3, 4 |
| d. Release information on a catchment basis on water availability, water use and water traded to increase transparency and information available to the community and stakeholders. | 1, 2, 3, 4 |
| e. A holistic water balance is developed for Queensland that is suitable for reporting all water in Queensland and the regions and for separately water managed areas. | 1, 2, 3, 4 |

| RECOMMENDATION | RELEVANT TERMS OF REFERENCE |
|---|-----------------------------------|
| METERING POLICY | |
| <p>7. Introduce a metering policy that applies to supplemented and unsupplemented water extractions, which includes a stronger validation, verification and maintenance oversight regime and an assessment system to ensure the meter chosen and installed is fit for purpose. It should be consistent with the principles of AS4747, and allow a transition period for grand-fathering arrangements of the existing meter fleet.</p> | 1, 2, 2a, 4, 5 |
| <p>8. Specify and introduce a stronger meter validation and maintenance oversight regime which includes auditing of meters, DNRME validation and verification of meters. DNRME should engage the accredited meter validators directly to ensure consistent practices and to remove any potential conflicts of interests. A pre-requisite knowledge and experience of water meters, or appropriate training should be required for validators.</p> | 1, 2, 2a, 5 |
| <p>9. The appropriate powers or polices should be provided to DNRME:</p> | 3 |
| <p>a. To compel the repair of a faulty water meter owned by the land holder (not working or inaccurate).</p> | 3 |
| <p>b. For ROL holders and meter owners to be required to keep systematic records of meter maintenance and of audits completed.</p> | 3 |
| <p>c. For penalties/sanctions to be introduced for validators providing certificates that are inconsistent with the Queensland meter standard.</p> | 3 |
| <p>d. Such that the application of the metering standard forms part of a quality management system.</p> | 3 |
| <p>10. DNRME investigate further to identify why a large number of entitlements are not metered. If any of the entitlements should be metered, an action plan should be established to have meters installed.</p> | 2, 2a, 3, 5 |
| | |

| RECOMMENDATION | RELEVANT TERMS OF REFERENCE |
|---|-----------------------------------|
| RESOURCING | |
| 11. DNRME invests additional resourcing in management systems, information systems and people to deliver sustainable metering and compliance arrangements to support Queensland's water management framework state-wide. In particular: | 1, 3, 5 |
| a. Increase the investment in its staff with knowledge and skill capacity in water measurement and monitoring fields. | 1, 3, 5 |
| b. Invest in fit for purpose information systems and technologies to provide a water accounting system for supplemented and unsupplemented water which stores the information required to manage and monitor; and a compliance information reporting and a management system (Review if the existing system (CIRaM) remains the most appropriate and efficient system) and, remote read technology and supporting systems to improve timeliness and accuracy of meter reading data. | 1, 3, 5 |
| c. Review the existing hydrometric network and investigate alternative technologies that may be available to enhance the network such as satellite imagery and drones. | 1, 3, 5 |
| d. Review the ownership of groundwater and stream measurement devices to transfer those gauges which are required for resource management or compliance purposes to DNRME from ROL holders. The remaining groundwater and stream measurement devices, which serve an operational role to ROL holders, would remain in ROL holder ownership and be managed to a standard determined by the ROL holder. | 1, 3, 5 |
| e. Establish a scientific and technical committee with appropriate technical experts within and outside DNRME to focus on researching and advising on water measurement standards, policies and technologies. The committee would report to the senior DNRME officer responsible for water policy. | 1, 3, 5 |
| 12. DNRME should review the indicative resourcing requirements and costings for modelled scenarios provided in this report to produce more detailed financial assessments that can be used as a basis for development of investment programs for defined periods to implement the recommendations of the Audit. | 5 |
| | |

| RECOMMENDATION | RELEVANT TERMS OF REFERENCE |
|---|-----------------------------------|
| METER OWNERSHIP | |
| 13. A series of actions take place over the next 18 months to assist DNRME gather the required information to make a long-term decision on meter ownership: | 1, 5 |
| a. Seek Expressions of Interest from third party providers to explore the potential of a delivery option model including supply, maintain and read meters, and identify any necessary meter charges required under such a model. | 1, 5 |
| b. Within 18 months start a review to compare the success of whether the stronger oversight has had desired impacts, against the merits of changing the meter ownership model with either the government or a third party provider owning the meters and taking into account stakeholder views. | 1, 5 |
| c. Resolve the meter ownership model within 24 months. | 1, 5 |
| WATER PLANS AND WATER REGULATION 2016 | |
| 14. Ensure greater consistency across the various water planning and regulatory instruments and increase transparency by: | 1, 2, 2a, 3 |
| a. As part of reviews required under legislation, a greater focus is given to water plan operational rules and implementation plans to ensure rules and limits remain relevant and consistent with overall water management objectives and compliance outcomes. The community and stakeholders should be consulted about these reviews | 1, 2, 2a, 3 |
| b. Regular reviews of DNRMEs decision framework for metering to ensure it remains relevant and appropriate. DNRME also investigate making metering programs more transparent by including them in the Water Management Protocols for each catchment rather than the Water Regulation 2016. DNRME publicly releases the metering programs. | 1, 2, 2a, 3 |
| c. Catchment based risk assessment to include assessments for stock and domestic use. If there is increased competition for water in an area which includes impacts of increased stock and domestic use further controls on stock and domestic water use should be imposed. | 1, 2, 2a, 3 |
| d. Review of overland flow is completed to ensure take is consistent with the relevant water plans. | 1, 2, 2a, 3 |
| e. Review the timeframes associated with the meter roll out program and shorten the 2 year timeframe from when a decision is made to meter an area to when meters are actually installed. | 1, 2, 2a, 3 |
| f. Timely reports are released publicly by DNRME on the status of water plans and the decisions made whether to rollover, amend or replace a plan. The community and stakeholders are consulted during this process and the performance assessments of water plans are publicly released. | 1, 2, 2a, 3 |
| g. ROL compliance with respect to environmental flow obligations is made transparent with reports by ROL holders to be made publicly available. | 1, 2, 2a, 3 |

| RECOMMENDATION | RELEVANT TERMS OF REFERENCE |
|--|-----------------------------------|
| MEASUREMENT OF OVERLAND FLOW AND WATER HARVESTING | |
| 15. The reliability and accuracy of water harvesting and overland flow measurement and monitoring is improved by: | 1, 2a, 3, 4, 5 |
| a. Adopting data logger and remote read technology. | 1, 2a, 3, 4, 5 |
| b. Establishing an overland flow measurement methodology for inclusion in the meter policy which extends to the Border Rivers and other parts of the state and takes into account the methodology for measurement of overland flow in the Lower Balonne. The technical and scientific committee (see recommendation 12) should develop the proposed methodology. DNRME should publicly release the overland flow assessment methods to the community and stakeholders. | 1, 2a, 3, 4, 5 |
| c. Reviewing the water licence conditions in the Queensland Murray Darling Basin catchments against the sustainable diversion limits to identify if any conflicts arise, particularly in relation to carry over rules and assess how best any conflicts can be resolved or managed. The community and stakeholders should be consulted during this process | 1, 2a, 3, 4, 5 |
| d. Establishing a system to manage overland flow works authorisations including the conversion of these authorisations to a volumetric entitlements. DNRME publicly release the authorisation conversion information to the community and stakeholders. A risk based audit program should involve site visits to confirm that all works are authorised. | 1, 2a, 3, 4, 5 |
| e. Implementing a fit for purpose water accounting system linked to information management systems that provides all the information required to perform the water measurement and monitoring of water harvesting and the take of overland flow. | 1, 2a, 3, 4, 5 |

APPENDIX D – LIST OF KEY DOCUMENTS

The following key documents have informed the Audit. This list of not meant to be extensive as the Audit also drew on a range of reports and other information provided by DNRME.

The research and gathering of evidence was undertaken by the Panel as well as the independent research team. A number of information requests were made to DNRME. The information requested included policy and planning documents, reporting on compliance activities, and a sample of compliance case studies, data relating to meter and water allocation information and any supporting information relating to the information requests made.

The research team interviewed a number of DNRME staff based in the Brisbane and in regional offices.

National Water Compliance Framework (2009)

National Framework for Non-urban Water Metering (Dec 2009)

Australian Standard 4747 Meters for Non-Urban Water Supply

Queensland State Implementation Plan for Non-Urban Water Metering 2014

National Water Compliance Framework Final Report Queensland (April 2016)

Queensland Non-Urban Water Metering Policy for Unsupplemented Water Extractions 2016

Water Meter Installer and Validator Guide for Nonurban Water Meters (December 2016)

Queensland Interim Water Meter Standard for Non-Urban Metering (April 2017)

Natural Resources Compliance Response Guidelines (May 2017)

APPENDIX E – GLOSSARY OF TERMS

The Glossary of Terms has been included to ensure that the terms used in this report are clearly defined and understood. Most of the terms are sourced from the *Water Act 2000* or other documents released by DNRME.

| Term | Definition |
|--|---|
| CIRaM | CIRaM is the Compliance Information Register and Management system used for recording and managing compliance issues relating to Land, Vegetation and Water resources administered by DNRME. |
| Meter testing | <p>A procedure to confirm if the confidence level of the meter's measuring accuracy is within maximum permissible limits of error ($\pm 5\%$).</p> <p>Consideration needs to be given to in-situ meter testing procedures, and although this task is far more difficult with large diameter meters, an appropriate methodology needs to be determined.</p> <p>Considerations should include:</p> <ul style="list-style-type: none"> • Where possible, meters tested by directing water into known storage holdings; • Use of wrap-around test meters; • Mobile certified test meters connected via testing points; • Temporary insertion meters suitable for the velocity range; and • Other site-specific flow testing arrangements. |
| Overland flow | <p>Overland flow is water that runs across the land after rainfall, either before it enters a watercourse, after it leaves a watercourse as floodwater, or after it rises to the surface naturally from underground.</p> <p>It does not include:</p> <ul style="list-style-type: none"> • water that has naturally infiltrated the soil in normal farming operations • irrigation tail water if its recycling meets best practice requirements • water collected from roofs for rainwater tanks. |
| Resource operations licence (ROL) | <p>Resource operations licences may be granted in relation to existing infrastructure in an area where a water plan has been approved.</p> <p>Resource operations licences include:</p> <ul style="list-style-type: none"> • details of the water plan to which the licence relates • the water infrastructure, such as dams and weirs, covered by the licence • any conditions that the holder of the licence must comply with, including operating arrangements and water supply requirements • any transitional arrangements that the holder of the licence requires until the requirements of the plan can be met. <p>A resource operations licence can only be granted within a water plan area.</p> |

| Term | Definition |
|---------------------------------------|--|
| Resource operations plan (ROP) | A plan that details the water sharing rules, infrastructure operating rules and other water management rules that will be applied in the day-to-day management of water supplies within a catchment or water supply scheme. |
| Supplemented water | Water supplied under an interim resource operations licence, resource operations licence or other authority to operate infrastructure. |
| Telemetry | Automated meter reading with a communications process which collects and transmits data to receiving equipment for monitoring. |
| Unsupplemented water | Water that is not supplemented water, i.e. run of the river. |
| Validation | <p>Mandatory inspection and/or testing of the meter and installation undertaken by a validator to ensure the meter is pattern approved, laboratory verified, correctly installed and there is an acceptable level of confidence that it operates within the maximum permissible limits of error ($\pm 5\%$) allowable under in situ conditions. Inspections may include removal of the meter and an internal check of lead in/lead out pipes where necessary.</p> <p>Post-installation validation is an initial in situ inspection undertaken after a meter is installed and may also include in situ volumetric testing where appropriate. No evidence was found to suggest that testing is occurring.</p> <p>Ongoing validation is undertaken every 5 years and at any time during the meter's operating life and may include an inspection and/or in situ or laboratory testing where appropriate. No evidence was found to suggest that testing is occurring.</p> <p>As part of the validation process, anti-tampering seals are attached to the meter, couplings or pipe work to indicate whether the meter has been removed, interfered or tampered with by unauthorised persons.</p> |
| Water entitlement | A water allocation, interim water allocation or water licence. |
| Water harvesting | The taking of unsupplemented water during high flow events. Water harvesting generally involves extraction of water when set flow thresholds are exceeded and pumping and storing the water off-stream for later use. |
| Water Management System (WMS) | The Water Management System is the Department's information management system that stores the state's water entitlements and unsupplemented water use data. In WMS a meter's water use is not directly linked to a water entitlement but may be associated to a number of water entitlements via a client's water account. A water account can then have multiple water entitlements, meters, metered water use and works. |

| Term | Definition |
|------------------------------|--|
| Water Plan | <p>A plan approved under the <i>Water Act 2000</i>.</p> <p>They are developed through technical and scientific assessment as well as extensive community consultation, to determine the appropriate balance between the economic, social and environmental demands on the state's water resources.</p> <p>Generally, a water plan will apply to a catchment's rivers, lakes, dams, overland flow and springs and, where necessary, underground water. Or sometimes, only underground water. In developing a plan, the size and nature of the resource is assessed to ensure that water is allocated within sustainable limits.</p> |
| Water Regulation 2016 | <p>The role of the Water Regulation 2016, which replaced the Water Regulation 2002, has been expanded to take a greater role in supporting the water planning process. Specifically the water regulation now:</p> <ul style="list-style-type: none"> • allows for unallocated water to be reserved outside of a water plan, in addition to prescribing the process for releasing unallocated water • establishes generic criteria for converting water allocations • provides for water allocation dealings and the process for seasonal water assignments • provides for Minister's reporting requirements on water plans • provides the works requirements for taking or interfering with water • includes additional prescribed activities where a water entitlement or permit is not required. |

APPENDIX F – FIELD VISIT REPORTS

Approach for field visits:

- The Panel investigated the following components of the current governance framework:
 - Implementation of water planning in accordance with the *Water Act 2000* (QLD);
 - Management and compliance objectives and rules;
 - Measurement required to address objectives and rules;
 - Implementation of measurement;
 - Monitoring programs; and
 - Compliance actions.
- Performance for each component was assessed according to the following traffic light system:
 - Green – strong;
 - Amber – medium; and
 - Red – weak.

