Bulk Water Supply System Interim Operating Strategy 2014-2029

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FINAL

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SOURCE STORE SUPPLY

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Contents

Executive Summary

Introduction and Purpose

As owner, manager and operator of the South East Queensland (SEQ) bulk water supply network, Seqwater's functions include flood management, maintaining and renewing bulk water treatment and transport infrastructure, managing water quality throughout the bulk water supply network and prudently and efficiently planning for the long term water supply needs of the region.

'Whole of system' integrated planning is being progressed through the development of the *Water Security Program* (WSP), as legislated under the *Water Act 2000* with a number of clearly documented deliverables. The first Seqwater WSP is currently scheduled for completion around June 2015 (refer Section 6).

Prior to the finalisation of the comprehensive 30 Year Integrated Master Plan to be developed under the WSP; this *Bulk Water Supply Interim Operating Strategy 2014-2029 Report* provides a provisional document to permit ongoing investment planning to proceed consistently across the organisation using recently adopted preliminary planning criteria (refer Section 2) and demonstrated prudent and efficient system operating strategies.

This *Interim Operating Strategy* is structured to provide a consistent understanding across Seqwater of the primary proposed modes of operation of the bulk water supply system for the period 2014 to 2029. These proposed operating modes have been developed to ensure that all major investment (i.e. capital, renewals and operations) are underpinned by effective water supply strategies that align with our Bulk Water Customers' (BWCs') expectations and deliver of 'whole of system' outcomes.

Bulk Water Demand Projections

As part of core business processes, Seqwater maintains water forecasting capabilities to review and monitor existing consumption and potential future water demands (refer Section 3). Applying these demand forecasting capabilities Seqwater concludes that the 'Most Likely' average regional demand is about 285L/p/d, across SEQ as a whole, consisting of:

- Average residential consumption of about 185L/p/d
- Average non-residential consumption of about 100L/p/d, including system losses.

This process of consolidating bulk water demand projections and the application of planning criteria is an efficient means of undertaking integrated system planning and for identifying emerging risks to achieving the adopted service specifications; however, it is imperative to note that actual project delivery will be based on assessments of actual system performance (including recorded local consumption profiles etc.) to ensure that all investment is demonstrated as being prudent.

Defining System Capability

Central to the development of existing and future operating strategies is a consistent understanding of current facility and system capability. For the purposes of this *Intermin Operating Strategy*, capability has been developed based on the adopted preliminary planning criteria and the outcomes of the *Preliminary Asset Capability Statement - Treatment and Transport* (Trim Ref: D14/46384) that was recently compiled for all major Seqwater assets, which is considered to be the current baseline capability for Seqwater's water treatment plants and bulk water supply transport infrastructure.
It should be noted that the asset capabilities are based on normal operating conditions, and do not provide an assessment of asset capability outside of normal operating conditions (e.g. during an event causing significant changes raw water quality).

System Operating Scenarios

The adopted service specifications and preliminary planning criteria are structured to address the primary requirements in the delivery of a bulk potable water service to our BWCs and are focused on providing maximum value in delivering:

- A reliable and resilient bulk water supply
- Specific adherence to the Level of Service (LOS) objectives
- Bulk water supply of an assured quality.

To demonstrate how these outcomes are to be achieved, the following system operating scenarios undertaken for this *Interim Operating Strategy* are provided in Table E1.

Table E1: Critical Operating Scenarios Adopted for Capability Assessment

Scenario	Planning Intention	Primary Planning Criteria[1]	Network Demand Scenario
Sustainable Regional Supply	Demonstrate a sustainable regional bulk water balance	Within individual raw water source entitlement	AD All Planning Horizons
Regional Drought Resilience	Demonstrate a sustainable regional bulk water balance	Within total LOS objectives and water security criteria	2029 AD
Sustained Peak Demand	Demonstrate network is capable of sustained high demand during normal operating conditions (i.e. raw water quality)	Within WTP and bulk transport network capacity	MDMM All Planning Horizons
Short-term Peak Demand	Demonstrate that the network is capable of sustained high demands during normal operating conditions (i.e. raw water quality)	Maintain supply bulk water supply reservoirs	2029 MD
Critical Infrastructure Failure	Demonstrate that the failure of a major water treatment facility asset can be managed for minimum of 48 hours	Maintain supply in all major system reservoirs	2029 AD

To undertake the capability assessments against the adopted demand forecasts, the outcomes of previous planning studies undertaken internally by Seqwater and in conjunction with the BWCs have been adopted (refer Table 5). Where appropriate, this planning aligns with the BWCs' Netserv Plans (e.g. the provision of additional Bulk Supply Points; BSPs).

These previously identified planning intitiatives included in the future system assessments exclude the comprehensive list of the ongoing renewals based capital works program that is required to to maintain asset capability. The Integrated Master Plan to be developed under the WSP (refer Section 6) will focus on providing a better understanding of the expected future operation of each asset allowing a targeted program based on whole of system operational flexibility and defined risk tolerance to further generate efficiencies in the renewals schedules.

Key Planning Outcomes

Sustainable Regional Supplies

The collective bulk water entitlements available for treatment by Seqwater are well in excess of the projected Year 2029 AD demands, such that no additional sources are required to meet this collective constraint, so long as effective asset management and operating strategies are available to treat and transport this water to meet sub regional and local demands.

Regional Drought Resilience

The current adopted LOS yield is well in excess of the projected Year 2029 AD demands, such that no additional sources are required to meet this collective constraint whilst achieving the regional drought resilience objectives that underpin the adopted LOS.

Furthermore, the current *System Operating Plan* risk criteria are achieved for the adopted Year 2014 and Year 2029 bulk water demands with the current infrastructure configuration and operating modes; however, it should be noted that this is largely related to the modelling assuming starting at the current level of the key regional bulk water storages of around 90% of full supply volume.

Sustained Peak Demands

Based on the current projected 'Most Likely' Mean Day Maximum Month (MDMM) demands, it is probable that additional sources of bulk treated water will be required prior to the Year 2029 to meet peak monthly demands (refer Section 5.5). Given the criticality of Water Treatment Plants (WTPs) in meeting these projected seasonal demands; it is imperative that Seqwater continue to actively monitor bulk water demands and particularly seasonal impacts to ensure any proposed system augmentation is adequately planned for.

Based on previously undertaken facility based planning, two potential bulk treated water upgrades have been identified as demonstrating the greatest efficiency from a 'whole-of-system' perspective, notably:

1. North Pine WTP upgrade to 250ML/d (24 hour capacity), currently not required before 2022
2. Mount Crosby WTP combined Eastbank and Westbank upgrade to 850ML/d (24 hour capacity), currently not required before 2027.

Short-term Peak Demands

Under the adopted service specification, short-term peak demands in excess of MDMM are managed through the combined system network reservoir storages (i.e. bulk and distribution/reticulation) reservoir storages and additional reservoir storage has been identified as being required at the Narangba reservoir complex to meet the adopted preliminary planning criteria.

Critical Infrastructure Failure

The current available capacity in the SEQ bulk water supply system gives a degree of operational flexibility to reconfigure network operations to meet resilience objectives; however there remain a number of critical facilities whose reliable operation is essential to maintaining supply.

As an initial approach to critical infrastructure assessments, a preliminary assessment has been undertaken to determine the impact across the bulk water supply network due to the full loss of supply from individual, connected WTPs for up to 48 hours under the Year 2029 'Most Likely' AD demands.

The preliminary assessment has concluded that, with the upgrades noted above; with the exception of the northern areas of the Landers Shute supply zone (i.e. Maroochydore, Buderim et al), the vast majority of the connected areas of the bulk water supply system are able to effectively maintain supply to end-use customers; however, the assessment notes that the outcomes are particularly sensitive to system storage at the time of facility failure, the inclusion of any seasonal demands peaking and mobilisation times to implement any system reconfigurations.

1. Introduction

1.1 Overview and Purpose

As owner, manager and operator of the South East Queensland (SEQ) bulk water supply network, Seqwater's functions include flood management, maintaining and renewing bulk water treatment and transport infrastructure, managing water quality throughout the bulk water supply network and prudently and efficiently planning for the long term water supply needs of the region.

Seqwater's current network stretches from Noosa on the Sunshine Coast, to Tugun on the Gold Coast, North Stradbroke Island in the east to Gatton in the west (refer Figure 1). This network currently delivers around 750 Megalitres per day (ML/day) of potable bulk water from Seqwater's Water Treatment Plants (WTPs) to a number of Bulk Water Customers (BWCs) and ultimately to virtually all homes and businesses across SEQ.

To ensure that effective integration of supply across the Seqwater's asset portfolio requires a consistent and structured framework for delivering operating and infrastructure planning outcomes through a rigorous approach to integrated master planning. This ensures that Seqwater maintains regard to existing service requirements, the current and emerging compliance obligations including those pertaining to water quality and any scope for delivering immediate efficiencies.

As directed under the current *System Operating Plan* (SOP; Revision 5), Seqwater produced a *Water Supply Asset Plan* (WSAP) in October 2013 which broadly provides an overview of the organisation's asset management capability and specifically demonstration of the ability of the existing portfolio of assets effectively meet the current legislated Level of Service (LOS) objectives over the next 20 years (refer Section 2.2).

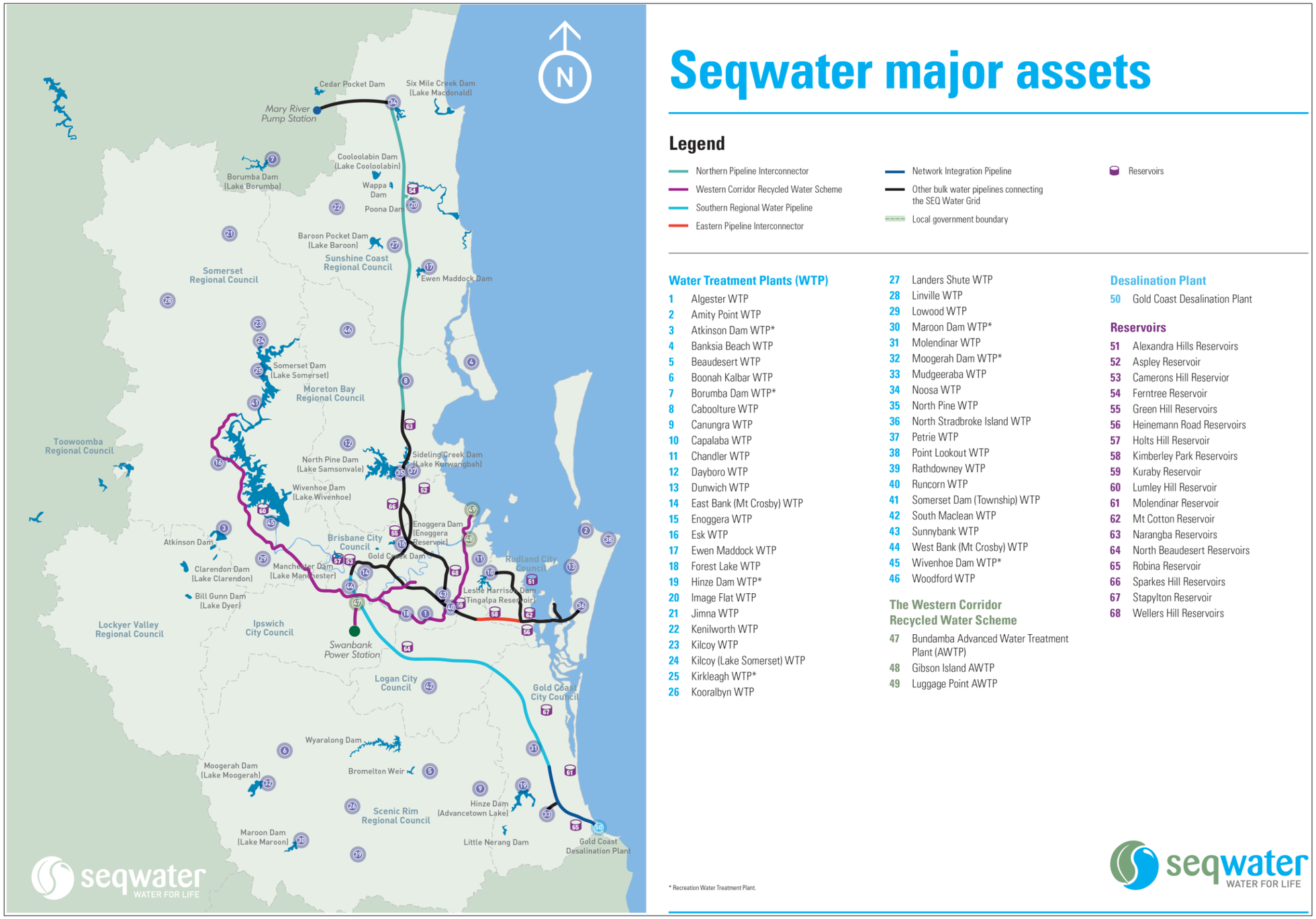
The current WSAP is focussed primarily on demonstrating compliance with the LOS objectives and does not necessarily address 'whole of system' integrated planning. This planning obligation is being progressed through the development of the *Water Security Program* (WSP), which is a legislated requirement under the *Water Act 2000* with a number of clearly documented deliverables. The first Seqwater WSP is currently scheduled for completion around June 2015 (refer Section 6).

Prior to the finalisation of the comprehensive 30 Year Integrated Master Plan to be developed under the WSP; this *Bulk Water Supply Interim Operating Strategy 2014-2029 Report* provides a provisional document to permit ongoing investment planning to proceed consistently across the organisation using recently adopted preliminary planning criteria and demonstrated prudent and efficient system operating strategies.

This *Interim Operating Strategy* is structured to provide a consistent understanding across Seqwater of the primary proposed modes of operation of the bulk water supply system for the period 2014 to 2029. These proposed operating modes have been developed to ensure that all major investment (i.e. capital, renewals and operations) are underpinned by effective water supply strategies that align with our Bulk Water Customers (BWCs) expectations and deliver of 'whole of system' outcomes to achieve Our Vision[1]:

Healthy communities. Prosperous region.

[1] *Seqwater's Strategic Plan 2013–2018 Outline*



Seqwater major assets

Legend

- Northern Pipeline Interconnector
- Western Corridor Recycled Water Scheme
- Southern Regional Water Pipeline
- Eastern Pipeline Interconnector
- Network Integration Pipeline
- Other bulk water pipelines connecting the SEQ Water Grid
- Local government boundary
- Reservoirs

Water Treatment Plants (WTP)

1 Algester WTP
2 Amity Point WTP
3 Atkinson Dam WTP*
4 Banksia Beach WTP
5 Beaudesert WTP
6 Boonah Kalbar WTP
7 Borumba Dam WTP*
8 Caboolture WTP
9 Canungra WTP
10 Capalaba WTP
11 Chandler WTP
12 Dayboro WTP
13 Dunwich WTP
14 East Bank (Mt Crosby) WTP
15 Enoggera WTP
16 Esk WTP
17 Ewen Maddock WTP
18 Forest Lake WTP
19 Hinze Dam WTP*
20 Image Flat WTP
21 Jimna WTP
22 Kenilworth WTP
23 Kilcoy WTP
24 Kilcoy (Lake Somerset) WTP
25 Kirkleagh WTP*
26 Kooralbyn WTP
27 Landers Shute WTP
28 Linville WTP
29 Lowood WTP
30 Maroon Dam WTP*
31 Molendinar WTP
32 Moogerah Dam WTP*
33 Mudgeeraba WTP
34 Noosa WTP
35 North Pine WTP
36 North Stradbroke Island WTP
37 Petrie WTP
38 Point Lookout WTP
39 Rathdowney WTP
40 Runcorn WTP
41 Somerset Dam (Township) WTP
42 South Maclean WTP
43 Sunnybank WTP
44 West Bank (Mt Crosby) WTP
45 Wivenhoe Dam WTP*
46 Woodford WTP

The Western Corridor Recycled Water Scheme

47 Bundamba Advanced Water Treatment Plant (AWTP)
48 Gibson Island AWTP
49 Luggage Point AWTP

Desalination Plant

50 Gold Coast Desalination Plant

Reservoirs

51 Alexandra Hills Reservoirs
52 Aspley Reservoir
53 Camerons Hill Reservior
54 Ferntree Reservoir
55 Green Hill Reservoirs
56 Heinemann Road Reservoirs
57 Holts Hill Reservoir
58 Kimberley Park Reservoirs
59 Kuraby Reservoir
60 Lumley Hill Reservoir
61 Molendinar Reservoir
62 Mt Cotton Reservoir
63 Narangba Reservoirs
64 North Beaudesert Reservoirs
65 Robina Reservoir
66 Sparkes Hill Reservoirs
67 Stapylton Reservoir
68 Wellers Hill Reservoirs

* Recreation Water Treatment Plant.

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Figure 1: Major Assets Map

2. The SEQ Planning Framework

2.1 The Role of the Bulk Water Supply System

The function of the SEQ bulk water supply system is to efficiently treat and transport potable water to the BWCs for distribution to end-use consumers. The SEQ bulk water supply system assets include:

- Catchments and dams
- Rivers, bores and raw water pipelines
- WTPs and the Gold Coast Desalination Facility (GCDF)
- The Western Corridor Recycled Water Scheme (WCRWS)
- Bulk transport pipelines, pump stations and reservoirs
- Water quality management facilities.

Seqwater's role in this integrated water supply chain is to store, treat and transport bulk treated water (including the GCDF) whilst meeting a number of key drivers, including:

- Obligations under the *Statement of Obligations* (SOP), including cost-effective service delivery
- Obligations under the Bulk Water Supply Agreements, including maintaining treated water quality parameters
- Obligations under the *Bulk Water Supply Code* including; operation in accordance with documented Operating Protocols
- Requirements under the SOP including that investment and other decisions are made considering whole of SEQ, least-cost planning outcomes
- Regulatory requirements of a Registered Service Provider, including operating under a Drinking Water Quality Management Plan (DWQMP)
- Costs and other commercial factors such as access to funds, return on investment and dividend requirements.

2.2 Level of Service Objectives

The South East Queensland Water Strategy (Strategy) was developed during the Millennium Drought in SEQ and further updated in 2010 and aimed to reflect the community's attitude towards water at the time. The vision was encapsulated by three general themes of: *use less, be supply ready and manage efficiently* and this was articulated through the setting of desired LOS objectives.

