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Water Security Levels of Service

Reviewing concept and development in South East Queensland

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ABSTRACT

In South East Queensland (SEQ), Levels of Service (LOS) objectives have been in use since the Millennium Drought (2001-2009). They are a way of defining the security of supply that the community can expect by finding a balance between the desirable supply reliability and the cost of that service.

LOS objectives in SEQ are required to be reviewed every five years. This paper provides an overview of the current LOS objectives review for SEQ. It discusses the concept behind LOS, the application of LOS across Australia, the opportunities available for improvement, and how collaboration with large and diverse interest groups will be managed.

Key Words: Level of Service, Water Security, South East Queensland.

INTRODUCTION

The level of service (LOS) objectives in SEQ have been used since about 2006 during the Millennium Drought but were set in regulation in 2014 along with a requirement for the state government (Department of Natural Resources, Mines and Energy – DNRME) to review them every 5 years. The first formal review of LOS in SEQ is to occur in 2018-19.

The objectives apply to the bulk water supply authority (Seqwater) which under the *Water Act 2000 (Qld)* is required to facilitate achievement of desired LOS objectives through publication of a water security program.

The nature of reviewing LOS is a technical process and requires consultation between the state government (DNRME), Seqwater and the SEQ water service providers[1]. In addition, reviewing the LOS objectives requires confirmation that the standards are acceptable to the community. The challenge is in how to gain useful community feedback on a highly technical subject.

LOS CONCEPT

In Australia, the LOS concept for water security was first discussed formally in the paper 'Framework for Urban Water Resource Planning' (Erlanger and Neal 2005). The paper identified that water utilities have a responsibility to ensure the community has a safe and reliable supply of water (i.e. never runs out of water), however as periods of low rainfall are inevitable, restrictions are a necessary tool to minimise the probability of running out of water.

Communities are generally tolerant and understanding of the need for restrictions unless they are overly frequent, severe or long-lasting. Urban areas, tending to be more affluent, are generally more willing to pay more to receive a higher level of water supply security (Erlanger and Neal 2005). However, determination of the levels that are acceptable requires an understanding of community desires, the associated costs (social, economic and environmental), and the future stresses on the water supply system.

[1] City of Gold Coast, Logan City Council, Queensland Urban Utilities (Brisbane, Ipswich, Somerset, Lockyer & Scenic Rim), Redland City Council, Unity Water (Sunshine Coast, Noosa & Moreton Bay).

Erlanger and Neal proposed that three main components could be used to ensure a safe and reliable supply:

- The supply system should be able to maintain adequate supply over the long term
- Short-term measures (restrictions) to protect against running out of water
- Contingency plans that ensure basic water needs for a community can be met in an emergency

These components can be adapted into objectives for specific systems, usually by setting the frequency, severity and duration of staged restrictions which then defines the average annual volume, or yield, a system needs to supply to meet their adopted LOS objectives.

Determination of appropriate LOS objectives requires investigation of associated trade-offs (see Figure 1). High investment in infrastructure to augment supply reduces the social costs of restrictions and the financial cost of implementing them. However, infrastructure is generally more expensive than the cost of restrictions, thus leading to potentially increased costs to the customer and the prospect of the bulk water supply system being 'gold plated'.

Conversely, lack of investment in the system could result in system failure or a high likelihood of severe and long-lasting restrictions. This could cause unpalatable service provider costs for restrictions messaging and enforcement.

Under severe restrictions, there could be many social costs too. There could be a loss of amenities (fountains, pools), inconvenience due to specified watering times, and restricted watering of local parks with associated poor aesthetics (brown lawns). This would ultimately impact the earning prospects (tourism and gardening industries), lifestyle, and liveability of the locality.

Although restrictions are the primary LOS component for determining yield and community acceptability, the other two components (supply/demand balance and contingency plans) also form an important part of water security planning.

Assessment of the system's ability to maintain supply enables the identification of future stresses on the system (e.g. climate change or population growth) and therefore the determination of the year when the next supply augmentation is required. This links back to determining LOS because augmentation can also be delayed through restrictions (or other drought response measures) or brought forward in times of drought.