Barron Field Visit – 17 January 2018

Comprising:

- a briefing by the Cairns Regional Office and Mareeba Office of DNRME;
- a meeting with local meter validator; field inspection of cane farm taking supplemented and unsupplemented water; and
- field inspection of banana farm taking groundwater from Atherton Subartesian Groundwater Management Area.

Compliance issues

- Water Regulation 2016 (the Regulation) needs to be amended to provide powers to compel the repair or replacement of a meter.
- Quarterly and annual take is measured in the Mareeba Dimbulah scheme and annual take is measured for unsupplemented surface water allocations across the plan area. This frequency of measurement makes it difficult for DNRME to assess overuse of surface water on a daily or weekly basis particularly in the low flow periods where demand for water escalates and water sharing rules are likely to be in place. This level of measurement does not provide an adequate assessment of the achievement of environmental flow objectives for the Barron catchment.
- Annual take is measured from groundwater licences in the Atherton Groundwater Management Area. Regular measurement is required to manage the use of groundwater during low percentage announcement periods where overuse is likely to impact on highly connected surface water flows. This level of measurement also does not provide an adequate assessment of the achievement of environmental flow objectives for the Barron catchment.
- Unsupplemented water allocations are metered but the requirement for metering has shifted from the water plan to the Regulation. It is understood that the requirement in the Regulation did not adequately provide for the conversion of water licences to water allocations as provided for in the Barron Plan. The Regulation only requires water licences to be metered.
- A field monitoring program is conducted by Regional Office but it takes considerable time to complete a full audit or even a regular check on whether meters are operational due to limited resourcing. The office relies on reports of non-compliance from community members and other users impacted by the suspect non-compliance.
- There is no program for monitoring the take or interference with water for stock and domestic use or low risk use, unless it goes through the same meter as water used under a rural entitlement.
- Regional Office has a complex system of multiple spreadsheets to record meter reads submitted for different rules and parts of the plan area (e.g. areas of surface and groundwater take) This system makes it difficult for the office to assess compliance and to use these spreadsheets as evidence of non-compliance. This system also makes it difficult for DNRME's head office to monitor compliance performance across regional offices.
- DNRME believes that the inability to monitor take at intervals less than quarterly and less than annually for groundwater encourages non-compliance in the hope that accounts can be balanced by temporary trading at the end of the quarter or by end of the water year. There is also concern that in view of these conditions some entitlement holders are more willing to accept fines for overuse given the financial return that can be achieved with increased production of higher value crops.

Understanding obligations/Establishing rules and limits

- Initial Barron Water Resource Plan in 2002 (the plan) was implemented by Barron Resource Operations Plan in 2005. The plan was amended and implemented in 2015.
- The plan defines how supplemented and unsupplemented surface authorisations are to be converted to water allocations. 90% of surface entitlements have been converted to water allocations in supplemented and unsupplemented areas.
- The plan also defines how groundwater licences are to be amended to implement volumetric limits and long term volumes. All groundwater authorisations have been amended to include an annual volume (nominal entitlement) and most are relocatable (i.e. Atherton groundwater management area).
- Average water usage in the Mareeba Dimbulah scheme has increased from 50% to over 75% due to good reliability and the introduction of tradable water allocations. Unsupplemented water usage is around 25% and groundwater around 50%.
- Under the plan water for stock and domestic use can be taken without a licence and an additional take of 20ML without a licence is permitted for low risk requirements such as dairy cow needs (consumption and cooling) and packing shed product washing.
- The Regulation that supports the metering framework needs to be amended to provide the state powers to compel the repair or replacement of a meter that has been found to be not working or inaccurate.

Developing compliance objectives

- The scheme is managed in accordance with quarterly announced allocations and the annual volumetric limit.
- Groundwater licences are managed in accordance with announced entitlements for percentage of nominal entitlement and reviewed monthly.
- Unsupplemented water allocations are also managed with water sharing rules applied to daily volumetric limits and annual volumetric limits.
- Management of low flows is a significant issue for the implementation of environmental flows. This is particularly the case over the last 5 years as there has been persisting low flows in late winter and spring. Performance indicators and objectives defined in the Plan provide for management of environmental flows during these low flow periods and across all flow conditions.
- There is a high connectivity between surface and groundwater in the Upper Barron (above Tinaroo Dam). Excessive use of surface and groundwater can impact on surface flows and the achievement of environmental flows. Annual limits and announced entitlements defined for groundwater licences in the Atherton Groundwater Management Area provide a basis for the management of take of groundwater and the impact this may have on surface flow. So does the daily volumetric limits and water sharing percentages for unsupplemented surface water allocations.
- Management of releases from Tinaroo Dam also requires careful management in accordance with the provisions of the plan. In particular, the take of water from below the Dam to the coast must be monitored through the nodes (gauging stations) to ensure environmental flows are passed down the Barron River to meet end of system requirements. SunWater must comply with operating conditions to meet the requirements of the Plan and the Water Management Protocol. Cairns Regional Council is also required to report against operating conditions for Copperlode dam which releases water to Freshwater Creek for Cairns water supply.

Determining measurement

- All surface water allocations in supplemented and unsupplemented areas are metered. Supplemented water allocations have been defined based upon data available over the life of the scheme. Unsupplemented water allocations have been defined using any data for individual authorisations that is available including annual, seasonal and daily volumetric limits, maximum rates of take for installed pumps and any defined conditions for the take of water from surface flows.
- Quarterly take in the Mareeba Dimbulah scheme is measured along with total take for the water year. The annual take is measured for unsupplemented surface water allocations. Quarterly and annual measurement make it difficult for the DNRME to assess overuse of surface water on a daily or weekly basis particularly in the low flow periods where demand for water escalates and water sharing rules are likely to be in place. This level of measurement does not provide an adequate assessment of the achievement of environmental flow objectives for the Barron catchment.
- Amended licences are in place for all groundwater authorisations in the Atherton Groundwater Management Area which define annual volumetric limits. Only annual take is measured. Regular measurement is required to manage the use of groundwater during low percentage announcement periods where overuse is likely to impact on highly connected surface water flows. Annual measurement also does not provide an adequate assessment of the achievement of environmental flow objectives for the Barron catchment.
- SunWater must also comply with the requirements of the Water Management Protocol and their Resource Operations Licence in regard to issues such as releases of water below minimum operating dam levels, maximum discharge rates, flows to be maintained through water holes etc. Also SunWater must have adequate arrangements to manage allocation rules, water allocation change rules and seasonal water assignments.

Measuring take

- SunWater owns surface water meters in the Mareeba Dimbulah scheme but the standards vary i.e. some meters are no more than 5 years old but there are a number that are more than 10 years old. There is a preference for mechanical meters as they are easier to maintain. Checks on meter accuracy are mainly triggered by customer requests. Checks tend to confirm meters are either accurate or over-reading to a small extent. The main factors affecting accuracy are problems with piping installation and damage to meters.
- Take in the Mareeba Dimbulah Scheme is measured quarterly for compliance with announced allocations. Compliance with the annual limit is enforced. Customers who overuse during the water year are encouraged to temporary trade. Temporary trading is also used to balance accounts at the end of the water year. SunWater also has a clear outline of steps that will be taken to enforce compliance including deducting overuse from the following year allocations, shutting off supply and referring repeated non-compliance to the Department. SunWater checks whether meters are operational at quarterly meter reads.
- Unsupplemented water allocations are metered. However the requirement for metering has shifted from the Water Plan to the Water Regulation. It is understood that the requirement in the Regulation did not adequately provide for the conversion of water licences to water allocations as provided for in the Barron Plan. (The Regulation only requires water licences to be metered). Despite this all entitlements in the Barron were metered prior to this change. Water allocation holders now own their meters and those that have been installed comply with the interim standard defined in the interim metering policy introduced in 2013. A revalidation program for unsupplemented meters is about to proceed.
- Take from unsupplemented water allocations is reported by entitlement holders at the end of the water year for compliance assessment. The Department reports that the reading and reporting of meter by customers is working well. Entitlement holders can seasonally assign at the end of the water year to rectify overuse. However, end of year reporting does not identify non-compliance at critical times during the year, for example, when a reduced percentage applies to daily volumetric limits.
- Supplemented and unsupplemented water taken through the same meter is managed with the assistance of reporting from SunWater.
- The Department does not have the staff to undertake regular checks whether meters are operational.
- Groundwater licences are amended to define volumetric limits are fully metered.
- There are issues of compliance if take of the 20ML allowance for low risk water is taken before the meter rather than a deduction from metered take.
- It is expected that telemetry or other automatic recoding system will be required to implement daily and seasonal reporting of take. Inspections identified difficulties with telemetry. In particular, there would be costs involved to achieve transmission of data due to topography.

Monitoring measurement

- There is no program for monitoring the take or interference with water for stock and domestic use or low risk use, unless it goes through the same meter as water used under a rural entitlement.
- SunWater has a compliance program supported by the quarterly meter reading program and a transparent compliance policy. It is apparent that DNRME relies fully on SunWater to implement compliance. There is a basic DNRME program to take action in regard to annual non-compliance reports from the schemes or cases where SunWater could report cases of continuing non-compliance but it is generally to follow up with SunWater about the actions they have taken in respect of the non-compliance.
- DNRME reports that SunWater has consistently complied with the reporting requirements defined in the Water Management Protocol and the resource operating licence. DNRME reports that there are no significant issues arising from monitoring of the SunWater reports.
- Regional office reported that they implement a field monitoring program but limited resourcing means that it takes considerable time to complete a full audit. The office relies on reports of non-compliance from community members and other users impacted by the suspect non-compliance.
- Regional Office has a complex system of multiple spreadsheets to record meter reads submitted for different rules and parts of the plan area (e.g. areas of surface and groundwater take) This system makes it difficult for the office to assess compliance and to use these spreadsheets as evidence of non-compliance.
- This system also makes it difficult for DNRME's head office to monitor compliance performance across regional offices.
- DNRME's Regional Office makes an effort to communicate the need for compliance particularly during low flow periods. This effort focuses on encouraging self-reporting daily in areas such as the upper catchments of the Barron.

Issuing notices and imposing penalties

- Regional office is aware and supportive of stronger enforcement but cite systematic issues that are barrier to effective action. The office submitted case examples of non-compliance to the Panel. The Department brought entitlement holders to court but were unable to proceed because time was barred by the statute of limitations.
- The Department believes that the inability to monitor take at intervals less than quarterly and less than annually for groundwater gives the opportunity for non-compliance by users in the hope that accounts can be balanced by temporary trading at the end of the quarter or by end of the water year.
- There is also concern that in view of these conditions some entitlement holders are more willing to accept fines for overuse given the financial return that can be achieved with increased production of higher value crops.