The Strategy's vision and the desired LOS objectives are dependent upon water supply planning that:

- Ensures that the system has the capacity to maintain adequate water supply over the long term
- Involves a drought response plan to protect against water shortages through planned implementation of appropriate demand management measures and construction of new climate resilient supplies, such as desalination
- In the case of extreme drought or critical water shortage, provides a contingency plan to ensure that the basic water needs of SEQ can be met for the duration of that situation.

The Strategy incorporating the LOS objectives was developed as an adaptable blueprint for maintaining water security in SEQ. As noted in the Queensland Water Commission (QWC) *South East Queensland Water Strategy Annual Report 2012* (QWC 2012 Annual Report), actual regional water consumption remains well below the planning assumptions adopted for the Strategy with the "Most Likely" long term average regional water demand currently predicted to be around 285L/p/d (including residential, non-residential and system losses), of which 185L/p/d is directly attributed to residential demand.

To determine the impacts of changes in the background assumptions underpinning the LOS objectives and to ensure future prudency and efficiency in the delivery of bulk water supply services, the Department of Energy and Water Supply (DEWS) is currently undertaking a comprehensive review of the existing LOS objectives in order to:

- Assess whether the water allowance set in the current LOS objectives of 375 litres per person per day is still appropriate for planning purposes
- To promote cost effective operation of bulk water supplies by optimising existing assets and preventing over-capitalisation on existing and future infrastructure.

DEWS has been working with the water service providers across SEQ, including Seqwater, during a targeted consultation process to define the final LOS objectives to be developed. Once these new objectives are determined, the new LOS criteria will be prescribed in regulation (nominally by mid-2014). Once new LOS are prescribed, Seqwater will have 12 months to develop a revised WSP, in line with obligations under the *Water Act 2000* (refer Section 6).

2.3 Service Specifications

Service specifications provide the overall customer expectations of the system such as the acceptable frequency of service interruptions or the maximum level of risk to which the customer may be exposed (e.g. drought security risk).

There are currently no directly mandated service specifications for the SEQ bulk water supply system; however, Seqwater has a number of bulk water supply objectives derived from the Statement of Obligations (SoO), Bulk Water Supply Agreements and the Bulk Water Supply Code. These are essentially defined in terms of providing an integrated bulk water supply service that is able to achieve a prescribed set of water security risk criteria, with consideration to prudent and efficient least-cost planning outcomes.

The service specifications recently adopted by Seqwater are a set of outcomes that underpin the planning criteria for the bulk water supply system to align with the Seqwater purpose to efficiently utilise our catchments and infrastructure meet the objectives and with our approach to maintaining safe and secure water by "*continuing to meet regulated standards, particularly for drinking water, and ensuring water security for the business and the community*"[2] (refer *Preliminary Service Specifications and Planning Criteria Report*; Trim Ref: D14/27787).

The proposed service specifications are structured to address the primary requirements in the delivery of a bulk potable water service to our BWCs and are focused on providing maximum value in delivering:

- A reliable and resilient bulk water supply
- Specific adherence to the LOS objectives
- Bulk water supply of an assured quality.

The proposed service specifications are therefore fundamental to defining operations and the provision of future infrastructure to dictate future investment decisions and therefore have significant financial sustainability implications for the organisation.

2.4 Preliminary Planning Criteria

Planning criteria are a set of assessment parameters which translate the adopted service specification to enable a structured process for planning to progress and allow the assessment of portfolios of options in using a consistent approach. This enables a balance between water users' requirement for a safe, secure, reliable, quality water supply and the desire for this service to be provided at minimal cost.

The application of planning criteria is an efficient way of assessing system performance and capability to inform future investment; however, they are not intended to preclude the identification of innovative options or to diminish the goal of least-cost planning in promoting efficiency during planning. Actual infrastructure delivery will still be underpinned by appropriate planning investigations and developing effective investment 'triggers' to ensure that all decisions meet the underlying service objectives in a demonstrably prudent and efficient manner.

[2] *Seqwater's Strategic Plan 2013–2018 Outline*

In line with this requirement, the preliminary planning criteria provided in Table 1 have been identified as being critical to progress the integrated master planning process and associated asset investment planning activities.

Table 1 Preliminary Planning Criteria

Element	Planning Criteria	Notes
Average Day (AD) Demands	185L/p/d residential 285L/p/d total	Sensitivity assessments to be undertaken to determine the impact of any significant departures from this base case demand
Sustained peak persistence demands Mean Day of the Maximum Month (MDMM)	1.3 – 1.5 x AD Based on demand zone analysis	Consistent with *Planning Guidelines for Water Supply and Sewerage* (DEWS) and *SEQ Water Supply and Sewerage Design & Construction Code* (as developed by the BWCs)
Short term peak persistence demands Maximum Day (MD)	1.6 – 1.9 x AD Based on demand zone analysis	Consistent with Planning Guidelines for Water Supply and Sewerage (DEWS) and SEQ Water Supply and Sewerage Design & Construction Code (as developed by the BWCs)
Diurnal consumption profiles	As a minimum residential and commercial water consumption patterns	Undertaken on an as needed basis to support detailed operational and infrastructure planning outcomes
Large Connected WTPs (>100ML/d)	23hour Availability 24/7 Production	Demonstrated cost effective staged integration between water treatment and network in line with the proposed water quality specification and at a low risk for water quantity outages
New WTPs		
Desalination Plants		
Medium Connected WTPs (10-100ML/d)	20hour Availability Production to meet demand	
Small and Unconnected WTPs		
Bulk Transport Mains	Gravity mains to transport MDMM over 24 hours	System to be configured and operated above minimum flow to achieve water quality objectives
	Pumped mains to transport MDMM over 20 hours	
Bulk Transport Pump Stations	MDMM over 20 hours	Standby pump capacity to match the largest single unit pump capacity
Regional Interconnector Pipelines	Maximum operation in line with design basis	System to be configured and operated above minimum flow to achieve water quality objectives
	Pump design basis 23hours/day	Standby pump capacity to match the largest single unit pump capacity
	Serve as MDMM mains for distribution along Regional Interconnector corridor	Fully metered, flow controlled off takes to BWC system
		A future assessment to be made as to appropriateness of using the Regional Interconnectors for this purpose
Bulk Network Reservoirs	3 x (MD – MDMM) < Operating Protocol effective reservoir operating volume	For direct service zone only
	Maintain supply above Operating Protocol minimum operating level after 3 x MD	Minimum desired reservoir operating levels to provide the initial basis for the assessment bulk water supply network reservoir requirements

Element	Planning Criteria	Notes
Regional Interconnectors Reservoirs	No allowance for direct reservoir storage for demand zones	In accordance with design basis
Extended Period Analysis for bulk system transport and treatment	1. 3 x MDMM Demands	Reservoir initial levels to correspond to top operating level and reservoirs to have a net positive inflow each day.
Extended Period Analysis for bulk system transport, treatment and reservoir storage	2. Scenario 1 followed by 3 x MD Demands	Reservoirs cannot empty below Minimum Operating Level
Water Quantity	Risk of outage to be planned as "Low Risk" under "normal operation" (i.e. non-contingency modes)	Aligned with Consequence and Probability parameters under Seqwater *Risk Management System* (Draft)
LOS Objectives	Review current being undertaken by DEWS	Seqwater will remain in regular contact with DEWS to gain early understanding of the preferred options
Water Quality	Refer: *Preliminary Service Specifications and Planning Criteria Report*; Trim Ref: D14/27787	Current and emerging chemical and physical water quality parameters representing a low water quality risk approach that is consistent with the 'catchment to tap' approach
Catchment	Investigations to address extreme and high risks currently in progress	Evaluation studies of efficacy and efficiency including risk mitigation and benefit analysis will be undertaken so the natural asset may better support reducing source water risks prior to the treatment process

For the purposes of this *Interim Operating* Strategy; the preliminary planning criteria represent the "base case" for identifying bulk water consumption and risk based triggers to develop planning level cost estimates for major infrastructure investment.

Of note is that in addition to the planning criteria nominated in Table 1, there are additional constraints on the bulk water supply system that must be considered and which drive operational outcomes (e.g. raw water bulk water allocations/entitlements).

3. Future Bulk Water Demands

3.1 Adopted Bulk Water Demands

As part of core business processes, Seqwater maintains water forecasting capabilities to review and monitor existing consumption and potential future water demands. Applying these demand forecasting capabilities Seqwater concludes that the 'Most Likely' average regional demand is about 285L/p/d, across SEQ as a whole, consisting of:

- Average residential consumption of about 185L/p/d
- Average non-residential consumption of about 100L/p/d, including system losses.

Of note is that this projection:

- Reflects actual consumption since 2008, based on assessing bulk water billing data and SEQ service provider account information collected by the Water Hub information system
- Is consistent with Seqwater short term demand forecasts based on a continuation of the current trends and 'average' weather conditions
- Was endorsed on 23 August 2013 by DEWS for the Seqwater Year 2013 *Water Supply Asset Plan* (WSAP)
- Aligns the water demand forecasts used with the current State Government bulk water price path and current LOS review considerations of the DEWS
- Incorporates projected population growth as developed by the Office of Economic and Statistical Research (OESR), Queensland Treasury
- Incorporates a likely level of potential future behavioural change, stabilising in 2018.

The total projected regional bulk water demand used in this *Interim Operating Strategy* is provided in Figure 2.

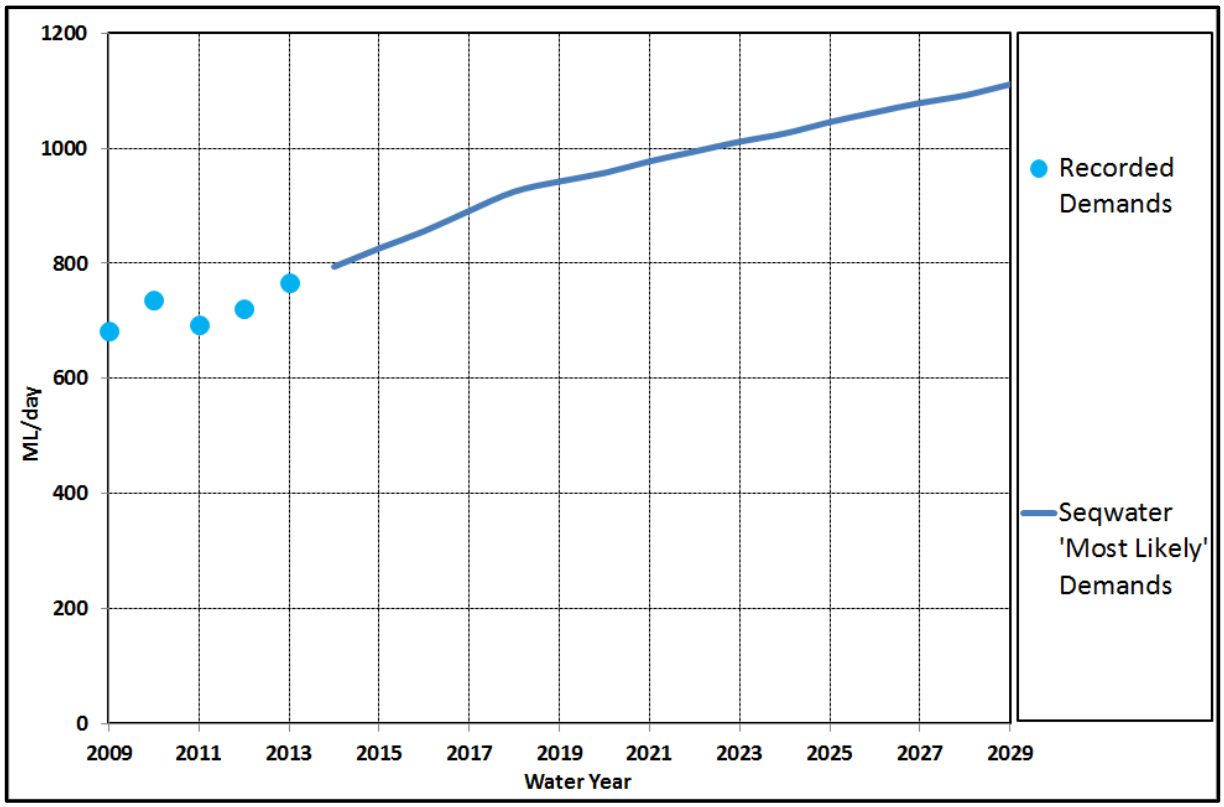


Figure 2: Projected Regional 'Most Likely' Average Day Demands

Whilst the above consolidated bulk water demand projections and the application of planning criteria is an efficient means of undertaking integrated system planning and for identifying emerging risks to achieving the adopted service specifications; it is imperative to note that actual project delivery will be based on assessments of actual system performance (including recorded local consumption profiles etc.) to ensure that all investment is demonstrated as being prudent.

3.2 Bulk Water Demand Distribution

The Seqwater bulk water demand forecasts are developed on a Local Government Area (LGA) which does not provide an adequate level of granularity around the distribution of demands to effectively assess network capability at a facility level (e.g. Brisbane is a single demand zone).

To progress a system wide and facility based analysis, Seqwater has used a variety of spatial distribution modelling approaches based on information received from the BWC which were largely derived from the 'Low series' demand forecasts provided by them for the Year 2013 WSAP. This has enabled the capability assessment to be undertaken at a subregional level; however, this is not considered to be a comprehensive approach to demand distribution, in particular for small, stand-alone demand zones not connected to the wider bulk water supply system (e.g. Canungra) and for those where Seqwater provides a distribution/reticulation service in addition to that of the bulk water supplier (e.g. Redland City).

Seqwater is currently undertaking a project in conjunction with the BWCs to improve the desired format/breakdown for the provision of demand forecast information that adequately meets Seqwater's business needs, taking into consideration the existing demand forecasting practices of the BWCs. It is intended that this approach will result in more robust methods for demand distribution and integrated system planning to be used in regional water planning and will be progressed under the WSP.

3.3 Major Growth Areas

As the bulk water supplier for SEQ, Seqwater maintains a strong awareness of the distribution of existing and future network demands, in particular new and emerging development corridors throughout the region, and continues to engage with the BWCs on the most efficient means of servicing new development areas. This understanding is developed primarily through consultative work with our customers on infrastructure planning and operational activities across the region.

For example, population growth within Brisbane is largely planned as infill development (e.g. densification of the Brisbane Central Business District (CBD)), which will generally be supplied through existing infrastructure; whereas development throughout other parts of the region is characterised by new Major Developments Areas (MDAs) as essentially Greenfield estates and will require largely network expansions.

Of note, is that many of these MDAs will be implemented using water sensitive urban design principles, with some including full Total Water Cycle Management (TWCM) Plans. These new developments will be characterised by a lower than average water consumption per person. This level of detail is not yet reflected in the demand forecasts developed by Seqwater or provided by the BWCs; however, future master planning and consideration to local supply issues will invariably result in more efficient outcomes.

3.4 Uncertainties with Demand Forecasts

Demand forecasts are based on a range of inputs, and are constructed by analysing the key input factors/drivers, such as forecast residential and non-residential per capita usage, population growth and potential changes to consumption behaviours.

Seqwater tracks residential consumption patterns given there is uncertainty regarding the timing and magnitude of any residential behavioural change. This has the potential to vary the consolidated most likely demand forecast for SEQ, given that residential demand comprises approximately 70% of the total water supplied by the SEQ Service Providers. Quarterly tracking of actual demand against forecast demand, including application of a 10% variation trigger which if experienced, requires more frequent demand forecast model reviews.

4. South East Queensland Bulk Water Supply System

4.1 Assessing System Capability

Central to the development of existing and future operating strategies is a consistent understanding of current facility and system capability. For the purposes of this *Intermin Operating Strategy*, capability has been defined as:

- For bulk water treatment assets - the capacity of the WTPs to meet the performance requirements dictated by the preliminary planning criteria with respect to water quality outcomes under specified raw water quality scenarios.
- For water transport assets - the capacity of facilities (e.g. pump stations) and schemes (e.g. pipeline systems) to meet the performance requirements dictated by the preliminary planning criteria with respect to water quality outcomes.

A *Preliminary Asset Capability Statement - Treatment and Transport* (Trim Ref: D14/46384) was recently compiled for all major Seqwater assets and is considered the current baseline capability for Seqwater's water treatment plants and bulk water supply transport infrastructure.

The *Preliminary Asset Capability Statement* was undertaken by the Asset Capability and Sustainability Team with the assistance of the Engineering and Technical Support Team and is structured to provide accurate and consistent asset information to be used for future infrastructure and operational planning and in corporate risk management. The intent of the *Preliminary Asset Capability Statement* is to investigate, analyse and review the capacity and baseline capability of the infrastructure and incorporates:

- A thorough review of existing asset information and technical reports
- Assessment of capacity of the assets
- Assessment of the capability of the assets to meet baseline performance requirements
- Identification of critical attributes of infrastructure relevant to drinking water quality and quantity
- Identification of major process limitations.

In developing this *Interim Operating Strategy*, the documented asset capability has been correlated with the adopted planning criteria to develop integrated system operating philosophies which effectively utilise assets subject to these established limitations.

4.2 Water Treatment Capability and Raw Water Entitlements

A large number of Seqwater's water treatment assets were designed at a time when water quality legislation was not as stringent as it is today such that the nominal hydraulic treatment capacity of many of Seqwater's WTPs is greater than that which can actually be achieved while meeting water quality compliance outcomes.

In addition to the hydraulic capacity, the capability of the WTPs to meet these outcomes is impacted by a range of factors including:

- Raw water quality – impacts on plants ability to produce treated water, in particular, raw water turbidity can reduce a plant's treatment capacity
- Minimum production – can be limited both by plant operational features and SEQ bulk water supply system constraints such as the requirement to maintain minimum flow through large diameter mains.
- Raw water entitlement – limits on maximum water licensed to be drawn from a resource over the course of a year.

For the purposes of the *Interim Operating Strategy*, Table 2 provides the adopted capabilities for the WTPs connected to the SEQ bulk water supply system.