Determining the basic needs of the community in severe drought again requires the balancing of costs. Providing only adequate water to meet basic human survival needs could damage the economy but with a sufficiently low frequency of occurrence could be perceived an acceptable risk to avoid over-investing in the supply system. Determining a base level of critical supply enables a minimum point from which planning can commence to ensure there is enough buffer within the system during severe drought.

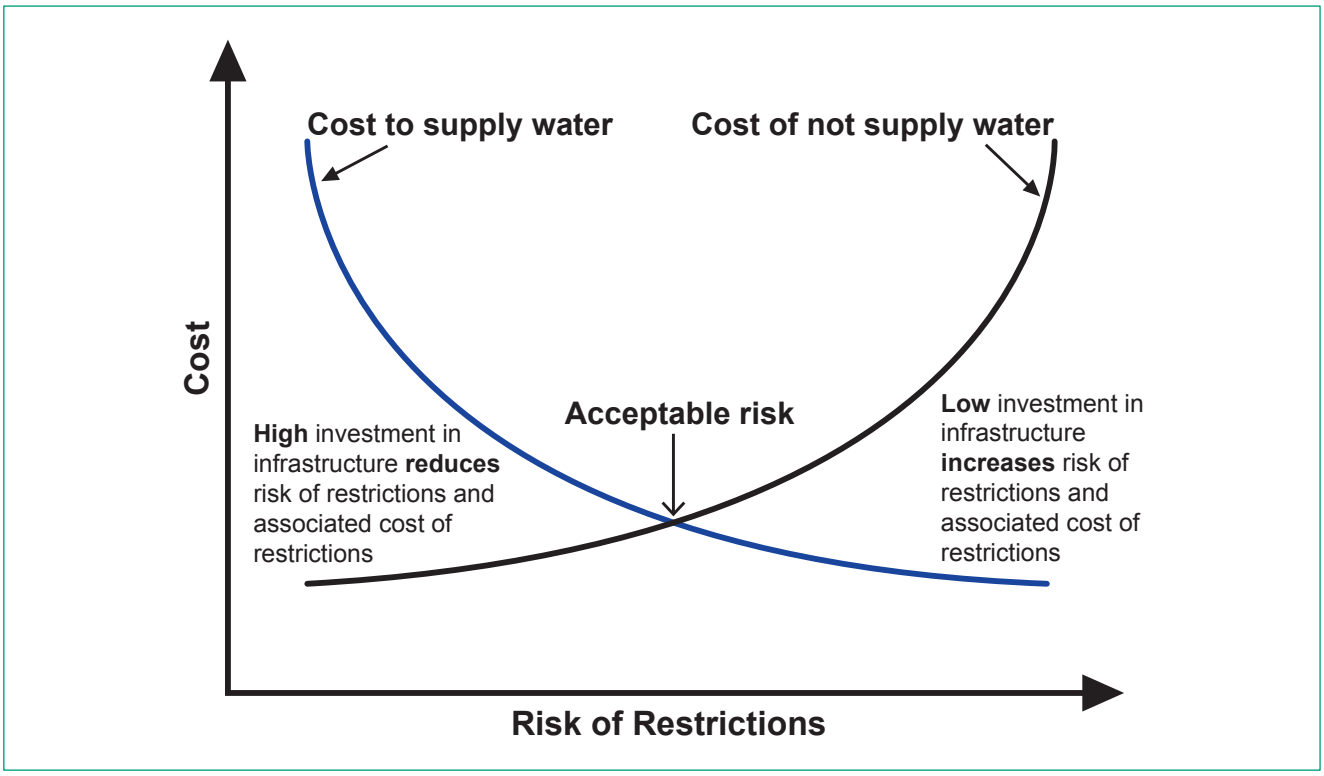

Figure 1: Trade-off for setting level of service objectives (Source: Erlanger and Neal, 2005. Figure 3-1)

LOS Development

In 2008, the Council of Australian Governments (COAG) adopted the National Urban Water Planning Principles (NUWPP) to provide governments and utilities with better planning tools for the development of urban water and wastewater service delivery. There are eight principles, the first key principle being:

- Deliver urban water supplies in accordance with agreed levels of service.

This is further detailed as 'the service level for each water supply system should specify the minimum service in terms of water quantity, water quality and service provision (such as reliability and safety).'