Bundaberg Field Visit – 24 January 2018

Comprising:

- A briefing by the Bundaberg Regional Office of DNRME;
- An on farm field trip to Moorlands & Moore Park;
- A meeting with Bundaberg Fruit & Vegetable Growers, Isis Canegrowers, Kirkwood Farms & SunWater; and
- SunWater briefings and field inspections

Compliance Issues:

- The Water Regulation 2016 needs to be amended to provide powers to compel the repair or replacement of a meter.
- SunWater owns the water meters in all of the five schemes. Meters are old across most schemes and meter replacement has commenced in the Bundaberg Water Supply Scheme to NWI specifications (higher than AS4747). No comment on checks on meter accuracy.
- Take in all five schemes is measured quarterly for compliance with announced allocations. Compliance with the annual limit is also enforced. Customers who overuse during the water year are encouraged to temporary trade. Temporary trading is also used to balance accounts at the end of the water year. Customers of the Bundaberg Scheme confirm that this process works well. SunWater also has a clear outline of steps that will be taken to enforce compliance including deducting overuse from the following year allocations, shutting off supply and referring repeated non-compliance to the Department. SunWater advise that deduction for overuse reduces the pool of water available for sharing in the new water year and customers in high demand schemes like Emerald complain that this practice disadvantages all customers not just those who were non-compliant.
- SunWater has a compliance program supported by the quarterly meter reading program and a transparent compliance policy. DNRME relies on SunWater to implement compliance and quarterly and annual reports by SunWater on compliance are audited. However, SunWater reports total usage at a zonal level which fails to disclose specific non-compliance cases due to “sleeper” and “dozer licences” i.e. holders who do not use water allocated. Individual overuse is not reported by SunWater to the DNRME. There has only been one individual report of non-compliance recently but there was insufficient information supplied to allow DNRME to act. Request was made for details such as overuse in terms of water allocation number, owner and time and place of reported overuse.
- Implementation of groundwater regulation is facing resistance in some Groundwater Management Areas e.g. Barambah. Farmers question why regulation has to occur in some areas and not in others. The key issue is to establish a clear understanding entitlements and rules that are to be put in place. Decisions to manage an aquifer are based on detailed risk assessments i.e. risks to water users, environment and plan outcomes.
- DNRME advises that the system for recording use against accounts and entitlements is poor. There is a limited ability to share this data between resource operations licence holder and DNRME.
- DNRME reports there is about 3 to 4% of overuse. The majority cases of overuse at the end of the water year is generally small. These are treated in accordance with DNRME’s compliance procedures – advice letter followed by warning and then Penalty Infringement Notice etc. depending on the degree of overuse. There has only been one serious overuse incident in the last two water years which resulted in a compliance notice to stop taking followed by the implementation of weekly meter reads by DNRME.
- There appears to be no difficulties implementing the revision to stock and domestic take defined in the 2014 amendment to the *Water Act 2000*.

Understanding obligations / Establishing rules and limits

- Initial Burnett Water Resource Plan in 2001 was implemented by Burnett Resource Operations Plan in 2003. Amendments were made to the Resource Operations Plan over subsequent years to include additional schemes and Water Management Areas. The Burnett Plan (the plan) was amended in 2007 to include the Coastal Groundwater Management Area implemented by the last resource operations plan amendment before the review of the plan in 2014.
- The plan provides for a mix of high and medium priority water allocations in five water supply schemes (Bundaberg, Barker Barambah, Boyne Tarong, Upper Burnett (sub schemes) and Three Moon Creek). All have water allocations except Three Moon Creek which has interim allocations in preparation for conversion.
- There are five Water Management Areas which have water allocations except for Three Moon Creek WMA where licences are managed under existing conditions.
- Average water usage in the Bundaberg Scheme is about 42%. Unsupplemented water usage in the WMA's varies from zero to 6%.
- There are six Groundwater Management Areas (GMAs) including the Coastal Burnett, Barambah Creek, Central Burnett, Barker, Ban Ban Springs and Upper Burnett. Significant progress has been made in the Coastal Burnett putting in place water allocations and amended licences and utilisation now ranges from 30 to 70%. Plan implementation in the other GMAs is being initiated.
- Construction of overland flow works in the Coastal Burnett is being managed.
- Under the plan water for stock and domestic use can be taken without a licence. The amendment of the *Water Act 2000* in 2014 doubled the area available for the use of this water from 0.25 of a hectare to 0.5 of a hectare in unsupplemented areas but in schemes it is limited to that taken by existing works at plan commencement in 2014. Stock and domestic take is at a low level across the plan area and is stable. If there is a risk of an increase in take an amendment to the plan could be contemplated.
- The plan requires that monitoring and regular reporting is to be undertaken to ensure that any emerging issues are addressed promptly through an amendment plan, rather than being left until the mandatory 10 year review.
- The Water Regulation 2016 that supports the metering framework needs to be amended to provide the state powers to compel the repair or replacement of a meter that has been found to be not working or inaccurate.

Developing compliance objectives

- The environmental flow objectives in the first water plan were based upon modelled statistical flows which were not understood by water users and the community. The 2014 plan provided environmental flow rules and infrastructure operating rules to meet environmental outcomes that were more specific i.e. better management of infrastructure, lowering of risk to defined environmental assets, targeted flows for pools and riffles for endangered species. This is a good example of best available science supporting planning.
- Environmental Flow Objectives for groundwater have been defined for management of salt water intrusion, discharge to submarine groundwater and standing groundwater levels for terrestrial, riparian and wetland vegetation. Also these objectives have been defined to ensure discharge and recharge to identified watercourses within the Coastal Burnett GMA are maintained.
- Water allocation security objectives and water sharing rules are defined for water allocations within specific areas of the plan.
- Management to achieve environmental outcomes focuses within the schemes on specific operating and environmental management rules (e.g. inflow/outflow rules for releases and operating levels) the quarterly and annual take of scheme infrastructure. Within the water management areas most entitlements have flow conditions for water harvesting which are managed through announcements when water can be taken from flows. Groundwater take is managed through annual volumetric limits and annual announced allocation limits based on aquifer unit water levels Overland flow take is managed in the Coastal Burnett by limiting the size of new infrastructure.
- There is no control of overland flow take in other parts of the basin as the risks of growth in overland flow storage in these areas impacting upon plan outcomes were assessed as low.

Determining measurement

- All water entitlements in the schemes are metered in accordance with the requirements of the Burnett Water Management Protocol and SunWater's policies and supply contracts. The water plan defines announced allocation rules for the Bundaberg, Barambah Creek and Upper Burnett schemes. Announced Allocation Rules for the Boyne River and Tarong are in the Burnett Basin Water Management Protocol and Three Moon Creek is still operated under interim rules in the Interim Operations Licence. The delay in planning for the latter scheme involves the interconnection between supplemented surface supply and groundwater in the Upper Burnett GMA. Quarterly take in the schemes is measured along with total take for the water year.
- SunWater must comply with the requirements of the Water Management Protocols and their Resource Operations Licences in regard to issues such as environmental flow releases, operating levels within infrastructure and release volumes and rates. Also SunWater must have adequate arrangements to manage allocation rules, water allocation change rules and seasonal water assignments.
- All water entitlements (unsupplemented) in the five Water Management Areas are metered with most being 'shared' meters used in the water supply schemes. Also most entitlements have flow conditions (water harvesting) with announcements done by DNRME when events start and stop. There are 425 area based entitlements and 101 are volumetric with a total volume of 12,170 ML which are not included in water management areas. Only 3% Of these are metered.
- The Coastal Burnett Groundwater Management Area (GMA) is managed in two areas. Area A (the original Bundaberg Sub-artesian area) has water allocations (660 entitlements) and Area B (to the west and south of Bundaberg) has 150 water licences with volumetric limits. Usage is about 70% over the past 10 years.
- Investigations are proceeding to implement volumetric licences in the Barambah Creek GMA and the Central Burnett GMA. The former has been prioritised because of the possible impact of groundwater take on the Barambah Creek water supply scheme. The implementation of volumetric entitlements in this GMA is taking time due to investigations being undertaken to assess the volumetric limit for the aquifer. Definition of entitlements in the Central Burnett GMA is to be completed at the same time as the Mulgildie Management Area of the Great Artesian Basin because of common water users. Meters are to be installed once volumetric entitlements are defined. The timing of this process has been dictated by the ten year review of the Great Artesian Basin Plan which was completed in September 2017. It is not intended to meter the Baker Creek and Ban Ban Springs GMAs (as there is no water licences to be issued – it is simply a no more bores management regime) and the Upper Burnett GMA as risk of significant demand are assessed as low. Other criteria are assessed such as impact on town use of groundwater.
- The water plan allows the construction of new overland flow storages (for a purpose other than stock and domestic) of no more than 20 ML in the Coastal Burnett Overland Flow Area unless environmental approval is to be sought say for capture of contaminated agricultural runoff. The 20 ML limit is the run off that could be expected from a limited catchment of 25ha. An entitlement holder commented that variations to this limit on a case by case basis could have been considered within an overall volume cap. Larger developments may proceed in the Gregory and Isis where unallocated water may be available.
- There is no priority yet for a program of conversions to water allocations or amendments to licences in the coastal catchments (Elliott, Isis and Gregory). Conversions or amendments are being made for permanent trades only.

Measuring take

- SunWater owns the water meters in all of the five schemes. Meters are old across most schemes and meter replacement has commenced in the Bundaberg Water Supply Scheme to National Water Initiative specifications (higher than AS4747). We did not receive comments on checking of meter accuracy. Comment also from the customers of the Bundaberg scheme that the capacity of the channel system limits supply in peak use times necessitating rostering. The expansion of horticulture which requires more constant supply all year has reduced the need for rostering in peak times. Customers do not consider that meter accuracy is important when compared with distribution inefficiency and losses.
- Take in all five schemes is measured quarterly for compliance with announced allocations. Compliance with the annual limit is also enforced. SunWater checks whether meters are operational at quarterly meter reads in each scheme. Customers who overuse during the water year are encouraged to temporary trade. Temporary trading is also used to balance accounts at the end of the water year. Customers of the Bundaberg Scheme confirm that this process works well. SunWater also has a clear outline of steps that will be taken to enforce compliance including deducting overuse from the following year allocations, shutting off supply and referring repeated non-compliance to DNRME. SunWater advise that deduction for overuse reduces the pool of water available for sharing in the new water year and customers in high demand schemes like Emerald complain that this practice disadvantages all customers not just those who were non-compliant.
- Most of the meters in all Water Management Areas are scheme meters owned by SunWater. That is both supplemented and unsupplemented take is measured through the same meters. As most of the unsupplemented entitlements have flow conditions, event readings are forwarded to DNRME at the start and finish of announced events. These readings are forwarded to SunWater so they can discount unsupplemented take from their quarterly meter readings. Failure by entitlement holders to provide unsupplemented take or over use is taken to be use of water supply scheme water and is subject to fixed and variable charges. SunWater checks whether meters are operational at quarterly meter reads. There was no comment on the condition and age of the meters. It is assumed that the balance of the meters are owned by the entitlement holders who report readings on an annual basis. The amount of take involved would be small given that the maximum take for 450 unsupplemented entitlements across the WMAs is only 3000 ML.
- Metering in the coastal catchment areas is in conformance with 2013 interim standards and validated. Self-reading in the Coastal Burnett is recording response rates in excess of 90%.
- Metering roll out has been finalised in both Area A and Area B of the Coastal Burnett GMA. Meters in Area A are to pre 2013 standards i.e. DNRME's standard for meters they owned. Area B meters conform to the 2013 standard. Groundwater licences amended to define volumetric limits are also fully metered. There is a network of 647 monitoring bores of which 160 monitor seawater intrusion. 42 of the bores have real time measurement to encourage self-management. Seasonal water sharing through announced entitlements has just commenced in 2016-17 in Area A. Voluntary management is encouraged by DNRME but telemetry is installed and checked regularly. Moore Park seawater intrusion rules have a cut off. DNRME is encouraging water users in that area to establish voluntary rostering to keep water above cut off levels.
- Implementation of groundwater regulation can face resistance in other GMAs e.g. Barambah. There is a focus on why regulation has to occur in some areas and not in others. The key issue is to establish a clear understanding entitlements and rules that are to be put in place. Decisions to manage an aquifer are based on detailed risk assessments i.e. risks to water users, environment and plan outcomes.
- There appears to be no difficulties implementing the revision to stock and domestic take defined in the 2014 amendment to the *Water Act 2000*.

Monitoring measurement

- DNRME reports that there is regular auditing of unsupplemented entitlements in high risk catchments which are the Coastal Burnett GMA and the Mulgildie Management Area for the Great Artesian Basin. The audits cover a 15% sample and include water use auditing of metered entitlements and compliance auditing of non-metered entitlements. There is no program for monitoring the take or interference with water for stock and domestic as there is no evidence of growth in this take.
- SunWater has a compliance program supported by the quarterly meter reading program and a transparent compliance policy. DNRME relies on SunWater to implement compliance and quarterly and annual reports by SunWater on compliance are audited. However, SunWater reports total usage at a zonal level which hides specific non-compliance cases due to sleeper and dozer licences. Individual overuse is not reported by SunWater to DNRME. There has only been one individual report of non-compliance recently but there was insufficient information supplied to allow DNRME to act. Request was made for details such as overuse in terms of water allocation number, owner and time and place of reported overuse.
- It is understood that SunWater has consistently complied with the reporting requirements defined in the Water Management Protocol and the resource operating licence. DNRME reports that there are no significant issues arising from monitoring of the SunWater reports.
- DNRME advises that the system for recording use against accounts and entitlements is poor. There is a limited ability to share this data between resource operations licence holder and DNRME.
- The Regional Office makes an effort to communicate the need for compliance particularly at high demand periods. This effort focuses on encouraging self-reporting and compliance through newsletters and irrigator committees. The office considers this effort is important in reducing non-compliance.