Table 2: Connected Bulk Water Supply System WTP Capabilities (under "good" raw water quality)

Location	Water Treatment Plant	Current Maximum Capacity (ML/d)[1]	Current Minimum Capacity (ML/d)[1]	Current Source Entitlement (ML/y)	Maximum Run Hours/day[2]	Maximum Capacity (ML/d)
Sunshine Coast	Noosa	30	6	9,995	20	25
	Image Flat	24	8.6	16,500	20	20
	Ewen Maddock	14	0	2900	20	12
	Banksia Beach	4.5	1.8	1570	20	3.8
	Landers Shute	140	36	36,495	23	134
Brisbane	Mt Crosby	750	150	253,725	23	719
	North Pine	160	0	59,000	23	153
Redlands	Capalaba	23	5	7,640	20	19
	North Stradbroke Island	50	2	21,275	20	42
Gold Coast	Molendinar	144	60	83,995	23	138
	Mudgeeraba	60[3]	30			58
	GCDF	133	0	-[4]	23	125
Sub-Total		**1,567**		**493,095**		**1,477**

Notes
1. Hydraulic and process capacity to meet water quality objectives (refer *Preliminary Asset Capability Statement - Treatment and Transport*; Trim Ref: D14/46384)
2. Consistent with adopted Preliminary Planning Criteria (refer Table 1)
3. Current capacity temporarily limited by treated pipework configuration associated with fluoride dosing requirements
4. No actual source water entitlement applicable for GCDF.

Of note is the relationship between catchments in good condition and WTPs whose capacity is regularly subject to significant reduction during events resulting in very poor raw water quality. For example:

- Hinze and Little Nerang dams have catchments which are assessed as being in good condition. Consequently Mudgeeraba and Molendinar WTPs enjoy relatively stable raw water quality and are rarely subjected to events which significantly affect plant capacity.
- The Mount Crosby WTPs source water from poor scoring catchments (Somerset, Wivenhoe, Mid Brisbane River, Lockyer) and therefore experience extreme variations in raw water quality which can significantly reduce plant capacity (as evidenced during the January 2011 Floods and the January 2013 Weather Event).

4.3 Bulk Water Transport System Capability

The bulk water transport network moves treated potable water from WTPs throughout SEQ to the BWCs who operate the local distribution networks that supply the end consumers.

To undertake this service, Seqwater utilises:

- Over 600km of bulk water mains
- 26 pump stations
- 30 reservoirs
- 9 water quality management (dosing) facilities
- Associated bulk water transport network control and telemetry systems.

The above assets include the major interconnecting pipeline systems built in response to the Millennium drought i.e. Southern Regional Water Pipeline (SRWP), Eastern Pipeline Interconnector (EPI), Northern Pipeline Interconnector – Stages 1 and 2 (NPI – Stage 1 and 2) and the Network Integration Pipeline (NIP). The balance of the network comprises the 'acquired assets' that were transferred from the various Councils from the Sunshine Coast in the north and the Gold Coast in the south.

The creation of the bulk water supply network (previously known as the Water Grid) in 2007 was largely driven by the water reform initiated by the Queensland State Government. The desire for reform was influenced in part by the very severe drought that affected Queensland and much of Australia starting early in the last decade (the 'Millennium Drought'). As such, a key operating capability is the flexibility to move water throughout the region to maximise the overall sustainable yield of all the connected water sources. This capability existed to a limited extent prior to the construction of the interconnecting pipelines.

The actual capacity of the bulk transport network varies significantly depending on the mode of operation and on the water demands occurring at the time. The mode of operation for the capacities noted in this *Interim Operating Strategy* is based on capability during a "normal" mode of operation (i.e. not during an incident management scenario).

In addition to the maximum hydraulic capability of the network; maintaining water quality is dependent on managing water age and promoting 'turnover' of the network giving rise to minimum flow requirements. These serve as an operating constraint which further dictates the capability of the network.

4.4 Operational Reliability

The resilience of the bulk water supply system has been demonstrably improved due to the construction of the regional interconnector pipelines. Previously, the major population centres in SEQ were supplied from separate water systems with minimal connectivity. While some of these systems included multiple supplies, many did not. The construction of the SEQ bulk water supply system means that most major demand zones are able to be supplied from multiple sources.

For an interconnected supply scheme, reliability is assessed at a system level to determine the consequence of asset failure; rather than each individual infrastructure element being required to be maintained to a common level of reliability. By adopting a risk and consequence based approach to maintenance, different reliability standards may be required at individual facilities.

Similarly, across an integrated water supply chain, operational reliability is taken in consideration of the BWC's asset capability (e.g. distribution reservoir storage). As part of ongoing operations contingency planning, Seqwater is undertaking reliability assessments to determine existing vulnerabilities to loss of supply across the bulk water supply system (refer Section 5.7).

4.5 Connection to the Bulk Water Supply Network

Based on previous planning undertaken by Seqwater and the BWCs, a number of demand zones are unlikely to form part of the connected SEQ bulk water supply system within a15 year planning horizon. Work is continuing to review the cost-effectiveness of connecting some areas to the bulk water supply system; however, for the purposes of this *Interim Operating Strategy*, these demand forecast zones are shown in Table 3, and comprise:

- Scenic Rim Regional Council (except Beaudesert)
- Lockyer Valley Regional Council
- Somerset Regional Council
- Kenilworth
- North Stradbroke Island townships (Amity Point, Dunwich and Point Lookout).

Table 3: Local Government Connection to the Bulk Potable Water Supply System

Local Government Area	2014 Bulk Water Supply System Connectivity	2029 Bulk Water Supply System Connectivity
Brisbane City Council	Fully	Fully
Gold Coast City Council	Fully	Fully
Ipswich City Council	Fully	Fully
Lockyer Valley Regional Council	None	None
Logan City Council	Fully	Fully
Moreton Bay Regional Council	Mostly	Fully
Redland City Council	Mostly	Mostly
Scenic Rim Regional Council	None	Partly
Somerset Regional Council	None	None
Sunshine Coast Regional Council	Mostly	Mostly

Notes

1. The excluded demand zones represent less than 2% of the total demand across the SEQ bulk water supply system

4.6 Western Corridor Recycled Water Scheme

Under the current operating rules in the SOP; once volume of water stored by the key bulk water storages falls below 40%, the supply of Purified Recycled Water from the WCRWS "*shall be maximised, subject to appropriate approvals from the Office of the Water Supply Regulator and operational constraints*"[3]

In December 2010, a decision was made by the State Government to place the Gibson Island Advanced Water Treatment Plant (AWTP) and part of Bundamba AWTP into standby and in July 2013, a decision was made by the State Government to decommission the entire WCRWS.

Whilst these standby activities are likely to require significant activities by Seqwater in the immediate future, the estimated probability of the WCRWS being required in response to the key bulk water storages reaching 40% in the next 10 years is currently around 1%[4]. For the purposes of this *Interim Operating Strategy*, it has been assumed that the scheme will be recommissioned if required to achieve water security outcomes in line with the current State Government policy.

4.7 Dam Improvement Program

Seqwater has a portfolio of 26 referable dams that fall under the regulation of the DEWS, with a number of the dams identified as having dam safety issues.

The safety assessments and work required as part of the Dam Improvement Program have been addressed in separate reports in specific detail. The yield assessments in this *Interim Operating Strategy* have been based on all raw water storages being fully available as demands approach the required yield for each individual site.

[3] *System Operating Plan* (SOP; Revision 5), Department of Energy and Water Supply

[4] *Seqwater Report - Modelling Input to DEWS Report on Western Corridor Recycled Water Scheme February 2014*

5. Bulk Water Supply Planning

5.1 System Operating Scenarios

The primary intention of this *Interim Operating Strategy* is to develop a provisional Integrated Master Plan that considers 'whole of system' infrastructure and operational performance in line with the adopted planning criteria to permit ongoing investment planning to proceed consistently across the organisation based on a clearly documented system operating strategy which is prudent and efficient and meets the adopted service specifications.

As noted in Section 2, the adopted service specifications and preliminary planning criteria are structured to address the primary requirements in the delivery of a bulk potable water service to our BWCs and are focused on providing maximum value in delivering:

- A reliable and resilient bulk water supply
- Specific adherence to the Level of Service (LOS) objectives
- Bulk water supply of an assured quality.

To demonstrate how these outcomes are to be achieved, the following system operating scenarios undertaken for this *Interim Operating Strategy* are provided in Table 4.

Table 4: Critical Operating Scenarios Adopted for Capability Assessment

Scenario	Planning Intention	Primary Planning Criteria[1]	Network Demand Scenario
Sustainable Regional Supply	Demonstrate a sustainable regional bulk water balance	Within individual raw water source entitlement	AD All Planning Horizons
Regional Drought Resilience	Demonstrate a sustainable regional bulk water balance	Within total LOS objectives and water security criteria	2029 AD
Sustained Peak Demand	Demonstrate network is capable of sustained high demand	Within WTP and bulk transport network capacity	MDMM All Planning Horizons
Short-term Peak Demand	Demonstrate that the network is capable of sustained high demands	Maintain supply bulk water supply reservoirs	2029 MD
Critical Infrastructure Failure	Demonstrate that the failure of a major water treatment facility asset can be managed for minimum of 48 hours	Maintain supply in all major system reservoirs	2029 AD

Note

1. Refer Table 1; Proposed Preliminary Planning Criteria

To assess the capacity of the SEQ bulk water supply system to meet the adopted planning criteria for AD and MDMM demand conditions, regional bulk water planning has been undertaken in 5 year planning horizons, those being:

- Existing (Year 2014)
- Year 2019
- Year 2024
- Year 2029

Furthermore, in an overall planning context; given that the adopted Forecasts are below the current LOS yield of the system over the life of this 15 Year *Interim Operating Strategy* (refer Section 5.4); under "normal" climatic conditions (i.e. non-drought) regional raw water security is not compromised for the connected bulk water supply system and system capability has been broadly assessed based on minimising operating costs whilst giving consideration to operational constraints, water quality risks and operational resilience. This can be generally categorised by:

- Minimising or eliminating the use of small, higher unit cost WTPs (e.g. Caboolture)
- Minimising the use of the GCDF; however, maintaining it in a 'hot-standby mode' such that it is able to rate up rapidly to respond to operational issues around the SEQ bulk water supply system
- Maximising the use of the larger, lower unit cost WTPs subject to allocation (e.g. Landers Shute WTP) and using the regional interconnectors to reduce variable operating costs across the system through the flexibility offered by the bulk water transport network.

5.2 Previously Identified Planning Initiatives

To undertake the capability assessments against the adopted demand forecasts, the outcomes of previous planning studies undertaken internally by Seqwater and in conjunction with the BWCs have been adopted (refer Table 5). Where appropriate, this planning aligns with the BWCs Netserv Plans (e.g. the provision of additional Bulk Supply Points; BSPs).

Note that given the uncertainty in the Forecasts and the inability to accurately identify local supply issues using the provided demand forecast zones; many of the current planning assumptions remain subject to detailed planning and options finalisation, particularly with respect to the optimal timing for implementation. Similarly, as integrated master planning progresses and an improved understanding is gained in asset condition and criticality, these planning initiatives will be subject to further review.

Table 5: Previously Planned Amendments to Infrastructure Configurations

Infrastructure Element	Site	Proposed Infrastructure	Adopted Planning Horizon[1]
WTP Upgrade	Capalaba WTP	Renewals based upgrade to 19ML/d	2019
WTP Decommissioning	Albert River	Existing bulk water system connection	Current
	Aratula	Existing bulk water system connection	Current
	Beaudesert WTP	Connection via Woodhill	2019
	Brisbane Aquifer Plants	Existing bulk water system connection	Current
	Caboolture WTP	Existing bulk water system Connection	Current
	Petrie WTP	Bulk water system connection via North Pine system	2019
	Maleny	Bulk water system constructed from Landers Shute WTP	Current
	South Maclean WTP	Existing bulk water system connection	Current
	Toogoolawah	Existing bulk water system connection	Current
	Woodford WTP	Existing bulk water system connection	Current
	Woorim	Existing bulk water system connection	Current
Additional Bulk Water Off Takes	Kinross Road (Redlands)	Additional network connection	2019
	Boundary Road (NPI)	New off take and main from NPI to Boundary Road reservoir complex	2019
	New Beith Road (SRWP)	Upgrade to existing off take	2019
Pump Station New/Upgraded	Woodhill to Beaudesert	New main and pump station from Woodhill to Beaudesert. Related to decommissioning of Beaudesert WTP	2019
	Byrnes Road Pump Station	Pump station upgrade to account for demand growth in Petrie area.	2024
	Narangba Pump Station	Installation of standby pump in line with adopted Planning Criteria	2024

Notes

1. To align with adopted planning horizons being assessed (refer Section 5.1)

These previously identified planning intitiatives included in the future system assessments provided in Table 5 exclude the comprehensive list of the ongoing renewals based capital works program that is required to to maintain asset capability. The Integrated Master Plan to be developed under the WSP (refer Section 6) will focus on providing a better understanding of the expected future operation of each asset allowing a targeted program based on whole of system operational flexibility and defined risk tolerance to further generate efficiencies in the renewals schedules.

5.3 Sustainable Regional Supply

A primary consideration of the bulk water supply system is the capacity to operate within the available raw water source entitlements. From Table 2, the current total raw water entitlements of the connected bulk water supply system is around 490GL/year with a total volume available for treatment of around 535GL/year if the full treatment capacity of the GCDF is included.

As illustrated in Figure 3, the collective bulk water entitlements available for treatment by Seqwater are well in excess of the projected Year 2029 AD demands, such that no additional sources are required to meet this collective constraint, so long as effective asset management and operating strategies are available to treat and transport this water to meet subregional and local demands.

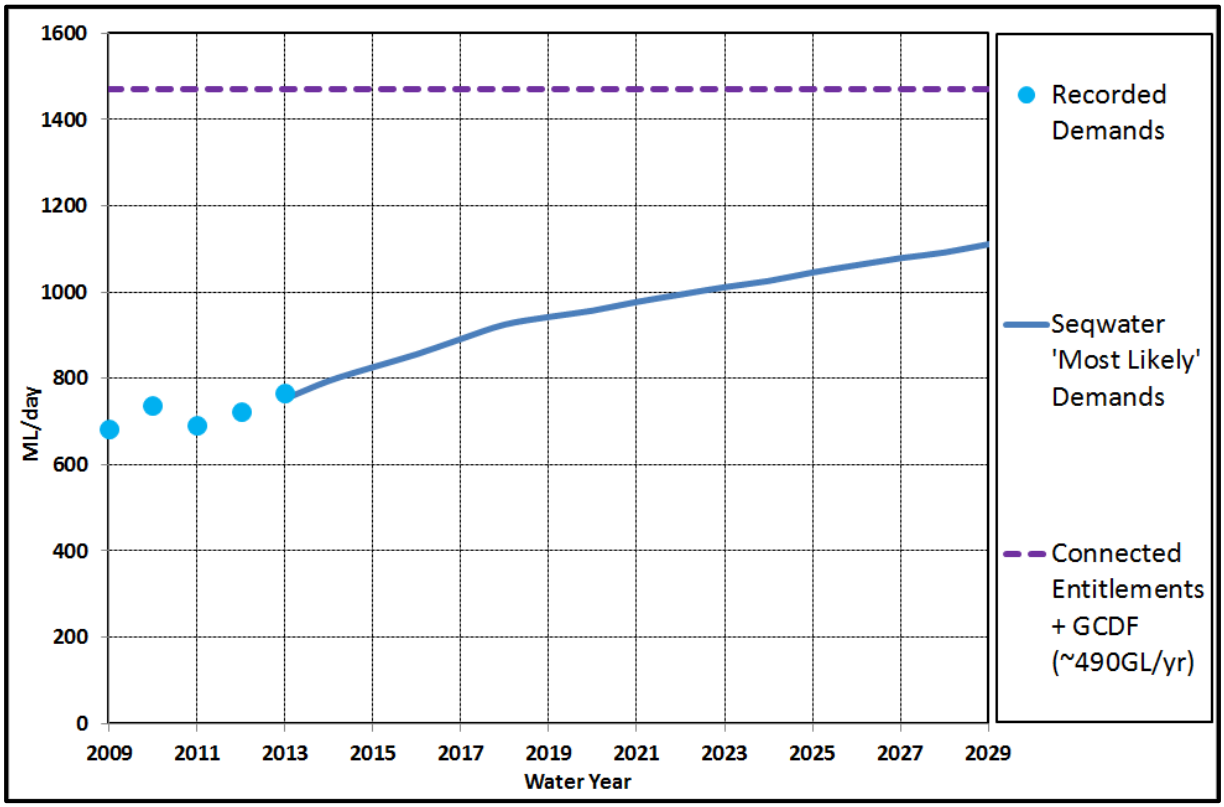


Figure 3: "Most Likely' AD Demands and Connected Raw Water Entitlements

To assess the capacity of the connected SEQ bulk water supply system, regional bulk water balances were developed for AD demand conditions using the Seqwater Cost Optimisation Model. The Seqwater Cost Optimisation Model is a static bulk water balance modelling approach that is able to minimise for operational costs subject to network constraints (e.g. maximum and minimum infrastructure capacities). The adopted inputs of the Seqwater Cost Optimisation Model are provided in Appendix C.