The other principle of relevance to this paper is:

- Adopt a partnership approach so that stakeholders are able to make an informed contribution to urban water planning, including consideration of the appropriate supply/demand balance

Since then the Water Services Association of Australia (WSAA) has released the 'Urban Water Planning Framework and Guidelines (2014)'. This paper expanded on the Erlanger and Neal 2005 paper to provide a broader context of (a) urban water planning, (b) the role of communities and stakeholders in decision-making, and (c) other broader objectives the water industry is seeking to address. The 2014 framework identified three key phases: (i) influence the strategic environment, (ii) broaden the vision, and then (iii) plan, implement, adapt and review. The third phase incorporates 11 core elements, many of which reflect some of the COAG's principles but in a step-by-step process. Some of the core elements include: establishing clear urban water servicing objectives between stakeholders, adopting a whole-of-water-cycle approach, quantifying cost/benefits, publishing outlooks (on water availability, climate scenarios, and LOS achievement), and reviewing plans every 5 years.

Terminology

Level of Service (LOS) is a term used for more than just water supply security. In Queensland, the *Water Supply (Safety and Reliability) Act 2008* requires most service providers to have customer service standard (CSS) targets which should contain 'a target for the level of service to be provided for the CSS KPIs' (key performance indicators). In SEQ, service standards are set in accordance with the South East Queensland Customer Water and Wastewater Code (DEWS, 2017) and require the five SEQ service providers to specify KPIs for line breaks, unplanned interruptions, pressure and flow rates, and response times.

Understandably, the multiple uses of the term 'Level of Service' can result in confusion as both (water security and customer standards LOS) reflect standards about the reliability of supply. The crucial difference is that LOS for water security enables the determination of the total water supply system yield. Security of supply now and into the future is a function of the quantity of water that can be supplied reliably. It can be affected by climate variability (particularly drought) or population growth.

In SEQ, the ability to move water to where it is needed, either due to climate variability or population growth around the region, is an additional factor that affects the LOS yield. Customer service standards, on the other hand, are often a KPI measure used by service providers to set up customer expectations about the reliability of supply to their property with specific targets. Use of these targets can also help the business determine planned operation and maintenance work. Both the LOS and CSS can be used by economic regulators to support the establishment of pricing structures and tariffs.

APPLICATION OF LOS

SEQ

LOS objectives in SEQ have been in existence since the middle of the Millennium Drought when the Queensland Government was responsible for water security planning. This responsibility passed to Seqwater in 2013 and shortly after, in 2014, the LOS objectives were incorporated into *Water Regulation 2002*, a subordinate piece of legislation under the *Water Act 2000 (Qld)*. Desired LOS objectives in SEQ are now set in *Water Regulation 2016*.

Levels of service in SEQ directly follows the concept described in Erlanger and Neal 2005 (maintenance of supply, restrictions as drought response, and severe drought). The objectives can be paraphrased as:

- The bulk water supply system must be able to meet Projected Regional Average Urban Demand (PRAUD) and must annually report on PRAUD (PRAUD = total demand for the next 30 years in L/p/d).
- Medium Level Water Restrictions (MLWR) will not occur more than 1 in 10 years on average, will be no more severe than 140 L/p/d, and will not last longer than a year on average (applies only to residential water use).
- Minimum Operating Levels (MOLs) of three of the key storages will not be reached more than once in every 10,000 years on average.
- The bulk water supply system must be able to meet Essential Minimum Supply Volume (EMSV) and will not be reduced to EMSV more than once in every 10,000 years on average (EMSV = 100 L/p/d total demand).

Seqwater have prepared a Water Security Program to show how the LOS objectives are proposed to be achieved over the 30-year period. Achievement is generally evidenced through the Regional Stochastic Model (RSM); all objectives to date have been met or exceeded.

Application Elsewhere

Most large Australian cities[2] have established LOS objectives to underpin water security planning. However, the definition and approach of LOS varies and is not always consistent with Erlanger and Neal 2005.

For clarity on terminology in this section, LOS objectives for water security will be denoted 'LOS objectives', and LOS for service standards 'SS'.