Issuing notices and imposing penalties

- DNRME submitted case examples of non-compliance to the research team and the Panel. They advise that meter tampering was reported in the early stages of reform and it was fully covered in the media therefore this form of non-compliance has reduced substantially.
- Entitlement holder for groundwater commented that compliance notices are issued but not frequently.
- DNRME reports there is about 3% to 4% of overuse. This is discovered when water users apply for seasonal assignment. The majority cases of overuse at the end of the water year is generally small. These are treated in accordance with DNRME's compliance procedures – advice letter followed by warning and then Penalty Infringement Notice etc. depending on the degree of overuse. CIRaM can provide the details. There has only been one serious overuse incident in the last two water years which resulted in a compliance notice to stop taking followed by the implementation of weekly meter reads by DNRME.

Condamine Balonne Field Visit – 4 to 6 October 2017

As this field visit was conducted by Panel Chair Tim Waldron prior to the Independent Expert Panel being fully constituted, it was decided to primarily focus on metering issues, meeting farmers and regional DNRME staff.

The visit comprised:

- briefings by DNRME Toowoomba Regional Office during the inspections;
- meeting with Condamine Plain irrigators and an inspection of broad acre farming and off stream storages and Condamine Plains Water Board off stream storage;
- inspections of Cubbie Station and two other farms with off stream storages: and
- an inspection of the Beardmore Dam and the St George Irrigation Scheme including the Thuraggi off take channel.

Measuring take

- Most of the large diameter meters were buried in difficult locations and gave no indication that they would be measuring accurately.
- Many meter locations presented health and safety issues for anyone attempting maintenance.
- One irrigator was comparing a meter by also measuring volume into a storage and said he could not correlate the readings to less than 15%. He had been advised by the meter company that this is all he could expect.
- Poor advice is being given by meter suppliers to farmers about the correct installation and setup of new meters.
- There is still a need for specialist advice on meters, and the irrigators noted that there are very few people working for the DNRME that now have that knowledge, as the majority of such technical people lost their jobs when the ownership of meters was changed
- Irrigators made strong comments about the lack of transparency of what other irrigators are taking.
- Excellent working relationships were demonstrated between farmers and the Department staff.
- It appeared a necessity for there to be good working relationships between local staff and the irrigators. However this also created a situation where pushing a hard compliance line would create community problems.

Overland flow measurement

- Trials have been carried out in these areas to measure overland flow takes.
- Research has included various methods of measurement change in storages.
- Equipment utilising data recorders and buoys have been extensively tested.
- It appears to have recently had some success, following many learning experiences.
- The equipment is reasonably priced, but needs expertise to set up and monitor.
- There appeared no other alternative method to resolve this different problem.
- New technology through satellite measurements may be an alternative, but would require daily readings. Research of all opportunities need to take place, but in the meantime the buoy system seems the only immediate option.
- A problem utilising this system may well arise from the lack of technical field staff who would be capable of using and interpreting such equipment.
- Significant training would be necessary.

Other issues related to Condamine and Balonne

- It was decided that a separate field trip was needed in the region to visit the Gowrie Oakey Creek area, due to the large number of extractors in a relatively small area.
- It was also decided that as the other panel members had not visited this area, due to not being appointed, then a separate part of the Independent Expert Panel's report would be necessary covering all the issues related to the other member's area of expertise.

Gowrie Oakey Field Visit – 22 January 2018

Comprising:

- A briefing by the Toowoomba Regional Office of DNRME;
- A meeting with meter validators in the Toowoomba Office; and
- A field inspection and meeting with entitlement holders in the Oakey Creek area

Compliance Issues:

- Water Regulation 2016 needs to be amended to provide powers to compel the repair or replacement of a meter.
- Annual volumetric limits are enforced and the department relies on the system of gauging stations and voluntary reporting to identify non-compliance. This system does not identify overuse that may occur on a daily or weekly basis. In addition, the system has only been installed and is not fully operational.
- There is no measurement of overland flow take stored in on farm infrastructure.
- Take from flow events (water harvesting) must be as advised by the department and reported (per events). However there is no regular assessment of total take i.e. water harvesting, river pumping and overland flow.
- Telemetry has been trialled but not implemented due to policy change. There is an opportunity to reinvestigate telemetry including mobile phones or other technology.
- There are significant numbers of stock and domestic bores that may be taking water for irrigation purposes. These bores may or may not be registered.
- There is no system of regular audits on the operation of meters and compliance.

Understanding obligations / Establishing rules and limits

- The Condamine Balonne Water Resource Plan 2004 has been implemented with a series of Resource Operations Plan amendments in various areas of the catchment. An amendment in 2014 included the Gowrie Oakey and its tributaries. This area was not dealt with earlier due the complexities around how to handle inflows to the creek system from the Toowoomba Wetalla sewerage plant.
- In 1996 management guidelines were implemented for Gowrie Oakey which included provisions to standardise areas for management and place volumes and conditions on all licences. Old unconditional licences became 'class A' and newer conditional licences became 'class B'.
- The key changes implemented by the Resource Operations Plan was to amend these area based licences (class A and B) to provide daily rate of take, nominal long term volumes and volumetric limits converting them to unsupplemented water allocations capable of being traded. Water harvesting licences were also converted to tradable water allocations.
- Water Regulation 2016 that supports the metering framework needs to be amended to provide the state powers to compel the repair or replacement of a meter that has been found to be not working or inaccurate.

Developing compliance objectives

- The area licences had previously included conditions providing notional volume limits (named Annual Notional Volumetric Entitlement (ANVE) to take account of the added inflows from the Wetalla sewerage plant. However in the resources operation plan these area licences were converted on the basis of area not ANVE as there was no certainty regarding the Wetalla inflow. But rules were included to enable the traditional ANVE to be achieved. The conversion was fixed ML/hectare volume limits and was about 50% smaller than the ANVE volume. However, a rule was included in the resource operations plan to allow the ANVE volume to be taken to be adjusted by an 'annual multiple'. This multiple is like an announced allocation, however assessment is based on a longer term trend of changing flows and diversions rather than a detailed resource assessment. The year to year inflows from Wetalla would not be known in a single season as both the Millmerran Power Station and the Acland mine had contracts to take quantities of Wetalla inflow. These takes vary from year to year. On average Wetalla releases about 7000 ML which Millmerran Power Station and Acland Mine can take up to 3000 ML leaving at least 2000 ML for release for medium priority use.
- Water harvesting licences were converted using modelled long term take. Daily rate and volumetric limits the key volumetric accounting. Each allocation is designed around existing farm development (consistent with the rest of the Condamine Balonne).
- Overland flow take and groundwater take is not assessed for compliance. The overland flow take is limited by "existing works" meaning works in place at Sept 2000. The groundwater take is regulated by volumetric water licences and managed by water sharing rules for the Oakey Creek Alluvium under the Water Regulation 2016 (applying annual announced entitlement). Metering of overland flow does not occur at this stage. Metering of groundwater water licences does occur. The stock and domestic bores are unmetered.
- The above conditions were defined to control overall take of water (i.e. no growth in take from Sept 2000 development levels). The environmental performance indicators for environmental flow objectives (EFOs) are used in assessment of any changes from that baseline development level. This test is to assess performance of the flow regime for low flow, summer flow, beneficial flooding flows and 1 in 2year and 1 in 10 year flood when a change is proposed. Nodes along the Condamine are points throughout the plan area where the environmental performance is assessed. The assessment of these EFOs occurs in situations such as a water trade or a change in water sharing rules.
- The water plan does contain other assessment triggers or tests. These are the No growth test, the third party impact test (more formally the Water Allocation Security Objective) as well as the environmental performance test (formally the Environmental Flow Objective).

Determining measurement

- These water sharing rules appear to be understood by entitlement holders. In volume terms most licences have entitlements that specify volume limits of between 72 and 108 ML each with Class A licences being converted at 9 ML/ha and Class B at 6 ML/ha. However the annual limit rule gives everyone up to 180 ML which is what each licence had under the ANVE rules.
- Annual volumetric limits are enforced but this does not address impact that can occur on flows on a weekly basis.
- Irrigators want to see inflowing creeks to the system monitored and flows added to allocations. It is not clear what amount of water the tributaries would deliver and how regularly. There will also be added costs of establishing this monitoring and resolution of who would be responsible for these costs.
- Water harvesting is permitted along the mainstream where passing flow conditions are monitored on the upstream gauging station (i.e. there are no announced flow conditions).
- On farm infrastructure can take overland flows but there is no measurement in place to assess this component of take that is stored in farm dams. DNRME advises that overland flow is authorised by the water plan and 'existing works' which is defined in the Water Plan as notified works that could take overland flow water at September 2000. The infrastructure constrains the take to this level of development. However, if a person amends the works, or moves away from water harvesting the general authority is replaced with a water licence with volume parameters. Measurement would be a requirement but in some circumstances practical solutions to such devices are still a key consideration. Storage level meters are used in the Lower Balonne but this still requires considerable assessment to deal with the multiple sources of water making the storage change volume.

Measuring take

- Annual volumetric take is assessed for compliance. Trading arrangements are now in place to allow temporary trades to balance accounts.
- Announcements are made via recorded messages twice weekly (Monday to Friday and Friday to Monday) stating volume that can be taken over the period to the next announcement. The announced volume can be taken at any time during the period provided that the rate of take is no more than 2 ML/day/entitlement.
- Two new gauging stations have been installed along the creeks which has allowed improved management of take and giving access to losses that would have been incurred over lengths of the creeks in the absence of additional gauges. The new system gives a greater measure of control over take but reporting over weekly periods is still voluntary and it is not clear what proportion voluntarily report.
- Entitlement holders comment that the system makes it difficult to take water in excess of entitlement because the impact would be felt particularly at times of low flows. They accept the need for meters and mechanical meters are preferred because of the ease of repair.
- Irrigators accept that they could move to a mobile phone technology to report regular take.
- Meters were fitted with telemetry devices. A company called Taggle was keen to invest and support trials in the area. The infrastructure relied on radio devices on each meter relaying information to a receiver station which would then relay using 3G to a data base in the Taggle office before being sent on to DNRME in Toowoomba. The cost comparison between the data loggers and telemetry was very similar. Under changes to metering policy in 2013-14 data loggers were no longer required and the initiative stopped. The infrastructure (radio receivers) and telemetry devices on some meters remain in place. The program could be reinvigorated but DNRME expects that there would be opposition from irrigators given the go stop process conducted recently.
- Water harvesting allocation holders are required to report water use within five days of each event. Trading arrangements are in place for water harvesting
- Overland flow take is not measured. Groundwater take under volumetric water licences in the Oakey Creek Alluvium is metered (since around 2011). Stock and domestic bores are not metered and these bores may be taking water for irrigation.

Monitoring measurement

- Annual volumetric take is assessed for compliance.
- DNRME relies on the system of gauging stations real time management system and voluntary reporting to identify whether there is excessive take in any section of the creeks over weekly periods. But this system does cannot be relied upon to identify the entitlement holders responsible for non-compliance.
- DNRME advises that the gauging station monitoring and reporting system is still being tested and confirmed. It is understood that this means that DNRME is not able to implement a full compliance program. The irrigators are satisfied with the operation of the technology.
- Entitlement holders report take from flow events to DNRME which are checked by against passing flow conditions at the upstream gauging station. It is questioned whether DNRME can accurately assess level of take from both river pumping and water harvesting. There is the added difficulty of measuring overland flow take in farm storages.
- Irrigators advise that as a group they understand the importance of measuring take to ensure that all are able to take water under their entitlements. Take above entitlement will impact significantly on the availability of water in the lower parts of Oakey Creek particularly at times of lower flows.
- The current system relies on voluntary compliance and policing. DNRME does not have the capacity to identify specific non-compliance. DNRME did not table a system of regular audits on the operation of meters and other non-compliance.

Issuing notices and imposing penalties

- One case of non-compliance was discussed. DNRME advised that the entitlement holder was notified and he ceased irrigating advising that he was not aware of the restrictions.
- Cases in the area reported by a pump validator have been investigated by DNRME but they have been unable to establish any non-compliance.
- Photographs of non-compliance from wider areas of the Condamine catchment were submitted by another validator. These photographs showed numerous examples of non-compliant pipe connections, non-operational meters, meters of varied accuracy and many other examples. He also advised that entitlement holders would often reject installation of a compliant meter in favour of a lower cost option. He advised that some entitlement holders use validators who were likely to approve questionable installations.
- Discussions with validators also raised questions about the adequacy of training of validators and their level of experience.
- The above cases show that there is no system for validators to report on non-compliance and no checks on their work.