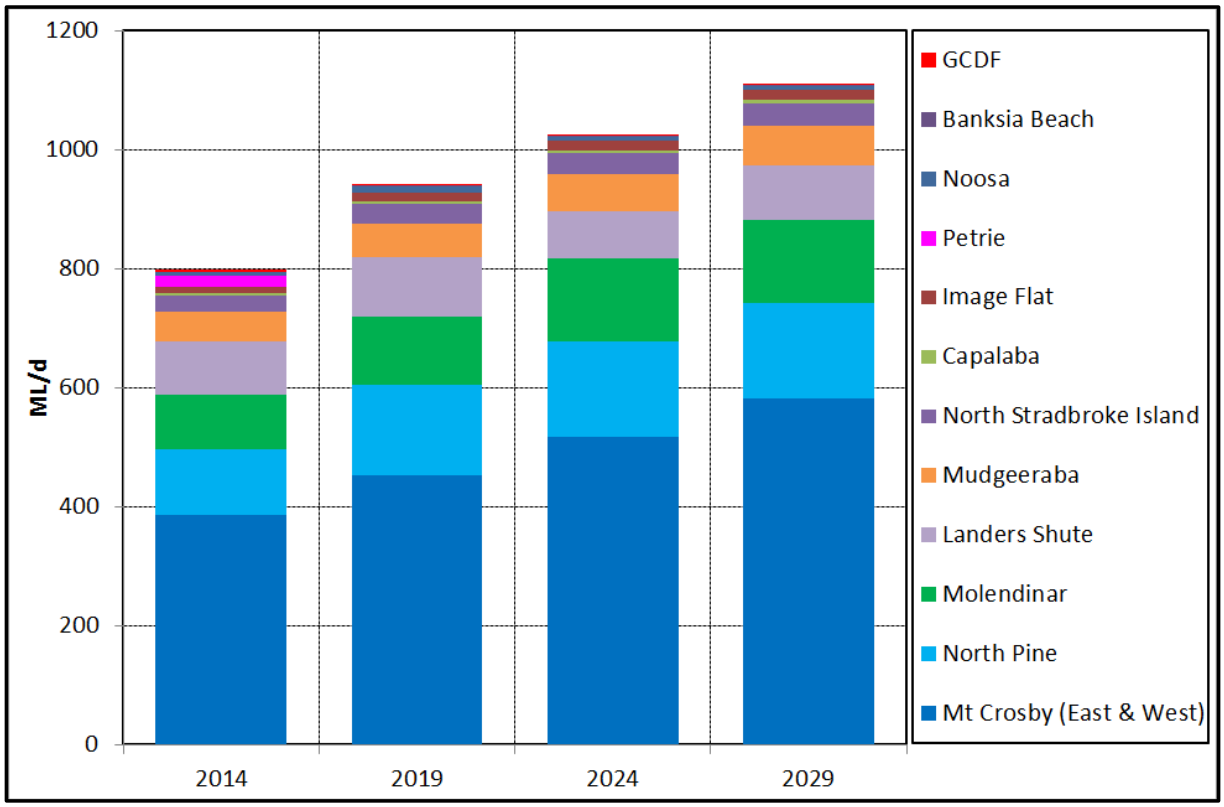


Figure 4: Projected Average Day Production Required from Connected WTPs

Figure 4 provides the projected AD treated water required from each of the connected WTPs, by considering WTP production cost, bulk transport network operating costs, overall system constraints (e.g. minimum flow to achieve water quality objectives) and individual raw water entitlement for each treatment facility.

The bulk water supply network strategies for AD operations to achieve these prescribed modes are presented in the bulk water balance schematics as extracted from the Seqwater Cost Optimisation Model in Appendix A and tabulated for all major network facilities in Appendix B.

5.4 Regional Drought Resilience

Based on the most current assessments undertaken by Seqwater (e.g. Wivenhoe, Somerset Dam Optimisation Study, WSDOS) the current adopted LOS yield for the SEQ bulk water supply system is around 430,000ML/year. This represents the total water that can be extracted using the existing water supply assets at the level of security as described by the currently adopted LOS objectives.

As illustrated in Figure 5, the current adopted LOS yield is well in excess of the projected Year 2029 AD demands, such that no additional sources are required to meet this collective constraint whilst achieving the regional drought resilience objectives that underpin the adopted LOS.

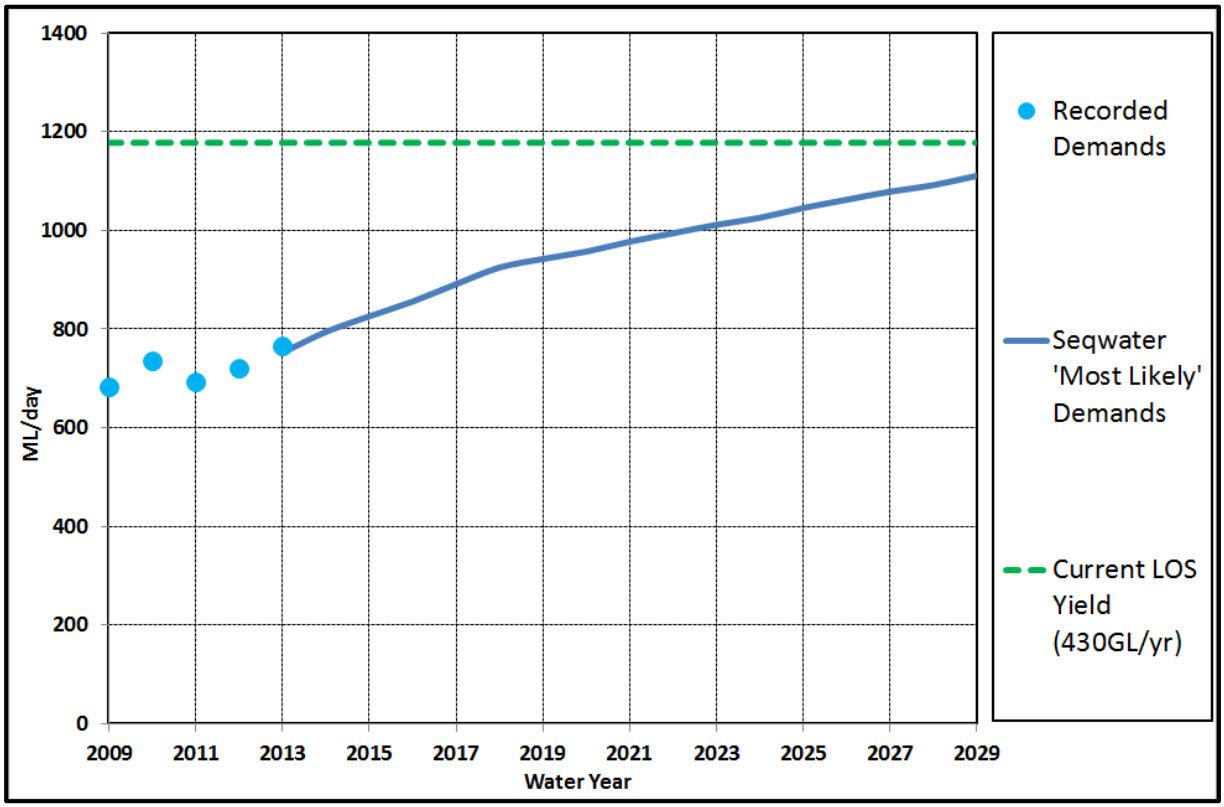


Figure 5: Projected Average Day Regional Demands and Adopted LOS Yield

The current SOP prescribes a number of risk criteria which must be considered as part of the annual operations planning process and a requirement to review the balance between current operational cost and water security on a six monthly basis. The SOP further includes a number of specific water security rules that align with the risk criteria and contribute to the prescribed LOS yield:

- *"When the total volume of water stored by key water grid storages falls below 40 per cent of the total water storage capacity of these storages:*
    1. *The supply of manufactured water from the South East Queensland (Gold Coast) Desalination Plant shall be maximised, subject to operational constraints;*
    2. *The supply of manufactured water to Wivenhoe Dam from the Western Corridor Recycled Water Scheme shall be maximised, subject to appropriate approvals from the Office of the Water Supply Regulator and operational constraints."*

A cost-benefit analysis that was subsequently undertaken by the SEQ Water Grid Manager (WGM) as part of the annual operations planning process identified benefits in operating the GCDF at one-third (44ML/d) when the combined key regional bulk water storages reach 60% of the full supply volume, and this is the currently the preferred operating philosophy.

For this *Interim Operating Strategy*, analysis has been undertaken using the SEQ Regional Water Balance Model for the Year 2014 demand and for the Year 2029 demand to determine if the currently adopted SOP risk criteria are able to be achieved for this prescribed operating mode (refer Table 6).

Table 6: SOP Risk Criteria for Year 2014 and Year 2029 Demands

Volume of water stored by key bulk water storages	Current Probability of Reaching Volume of Water Stored – Year 2014 Demands					
	Within 1 year		Within 3 years		Within 5 years	
	SOP	Current operation	SOP	Current operation	SOP	Current operation
40%	*Less than 0.2%*	**<0.01%**	*Not specified*	**NA**	*Less than 5%*	**0.1%**
30%	*Not specified*	**NA**	*Less than 0.5%*	**<0.01%**	*Less than 1%*	**<0.01%**
Volume of water stored by key bulk water storages	**Future Probability of Reaching Volume of Water Stored – Year 2029 Demands**					
	Within 1 year		**Within 3 years**		**Within 5 years**	
	SOP	**Future operation**	**SOP**	**Future operation**	**SOP**	**Future operation**
40%	*Less than 0.2%*	**<0.01%**	*Not specified*	**NA**	*Less than 5%*	**0.8%**
30%	*Not specified*	**NA**	*Less than 0.5%*	**<0.01%**	*Less than 1%*	**<0.01%**

Note
Considering the precision associated with the reporting, modelled values of 0.0% are reported here as <0.01% and other values are reported to one decimal point only.

From Table 6, the current SOP risk criteria are achieved for Year 2014 and Year 2029 bulk water demands with the current infrastructure configuration and operating modes; however, it should be noted that this is largely related to the current starting level of the key regional bulk water storages at around 90% of full supply volume (FSV).

Using the current storage levels as the starting point for both simulations, the key regional bulk water storage volume exceedance curves are shown in Figure 6 and Figure 7 below for Year 2014 and Year 2029 demands, respectively.

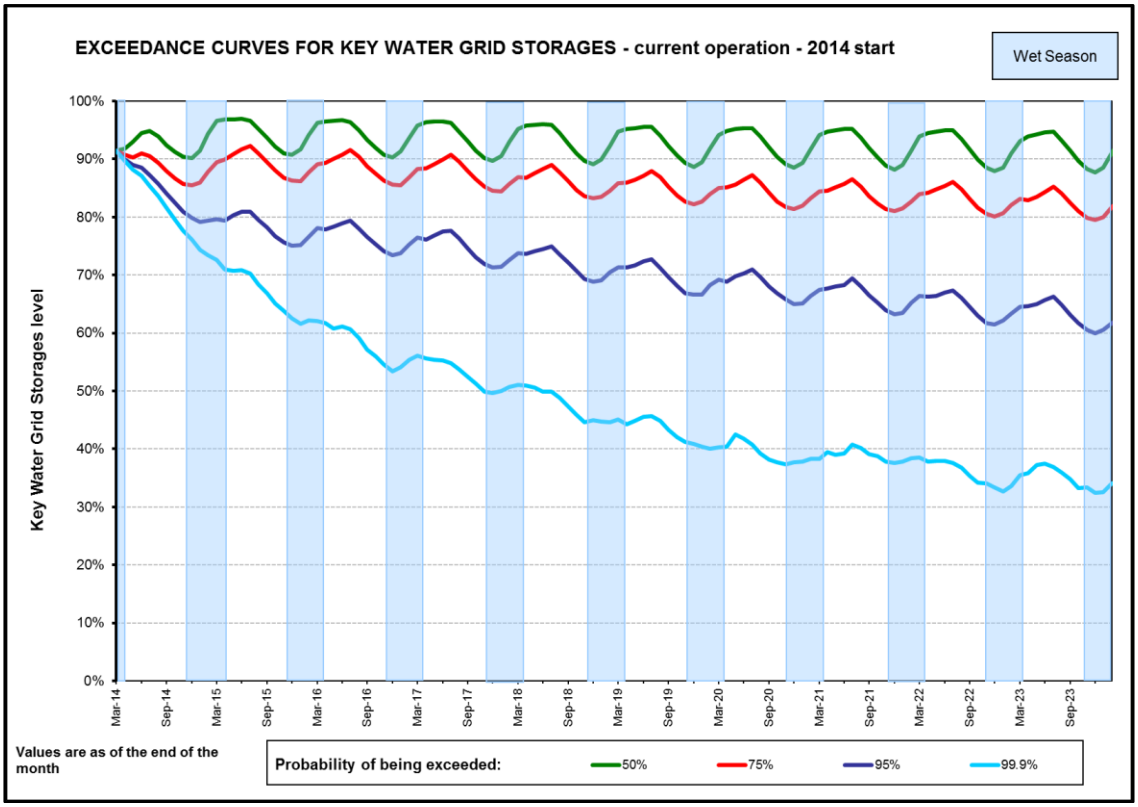


Figure 6: Key Bulk Water Storages Volume Exceedance Curves – Year 2014 Demands

Figure 7 also includes a simulation to determine the impacts of introducing desalinated water much earlier into the system by utilising the GCDF at full capacity (nominally 125ML/d) when the combined key regional bulk water storages reach 90%. This has been done to determine if this has the opportunity to potentially delay or eliminate the probability of the key regional bulk water storages reaching 40% and triggering a large investment program to recommission the WCRWS and introduce Purified Recycled Water.

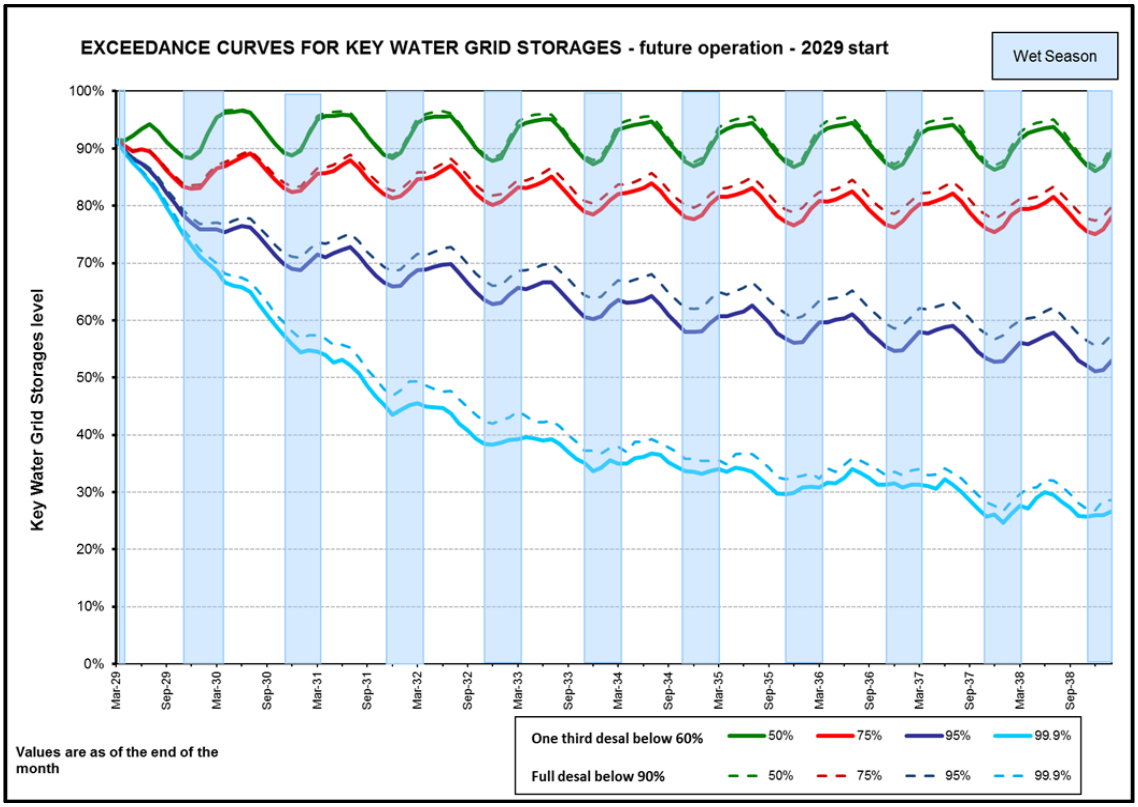


Figure 7: Key Bulk Water Storages Volume Exceedance Curves – Year 2029 Demands

From Figure 7, there is a minimal difference in drought security between operating the GCDF at one-third (44ML/d) when the combined key regional bulk water storages reach 60% and at full capacity (125ML/d) when the combined key regional bulk water storages reach 90%; however, the increased operating costs would nominally be in excess of $30M/year for a large proportion of the time.

Current assessments have indicated that the cost of recommissioning the WCRWS would be in the order of $88M (refer Section 4.6). Figure 7 illustrates that the additional operation cost of earlier introduction of desalinated water from the GCDF is unlikely to significantly offset this investment. Furthermore, as the trigger to recommission the WCRWS will actually be higher than 40% (as to have the scheme ready to operate at 40%) it is unlikely that any additional security will actually be realised by the earlier introduction of desalinated water.

5.5 Sustained Peak Demand

The bulk water supply system in SEQ must be planned to reliably treat and transport potable water during the sustained high demand period coinciding with a particularly high demand summer. This has being addressed through planning criteria of being able to continuously treat and transport the highest 30 day moving average daily water demand during a year (referred to as a Mean Day of the Maximum Month (MDMM)).

To achieve an effective integrated system outcome, the preliminary planning criteria for the connected bulk transport system is to provide MDMM bulk transport capability in conjunction with the water treatment facilities. Due to the inherent connectivity of the bulk water supply system, this essentially entails being able to efficiently and effectively maintain appropriate network reservoir operating levels under MDMM demands.

To facilitate this requires consideration of the system to initially determine if there is sufficient bulk water treatment capability and then to develop cost-effective bulk water transport operating modes that deliver the required operational outcomes. In consideration of the adopted planning criteria; Figure 8 illustrates the projected connected bulk water supply system MDMM demands and the collective WTP capability.