SEQ, Cairns, Sydney, Lower Hunter Valley, Ballarat, Canberra and Darwin seem to be the main cities that use Erlanger and Neal's proposed LOS objectives approach with SS usually referred to as service, or system performance standards.

Perth, Adelaide and Tasmania do have LOS objectives stated but publicly available information is sparse, and definitions of LOS differ. Perth's LOS objectives are referred to as reliability of supply objectives while Adelaide's LOS objectives are an overarching aim for the frequency of restrictions. Tasmania has not yet developed its LOS objectives although this has been identified as something that needs to be established. Adelaide and Tasmania have service standards for SS while Perth calls them LOS.

Melbourne again has a slightly different interpretation on the terminology with the state government setting the base LOS objective to not fall into the low zone (below 40%). This objective applies to the bulk water provider and the three service providers[3]. The LOS objective is further broken down into frequency targets in some of the service providers' water security plans (called Urban Water Strategies). The term LOS is also used for SS between the bulk water supplier to the service providers, and then 'guaranteed service levels' are used to show SS between the service provider and the customer.

Although not usually stated as a LOS objective all cities have supply-demand assessments in their long-term water security plans. The range of plan outlooks spans from 17 years to 50 years (Table 1). All cities either have sufficient supply to meet demand over this timeframe or have identified demand management initiatives and the year of required augmentation(s).

Most cities describe frequency and severity of their restrictions LOS objective with chosen frequencies of between 10 and 20 years average recurrence interval (ARI) for their first level or stage of restrictions. The exception is Cairns, where the service provider has chosen to accept more frequent restriction levels, but their stage 3 restrictions align with the 1 in 10 years ARI frequency (CRC, 2015). This is likely due to the dynamic nature of their supply and because Cairns city is smaller than most others mentioned in this paper.

Severity of restrictions seems to be ambiguous in its measurement with some cities specifying the volume targeted or the demand reduction aimed for, but most cities just use the stage of restrictions to determine severity. Duration is rarely stated, the exceptions being SEQ, Sydney and the Lower Hunter, but if the other two factors are stated, duration is determined as a result.

A few cities have determined the LOS for several stages of restrictions either for all stages (Cairns) or to 'bookend' restrictions by specifying LOS for both the first and last level of restrictions (SEQ, Darwin, Melbourne and Ballarat).

LOS contingency planning for severe drought is also ambiguous in its unit of measurement. The original definition (Erlanger and Neal, 2005) was about basic water needs in severe drought which Darwin and Adelaide have identified as water volumes to be available to address emergency situations whereas others use a severe level of restrictions as a LOS objective for severe drought. SEQ uses both with EMSV acting as an infrequent event with a set amount that must be supplied. However, several cities use a LOS objective relating to the frequency of low storage volumes with the trigger levels ranging between 5-20% storage and the ARI's between 1,000 to 100,000 years.

Although not a LOS objective, most cities (bar SEQ, Darwin and Tasmania) have a form of Permanent Water Conservation Measures (PWCM). This is important as it shows a general willingness to conserve water in Australia even when not in drought.

[2] LOS can be established by either state government, bulk water providers or service providers. To reduce confusion city names have been used.

[3] Melbourne Water is the bulk water provider and the three service providers are City West Water, South East Water, and Yarra Valley Water.