Logan Field Visit – 15 January 2018

Comprising:

- A briefing by Brisbane Regional Office DNRME officers during inspection;
- A meeting with Christmas Creek and Running Creek entitlement holders and meter inspection; and
- A meeting with Seqwater operators at Wyaralong Dam.

Compliance Issues:

- The Water Regulation 2016 needs to be amended to provide powers to compel the repair or replacement of a meter.
- The Minister has postponed the expiry of the plan until December 2026 on the basis that plan outcomes were being achieved and potential risks in the area were low. There is some criticism that this report is not readily available on the Department website and the process was not as transparent as it should be.
- There is no measurement of use of entitlements below the end of the Logan scheme and in the Albert River.
- Temporary trading to balance accounts at the end of the year relies on information being readily available on trading opportunities but Seqwater has no program in place to facilitate temporary trades comparable to that administered through SunWater.
- There does not appear to be any compliance issues in regard to Seqwater's implementation of their resource operating licence conditions. Seqwater refers to procedure written into their Resource Operations Licence (ROL) where non-compliance and operational reports may be made several times a year. There were a number of reports in the last two years which dealt with unavoidable operations events with two that had implications for a daily flow event.
- Seqwater also referred to annual reports prepared for each scheme which report on significant issues but there is no central reporting available to the public. Issues with compliance with the ROL used to be dealt with in Annual Reports on plans made by the Minister. These reports are now done on a five-yearly basis.

Understanding obligations / Establishing rules and limits

- The Logan Water Resource Plan 2007 was implemented by Logan Resource Operations Plan in 2009 and an amending Resource Operations Plan in 2014.
- The plan defines environmental flow objectives set to address the high flows required for river forming processes, medium flows for spawning fish species, estuarine habitat and mangroves and low flows for spawning of fresh water catfish.
- The plan defines how supplemented surface authorisations are to be converted to water allocations and unsupplemented licences in some subcatchments are to be amended to implement volumetric limits.
- The plan area includes the Albert River catchment but no action has been taken to plan and manage authorisations in this catchment. There is one monitoring node to assess flow conditions and complete the monitoring network for assessment of end of system flows.
- No regulation has been put in place for the take of groundwater and overland flows as it has been assessed that at this stage take does not put at risk achievement of plan objectives and outcomes.
- Under the Plan water for stock and domestic use can be taken without a licence.
- The Minister postponed the expiry of the plan until December 2026 on the basis that plan outcomes were being achieved and potential risks in the area were low. It was also assessed that there were no expected impacts from postponement and there can be a review or amendment at any time should risk assessment change or there are significant new demands for water. This Performance Assessment Report on which this decision was made was published in May 2016. There is some criticism that this report is not readily available on DNRME's website and the process is not as transparent as it should be.

Developing compliance objectives

- The plan puts in place a cap on the take of water for medium priority use but allows defined reserves of additional water for urban development. Implementation of this cap is important to the achievement of environmental objectives in the plan.
- There are 132 medium priority allocations with a total volume of 13,555 ML in the Logan Water Supply Scheme.
- 120 water licences were amended in the Christmas and Running Creeks catchments to implement volumetric limits. Flows from Christmas and Running Creeks are important to the operation of the Logan scheme and the delivery of environmental flows
- Licences below Wyaralong Dam have also been amended to implement volumetric limits.
- The Performance Assessment Report for the postponement of the Plan does analyse data from the monitoring node in the Albert catchment showing achievement of outcomes for the Logan and Albert estuaries. The assessment also confirmed little increase in take of water in the Albert catchment above the node.

Determining measurement

- Water allocations in the scheme were defined using available data on annual use, seasonal and daily volumetric limits, maximum rate of take for pumps and any flow conditions that were applied. The water allocations are tradable. Seqwater measures take on a quarterly basis in accordance with announced allocations. There is to be no take above the annual volumetric limit per season. The nominal volumes for licences assess the long term average take which is used to assess performance against the Water Supply Security Objectives stipulated in the plan.
- Unsupplemented water licences in Christmas and Running Creeks were amended using data available on annual, seasonal and daily volumetric limits and maximum defined rates of take for pumps. Entitlement holders opposed the introduction of regulation because of the cost of metering and they questioned the need given the voluntary arrangements they had in place for some time to share water under varied stream flow conditions. DNRME accepted that this sharing arrangement could continue noting that it was more conservative than modelled arrangements if resource operation conditions were to apply. DNRME has step-in powers to implement annual sharing of water take if voluntary sharing fails. Licence holders are still developing an understanding of water volumes that can be taken seasonally which have been in place for only 18 months.
- There is no measurement of use of entitlements below the end of the Logan scheme and in the Albert River
- Taking water for stock and domestic use in Christmas and Running Creeks without a licence is not considered a risk as both stock and domestic and irrigation users recognise the need to closely manage take seasonally.

Measuring take

- Seqwater owns surface water meters in the Logan scheme and use is measured quarterly. About 90% of volume for non-urban is now metered. Small users between 1 and 2ML are not metered. The quarterly meter reading identifies meters that are not operating which are replaced with Australian standard meters.
- Seqwater head office also advise that they have a rolling program of meter replacement focussing initially on high use meters with the intention to replace all meters to required standard in 12 years. Unsupplemented water is taken though scheme meters. Seqwater reports that there is no difficulty in measuring the different take.
- Unsupplemented amended licences are metered and measurement of take is on an annual basis. There is no permitted take above the annual volumetric limit and the scheme advisory committee manages the sharing of access to flows. Entitlement holders install and own meters and support this approach as it has given them a choice of meters to install. Costs seem to vary between \$1000 and \$3,000 and installed meters meet the Australian standard. Some problems have been encountered with meters being poorly located in flood zones. Entitlement holders read and report take annually. DNRME advises that this system is working well coupled with the voluntary sharing system.

Monitoring measurement

- Seqwater currently manages customer compliance in accordance with an internal approved procedure for the management of high and medium priority allocations and was approved in early 2017. The Procedure deals with water trading, announced allocations, stock and domestic use, over use and compliance, annual reporting to department, training, internal monitoring and audit and record keeping. Staff responsibilities are also defined including responsibilities for customer contact and information. Implementation of the procedures involves checking of usage every quarter and customers are notified if they overuse and are advised to temporary transfer to rectify their account. Seqwater also provides advice to customers about their usage during the year to help manage the potential for overuse at the end of the year.
- Seqwater would like to proceed with the implementation of telemetry but has faced strong resistance in areas such as the Central Brisbane area. All new meters have the capacity for telemetry.
- Temporary trading to balance accounts at the end of the year relies on information being readily available on trading opportunities but Seqwater has no program in place to facilitate temporary trades comparable to that administered through SunWater.
- At the end of the water year any take in excess of the volumetric limit is reported to DNRME. Seqwater takes no further action but DNRME advises that annual non-compliance is dealt with by an issue of a warning in the first instance followed by a Penalty Infringement Notice if the offence is repeated. DNRME finds little non-compliance in the Logan scheme.
- Seqwater reports non-compliance or operational issues as part of the implementation of their resource operating licence conditions. Reporting of events over 2016-17 and 2017-18 addressed: non-standard releases to prevent fish stranding, daily flow requirements from Mt Crosby Weir not being met necessitating releases from Wivenhoe Dam, reporting on land slips and bank erosion due to heavy rain and two cases of daily environmental flow not being met due to maintenance shut down in one case and a dam safety inspection in the other. It is expected that this type of operational reporting would occur across schemes but is not likely to be significant in terms of the ROL holder meeting environmental flow conditions. There are amendments proposed for the water plan tabled in State Parliament late last year to address significant but unavoidable dam operations.
- The Water Regulation 2016 that supports the metering framework needs to be amended to provide the state powers to compel the repair or replacement of a meter that has been found to be not working or inaccurate. DNRME advises that if the government owned the meters they could address this issue.
- Seqwater also referred to annual reports prepared for each scheme which report on significant issues but there is no central reporting available to the public. Issues with compliance with ROLs used to be dealt with in Annual Reports on plans made by the Minister. These reports are now done on a five yearly basis.
- DNRME conducts an annual inspection of the operation of unsupplemented meters for amended licences in conjunction with an annual meter compliance audit. This is a suitable approach at this time as meters have only been in place for 18 months.

Issuing notices and imposing penalties

- No cases of compliance were raised.

Issuing notices and imposing penalties

Wet Tropics Field Visit – 18 January 2018

Comprising:

- A briefing by the Cairns Regional Office of DNRME during inspections;
- A field inspection at a turf farm at Little Mulgrave;
- A meeting with Mulgrave Land Care Group; and
- A meeting with a farmer regarding a compliance issue

Compliance Issues:

- Water Regulation 2016 needs to be amended to provide powers to compel the repair or replacement of a meter.
- The monitoring node in the Daintree subcatchment uses theoretical modelling not actual flow measurement. As a result it is difficult for DNRME to assess whether water management strategies are meeting the water plan objectives.
- Surface water allocations have daily and annual volumetric limits but only annual take is measured against annual volumetric limits once meters are installed. DNRME is unable to assess whether daily take is complying with the rules defined in the Resource Operations Plan which set limits based upon nominated flow conditions in the river. This level of measurement does not allow for the assessment of the achievement of environmental flow objectives for the Wet Tropics subcatchments.
- Unsupplemented water allocations in the Mulgrave are fully metered but a change in metering policy from 2013 stalled the rollout of meters across the rest of the Plan area. The change shifted metering programming from the water plan to the Water Regulation. It is understood that the requirement in the Regulation did not adequately provide for the completion of metering of water entitlements.
- Unsupplemented surface water licence holders in the Upper Mulgrave own their meters which comply with the interim standard defined in the interim metering policy introduced in 2013. There has been no program to meter unsupplemented water licences in Johnstone (including South Johnstone), Liverpool Creek, Tully and Herbert subcatchments due to resourcing constraints and other departmental priorities.
- Take from amended unsupplemented water licences is also reported by entitlement holders at the end of the water year for compliance assessment. Annual self-reading of meters is working well and entitlement holders can seasonally assign water at the end of the water year to rectify overuse. However, end of year reporting does not measure take on a daily basis against defined daily limits for the amended licences. This level of measurement does not allow for the assessment of the achievement of environmental flow objectives for the Wet Tropics subcatchments.
- Groundwater licences in the Mulgrave Russell Groundwater Management Area (GMA) are metered in accordance with the standard defined in the interim metering policy introduced in 2013. Metering is not able to commence in the Herbert, Southern Tablelands, Tully, Johnstone, South Johnstone and Liverpool Creek GMAs until entitlements are granted from the notification of works process (must be an entitlement to be metered). As a result there is no program to implement metering of groundwater management areas. Take from groundwater licences is reported on an annual basis against nominal volumes. There are no requirements for measuring daily or quarterly take.
- There is no program for monitoring the take or interference with water for stock and domestic use or low risk use, unless it goes through the same meter as water used under a rural entitlement.
- It is expected that telemetry or other automatic recoding system will be required to implement daily reporting of take. Inspections identified difficulties with telemetry. In particular, there would be costs involved to achieve transmission of data due to topography.
- Action in regard to a case of non-compliance had to await reporting of annual use at the end of the water year. It was not clear from discussions how DNRME would proceed. There did not appear to be a defined process for handling non-compliance. There was also a case of non-compliance for the non-installation of a meter for installed works. There also did not appear to be a defined process for handling this non-compliance issue. It was inferred from this case that there was widespread abuse of the limits of stock and domestic take particularly in the Lower Mulgrave and Russell subcatchment.
- No comments were provided regarding the implementation of field monitoring program as implementation of metering proceeds.
- The Regional Office is implementing a system of multiple spreadsheets to record meter reads and compliance with water sharing and trading/accounting e.g. seasonal assignment. Such a system will make it difficult for the office to assess compliance and to use these spreadsheets as evidence of non-compliance. In addition daily compliance or otherwise will not be reported. This system will make it difficult for DNRME's head office to monitor compliance performance across regional offices.