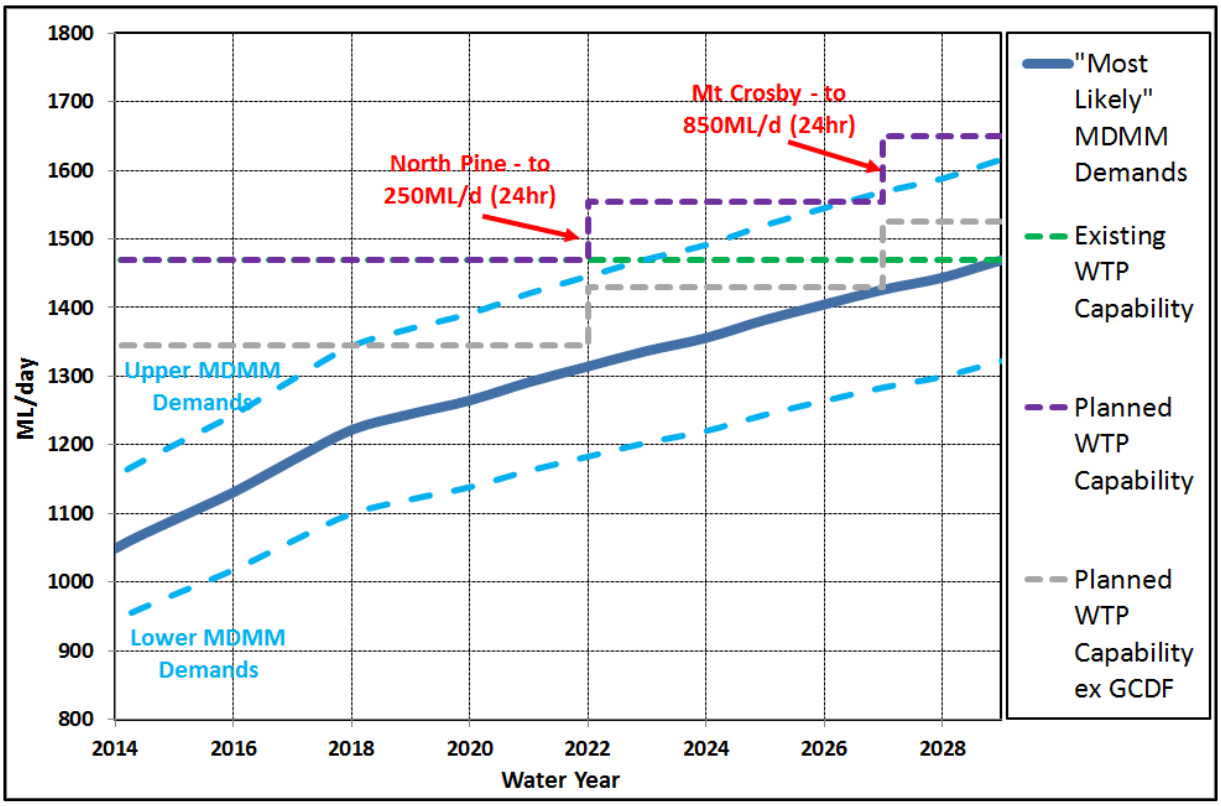


Figure 8: Connected Bulk Water Supply System MDMM Demands and WTP Capability

From Figure 8, based on the current projected 'Most Likely' MDMM demands, it is probable that additional sources of bulk treated water will be required prior to the Year 2029 to meet peak monthly demands. Given the criticality of WTPs in meeting these projected seasonal demands; it is imperative than Seqwater continue to actively monitor bulk water demands and particularly seasonal impacts to ensure any proposed system augmentation is adequately planned for.

For example, Figure 8 demonstrates that a 10% increase in peak seasonal demands (i.e. MDMM) would correspond with an additional bulk treated water upgrade being required as early as 2022. Figure 8 also demonstrates a deficiency in bulk water treated capacity unless the GCDF is committed to contribute directly to peak seasonal demands, which is yet to be demonstrated as a cost-effective operating mode for this facility.

The adopted approach is therefore to consider the upper demand as the earliest that the project may be required and to undertake ongoing reviews of system performance to determine when it is prudent to progress actual implementation.
Based on previously undertaken facility based planning, two potential bulk treated water upgrades have been identified as demonstrating the greatest efficiency from a 'whole-of-system' perspective, notably:

1. North Pine WTP upgrade to 250ML/d (24 hour capacity), currently not required before 2022
2. Mount Crosby WTP combined Eastbank and Westbank upgrade to 850ML/d (24 hour capacity), currently not required before 2027.

This *Interim Operating Strategy* is based on system assessments using discrete planning horizons (refer Section 5.1). To progress the integrated bulk water supply system planning, these identified treated water upgrades have been included in the appropriate planning horizon (i.e. North Pine 2024, Mount Crosby 2029; refer Section 5.1).

To assess the capacity of the connected SEQ bulk water supply system, regional bulk water balances were developed including the above bulk treated water augmentations for MDMM demand conditions using the Seqwater Cost Optimisation Model which has a philosophy of minimising variable operating costs subject to overall system constraints.

Figure 9 provides the projected MDMM treated water required from each of the connected WTPs, by considering WTP production cost, bulk transport network operating costs and overall system constraints (e.g. minimum flow to achieve water quality objectives).

The bulk water supply network strategies for MDMM operations to achieve these prescribed modes are presented in the bulk water balance schematics as extracted from the Seqwater Cost Optimisation Model in Appendix A and tabulated for all major network facilities in Appendix B.

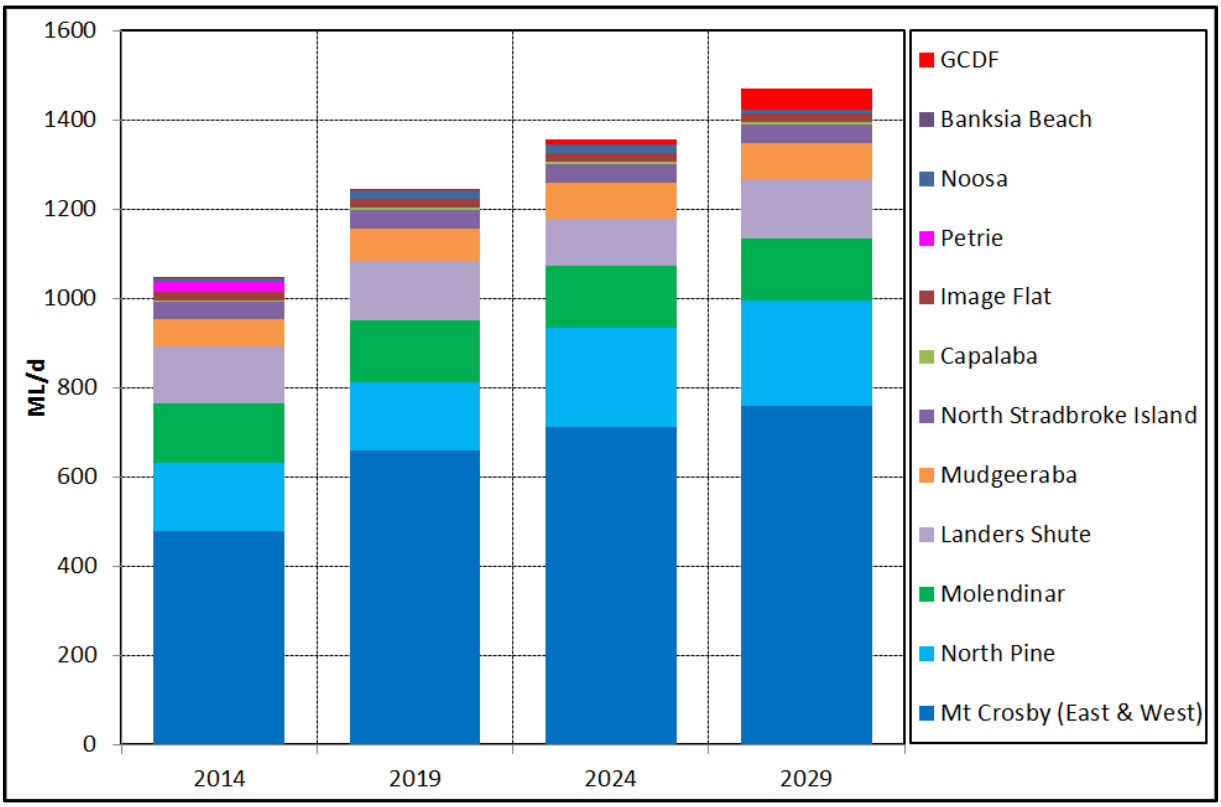


Figure 9: Projected MDMM Production from Connected Water Treatment Facilities

Of note in Figure 9 and Appendix A is that there is still some requirement to utilise the GCDF to meet potential peak seasonal demand on the Gold Coast from post 2020. This is largely related to the bulk transport capacity of the SRWP and the high projected growth in bulk water consumption within southern Logan City and northern Gold Coast City.

Of additional note is that even with the proposed bulk treated water augmentations for the North Pine and Mount Crosby WTPs prescribed above; there is projected to be limited "spare" WTP capacity across the bulk water supply system to treat seasonal peak water demands by the Year 2029 with Mount Crosby WTPs and the GCDF the only major treatment assets with any excess capability (refer major facility summaries in Appendix B). This demonstrates that it remains imperative for Seqwater to continually monitor emerging trends in bulk water demands to ensure that proactive planning identifies any potential deficiencies across the bulk water supply system. It also reinforces the importance of the ongoing renewals and maintenance program on existing assets to maintain capability at a high reliability.

5.6 Short-term Peak Demand

Under the adopted service specification, short-term peak demands in excess of MDMM are managed through the combined system network reservoir storages (i.e. bulk and distribution/reticulation) reservoir storages. The preliminary planning criteria that reflects this are related to ensuring that network storages are able to be maintained above agreed minimum operating levels under "normal" (i.e. non-contingency operations; refer Table 2).

To assess the capability of the bulk water supply to accommodate short-term peak demands over the life of this *Interim Operating Strategy*; Table 7 provides an assessment for the Seqwater owned and operated major storage reservoirs to meet the adopted planning criteria under Year 2029 demands.

Table 7: Seqwater Major Bulk Water Supply Network Reservoir

Reservoir Complex	Total Reservoir Volume (ML)	Operating Protocol Effective Capacity (ML)	Year 2029 Required Capacity (ML)	Augmentation Proposed
Alexandra Hills	63.7	31.6	27.8	No
Aspley	79.6	56.1	22.3	No
Camerons Hill	165.0	100.8	53.0	No
Green Hill	152.6	128	52.7	No
Heinemann Road	62.8	39.7	18.0	No
Kimberly Park	28.4	23.5	20.2	No
Kuraby	71.8	37.3	23.0	No
Molendinar	125	52.1	**65.3**[1]	No
Mount Cotton	6.8	2.3	**3.8**[2]	No
Narangba	40.1	9.1	**18**	**Yes**
Robina	60.0	20.0	13.1	No
Sparkes Hill	112.0	101.8	12.7	No
Wellers Hill	153.3	127.7	52.6	No
Total	**1,121.1**	**730**	**382.5**	

Notes

1. Minor deficiency at the Molendinar Reservoir complex. Proposed to be managed by including the SRWP Molendinar reservoir within the overall site storage capacity
2. Minor deficiency at the Mount Cotton reservoir. Proposed to be managed by lowering the minimum operating level to around 45%

From Table 7, additional reservoir storage is required at the Narangba reservoir complex to meet the adopted preliminary planning criteria.

Note that for the bulk water supply system reservoirs, a deficiency in reservoir storage volume in the Operating Protocol effective operating volume below the preliminary planning criteria will not necessarily directly constitute a reservoir augmentation. This may include, for example, rezoning works within the BWC reticulation system to enable full use of actual reservoir volumes or investigating the supply and bulk transport capacity into the reservoir complex to determine the actual system vulnerability.

As with the water treatment facilities and bulk transport system; future network reservoir augmentations are likely to constitute major capital projects such that they will be assessed on a whole of system basis with the focus on effective integration and staging based demonstrating cost-effectiveness and to ensure the prudency and efficiency of any proposed reservoir augmentation program. This includes, for example, consideration of where in the integrated supply chain that any future reservoir storage most appropriately resides (i.e. bulk or distribution/reticulation).

5.7 Critical Infrastructure Failure

The current 'spare' capacity in the SEQ bulk water supply system gives a degree of operational flexibility to reconfigure network operations to meet resilience objectives; however there remain a number of critical facilities whose reliable operation is essential to maintaining supply.

There are entire demand zones (or significant parts thereof) that are potentially susceptible to a total or partial loss of supply in the event of an incident in the network. Depending on the nature of the incident, the loss of supply may be for a relatively short time while repairs are undertaken (e.g. a broken water main out of service for a number of hours) or for a protracted period (e.g. total loss of a facility resulting from a major fire).

The current Seqwater Risk Management Framework (Draft) provides a high level framework for the management of water quantity risk (noting that the tolerance levels are presently subject to review), as provided in Table 6. The framework currently stipulates that the loss of water to multiple suburbs for an extended period (i.e. more than 48hours) would be of major consequence. Work is progressing to improve understanding around the probability of losing major facilities (for any reason); however, preliminary consideration is that in many instances this is a "possible" outcome.

Table 6. Risk Management Framework (Draft) Water Quantity Risk Matrix

Water Quantity	Consequence	Almost Certain Occurs more than once a year	Likely Occurs once between 1 to 3 years	Possible Occurs once between 3 to 10 years	Unlikely Occurs once between 10 to 50 years	Rare Occurs once between 50 to 100 years
Widespread regional loss of water supply to customers >48 hours	Catastrophic	Extreme	Extreme	High	High	Medium
Loss of water supply to customers over multiple suburbs >48 hours	Major	Extreme	High	High	Medium	Medium
Loss of water supply to customers over an entire suburb for > 24 hours	Moderate	High	High	Medium	Medium	Low
Local loss of water supply to customers > 8 hours	Minor	High	Medium	Medium	Low	Low
Local loss of water supply to customers for <8 hours	Insignificant	Medium	Medium	Low	Low	Low

As an initial approach to critical infrastructure assessments, a preliminary assessment has been undertaken to determine the impact across the bulk water supply network due to the full loss of supply from individual, connected WTPs for more than 48 hours under the Year 2029 'Most Likely' AD demands. This is essentially to begin the process of determining those

areas that are unable to be effectively supplemented with supply from elsewhere and is therefore primarily related to bulk water transport capability.

The preliminary assessment has concluded that with the exception of the northern areas of the Landers Shute supply zone (i.e. Maroochydore, Buderim et al), the vast majority of the connected areas of the bulk water supply system are able to effectively maintain supply to end-use customers. This is qualified based on the following underlying assumptions:

- That the system storage is relatively high at the time of facility failure with the preliminary assessment adopting 80% of full supply volume across the system at the time of failure
- The adopted demand of Year 2029 AD excludes any seasonal peaking considerations. This is a key consideration when it is noted that, for example, the Year 2019 MDMM is more than 10% higher than the Year 2029 AD demands.
- That the individual WTP facility failure under consideration represents the only system malfunction and that all other facilities are fully operational (i.e. single facility failure only)
- That mobilisation times to implement system reconfigurations are very low with changes to effect network reconfigurations able to be undertaken essentially immediately. An ongoing rolling program of critical network valve actuations will assist in the delivery of this outcome.

There are also numerous demand zones that are invariably at risk due to pipeline failure. Some of these are associated with single supply areas (e.g. the trunk main from the Mudgeeraba WTP) and will be highly dependent on the location of the failure, to time to repair and critical direct supplies to our BWC.

Seqwater is progressing with condition and criticality assessments of all infrastructure to determine the supply risk and develop contingency plans and pipeline renewal programs. Integrated master planning will progress to detailed facility planning to determine supply risks for all key infrastructure and determine areas of the SEQ bulk water supply system where there is an unacceptable risk of loss of supply.

5.8 Network Operability and Resilience

The above capability assessments are largely focussed on regional water security and normal operational performance, including achieving the desired LOS objectives under 'ideal' operating conditions. Future assessments will establish the overall efficiency of the proposed modes of operation and review the overall operability of the network under 'non-ideal' operating conditions. These include for planned events (e.g. maintenance at major facilities) and ensuring adequate operational flexibility during operational incident management.

To ensure the future operability of the SEQ bulk water supply system, integrated master planning and operational contingency planning is progressing to consider critical modes of operation under a risk management framework with a strong focus on operability as water consumption increases and the current spare capacity in the network is utilised. There are a number of areas of the bulk water transport network that have already been identified for future assessment, based on flexibility and operability principles, notably:

- Bi-directional capability of the northern parts of the Greater Brisbane network, in particular, the northern flow capability from the Green Hill reservoir complex, through to the Sparkes Hill and Aspley reservoir complexes
- The central areas of the Unitywater system from the North Pine WTP to the Morayfield reservoirs. This had previously been identified as an area for augmentation through the NPI Stage 3
- The central areas of the Logan network, including supply into the Beenleigh water supply zone
- Flexibility in bulk water transport within the Redland water supply zones between the northern Alexandra Hills demand zone and areas to the south.

5.9 Stand-Alone Supply Schemes

Small communities are subject to potentially the highest variability and uncertainty in existing and future bulk water demands. This may be related to, for instance, the impacts of non-reticulation connected consumers adjacent to these communities filling onsite water tanks from "stand-pipes" creating short-term, high demand on individual WTPs. In other cases, future development of a relatively large industrial water user (e.g. an abattoir) will have a significant impact on future bulk water supply planning for the community.

For the 14 non-connected WTPs not currently expected to be connected the SEQ bulk water supply system over the planning horizon of this *Interim Operating Strategy*; an assessment has been undertaken of the existing WTP capability and current bulk water entitlements against the projected 15 year 'Most Likely' demand scenarios, as summarised in Table 7.

Table 7 excludes those communities that have been recently connected to the bulk water supply system and where the existing WTP is subject to decommissioning (e.g. Maleny) or those that have been identified for future connection to the bulk water supply system and subsequent decommissioning of the WTP (e.g. Beaudesert).

Table 7: WTPs Non-connected WTPs Projected Production

Non-connected WTP	2029 AD Demand (ML/year)	Current Bulk Water Entitlement (ML/year)	2032 MDMM Demand (ML/d)	24hr WTP Capacity (ML/d) (good raw water quality)	20hr WTP Capacity (ML/d) (good raw water quality)
Amity Point WTP	97.6	200	0.40	3.26	2.72
Boonah-Kalbar WTP	1054.8	9,110	4.33	2.87	2.39
Canungra WTP[1]	270.4	150/300	1.11	0.41	0.34
Dunwich WTP	172.7	500	0.71	1.5	1.25
Esk WTP[2]	331.6	-	1.36	1.34	1.12
Jimna WTP	6.6	20	0.03	0.18	0.15
Kenilworth WTP	102	220	0.42	0.53	0.44
Kilcoy WTP	1236.4	1,100	5.08	4	3.33
Kooralbyn WTP	318.8	450	1.31	1.96	1.63
Linville WTP	15.9	35	0.07	-	-
Lowood WTP[2]	1166.4	-	23.19	17.5	14.58
Point Lookout WTP	254.8	500	1.05	2.84	2.37
Rathdowney WTP	17.2	80	0.07	0.41	0.34
Somerset Dam WTP	27.1	37	0.11	0.27	0.23

Notes

1. Approved business case for Canungra WTP design for 1.5ML/day plant. Project currently under detailed scoping to determine any efficiencies in the delivery timing. There is an additional 150ML/year bulk water entitlement in strategic reserve if required
2. Lowood and Esk WTP entitlements are linked to Wivenhoe and the Mid-Brisbane River such that there are not expected to be any future shortages in available entitlement

Many of these identify a potential emerging capacity issue at some stage in the future (e.g. Lowood WTP); however, where the demand forecasts are highly variable, a staged implementation of infrastructure is prudent to avoid over-capitalisation. Seqwater will continue to engage with our local BWC and to actively monitor actual consumption and system capability to ensure prudency and efficiency of any infrastructure investment.