Table 1: Water Security LOS in Australia

	Planning horizon and projected demand	Restrictions			Severe Drought	
		F	S	D	Restrictions	Storage
SEQ [1]	30 years (2046) 285 L/p/d total 525,349 ML/a total D>S 2041	1 in 10	140 L/p/d (res)	< 1 year	EMSV F: 1 in 10,000 S: 100 L/p/d total demand	MOL 1 in 10,000
Cairns* [2]	30 years (2045) 47,000 ML/a total D>S after 2025	1 in 1.5 *1 in 10*	Stage 1 80% storage (10% reduction) *Stage 3* *60% storage (20% reduction)*	-	F: 100 ARI S: Emergency 40% storage	Dead storage 1 in 1,000
Sydney* [3]	50 years (2065) 650 GL/a total D>S after 2025	1 in 10	Level 2 40% storage	< 3%	-	Approach emptiness 1 in 100,000
Lower Hunter* [4]	35 years (2050) 75 GL/a total D>S 2035	1 in 10	Target 190 L/p/d	< 5%	-	MOL 1 in 10,000
Ballarat* [5]	50 years (2067) 23,000 ML/a total D>S 2041-62	1 in 20	Stage 1-2	-	F: 1 in 1,000 S: stage 3-4	Below 20% no more than 1 in 1,000
Canberra* [6]	30 years (2044) 40.5 GL/a total D>S 2035-70	1 in 20 (5%)	Stage 1 (10% reduction)	-	-	Below 5% no more than 1 in 10,000 (0.01%)
Darwin [7]	17 years (2030) 43,000 ML/a total D>S 2013	1 in 20 (5%)	Stage 1 (10% reduction)	-	F: 1 in 100 (1%) S: Stage 4 (50% reduction)	2 years contingency storage
Melbourne* [8]	50 years (2065) 625 GL/a 190.3 L/p/d D>S until 2043	1 in 100	Medium zone Stage 1 & 2	-	Low Zone F: 1 in 200 S: Stage 3 & 4	-
Adelaide* [9]	40 years (2050) 625 GL/a D>S past 2050	1 in 100	Level 2	-	Critical human water needs agreement	
Perth* [10]	50 years (2060) 515 GL/a 301 L/p/d total D>S before 2030	-	-	-	F: 1 in 50 S: Stage 5-7	-
Tasmania[11]	20 years (2038)	-	Stage 3	-	-	-

Notes: F= Frequency, S = Severity, D = Duration, * = has PWCM, D>S = year that demand exceeds supply
Citations: [1] Seqwater, 2017. [2] CRC, 2015. [3] MWD, 2017. [4] MWD, 2014. Hunter Water, 2017-18. [5] CHW, 2018. [6] DEP, 2014. Icon Water, 2018. [7] Power and Water, 2013. [8] Melbourne Water, 2017. CWW, 2017. [9] DEW, 2009. [10] Water Corporation, 2009. [11] TasWater, 2018

OPPORTUNITIES TO IMPROVE LOS IN SEQ

As required by legislation, DNRME started reviewing LOS objectives for SEQ in 2018. At the beginning of the process DNRME collaborated with Seqwater to write a paper identifying the purpose of the LOS, any issues and how the review would seek to address these. The key discussion points are summarised below with suggested resolutions in italics.

Are the LOS objectives fit for purpose?

The purpose of the review is to determine if the existing objectives are providing sufficient water security for SEQ at a reasonable cost. Each objective needs to be evaluated to determine if it is still relevant, achievable, necessary and effective. Where applicable, alternatives should be modelled (hydrologically and economically) alongside existing objectives to determine if changes are recommended.

DNRME will investigate each individual objective and test implications of using different LOS objectives as part of the review.

How will changing LOS objectives affect pricing?

Setting too strict a LOS objective can risk creating inefficient or 'gold plated' systems. There are objectives relating to the drawdown of three key dams, all in different sub-catchments, and a regional wide EMSV. Having to meet three MOL's and an EMSV objective means there are several potential 'first failure points' in the system depending on how, and where, the next supply augmentation occurs.

The significant investment in infrastructure during the Millennium Drought, and ongoing operational costs, contribute to the bulk water pricing SEQ customers pay. Given there is still outstanding debt in relation to these assets, the LOS objectives should not be seeking to provide system security that unnecessarily triggers the building of infrastructure in the near future.

An aim in the LOS review is to seek methods to reduce further system costs while maintaining adequate security.

How do we address the issues of differential performance?

In a complex system, the modelling of LOS becomes harder to successfully achieve. A large system may have objectives based on certain major parts of the network but transfer rules may limit a region receiving the same performance as the rest of the system. For instance, SEQ has four main regions connected by pipelines but dams have different rates of drawdown and catchment dynamics. Transfers between sub-regions can seek to supplement certain areas at a time, but there will always be different storage performances in sub-regions with the smaller coastal storages being far more dynamic. Additionally, there are 16 off-grid communities in SEQ that LOS applies to. However, historically there has been little formal guidance on how to evidence these as they are not included in the model (the RSM) established for the SEQ water grid.

DNRME will write two papers to address application of LOS to off-grid communities and opportunities for LOS application across sub-regions.

How will we manage consultation?