Understanding obligations / Establishing rules and limits

- The Wet Tropics Water Resource Plan 2013 was implemented by Wet Tropics Resource Operations Plan in 2016.
- The plan defines how unsupplemented surface authorisations are to be converted to water allocations in five defined subcatchment areas. Provision is made for amendment of remaining licences for unsupplemented surface water take in all subcatchments. There is no supplemented areas in the Wet Tropics Plan area
- Seven groundwater management areas are defined and within five of these areas new licences with volumetric limits are to be created for 'prescribed' existing groundwater works. Groundwater licences in two existing groundwater management areas (previously managed under the Regulation) are to be amended to implement volumetric limits. Outside these groundwater management areas bores can be drilled without a licence
- Under the plan water for stock and domestic use can be taken without a licence and an additional take of 20ML without a licence is permitted for low risk requirements such as dairy cow needs (consumption and cooling) and packing shed product washing. An additional 2 ML can be taken for stock and domestic use in the lower Mulgrave Russell catchment.
- The Water Regulation 2016 that supports the metering framework needs to be amended to provide the state powers to compel the repair or replacement of a meter that has been found to be not working or inaccurate.

Developing compliance objectives

- Unsupplemented water allocations are managed with daily and annual volumetric limits and conditions if any apply. Amended groundwater licences have a nominal entitlement and conditions if any apply
- Rainfall during the summer months is often adequate to grow most crops but surface and groundwater resources are needed in the drier winter and spring period to sustain most crops and other agriculture activity such dairying. Management of low flows is a significant issue for the implementation of environmental flows. Performance indicators and objectives defined in the plan provide for management of environmental flows during these low flow periods and across all flow conditions.
- The seven groundwater water management areas are defined to address the risk from groundwater take on highly connected surface water flows. The Mulgrave Russell GMA is a broad area covering the extent of the aquifer. The plan addresses the potential risk of saltwater intrusion in the future caused by take in this GMA in drier periods The Herbert and Southern Tablelands GMAs cover the full extent of aquifers. The Tully, Johnstone, South Johnstone and Liverpool Creek GMAs are designed to regulate take from the alluvium for a 1.5km strip along the both sides of rivers. This is to protect water allocation security objectives for surface water allocations defined in the plan.

Determining measurement

- The monitoring node in the Daintree subcatchment uses theoretical modelling not actual flow measurement. As a result it is difficult for DNRME to assess whether water management strategies are meeting the water plan objectives.
- In the Mulgrave -Russell catchment unsupplemented surface water allocations are in place in the lower Mulgrave River. The upper catchment has amended surface licences.
- Surface water allocations also exist in the Johnstone (including South Johnstone), Liverpool Creek, and Tully and Herbert subcatchments. As with the Mulgrave Russell subcatchment, these conversions were made in sections of the rivers as defined in the Plan.
- Surface water allocations must have daily and annual volumetric limits and conditions (if any) in addition to a nominal volume. However, only annual take is measured against annual volumetric limits once meters are installed. DNRME is unable to assess whether daily take is complying with the rules defined in the Resource Operations Plan which set limits based upon nominated flow conditions in the river. This level of measurement does not allow for the assessment of the achievement of environmental flow objectives for the Wet Tropics subcatchments.
- In remaining parts of the five subcatchments unsupplemented surface licences will be amended to define nominal entitlements and daily volumetric limits. Any existing conditions that may apply to these licences will be taken into account.
- New licences for 'prescribed' existing groundwater works and existing groundwater licences are to be amended to define nominal entitlements and conditions (if any). In the case of prescribed works entitlement holders have to submit notices of their works.
- There was no program defined for the implementation of metering for all entitlements within the subcatchment areas and the groundwater management areas.

Measuring take

- Unsupplemented surface water allocation holders in the Lower Mulgrave Russell subcatchment own their meters which comply with the standard defined in the interim metering policy introduced in 2013. There was no program for the completion of metering for entitlements in the remainder of the plan area.
- Take from unsupplemented water allocations is reported by entitlement holders at the end of the water year for compliance assessment. DNRME reports that the reading and reporting of meters by customers is working well. Entitlement holders can seasonally assign to rectify overuse. However, end of year reporting does not measure take daily against with Resource Operations Plan rules for nominated flow conditions. This level of measurement does not provide an adequate assessment of the achievement of environmental flow objectives for the Wet Tropics catchment.
- Unsupplemented water allocations in the Mulgrave are fully metered but a change in metering policy from 2013 stalled the rollout of meters across the rest of the plan area. The change shifted metering programming from the water plan to the Water Regulation. It is understood that the requirement in the Regulation did not adequately provide for the completion of metering of water entitlements.
- Unsupplemented surface water licence holders in the Upper Mulgrave own their meters which comply with the interim standard defined in the interim metering policy introduced in 2013. There has been no program to meter unsupplemented water licences in Johnstone (including South Johnstone), Liverpool Creek, Tully and Herbert subcatchments due to resourcing constraints and other departmental priorities.
- In the Mulgrave it is doubted that DNRME have the staff to undertake regular checks whether meters are operational.
- Groundwater licences in the Mulgrave Russell GMA are metered in accordance with the standard defined in the interim metering policy introduced in 2013. Metering is not able to commence in other GMAs i.e. Herbert, Southern Tablelands, Tully, Johnstone, South Johnstone and Liverpool Creek GMAs until entitlements are granted from the notification of works process (must be an entitlement to be metered). Take from groundwater licences is reported on an annual basis against nominal volumes. There is no requirements for measuring daily or quarterly take.
- There are issues of compliance if take of the 20ML allowance for low risk water is taken before the meter rather than a deduction from metered take. There may also be issues if take for stock and domestic use exceeds levels defined in the Act.
- It is expected that telemetry or other automatic recoding system will be required to implement daily reporting of take. Inspections identified difficulties with telemetry. In particular, there would be costs involved to achieve transmission of data due to topography.

Monitoring measurement

- There is no program for monitoring the take or interference with water for stock and domestic use or low risk use.
- No comments were provided regarding the implementation of field monitoring program as implementation of metering proceeds.
- It is expected that Regional Office is implementing a complex system of multiple spreadsheets to record meter reads and compliance with water sharing and trading/accounting e.g. seasonal assignment. Such a system will make it difficult for the office to assess compliance and to use these spreadsheets as evidence of non-compliance. In addition daily compliance or otherwise will not be reported.
- This system will make it difficult for DNRME's head office to monitor compliance performance across regional offices.
- DNRME's Regional Office makes an effort to communicate the need for compliance particularly during low flow periods. This effort focuses on encouraging self-reporting daily in the lower Mulgrave.

Issuing notices and imposing penalties

- A case of non-compliance was discussed. It was apparent that action in regard to the case had to await reporting of annual use at the end of the 2018 water year. It was not clear from discussions how DNRME would proceed. There did not appear to be a defined process for handling non-compliance. There was also a case of non-compliance for the non-installation of a meter for installed works. There also did not appear to be a defined process for handling this non-compliance issue. It was inferred from this case that there was widespread abuse of the limits of stock and domestic take particularly in the Lower Mulgrave and Russell subcatchment.
- DNRME believes that the inability to monitor take at intervals less than annually for surface water take for water allocations and amended licences encourages non-compliance on a daily basis in the hope that accounts can be balanced by temporary trading at the end of the water year.

APPENDIX G – CURRENT ARRANGEMENTS FOR NON-URBAN WATER MEASUREMENT AND MONITORING

This section of the report outlines the existing policies and arrangements associated with the non-urban water measurement and monitoring framework for non-urban water use in Queensland as documented by DNRME.

NATIONAL WATER INITIATIVE

Building on the 1994 Council of Australian Governments (COAG) Water Reform Framework, the National Water Initiative was a shared commitment by governments to increase the efficiency of Australia's water use, leading to greater certainty for investment and productivity, for rural and urban communities and for the environment.

Under the National Water Initiative, governments have made commitments to:

- prepare comprehensive water plans
- achieve sustainable water use in over-allocated or stressed water systems
- introduce registers of water rights and standards for water accounting
- expand trade in water rights
- improve pricing for water storage and delivery
- better manage urban water demands.

NATIONAL WATER COMPLIANCE FRAMEWORK

The National Water Compliance Framework (NWCF) has shaped the current arrangements for non-urban water measurement and monitoring in Queensland. The COAG in December 2009 agreed on the NWCF for implementing a cost-effective regulatory framework for non-urban water measurement and monitoring.

Queensland prepared an implementation plan to achieve the following eight elements associated with the framework:

1. Consistent water offences;
2. An appropriate mix of compliance and enforcement legislation options and evidentiary aids to ensure effective operation of a compliance and enforcement system;
3. Consistent penalties;
4. Risk based compliance and enforcement;
5. Best practice tools;
6. Public and stakeholder education;
7. Monitoring; and
8. Annual public reporting.

In accordance with the approved implementation plan, the Commonwealth Government provided funding to Queensland totalling \$10.5 million over five years to implement the national framework. The implementation and the funding for this plan ended on 30 June 2016.

NATIONAL METERING FRAMEWORK

In 2009, the Department of Agriculture and Water Resources published a policy paper titled *National Framework for Non-urban Water Metering*.

The purpose of the policy paper was to provide a nationally consistent framework for non-urban water meters, enabling jurisdictional governments to implement national metering standards and achieve the overarching objective of the National Water Initiative – a “nationally-compatible market, regulatory and planning based system for managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes”.

DNRME released the *Queensland State Implementation Plan for Non-Urban Water Metering 2014* in response to the National Metering Framework to provide all stakeholders with a clear understanding of the implementation of the National Framework for Non-Urban Metering in Queensland.

The implementation plan clearly set out the state governments position as follows – “Given the considerable cost to fully comply with the National Framework and with no offer from the Commonwealth for funding assistance for the upgrade of existing meters, the Queensland Government does not intend to mandate full compliance with the National Framework”

QUEENSLAND NON-URBAN WATER MEASUREMENT AND COMPLIANCE FRAMEWORK

The *Water Act 2000* (Water Act) provides powers for the Water Regulation 2016 (Water Regulation) to outline the water measurement and compliance framework. The Water Act and Water Regulation provide the regulatory framework which, amongst other key matters, defines:

- when water meters are required to be installed;
- who may install the meter;
- payment considerations for the installation;
- maintenance and reading of the meter; and
- the standards required for the design, construction, installation and maintenance of the meter.

The framework deals with access to water from unsupplemented (relying on run of the river), or supplemented (supplied, at least in part, from public works) water entitlements.

METERED ENTITLEMENTS

The Water Act requires that the holder of a metered entitlement must not take water under the entitlement other than through works that have an approved meter attached. A metered entitlement is an entitlement defined in the Water Regulation. The Water Regulation lists the authorisations that are defined as metered entitlements in certain areas of the state and also specifies any authorisations, such as licences for stock and domestic purposes only, which are exempt from being metered.

Over the past decade, there have been several approaches taken to implementing non-urban water metering in Queensland. The current policy document released in December 2016 titled *Queensland Non-urban Water Metering Policy for Unsupplemented Water Extractions 2016* (2016 Policy) relates to the taking of non-urban unsupplemented water by a holder of a metered entitlement under the Water Act in an area prescribed in the Water Regulation.

Under this 2016 Policy, metered entitlements may be declared where DNRME identifies requirements for metering such as:

- water systems at or approaching full allocation;
- water authorisations with area allocations, volumetric limits or rates of take;
- taking of floodwater or overland flow water;
- a need to ensure the equitable distribution of water or reduce the risk of environmental damage or water depletion; and
- water plans or water management protocols requiring metering.

Under the Water Regulation, the Director General has the power to declare a metered entitlement area the entitlement holder has 12 months to comply with the notice. Prior to the declaration of a metered entitlement area, DNRME conducts a consultation process with entitlement holders to ensure local issues are considered.

Not all entitlements are required to be metered. Unsupplemented water entitlements that have not been declared metered entitlements are not metered.

METERING - UNSUPPLEMENTED WATER

Approved meters

All new and replacement meters installed by an entitlement holder must be an “approved meter” as defined under the Water Regulation and comply with the Queensland interim standard.

Entitlement holder owned meters must comply with the requirements of the *Queensland Interim Metering Standard*, the *Guide to Queensland Non-urban Water Metering for Unsupplemented Water Extractions* or the Australian Standard AS4747.

As there are only a limited number of pattern approved meters available in Australia for the type and size of meters commonly used for non-urban water metering, the installation and use of contemporary meters is permitted until the end of the meter’s life or lesser period if the meter cannot be revalidated by a meter validator.

Most contemporary meters are mechanical and non-mechanical meters are permissible in areas where iron-bacteria is present or water quality is an issue.

Replacement of non-compliant meters by metered entitlement holders is required at the next major maintenance interval or no later than the next revalidation date.

Under the standard all meters must have the capability to produce an electronic output and, if directed by DNRME, be fitted with an electronic data logger or transmitter that will enable remote, telemetric reading of the meter.

Revalidation of meters

Water entitlement holders are responsible for ensuring that existing meters for unsupplemented water extractions are revalidated and if necessary replaced and/or upgraded to comply with the approved meter definition under the Water Regulation. The revalidation of meters is to occur at least once every 5 years at the cost of water entitlement holder.