6. Planning for the Future

6.1 Overview

The *Water Act 2000* places a legislated obligation on Seqwater to undertake short to long term planning to ensure that it can meet the growing demand for safe, secure, and reliable bulk water supply in SEQ in line with the least-cost stipulations in other instruments and to be appropriately responsive to emerging security issues. For example, the Statement of Obligations states that:

"*Seqwater must plan and manage water in a total water cycle framework including its water supply catchments and Seqwater is to focus on the catchment, storage, treatment, recycled water and bulk transport component of the water cycle, to achieve best social, environmental and economic outcomes, in partnership with land owners and affected parties*".

This *Bulk Water Supply Interim Operating Strategy 2014-2029 Report* provides a provisional mechanism to permit ongoing investment planning to proceed consistently across the organisation based on a documented, prudent and efficient system operating strategy prior to the finalisation of the comprehensive 30 Year Integrated Master Plan to be developed under the WSP.

6.2 Water Security Program

The *Water Act 2000* requires Seqwater to prepare a Water Security Program (WSP) one year after the regulation prescribing the desired LOS objectives is made by the Minister (refer Section 3.1). Based on the current timetables, this is likely to occur around June 2014 such that the draft Seqwater WSP is likely to be submitted to DEWS by June 2015.

The Act is very specific in relation to the content of the WSP, and requires Seqwater to present its arrangements, measures and strategies for:

- Operating our assets for supplying water services to the region
- Addressing future infrastructure needs (including building new or augmenting existing infrastructure)
- Managing the infrastructure relevant to the operations
- Managing demand for water
- Responding to drought conditions.

To achieve the Seqwater wider business requirements as well as to satisfy the legislative requirements of the WSP the following are the outcomes that Seqwater will seek to achieve in the WSP:

- Operate and optimise the use and management of the current asset portfolio to meet service requirements at least-cost
- Outline the augmentations required and the demand management measures to meet growth, water quality and short term continuity of supply requirements
- Determine the measures and augmentations required to manage extended supply disruptions from drought.

The components of the WSP to achieve these requirements are:

- A “Demand Management” component that will identify, demand management measures during normal operations, forecasting approaches and assumptions including per capita usage, reasonable reduction in use under restrictions for use in the operations, infrastructure and drought response components
- A “Systems Operations” component that will provide, system needs from infrastructure (bulk supply point service specification) for use in the infrastructure and maintenance components and determine when the current system capacity is reached for consideration in the infrastructure component
- An “Infrastructure Component” that will identify, infrastructure needs (renewals and augmented) including capacity, location and timing, service specifications at the bulk supply point level on which the infrastructure needs are based on
- A “Drought Response” component that will identify, assets and triggers for new infrastructure needs for use in the infrastructure component and triggers for demand management measures leading up to, during, and exiting a drought
- An “Infrastructure Management and Maintenance Component” that will provide, strategic guidance on maintaining the current asset suite for use in more detailed Asset Management Plans and the investment profile (and a maintenance schedule).

The system operating and infrastructure component will be developed as one element and will be referred to as Seqwater’s Integrated Master Plan.

The Seqwater WSP will remain a “live” process being developed in an iterative process being informed by hydrologic and hydraulic analyses, system optimisation analyses, supply-demand analyses including demand forecasting, economic analyses and engineering investigations.

6.3 Collaborative Planning

In developing the WSP, it is imperative that internal and external consultation is undertaken in a collaborative manner. The outcomes of these consultations will be utilised to inform and reshape these interim documents to achieve the required outcomes and adoption of a Total Water Cycle Management (TWCM) approach to achieve the “catchment to tap” obligations in the delivery of the program.

Whilst Seqwater has started the process to better understand and inform the business on the activities to be undertaken as part of the WSP, the detailed content and final timing of the delivery of the WSP is subject to a number of external influences, including:

- the Guidelines related to the content of the WSP (not expected from DEWS before June 2014)
- The State Governments review and setting of LOS objectives
- Netserv Plans of the SEQ service providers
- The outcomes of the Wivenhoe Somerset Dams Optimisation Study and the North Pine Dam Optimisation Study.

Regular interactions with the SEQ service providers will occur through the proposed Strategy and Planning Committee under the SEQ Water Service Providers Partnership and related networks feeding into this Committee. Regular information updates on SEQ service provider Netserv Plans and any other planning activities are expected to occur through this mechanism.

It is important to consider the cross-entity integration of other key aspects such as reliability of supply and water quality in the development of the WSP and its components. Water supply security and the delivery of the prescribed LOS objectives are a primary focus and a key obligation on Seqwater under the *Water Act 2000*; however, this is only one aspect of Seqwater's business requirements and the TWCM approach. The January 2011 floods and the Australia Day 2013 Weather Event have highlighted the need for more effort to be also invested across the entire water supply chain in the areas of water quality and reliability. This is consistent with the intent of legislation and content of forthcoming WSP Guidelines.

6.4 Ongoing Annual Operations Planning

Under the current SOP, Seqwater is obligated to biannually produce an *Annual Operation Plan* primarily to "*...demonstrate how it intends to meet the forecast water demands of its customers for the next 12 month period having regard to an appropriate balance between security and cost efficiency outcomes*"[5]

In line with this obligation, Seqwater completes an *Annual Operations Plan* based on current bulk water demands and water supply outlook every six months. The current version published in November 2013 is available at http://www.seqwater.com.au/about/publications/dam-operations.

The *Annual Operations Plan* is available for comment by DEWS and is a critical Seqwater document for operational budgeting and for monitoring short to medium-term water security by considering current regional dam storage levels, projected modes of system operation and the potential impacts of future climate events through stoichiometric rainfall inflow sequence modelling using the Regional Bulk Water Balance Model.

When the revised LOS are legislated, the SOP will be abolished and *Annual Operations Plan* will no longer by a compliance obligation; however, given the criticality of this function, a similar operational planning process will remain in place.

[5] *South East Queensland System Operating Plan Revision 5,* Department of Energy and Water Supply

7. Glossary of Acronyms

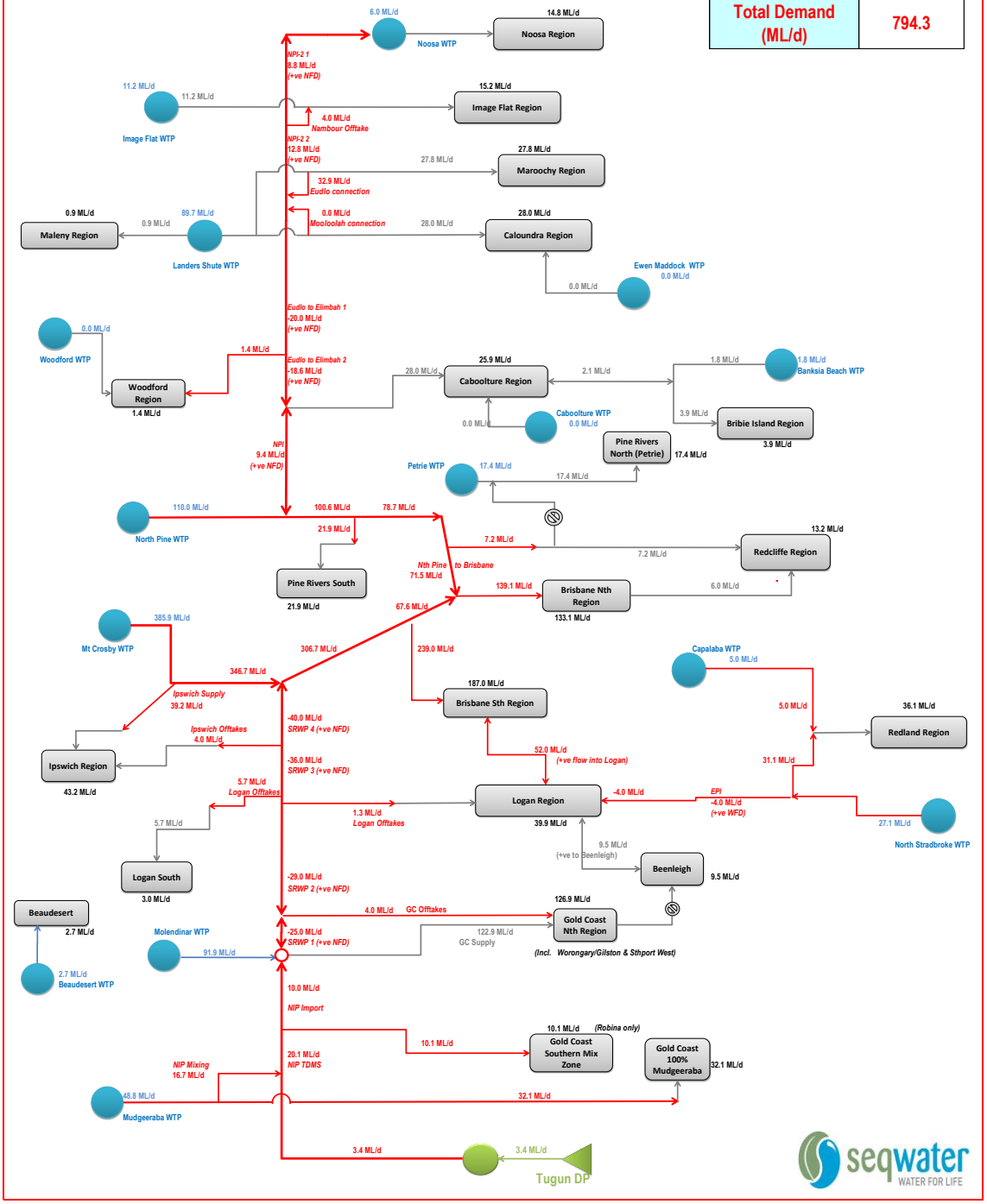
Acronym	Name
AD	Average day demand
ADWG	Australian Drinking Water Quality Guidelines
BSP	Bulk Supply Point
BWC	Bulk Water Customer
CBD	Central Business District
DEWS	Department of Energy and Water Supply
DWQMP	Drinking Water Quality Management Plan
EPI	Eastern Pipeline Interconnector
Forecasts	South East Queensland Bulk Water Demand Forecasts
FSV	Full Supply Volume
GCDF	Gold Coast Desalination Facility
L/p/d	Litres per person per day
LOS	Levels of Service
MDMM	Mean Day Maximum Month
ML	Megalitre
ML/a	Megalitres per annum
ML/day	Megalitres per day
NPI	Northern Pipeline Interconnector
QUU	Queensland Urban Utilities
QWC	Queensland Water Commission
SCADA	System Control and Data Acquisition
SEQ	South East Queensland
Service Specifications	South East Queensland Water Grid service specifications
SLMP	System Leakage Management Plan
SOP	*South East Queensland System Operating Plan 4.1*
SOS	Standards of Services
SRWP	Southern Regional Water Pipeline
Strategy	South East Queensland Water Strategy
Unit	Infrastructure Planning Unit
WCRW	Western Corridor Recycled Water
WSAP	Water Supply Asset Plan
WSDOS	Wivenhoe, Somerset Dam Optimisation Study
WSP	Water Security Program
WTP	Water Treatment Plant

Appendix A – Seqwater Cost Optimisation Model Bulk Water Balances

SEQ Water Grid
Bulk Water Balances

Go to Cover

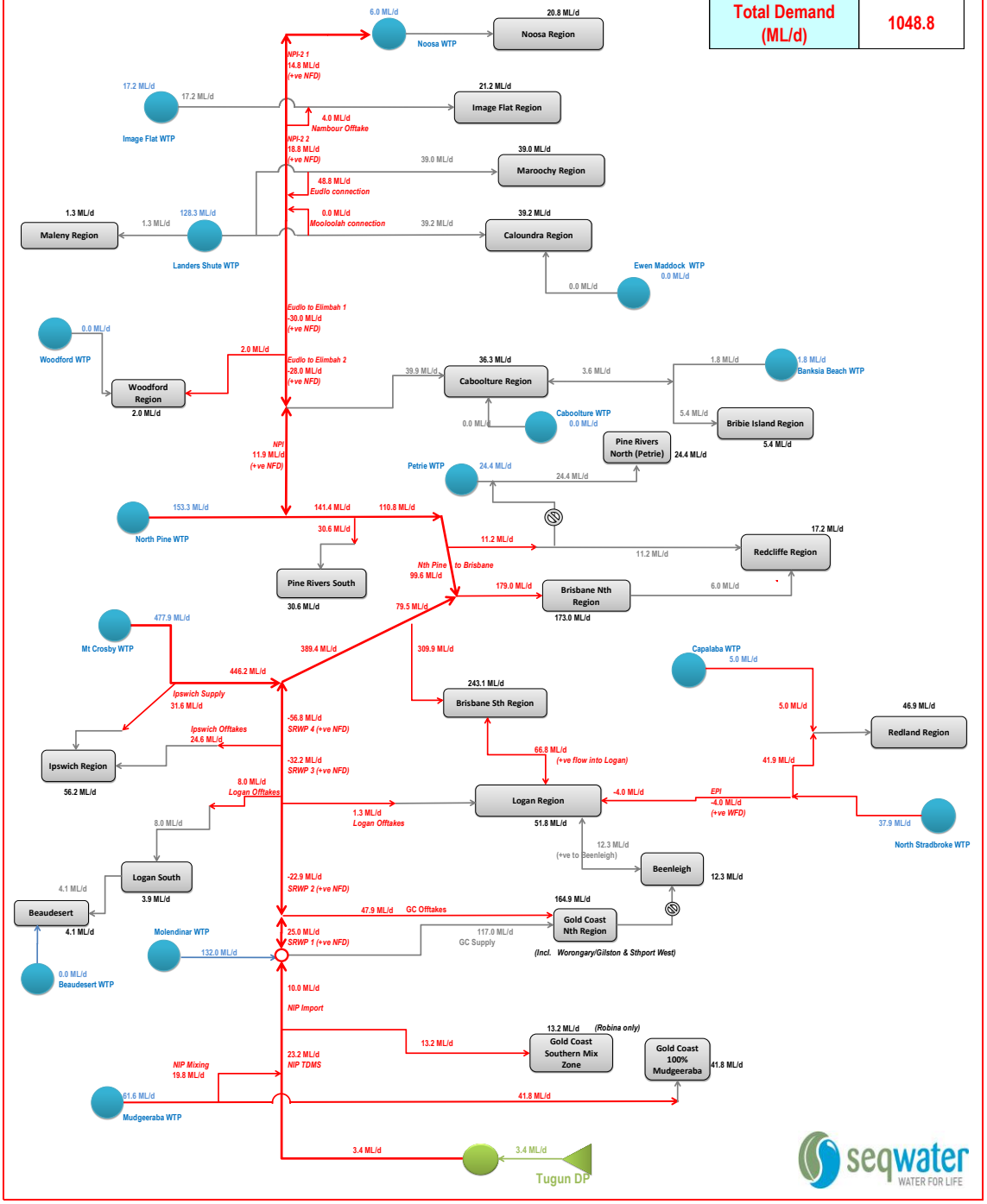
Planning Year	2014
Demand Scenario	Ave Day
Demand Multiplier	1.0
Total Demand (ML/d)	794.3



SEQ Water Grid
Bulk Water Balances

Go to Cover

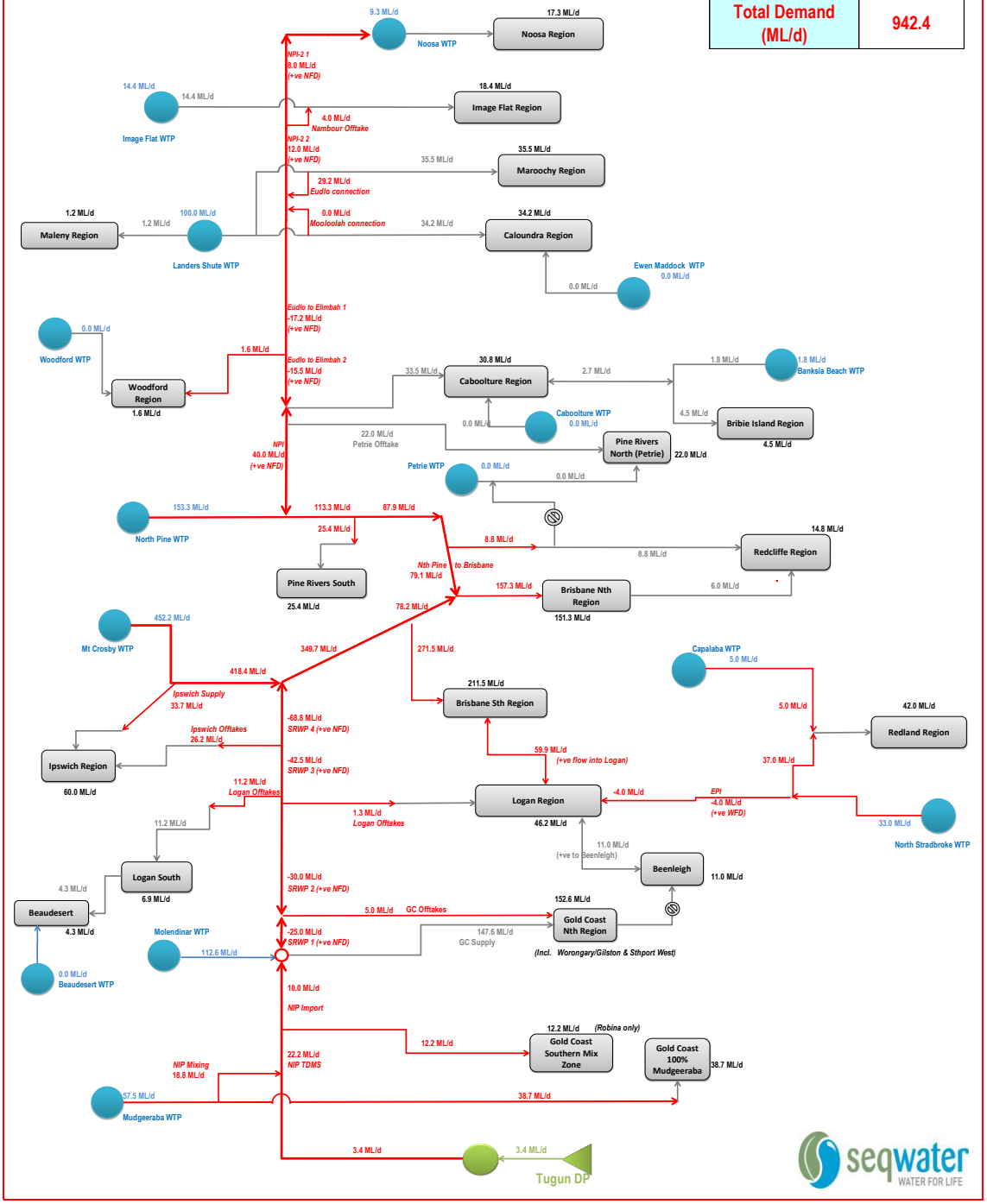
Planning Year	2014
Demand Scenario	MDMM
Demand Multiplier	1.0
Total Demand (ML/d)	1048.8