Government sets LOS in SEQ with the bulk water supply authority facilitating the achievement of LOS. There are also other important stakeholders in the system; namely the five SEQ water service providers and the community.

In legislation, there is only a requirement to do a 30-day public consultation if changes are made to the objectives, and there is no requirement built in to engage with stakeholders prior to release of the review. To be supportive of the ethos behind LOS and the third NUWP principle, it is proposed to undertake a more thorough consultation process.

Determination of the LOS is a very technical subject requiring an understanding of the system, modelling, costs, and drought response. This is fine when engaging with those with expertise in the area, such as Seqwater and the SEQ service providers, but makes it difficult to engage with the public. A quick review of responses back from the 2014 LOS consultation window found the responses from the service providers to be useful, but generally responses from the public were sparse and poorly informed.

The review will involve technical collaboration with the service providers and appropriate collaboration with the community.

COMMUNITY COLLABORATION

Although mentioned in Erlanger and Neal (2005) that the community should be involved in developing LOS objectives, there was little detail in that paper about how to involve the community. The more recent 'Urban Water Planning Framework and Guidelines' (WSAA, 2014) provides a more detailed process for incorporating communities into water security planning and included the International Association for Public Participation (IAP2's) public participation spectrum as a tool to assist defining the community's role using five different approaches.

Tasmania used this framework in their strategic planning, mainly falling under the 'inform' or 'consult' approach (Long Term Strategic Plan, 2017). This helped them develop focus groups and customer surveys which determined that the most important aspect for customers for financial spending, was drinking water quality.

Another example of recent and ongoing community engagement is Yarra Valley Water's Citizens' Jury. Every five years the Melbourne water service providers undergo a price review. As part of their process, Yarra Valley Water established a jury to shape future services and prices. The jury was formed from a random pool of customers, but individuals were selected to represent the community. All 'jurors' were given extensive evidence in order to make informed decisions and deliver effective feedback. The resulting recommendations suggested refinements to guaranteed service levels about supply disruptions. However, as a service provider-led exercise, the jurors did not seek to change the base LOS water security objective which is set by the Victorian government.

These examples show a move towards more community involvement in water security planning but as yet few of the water planning documents show evidence of the community informing LOS. The notable exception is Daylesford, Victoria where the community decided to reduce their frequency of restrictions to no more than 1 in 20 (instead of 1 in 10) years on average (Allan, 2018) although with a population of 2,500 it is hard to compare this to SEQ which has population of 3.5 million people.

Based upon the IAP2 framework, the level of consultation appropriate for the current DNRME review of LOS in SEQ was deemed to be 'consult' or 'involve' where public feedback is desirable, but a direct communication method is required to ensure a level of informed decision making. Due to the technical knowledge required to understand LOS, it was decided that a group should be formed to consult on behalf of the community before the release of the final paper. The group should be formed of people with adequate technical knowledge and with the community's interest as their priority. DNRME propose to provide workshops to engage with the community group to ensure feedback received is beneficial. This community consultation group would be in addition to the general public consultation required if changes to LOS objectives are proposed.

2019 LOS REVIEW

The 2019 LOS review, which will be undertaken by DNRME, has been designed to incorporate the opportunities for improvement described above.

The review process will occur in five phases, as depicted in Figure 2.

Phase 1 of the review requires writing a series of technical papers; one for each objective, one for each off-grid and sub-regional LOS application, and a final paper to determine how modelling and reporting can best show and support the achievement of LOS. Phase 1 includes extensive collaboration with Seqwater on each technical paper.

Phase 2 is the start of DNRME's consultation with the wider stakeholders, the five SEQ service providers, through a series of workshops to encompass their feedback on the technical papers. Phase 2 is also where DNRME starts consolidating the technical papers and their recommendations into the draft overarching review,and where the community consultation group is set up.

Phase 3 is where DNRME consults on the final review paper with all stakeholders (Seqwater, SEQ service providers and other state government departments) and the community consultation group.

Phase 4 is gaining the appropriate approvals from the Queensland Government and Cabinet.

Phase 5 is implementation. If no changes are proposed the LOS review will be published, but if legislative changes are required the project extends by a year to complete regulatory impact statements, public consultation and approval through Cabinet.