The Water Regulation shows the date by which each meter will need to be revalidated by a validator to continue to be an approved meter.

Persons undertaking meter validations activities are required to:

- hold certification under the national scheme developed by Irrigation Australia Limited on behalf of the Commonwealth Government; or
- be appointed by the Director General of DRNM as an authorised meter validator.

Where a water entitlement holder is also a validator, they may self-validate the installation of the meter or measuring system.

Maintenance of meters

The water entitlement holder is responsible for the maintenance of the meter and the associated cost. Any maintenance undertaken must be in accordance with the *Guide to Queensland Non-urban Water Metering for Unsupplemented Water Extractions* and AS4747.

All maintenance is to be validated by a person certified under the national certification scheme or trained with nationally approved training.

Meter readings

A metered entitlement holder is required to provide up to two readings within a water year for each meter.

DNRME has the authority for the water entitlement holder to provide additional readings to support DNRME's management activities.

Removal of meter

The water entitlement holder must notify DNRME in writing if they intend to permanently remove the meter from operation. The notification must include a final meter read at the time of meter removal and any other documentation requested by DNRME.

Keeping of records

Metered entitlement holders are required to keep adequate records of meter maintenance activities which meet auditing requirements.

Audits of meters

The Water Regulation provides powers for DNRME to undertake the following audits:

- undertake a validation of the meter
- request information from the entitlement holder about the meter and pumping activities, including validation certificates and records of pumping hours
- inspect and or disassemble a meter to determine if it is in working order

METERING - SUPPLEMENTED WATER

The 2016 policy does not apply to supplemented water provided by a water service provider, with the metering requirements covered by provider's resource operations licence or distribution operations licence. The Resource Operations Plan specifies the general metering requirements.

Water users with a supplemented water entitlement enter into a contractual arrangement with their service provider to determine arrangements associated with the water meter. In most cases, the service provider installs, maintains and reads the meter and recovers the charges from the water entitlement holder. It should be noted that a key driver for a meter in a supplemented water area is to recover infrastructure and delivery charges associated with the supply and delivery of water.

The service providers of supplemented water extractions have the flexibility to make decisions about the installation of new meters which best meet their operational and business requirements.

Despite the adoption of any particular standard not being mandated, service providers are encouraged by DNRME to apply AS4747 to all new non-urban water meter installations. Should the service provider have valid reasons for not adopting AS4747 for new installations, DNRME expects the service provider to communicate their reasons to its customers and DNRME.

DNRME also encourages the service provider to undertake the following:

- consider the cost-benefits of upgrading existing meter installations to achieve higher accuracy standards;
- maintain meters to ensure operational efficiency and effectiveness; and
- conduct regular audits of meters including compliance activities.

COMPLIANCE AND ENFORCEMENT

DNRME have developed the *Natural Resources Compliance Response Guidelines (May 2017)* to promote consistent, reasonable and proportionate decisions when responding to breaches of the Water Act and Water Regulation. These guidelines are an internal document to guide DNRME officers with compliance and enforcement responses.

The management of DNRME compliance activities combines its entire portfolio of responsibilities to capture vegetation, land and water.

DNRME's documentation states that its regulatory enforcement effort is directed towards activities that involve the greatest risk, cause serious natural resource impacts or undermine the regulatory regime. The available responses to any breach is flexible so that a fit for purpose response can be made depending if the breach was made by a business or an individual.

TOOLS TO ENCOURAGE AND ENFORCE COMPLIANCE

DNRME advise that they have available a range of tools to respond to non-compliance events. The spectrum of compliance tools available can be categorised as:

- education;
- regulation; and
- enforcement.

Education

Education tools are mostly proactive, can be industry specific and may be used as a reactive response to low risk, low impact non-compliance.

The tools available include:

| Tool | Description |
|--|---|
| Assistance and advice | DNRME officers provide support, assistance and advice to water users on their compliance obligations |
| Technology | use of approved devices that enable water users to monitor their own compliance is supported and encouraged to reduce compliance costs |
| Community and industry engagement activities | targeted field days and workshops can be an effective mechanism for educating water users on compliance obligations to deter non-compliant behaviour |
| Advisory letters | used when a low impact or minor offence has been detected and is often used as a first step to help increase the understanding of compliance requirements |
| Incentive/rewarding good behaviour | a record of compliant behaviour and performance can be rewarded with reduced monitoring which could result in financial benefits to the water user via lower effort and costs |

Figure 1 – Education tools available

Regulation

Regulation measures assist DNRME in encouraging and enforcing compliance with legislation. Types of regulation identified by DNRME include:

- self-regulation;
- co-regulation; and
- authorisation and licencing.

Self-regulation and co-regulation

Self-regulation and co-regulation occurs via codes of conduct and provide an opportunity for the stakeholders to have an involvement in their design. An example of a co-regulation compliance arrangement is the Water Interim Metering Standard. This standard outlines the obligations associated with the installation, validation, maintenance and re-validation of water meters.

Authorisation and licencing

Authorisation and licencing tools normally take the form of a lease, licence, permit, allocation or a similar authority. Authorities are normally time bound, quantity specific and are strictly conditional on how the activity is to occur. Examples of authorisation and licencing include a water entitlement, water licence and water bore drilling licences.

Enforcement

Enforcement activities are reactive responses by DNRME to a non-compliance event and are usually case specific. DNRME states that it records and assesses incidents of non-compliance and decides on a response using the following actions:

| Tool | Description |
|--|---|
| Administrative action | When a minor non-compliance event is detected such as a failure to provide a meter read, a reminder notice may be the most suitable action. If the reminder notice does not lead to a correction of the non-compliance within a reasonable time, then an elevated course of action might involve a show cause notice. |
| Formal warning notice | A non-statutory compliance response to convey that an alleged non-compliance has been detected which educates the recipient and warns the recipient that a sanction may apply in the future. |
| Penalty infringement notice (PIN) | Most appropriate where a breach of the law has occurred with relatively minor impacts. DNRME must ensure that the elements of the offence can be proved and the evidence is available, reliable and admissible. It is important that the PINs are issued in a timely manner to strengthen the deterrent message. |
| Statutory notices | Under the Water Act the issue of a statutory notice can require a person to cease taking or interfering with water. The legislation is prescriptive, specifying what statutory notices must contain and what they must state in order to be lawfully issued. There are also provisions for enforcement options should the statutory notice not be complied with. Statutory notices are often used alongside other enforcement actions such as official warning, a PIN or a prosecution. |
| Amendment, suspension or cancelation of a licence, permit or other authority | The Water Act provides provisions under certain circumstances to amend, cancel or forfeiture a water licence, allocation or permit. This action is often used alongside other enforcement actions such as official warning, a PIN or a prosecution. |
| Prosecution | <p>DNRME's policy outlines the factors to be taken into account when deciding whether or not the public interest requires prosecution. The relevance and weight of the factors varies from case to case. They include (but not limited to):</p> <ul style="list-style-type: none"> • Seriousness • Mitigating or aggravating circumstances • Degree of culpability of the alleged offender in relation to the offence • Previous and relevant compliance history |
| Court order | <p>A court order may impose a period of suspension of the authority, the cancellation of the authority or the restoration/rectification of a natural resource affected by the activity under the court order. Failure to comply with a court order can attract a penalty of imprisonment, even for simple offences.</p> <p>Offences in which court orders would ordinarily be sought include:</p> <ul style="list-style-type: none"> • Offences causing serious or irreversible harm impacting on natural resources • Cases amounting to fraud in so far as an intent to deceive is evident |

| Tool | Description |
|--------------------------------------|---|
| | <ul style="list-style-type: none"> • Cases where a court order will have a greater impact than the application of standard provision under the relevant legislation |
| Civil and administrative proceedings | <p>Civil proceedings are rarely commenced by DNRME for natural resource related offences as there are statutory provisions in legislation which provide the application of criminal law.</p> <p>There are a number of scenarios where commencement of civil proceeding may be appropriate:</p> <ul style="list-style-type: none"> • The recovery of outstanding debts to the state • An injunction to stop interference with a natural resource • Recover costs associated with remedying a natural resource related activity • Dispute over a contract, lease, licence or authority |
| Negotiated outcome | <p>In certain limited circumstances a negotiated outcome alternative to prosecution may better achieve the purpose of the Water Act in a way that is in the greater public interest.</p> <p>Negotiated outcomes are considered when:</p> <ul style="list-style-type: none"> • Approved by Natural Resource Compliance Committee (refer item 2.12) • Better achieves the purpose of the Water Act compared to other compliance responses • Still applies a proportionate penalty to the offender • Provides a satisfactory disincentive to others who may seek to commit a like offence • Lawful, transparent and in greater public interest • Any negotiated offset area is spatially identified and lawfully secured |

Figure 2 – Enforcement tools available

DETECTION ACTIVITIES

DNRME states that it uses tools to collect data and monitor Queensland's natural resources which help guide where focus is needed for education, regulation and/or enforcement.

The main monitoring tools are:

- surveillance and compliance monitoring;
- targeted compliance audits; and
- notifications.

Surveillance and compliance monitoring

DNRME states that it monitors natural resource compliance through a range of tools including:

- satellite detection of changes in vegetation cover and in water use practices;

- surveillance of specific industries, localities and catchment areas;
- audits of specific licenced activities, development approvals, self-assessable works;
- responding to notifications received from third parties; and
- receipt and assessment of mandatory reporting such as water meter reads.

This monitoring can assist DNRME to determine the levels of compliance trends, detect potential breaches of the law and to identify opportunities for educational or enforcement activities.

Targeted compliance audits

DNRME states that it undertakes risk based monitoring activities which includes inspections, audits and other verification activities with the aim of enhancing compliance with legislative requirements.

The proactive auditing of water entitlements issued under the Water Act in priority sub catchments across the state can be a key tool to monitor compliance with regulatory requirements. These audits can provide a useful mechanism to engage with entitlement holders, gain information about current water use and educate about the current regulatory regime.

DNRME can undertake an analysis of record keeping data to identify compliance trends to provide an additional means of ensuring compliance activity is optimally targeted.

Notifications

Notifications relating to incidents of alleged non-compliance can be received from the public, industry group, DNRME employee or an employee of another government agency.

Management of compliance and enforcement

The management and oversight of the DNRME compliance and enforcement activities is undertaken by the Natural Resources Compliance Committee. The terms of reference for the Committee states that it is a forum for operational compliance experts and legal experts to have full and frank discussion of legal matters concerning natural resource compliance.

Natural Resources Compliance Committee

The Natural Resource Compliance Committee's (NRCC) objective is to process, facilitate, obtain and provide legal advice relating to natural resource compliance taking into account the need to:

- ensure compliance decisions are legal and defensible and occur in a timely fashion.
- ensure that DNRME's Natural Resources Management compliance approach is strategic, astute and consistent across the broader legislative, geographic and community context.
- manage existing and emerging risks across regulated activities. Particularly to ensure significant matters are identified at an early stage.
- ensure resources are aligned to the greatest departmental priority and area of regulatory risk.
- provide guidance to enable the compliance workforce to appropriately prioritise enforcement and compliance activities within available resources.
- ensure senior executives are visible and active in compliance activities.
- ensure regulatory responses are consistent and proportionate.

- inform decision-making by reporting on the effectiveness of current and finalised prosecution and compliance activities; and
- consider recommendations for problem solving projects and targeted compliance projects and track the implementation of those that are approved

The NRCC is chaired by the Executive Director Operations Support and consists of the three regional Executive Directors, Director Systems and Support, Regional Compliance Champion, Director In-House Legal and Director Corporate Communications. The Committee is also supported by Manager (Compliance), Operations Support Compliance, Regional Investigations and additional departmental, business or compliance representation as required.

The NRCC is scheduled to meet every month or as required depending on when an urgent matter is received.

DNRME's operational experts (including Regional Investigations, Operations Support Compliance and the Compliance Working Group) present reports to the NRCC to obtain legal advice on compliance matters, including:

- Compliance Response and Assessment Reports (CRAR);
- investigation reports;
- intelligence and compliance reports;
- targeted compliance projects;
- natural resource problem solving matter; and
- Penalty Infringement Notices (PINs).