SEQ Water Grid
Bulk Water Balances

Go to Cover

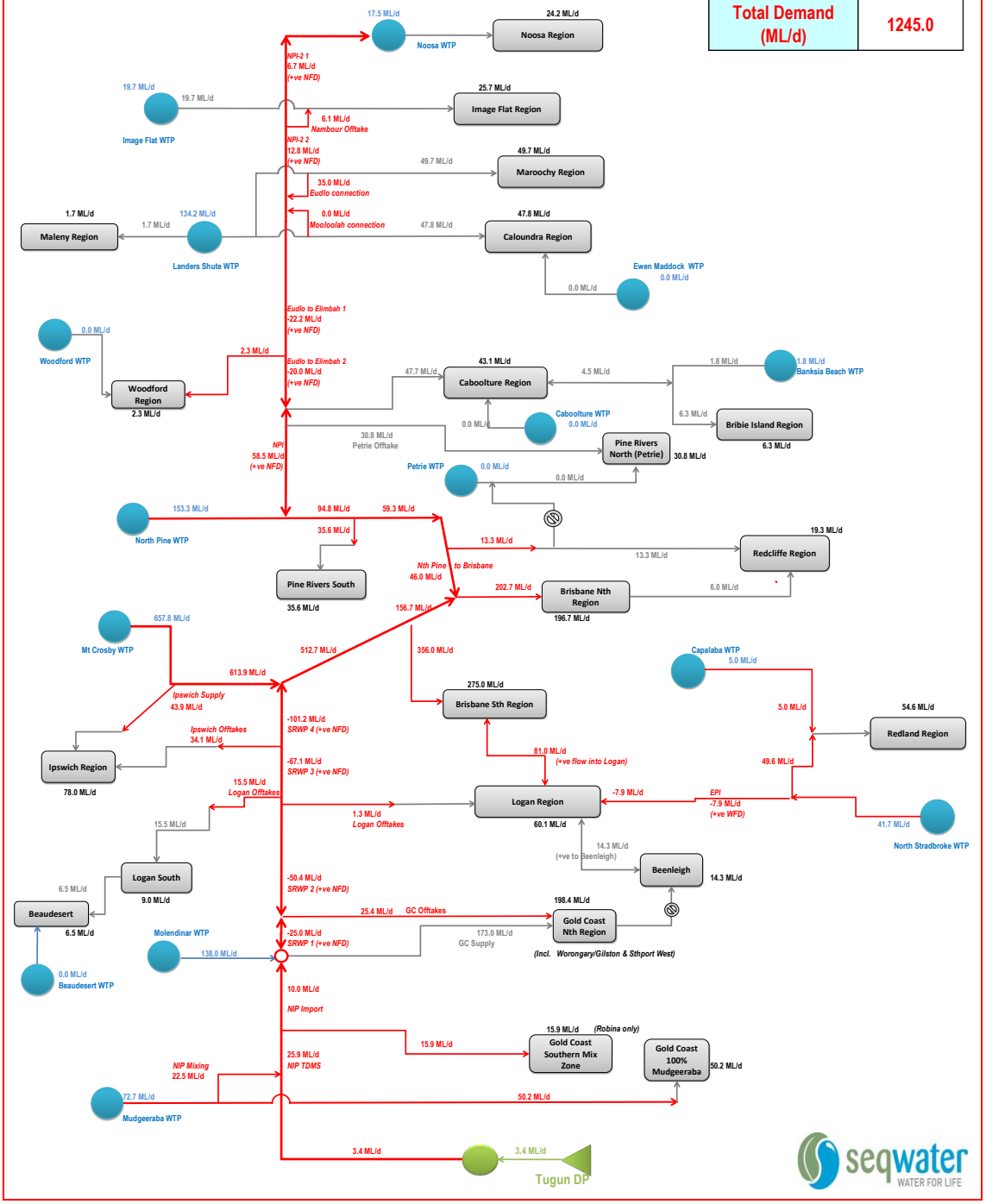
Planning Year	2019
Demand Scenario	Ave Day
Demand Multiplier	1.0
Total Demand (ML/d)	942.4



SEQ Water Grid
Bulk Water Balances

Go to Cover

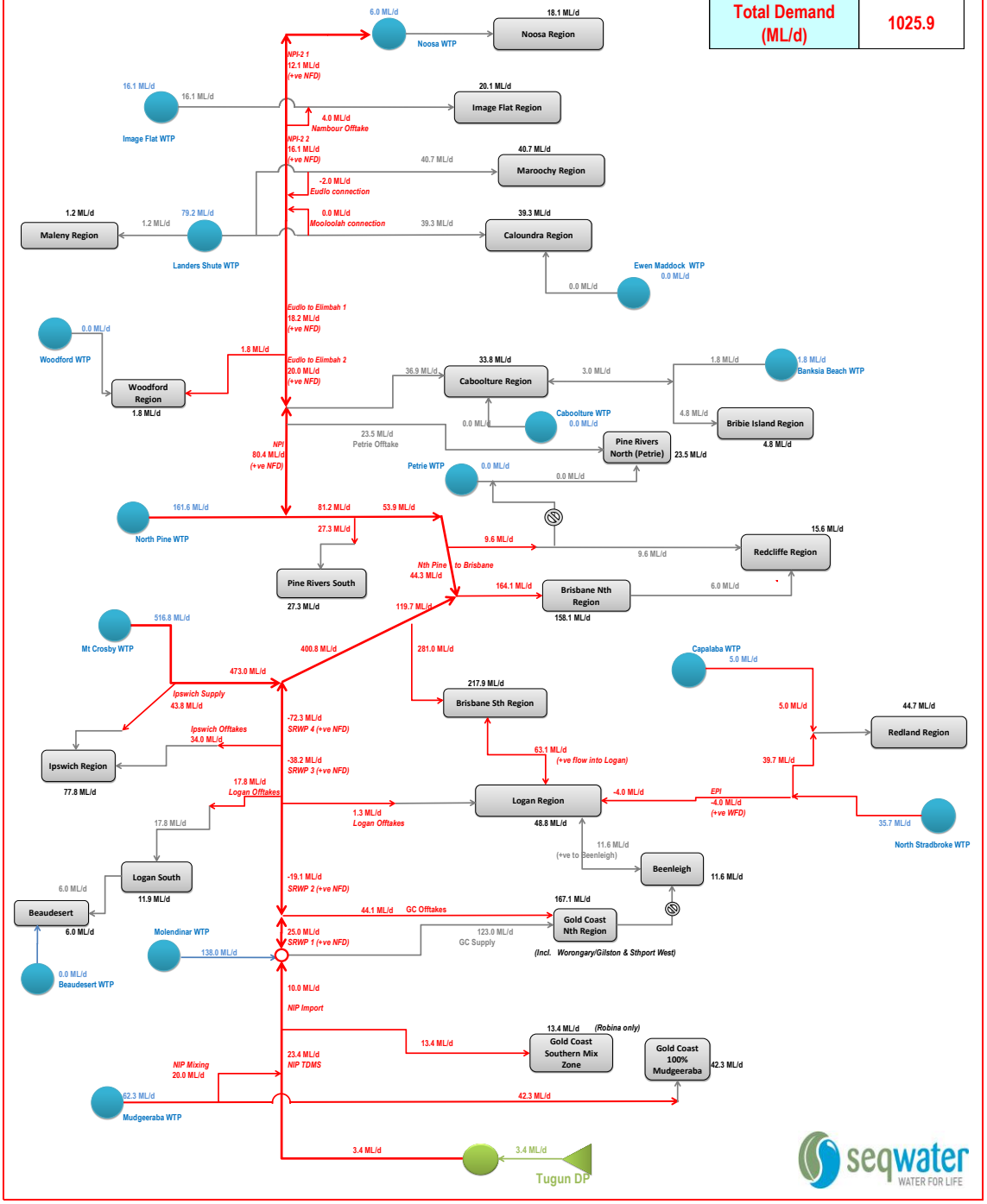
Planning Year	2019
Demand Scenario	MDMM
Demand Multiplier	1.0
Total Demand (ML/d)	1245.0



SEQ Water Grid
Bulk Water Balances

Go to Cover

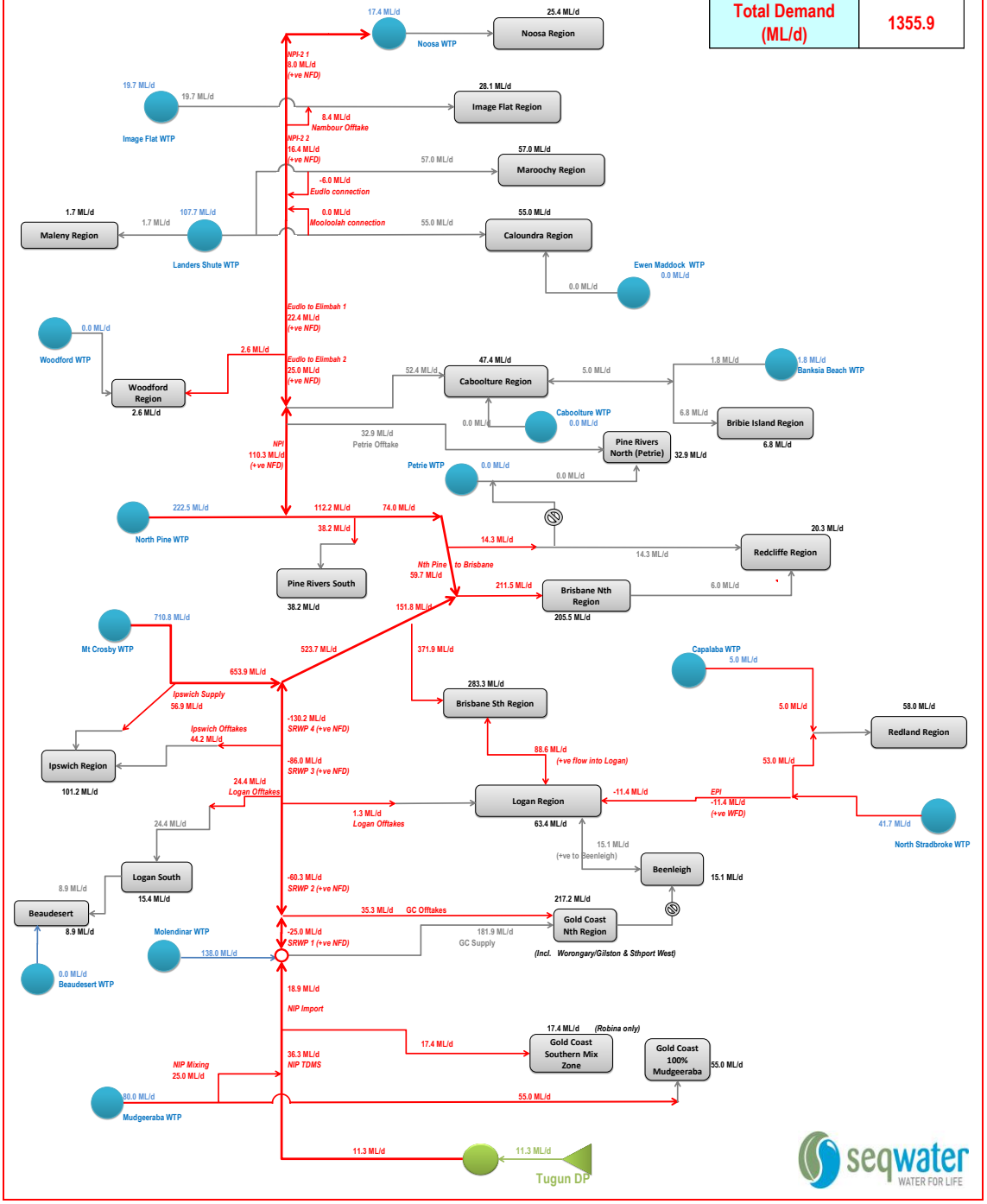
Planning Year	2024
Demand Scenario	Ave Day
Demand Multiplier	1.0
Total Demand (ML/d)	1025.9



SEQ Water Grid
Bulk Water Balances

Go to Cover

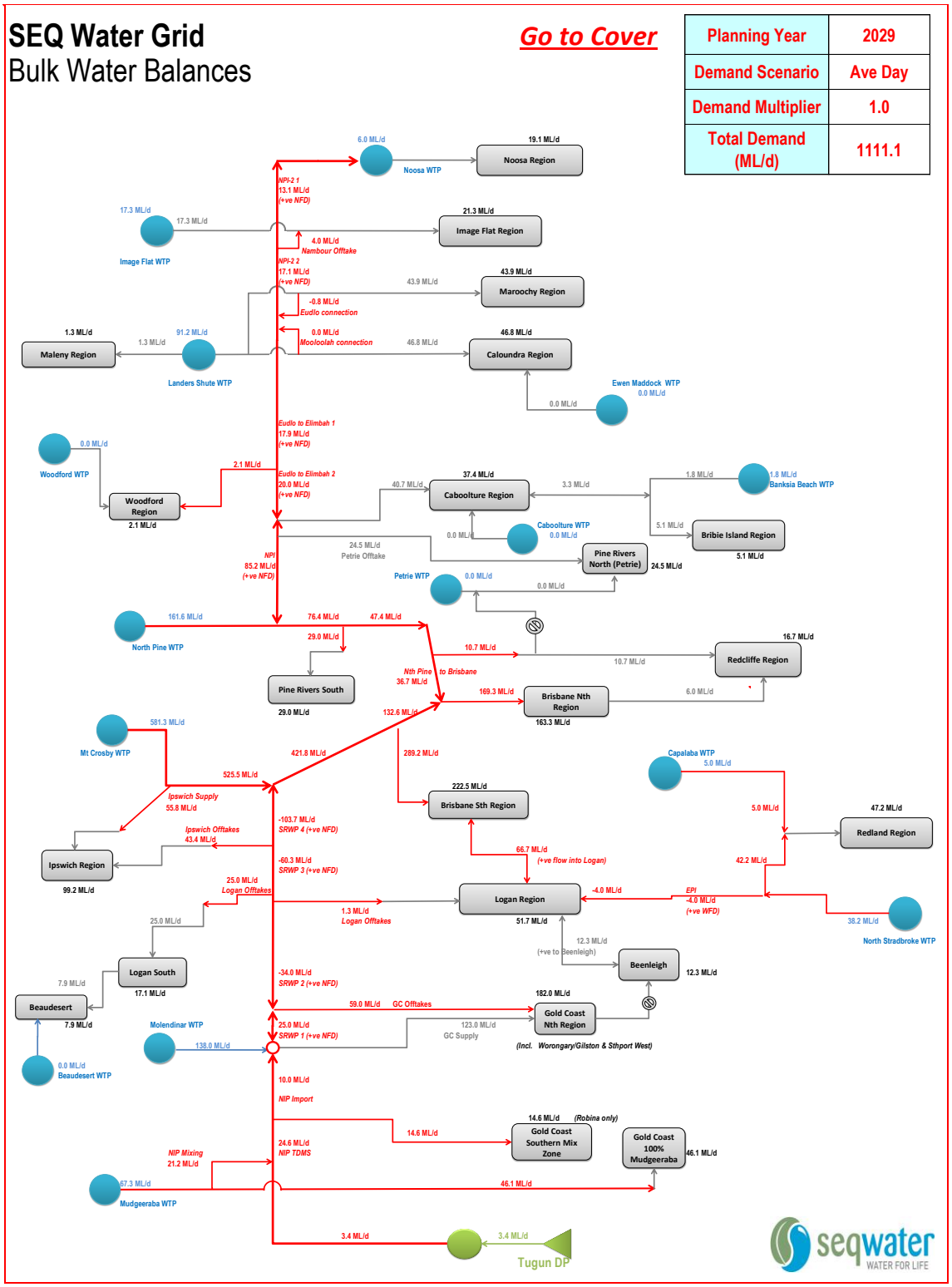
Planning Year	2024
Demand Scenario	MDMM
Demand Multiplier	1.0
Total Demand (ML/d)	1355.9