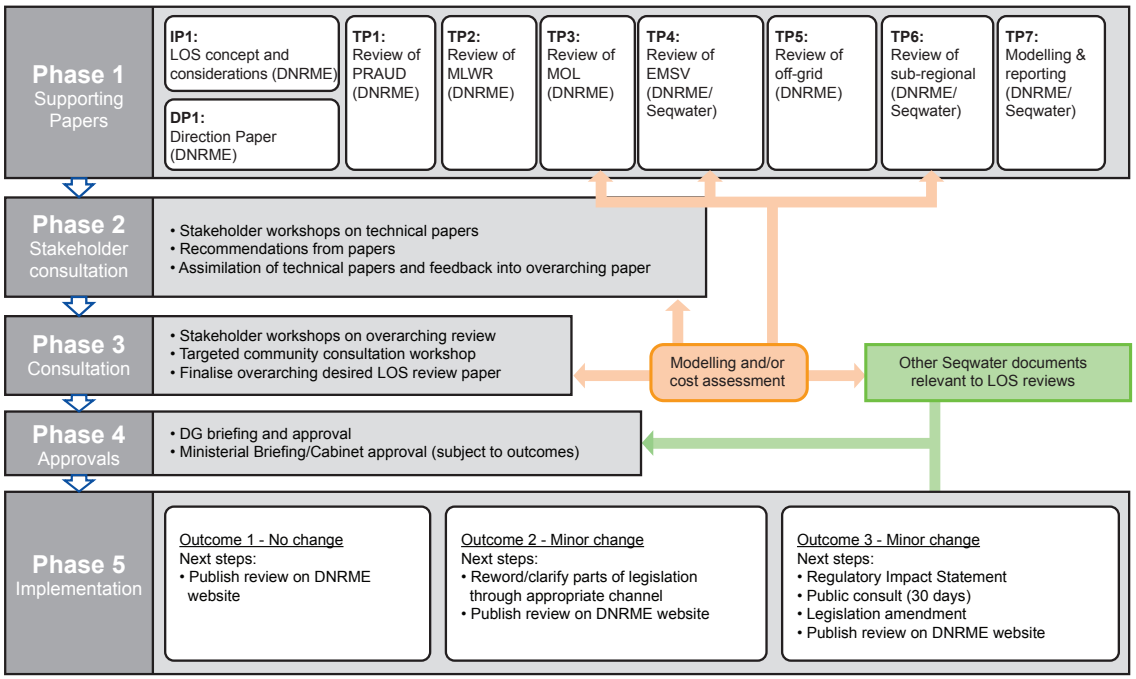

Figure 2: 2019 LOS review phases

CONCLUSION

This paper has reviewed the environment surrounding LOS in SEQ.

There are several key documents that encourage use of LOS as a tool for water security planning in Australia. The National Urban Water Planning Principles seems to be the most referenced document amongst water service providers with some state governments incorporating the guidelines into their policies and frameworks.

LOS application in Australia is not uniform in its approach, terminology or specifications. Nevertheless, similarities can be drawn between systems with similar LOS restrictions frequencies shown, although the definition of severity is ambiguous and duration is often not stated.

The main issues to bear in mind when conducting the SEQ LOS review are:

- The effectiveness of LOS objectives
- The need to put pressure against unnecessary pricing increases
- Management and application of LOS for sub-regions as well as for off-grid communities
- The need to adequately engage wider stakeholders and the community

To date community consultation on LOS nation-wide has been minimal, however recent consultations in the water planning environment are showing a shift towards better inclusiveness of communities.

The 2019 SEQ LOS review has been designed to be:

- As technically effective as possible – by scoping key areas for improvement prior to project planning; and
- As inclusive as possible – by engaging early and effectively with stakeholders as well as recognising the need to better engage the broader community.

The challenge now will be in managing and incorporating both the technical findings, and feedback from all parties in the timeframes available.

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Abi Killen has over six years of experience in the water sector. Originally trained as an environmental scientist, she started working for South West Water in the UK before becoming an adviser on catchment water quality in rural communities. For the last two years, Abi has been employed by the Department of Natural Resources, Mines and Energy (DNRME), working on water security planning throughout Queensland.