APPENDIX H – LIST OF METER TYPES SINCE 2005

This table shows the meter types commonly used in Queensland since 2005.

| Make | Model | Type | Fitting |
|---------|----------------|-----------------------|----------------|
| Elster | R1000 | Paddlewheel | Flanged |
| | R2000 | Propeller | Flanged |
| | V100 | Positive displacement | Flanged |
| Bermad | Turbobar | Turbine | Flanged |
| | Turbo IR | Paddlewheel | Flanged |
| Sensus | WP Dynamic | Turbine | Flanged |
| Arad | IRT | Paddlewheel | Flanged |
| | Multijet | Positive displacement | Threaded union |
| Mace | Agriflo | Ultrasonic | Insertion |
| | Flopro | | |
| Seimens | Mag 8000 | Electromagnetic | Flanged |
| | Sitrans | Ultrasonic | Insertion |
| Krohne | Waterflux 3070 | Electromagnetic | Flanged |

Source: *Water Meter Installer and Validator Guide for Non-Urban Water Meters (December 2016)*
 Table 2 – Meter types commonly used in Queensland

APPENDIX I – LIST OF UNSUPPLEMENTED METERS IN QUEENSLAND BY SIZE AND WATER ENTITLEMENT

The meter data and water entitlement data is based on information provided by DNRME.

The table includes unmatched meters as it is not possible to map metered water use directly to individual water entitlements in WMS, except under very specific circumstances (one authorisation, one water account, one meter, no transfers within the water year, etc.) This is due to the fact that any given meter reading may be associated to more than one water entitlement and that there is no record of how much of the reading's calculated water use is apportioned to each separate water entitlement.

The accuracy of the information presented in the table below cannot be assured due to the limitations in DNRME's information systems.

| Meter Size | Number of Meters | % of Total Meters | Total Water Entitlement Volume (ML) | % of Total Water Entitlement | Average Water Entitlement (ML) |
|--------------------|------------------|-------------------|-------------------------------------|------------------------------|--------------------------------|
| Less than 100mm | 1,704 | 34.1% | 162,582 | 26.4% | 95 |
| 101mm to 200mm | 1,190 | 23.8% | 218,636 | 35.6% | 184 |
| 201mm to 300mm | 36 | 0.7% | 7,786 | 1.3% | 216 |
| 301mm to 450mm | 17 | 0.3% | 5,579 | 0.9% | 328 |
| 451mm to 600mm | 27 | 0.5% | 24,332 | 4.0% | 901 |
| Greater than 601mm | 91 | 1.8% | 195,871 | 31.9% | 2,152 |
| Unmatched meters | 1,932 | 38.7% | n/a | n/a | n/a |
| TOTAL | 4,997 | 100% | 614,786 | 100% | 123 |

APPENDIX J – ESTIMATED COSTS KEY ASSUMPTIONS

The cost model which has applied the following key assumptions:

- The scenarios apply a simplifying assumption that all meters immediately comply with the AS4747 standard. This would involve all meters to be replaced to meet the AS4747 standard without any grandfathering provisions.
- The capital costs of meters has been calculated based on a number of nominal diameter meter size ranges:
 - ≤100mm
 - 101-200mm
 - 201-300mm
 - 301-450mm
 - 451-600mm
 - 600mm+
- The existing meter fleet excluding the meters not matched to a water entitlement is distributed across these size ranges as follows:

| | |
|-------------|---------------|
| ○ ≤100mm | 51% by number |
| ○ 101-200mm | 41% |
| ○ 201-300mm | 3% |
| ○ 301-450mm | 1% |
| ○ 451-600mm | 1% |
| ○ 600mm+ | 3% |
- The distribution of meters by size outlined above differ to that shown in Appendix I as the data above excludes meters not matched to a water entitlement.
- A simplifying assumption has been made that any future expansion to the meter fleet will maintain this size distribution
- The model applies a weighted average capital cost to meters
- The model assumes that for any future meter fleet expansion that there will be one meter installed for each metered entitlement. This is a simplifying assumption in that it is known that there are existing situations where there are multiple meters for a single entitlement. Conversely it is also known that there are situations where a single meter is utilised for multiple entitlements. The assumption applied is considered reasonable
- The cost of a water accounting system and water information dashboard has been estimated at \$10.75M
- The model has applied the following labour costs:
 - \$130/hr for trade level resource
 - \$200/hr for Professional services
 - These costs are based on a full absorption cost basis. This means that management and supervisory roles are not costed separately, but are included in the cost estimates for each function
- The model assumes (except for Case 1 and 2) that compliance and accounting functions are the responsibility of the department for all meters and entitlements, including supplemented
- Case 5 assumes that a third party provider will own and operate the meter fleet and charge an annual service fee equivalent to the annuity value of capital costs plus efficient annual operating costs

- The high technology cases assumes:
 - All meters are fitted with a data logger and a communication device
 - Information is collected from meters on a continuous basis through a network of radio towers similar to the commercial Taggle system
 - An effective radius of 50km has been assumed for all radio towers
 - It is recognised that there are emerging alternative data communication technologies that may have a lesser capital cost, however the assumptions are based on an existing system that is in operation
- Back to base technology included each meter providing a self-diagnostic. This plus loss of signal when a meter is non-functional reduces the human resources required in the field for assurance activities.
- The model (with exception of case 1) has applied an assumption of in-field verification testing of every meter every 5 years. Testing methods have not been verified for many installation types and sizes. A simplifying assumption has been made that on average each test will require 16 hours of labour, including travel time at \$200/hr.

APPENDIX K – DETAILED ESTIMATED COSTS

| Enhanced Metering and Monitoring Cost Scenarios | Case 1 Base Case | Case 2 Existing unsupplement ed meter fleet with improved assurance | Case 3 All existing meter fleet (incl. supplemented) with improved assurance | Case 4 Meter all entitlements >20ML (low tech) with improved assurance | Case 5 Meter all entitlements >20ML (high tech) with improved assurance | Case 6 Meter all entitlements >20ML (high tech) with improved assurance, Outsourced Model |
|---|---------------------|--|--|--|---|---|
| Opex | \$ 4,003,650 | \$ 19,423,547 | \$ 39,650,398 | \$ 65,126,431 | \$ 41,507,515 | \$ 67,817,188 |
| Department | \$ 2,204,926 | \$ 16,028,868 | \$ 30,938,499 | \$ 49,053,167 | \$ 31,301,930 | \$ 67,817,188 |
| Implement Measurement | \$ - | \$ 410,400 | \$ 511,200 | \$ 511,200 | \$ 511,200 | \$ 511,200 |
| Risk Assessment | \$ - | \$ 330,400 | \$ 431,200 | \$ 431,200 | \$ 431,200 | \$ 431,200 |
| other | \$ - | \$ 80,000 | \$ 80,000 | \$ 80,000 | \$ 80,000 | \$ 80,000 |
| Measure Water | \$ 299,820 | \$ 3,195,125 | \$ 5,582,360 | \$ 7,970,380 | \$ 2,431,647 | \$ 655,680 |
| Meter Reading | \$ - | \$ 324,805 | \$ 833,560 | \$ 1,537,900 | \$ - | |
| Metering Monitoring | \$ 299,820 | \$ 1,199,280 | \$ 3,077,760 | \$ 5,678,400 | \$ 946,400 | |
| Water Use Assessments | \$ - | \$ 1,624,000 | \$ 1,624,000 | \$ 655,680 | \$ 655,680 | \$ 655,680 |
| other | \$ - | \$ 47,040 | \$ 47,040 | \$ 98,400 | \$ 829,567 | |
| Monitor - Assurance | \$ 49,970 | \$ 5,913,117 | \$ 15,175,067 | \$ 27,997,667 | \$ 15,785,163 | \$ - |
| Meter field verification | \$ - | \$ 3,198,080 | \$ 8,207,360 | \$ 15,142,400 | \$ 15,142,400 | |
| Meter Audit | \$ 49,970 | \$ 2,715,037 | \$ 6,967,707 | \$ 12,855,267 | \$ 642,763 | |
| other | \$ - | \$ - | \$ - | \$ - | \$ - | |
| Monitor - Accounting | \$ 1,474,234 | \$ 1,776,951 | \$ 2,242,800 | \$ 2,242,800 | \$ 2,242,800 | \$ 2,242,800 |
| Compliance | \$ 380,902 | \$ 4,733,276 | \$ 7,427,072 | \$ 10,331,120 | \$ 10,331,120 | \$ 10,331,120 |
| Planning | \$ 151,040 | \$ 188,800 | \$ 246,400 | \$ 246,400 | \$ 246,400 | \$ 246,400 |
| Education | \$ - | \$ 944,000 | \$ 1,232,000 | \$ 1,232,000 | \$ 1,232,000 | \$ 1,232,000 |
| Investigation | \$ 229,862 | \$ 1,339,196 | \$ 3,436,832 | \$ 6,340,880 | \$ 6,340,880 | \$ 6,340,880 |
| Staff Training | \$ - | \$ 1,440,000 | \$ 1,440,000 | \$ 1,440,000 | \$ 1,440,000 | \$ 1,440,000 |
| Performance Reviews | \$ - | \$ 141,600 | \$ 184,800 | \$ 184,800 | \$ 184,800 | \$ 184,800 |
| Internal Audits | \$ - | \$ 679,680 | \$ 887,040 | \$ 887,040 | \$ 887,040 | \$ 887,040 |
| other | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| Service Fee | \$ - | \$ - | \$ - | \$ - | \$ - | \$ 54,076,388 |
| Entitlement Holder (EH) | \$ 1,798,724 | \$ 3,394,679 | \$ 8,711,900 | \$ 16,073,265 | \$ 10,205,585 | \$ - |
| Implement Measurement | \$ 1,473,919 | \$ 1,473,919 | \$ 3,782,578 | \$ 6,978,773 | \$ 6,978,773 | |
| Measure Water | \$ 324,805 | \$ 1,920,760 | \$ 4,929,322 | \$ 9,094,491 | \$ 3,226,811 | |
| Capex | \$ 51,374,663 | \$ 61,122,076 | \$ 144,566,041 | \$ 255,972,054 | \$ 312,774,464 | \$ 312,774,464 |
| Department | \$ - | \$ 9,747,413 | \$ 12,721,200 | \$ 12,721,200 | \$ 17,743,700 | \$ 12,721,200 |
| Implement Measurement | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| Measure Water | \$ - | \$ - | \$ - | \$ - | \$ 5,022,500 | \$ - |
| Monitor - Assurance | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| Monitor - Accounting | \$ - | \$ 8,237,013 | \$ 10,750,000 | \$ 10,750,000 | \$ 10,750,000 | \$ 10,750,000 |
| Compliance | \$ - | \$ 1,510,400 | \$ 1,971,200 | \$ 1,971,200 | \$ 1,971,200 | \$ 1,971,200 |
| Implement Measurement | \$ 51,374,663 | \$ 51,374,663 | \$ 131,844,841 | \$ 243,250,854 | \$ 295,030,764 | |
| Implement Measurement | \$ 51,374,663 | \$ 51,374,663 | \$ 131,844,841 | \$ 243,250,854 | \$ 295,030,764 | |
| Measure Water | \$ - | \$ - | \$ - | \$ - | \$ - | |
| Service Provider | | | | | | \$ 300,053,264 |
| Implement Measurement | | | | | | \$ 295,030,764 |
| Measure Water | | | | | | \$ 5,022,500 |
| Monitor - Assurance | | | | | | \$ - |
| Monitor - Accounting | | | | | | \$ - |
| Compliance | | | | | | \$ - |
| Annualised costs | \$ 7,811,703 | \$ 24,555,961 | \$ 51,151,558 | \$ 84,885,357 | \$ 68,984,068 | \$ 68,984,068 |
| Department | \$ 2,204,926 | \$ 17,353,229 | \$ 32,666,902 | \$ 50,781,570 | \$ 33,712,730 | \$ 68,984,068 |
| Implement Measurement | \$ - | \$ 410,400 | \$ 511,200 | \$ 511,200 | \$ 511,200 | \$ 32,555,726 |
| Measure Water | \$ 299,820 | \$ 3,195,125 | \$ 5,582,360 | \$ 7,970,380 | \$ 3,114,043 | \$ 6,340,855 |
| Monitor - Assurance | \$ 49,970 | \$ 5,913,117 | \$ 15,175,067 | \$ 27,997,667 | \$ 15,785,163 | \$ 15,785,163 |
| Monitor - Accounting | \$ 1,474,234 | \$ 2,896,097 | \$ 3,703,381 | \$ 3,703,381 | \$ 3,703,381 | \$ 3,703,381 |
| Compliance | \$ 380,902 | \$ 4,938,491 | \$ 7,694,895 | \$ 10,598,943 | \$ 10,598,943 | \$ 10,598,943 |
| Entitlement Holder (EH) | \$ 5,606,777 | \$ 7,202,731 | \$ 18,484,656 | \$ 34,103,787 | \$ 35,271,338 | |
| Implement Measurement | \$ 5,281,972 | \$ 5,281,972 | \$ 13,555,334 | \$ 25,009,296 | \$ 32,044,526 | |
| Measure Water | \$ 324,805 | \$ 1,920,760 | \$ 4,929,322 | \$ 9,094,491 | \$ 3,226,811 | |