SEQ Water Grid
Bulk Water Balances

Go to Cover

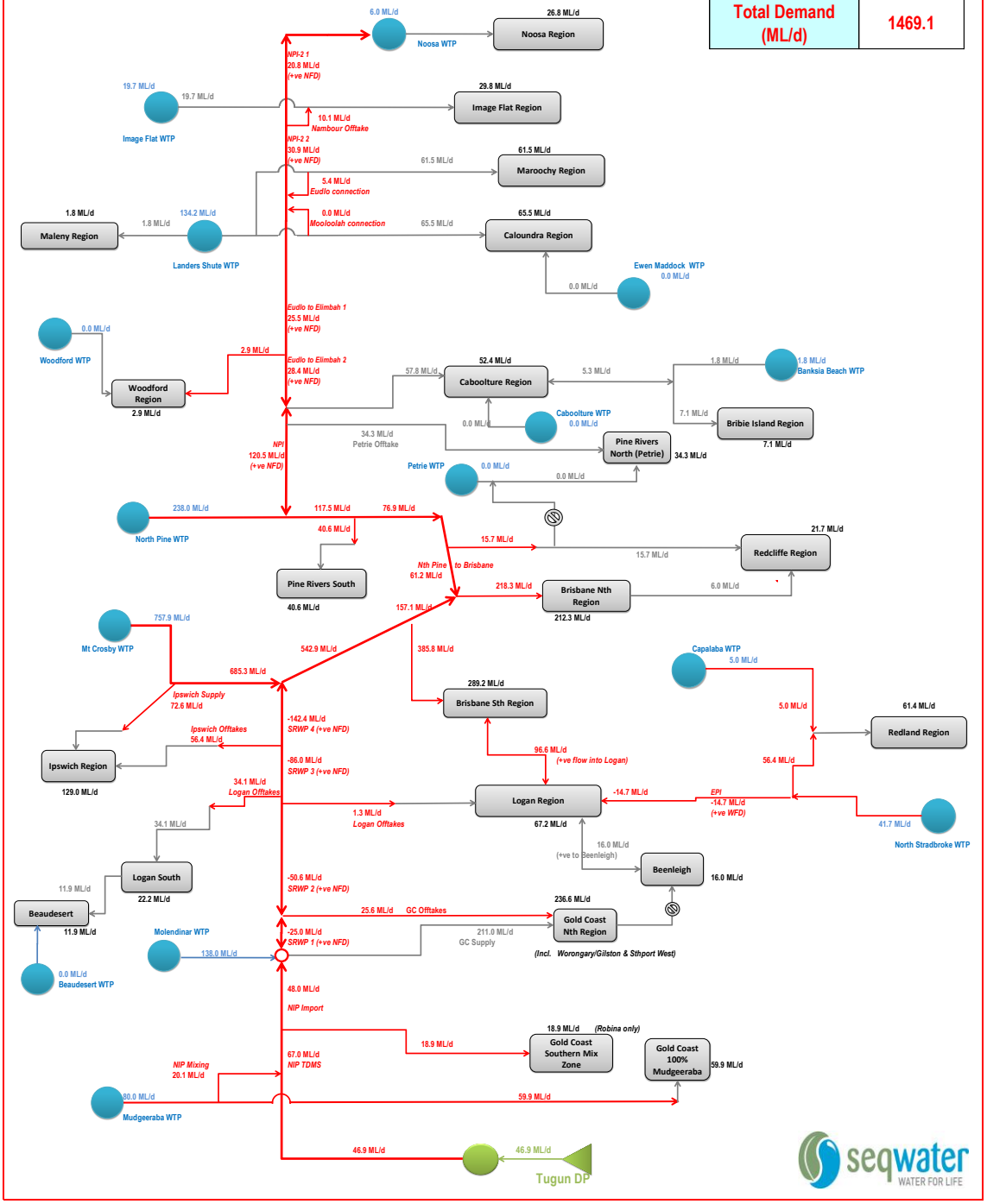
Planning Year	2029
Demand Scenario	Ave Day
Demand Multiplier	1.0
Total Demand (ML/d)	1111.1



SEQ Water Grid
Bulk Water Balances

Go to Cover

Planning Year	2029
Demand Scenario	MDMM
Demand Multiplier	1.0
Total Demand (ML/d)	1469.1



Appendix B – Seqwater Cost Optimisation Model Major Facility Utilisation Tables

Table B1 Connected Water Treatment Plants System Planning Parameters in Seqwater Cost Optimisation Model

Location	Water Treatment Plant	Current Maximum Capacity (ML/d)	Current Minimum Capacity (ML/d)	Current AD Source Allocations (ML/y)	Adopted Maximum Run Hours/day[1]	Adopted Maximum Capacity (ML/d)	Adopted Minimum Capacity (ML/d)	AD Source Allocations (ML/d)	Variable Operating Cost ($/ML)	Comments
Sunshine Coast	Noosa	30.0	6.0	10,000	20	25.0	6.0	25	$156	-
	Image Flat	23.6	8.6	16,500	20	19.7	8.6	20	$ 71	-
	Woodford	0.0	0.0	0	0	0.0	0.0	0	$331	**Decommissioned**
	Ewen Maddock	14.3	0.0	4,315	20	11.9	0.0	12	$156	-
	Banksia Beach	4.5	1.8	1,570	20	3.8	1.8	4	$228	-
	Caboolture	0.0	0.0	0	0	0.0	0.0	0	$343	**Decommissioned**
	Landers Shute	140.0	36.0	36,495	23	134.2	36.0	100	$ 60	-
Pine Rivers	Petrie	0.0	0.0	0	0	0.0	0.0	0	$ 95	**Decommissioned post 2014 - demand transferred to NPI**
Brisbane	Mt Crosby	750.0	150.0	278,725	23	718.8	150.0	719	$ 95	**Upgraded to 814ML/d (23hr) by 2024**
	North Pine	160.0	0.0	59,000	23	153.3	0.0	153	$ 63	**Upgraded to 238ML/d (23hr) by 2024**
Redlands	Capalaba	23.0	5.0	7,640	20	19.2	5.0	19	$182	-
	North Stradbroke Island	50.0	2.0	19,375	20	41.7	2.0	42	$ 93	**Potable water pumps upgraded post 2014 (38ML/d prior)**
Gold Coast	Molendinar	144.0	60.0	54,785	23	138.0	60.0	138	$ 80	-
	Mudgeeraba	80.0	30.0	29,210	24	80.0	30.0	80	$141	**57.5ML/d (23hr) in 2014. Max capacity 80ML/d post 2014 related to gravity supply main**
	Gold Coast Desalination Facility	133.0	3.4	46,000	23	125.0	3.4	125	$745	-
Logan	Beaudesert	0.0	0.0	0	0	0.0	0.0	0	$298	**Decommissioned post 2014 - demand transferred to SRWP via Southern Logan**
Sub-Total		**1552.4**	**302.8**		**259**	**1,470.4**	**302.8**	**1,436**		

Notes

1. Refer *Preliminary Service Specifications and Planning Criteria Report*; Trim Ref: D14/27787)

Table B2 Major Bulk Transport System Planning Parameters in Seqwater Cost Optimisation Model

Pipeline	Current Maximum Capacity (ML/d)	Current Minimum Capacity (ML/d)	Adopted Maximum Capacity (ML/d)	Adopted Minimum Capacity (ML/d)	Adopted Minimum Flow (ML/d)	Description
NPI Stage 2 from/into Noosa	35	-18	35	-18	5	Supply to/from Noosa
Eudlo connection	69	-50	69	-50	0	Supply from/to Landers Shute Zone
Caloundra St WQFM (+ve is South)	65	-65	65	-65	-20	Main line for NPI Stage 1
Petrie Offtake	55	4	55	4	0	Boundary Road supply
North Pine to Narangba	107	-57	200	-57	+/-4	North Pine to Narangba
Eastern Pipeline Interconnector (EPI)	22	-22	22	-22	+/-4	
Southern Regional Water Pipeline (SRWP) Southern Leg	130	-86	130	-86	+/-25	Molendinar outlet
Southern Regional Water Pipeline (SRWP) Central Leg	130	-86	130	-86	+/-10	Central Leg
Southern Regional Water Pipeline (SRWP) Northern Leg	90	-171	90	-171	+/-25	Into Brisbane
Network Integration Pipeline	130	10	130	10	10	Tarrant Drive pump station to Molendinar WTP
Robina Mudgeeraba Mixing	50	0	110	0	0	Mudgeeraba into Robina
Houghton Highway Offtake	6	0	6	0	0	Bracken Ridge to Redcliffe
Nambour Off take	20	4	20	4	4	Mudgeeraba into Robina

Table B3 Connected Water Treatment Plants System Operating Outcomes from Seqwater Cost Optimisation Model

Water Treatment Plant	Average Day Results				Comments	MDMM Results				Comments
	2014	2019	2024	2029		2014	2019	2024	2029	
Noosa	6.0	9.3	6.0	6.0	Generally run at minimum due to unit cost - required to supply in 2019 to assist in minimum flow volumes in NPI	6.0	17.5	17.4	6.0	Generally run at minimum due to unit cost - required to supply in 2019 to 2024 assist in minimum flow volumes in NPI
Image Flat	11.2	14.4	16.1	17.3	Generally run at minimum due to preferential supply from Landers Shute	17.2	19.7	19.7	19.7	Generally run at minimum due to unit cost
Ewen Maddock	0.0	0.0	0.0	0.0	Not required under fair weather planning	0.0	0.0	0.0	0.0	Not required under fair weather planning
Banksia Beach	1.8	1.8	1.8	1.8	Generally run at minimum due to unit cost	1.8	1.8	1.8	1.8	Generally run at minimum due to unit cost
Landers Shute	89.7	100.0	79.2	91.2	Generally run near maximum due to unit cost - some changes to assist in minimum flow volumes in NPI	128.3	134.2	107.7	134.2	Generally run near maximum due to unit cost - some changes to assist in minimum flow volumes in NPI
Petrie	17.4	0.0	0.0	0.0	Decomm post 2014	24.4	0.0	0.0	0.0	Decomm post 2014
Mt Crosby	385.9	452.2	516.8	581.3	-	477.9	657.8	710.8	757.9	-
North Pine	110.0	153.3	161.6	161.6	Generally run at maximum due to unit cost	153.3	153.3	222.5	238.0	Generally run at maximum due to unit cost
Capalaba	5.0	5.0	5.0	5.0	Generally run at minimum due to unit cost	5.0	5.0	5.0	5.0	Generally run at minimum due to unit cost
North Stradbroke Island	27.1	33.0	35.7	38.2	Generally run at maximum due to unit cost	37.9	41.7	41.7	41.7	Generally run at maximum due to unit cost
Molendinar	91.9	112.6	138.0	138.0	Generally run at maximum due to unit cost	132.0	138.0	138.0	138.0	Generally run at maximum due to unit cost
Mudgeeraba	48.8	57.5	62.3	67.3	-	61.6	72.7	80.0	80.0	-
SEQ Desal	3.4	3.4	3.4	3.4	Generally run at minimum due to unit cost	3.4	3.4	11.3	46.9	Generally run at minimum due to unit cost
Beaudesert	2.7	0.0	0.0	0.0	Decomm post 2014	4.1	0.0	0.0	0.0	Decomm post 2014
Totals	**801**	**942**	**1026**	**1111**		**1049**	**1245**	**1356**	**1469**	

Table B4 Major Bulk Transport System Operating Outcomes in Seqwater Cost Optimisation Model

Pipeline Element	Average Day Results				MDMM Results				Comments
	2014	2019	2024	2029	2014	2019	2024	2029	
Noosa Offtake	8.8	8.0	12.1	13.1	15	7	19	21	NFD is +VE
Landers North in NPI	12.8	12.0	16.1	17.1	19	13	28	31	NFD is +VE
Landers Shute to NPI	32.9	29.2	-2.0	-0.8	49	35	15	5	Landers to NPI is +VE
Caloundra Street WQMF	-20.0	-17.2	18.2	17.9	-30	-22	13	25	NFD is +VE
South of Woodford in NPI	-18.6	-15.5	20.0	20.0	-28	-20	16	28	NFD is +VE
Supply into Petrie zone	0.0	22.0	23.5	24.5	0	31	33	34	
NPI to Nth Pine WTP	9.4	40.0	80.4	85.2	12	58	101	120	NFD is +VE
Nth Pine to Aspley Supply Main	71.5	79.1	44.3	36.7	100	46	56	61	
Ipswich Offtakes	4.0	26.2	34.0	43.4	25	34	44	56	Ipswich via SRWP Offtakes
Eastern Pipeline Interconnector	-4.0	-4.0	-4.0	-4.0	-4	-8	-11	-15	WFD is +VE
Molendinar Pump Station	-25.0	-25.0	25.0	25.0	25	-25	-25	-25	NFD is +VE
Chambers Flat Pump Station & WQMF	-29.0	-30.0	-19.1	-34.0	-23	-50	-60	-51	NFD is +VE
Swanbank Pump Station	-36.0	-42.5	-38.2	-60.3	-32	-67	-86	-86	NFD is +VE
Bundamba Pump Station	-40.0	-68.8	-72.3	-103.7	-57	-101	-130	-142	NFD is +VE
Network Integration Pipeline into Molendinar WTP	10.0	10.0	10.0	10.0	10	10	25	48	
Network Integration Pipeline Mixing to Robina Reservoir	16.7	18.8	20.0	21.2	20	22	25	20	

Notes
EFD Eastern Flow Direction
NFD Northern Flow Direction
SFD Southern Flow Direction
WFD Western Flow Direction
WQMF Water Quality Management Facility

Appendix C – Adopted Demand Zone Peak Persistence Peaking Factors

Figure C1 – Adopted Preliminary MDMM Peaking Factors

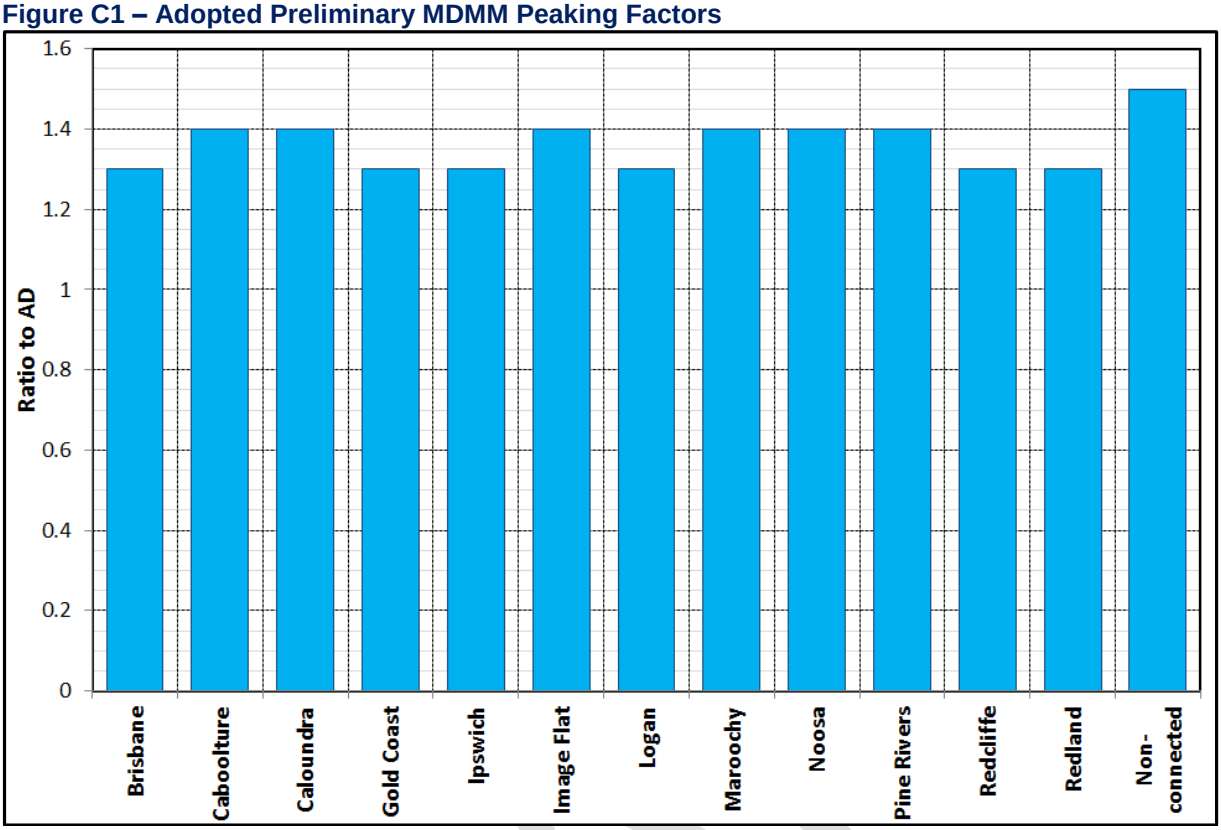
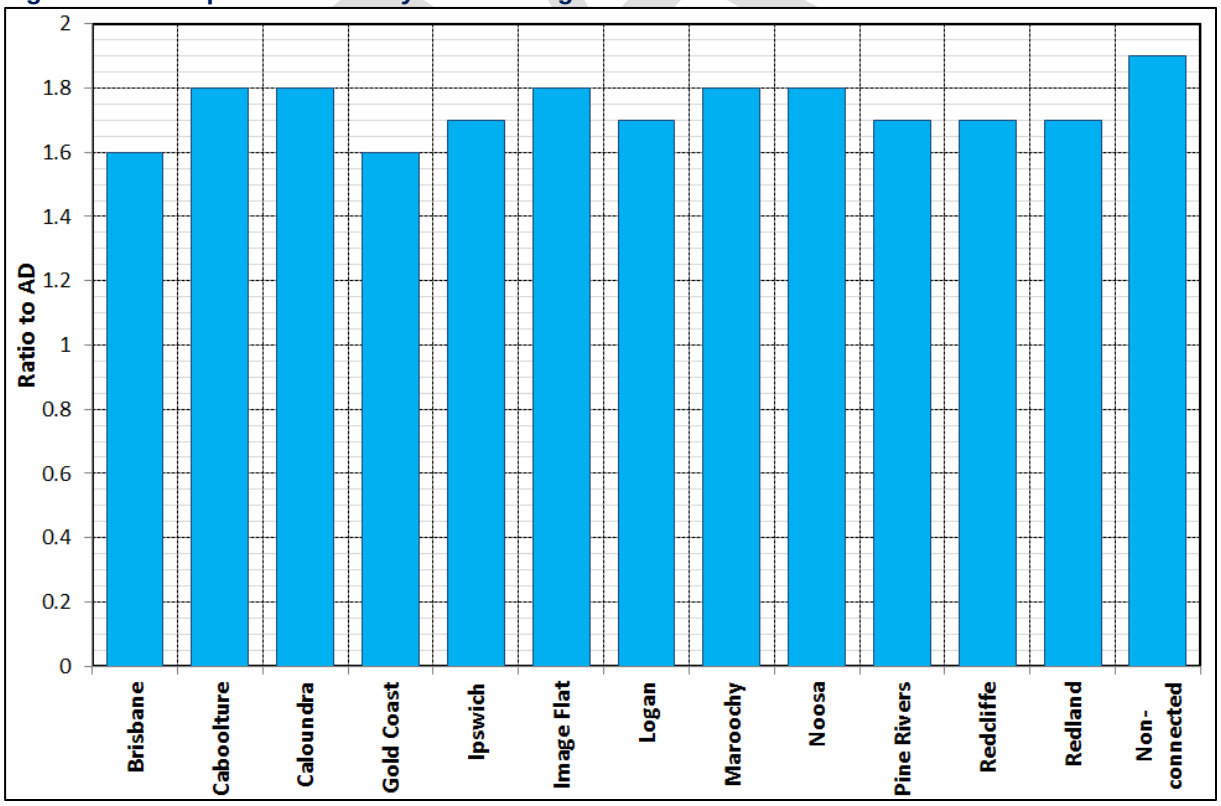


Figure C2 – Adopted Preliminary MD Peaking Factors



Refer *Preliminary Service Specifications and Planning Criteria Report*; Trim Ref: D14/27787)