Feasibility Study into options for sustainable water security

Report

3606-10

Prepared for
Longreach Regional Council

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1 Introduction

1.1 Background

Longreach Regional Council serves a population of around 4,000 in central western Queensland. The townships in the local government area are Longreach, Ilfracombe, Isisford and Yaraka.

The Longreach region has a hot and dry climate. Therefore, securing water supplies for domestic use over the long term is a significant challenge.

1.2 Purpose

The purpose of this report is to identify options that will:

1. Increase the availability of potable water for domestic use in the short and medium term
2. Secure the long term water security of each town.

The desired outcome is to ensure increased availability of potable water for domestic use, to allow prolonged beautification of the towns' open spaces and parks/gardens, and to allow maintenance/greening of private lawns/gardens. Increased storage and improved retention of water within exposed storages such as dams are two possible mechanisms for this outcome.

1.3 Scope

The scope of this project is broadly to propose and assess the viability of water security options which will increase or improve the capacity and efficiency of current water storages. This process is to include:

- A review of existing reports and documentation
- A search for relevant reports produced by government departments
- Development and demonstration of the positive and negative effects associated with all proposed water security options.

Specifically, the following water security options for each township are to be considered:

- Longreach:
  - Raise the levels of the town weirs
  - Construct a new off-stream storage area (dam)
  - Construct a new bore to provide an alternative potable water source
- Ilfracombe:
  - Investigate the possibility of harvesting water from Gin Creek
  - Confirm the harvest potential of Collumpton Creek
  - Explore evaporation reduction devices for town dams
- Isisford:
  - Investigate increases to storage capacity (e.g. enlarge town dams)
  - Explore evaporation reduction devices for town dams
- Yaraka:
  - Investigate the possibility of harvesting water from nearby waterways
  - Investigate increases to storage capacity (e.g. enlarge town dams)
  - Explore evaporation reduction devices for town dams.

2 Town profiles

2.1 Locality

The Longreach region is located in central western Queensland, approximately 700 kilometres (km) from the coastline, west of Rockhampton. The towns of Longreach and Ilfracombe are located on the Landsborough Highway, with Isisford 90 km south of Ilfracombe on the banks of the Barcoo River, and Yaraka being approximately another 100 km south-west of Isisford. The locations of Longreach, Ilfracombe and Isisford are shown in Figure 2-1.

Figure 2-1 Location of major towns in the Longreach LGA
Source: Queensland Globe[1]

2.2 Town profiles

Table 2-1 details relevant information relating to the water resources for each town.

Table 2-1 Summary information for each major town in the Longreach LGA[2]

	Longreach	Ilfracombe	Isisford	Yaraka
Population[3]	3,800	220	130	15
Water supply	1,612 (GBA 2015)	TBC	TBC	10 (GBA 2008)

[1] Accessible at: https://qldglobe.information.qld.gov.au/.
[2] Note that there is some difficulty in identifying
[3] Section 4.1 of Longreach Regional Council 2015.

	Longreach	Ilfracombe	Isisford	Yaraka
connections				
Water services	▪ Potable water ▪ Untreated bore water (non-reticulated)	▪ Potable water ▪ Raw water	▪ Potable water (with the option for consumers to receive untreated reticulated water)	▪ Potable water ▪ Untreated dam water ▪ Emergency untreated bore water
Sources	▪ Thomson River ▪ Wonga Street Bore ▪ Water Treatment Plant Bore	▪ Collumpton Creek ▪ Town Bore	▪ Barcoo River	▪ Tributary of Kiama Creek ▪ Town Bore
Annual water consumption (2014-15)[4]	2,074 ML/annum (Longreach Raw River Water)	93 ML/annum (Ilfracombe Raw River Water)	140 ML/annum (Isisford Treated and Untreated River Water)	22.4 ML/annum (Yaraka Untreated River Water and Untreated Bore Water)
Per capita demand (L/p/d) (2014-15)[5]	1,495	1,155	2,952	4,096

2.3 Climate

Under the Koppen Climate Classification System adopted by the Bureau of Meteorology, the Longreach region as being in the "hot (persistently dry) grassland" category[6]. The features of this climate category are low rainfall and high temperatures but of sufficiently high rainfall to support grassland vegetation. Table 2-2 summarises key climate characteristics for the Longreach and Isisford weather stations compared to Brisbane as a reference point.

Table 2-2 Summary information for each climate station in the Longreach LGA

Statistic category	Statistic	Longreach (Longreach Aero)[7]	Isisford (Isisford Post Office)[8]	Brisbane
Rainfall	**Mean annual rainfall (mm)**	444.0	449.3	1021.6
	Median annual rainfall (mm)	421.1	407.8	1061.2
	Mean number of days where rainfall > 1 mm	32.8	35.2	81.5
	Mean number of days where rainfall > 10 mm	11.8	12.8	27.7
Temperature	**Mean minimum temperature (°C)**	15.8	15.5	16.3
	Mean maximum temperature (°C)	31.5	30.9	26.5
Evaporation and humidity	**Mean daily evaporation (mm)**	8.5 (3.1 m per year)	No data	5.3
	Mean 9 AM relative humidity (%)	47	50	63

4 "Annual Water Consumption (ML)" (p. 18 – 20) from Longreach Regional Council 2015, *Water Conservation & Drought Management Plan*.
5 "Raw Water Usage 2014-2015 (l/p/d)" (p. 2) from Longreach Regional Council 2015, *Water Conservation & Drought Management Plan*.
6 The "Koppen Climate Classification (All Classes)" layer of the Atlas of Living Australia can be accessed at http://spatial.ala.org.au/?layers=koppen_all_classes#. The layer is based on data from the Bureau of Meteorology. Non-interactive maps can also be viewed at http://www.bom.gov.au/jsp/ncc/climate_averages/climate-classifications/index.jsp.
7 Obtained from http://www.bom.gov.au/climate/averages/tables/cw_036031.shtml.
8 Obtained from http://www.bom.gov.au/climate/averages/tables/cw_036026.shtml.

	Mean 3 PM relative humidity (%)	27	31	52

3 Regulatory framework for land and water

3.1 Regulatory framework for water management

A new water planning framework has been introduced to the *Water Act 2000* (Water Act) by the *Water Reform and Other Legislation Amendment Act 2014* (WROLA Act). The new framework replaces the previous water resource plans (WRP) and resource operations plans (ROP).

The new framework continues the catchment based approach to water planning, but uses different documents to deliver the water planning outcomes. The intent is to make the planning process more flexible and efficient in its delivery of planning outcomes, to be better able to respond to stakeholder and community needs.

The following documents are utilised as part of the new water planning framework:

> Water Regulation 2016

> Water plans

> Water entitlement notice

> Water management protocols

> Resource operations licences and distribution operations licences

> Operations manual.

Water Regulation 2016, which replaces the *Water Regulation 2002*, has been expanded to take a greater role in supporting the water planning process. Specifically, the regulation now:

> allows for unallocated water to be reserved outside of a water plan, in addition to prescribing the process for releasing unallocated water

> establishes generic criteria for converting water allocations

> provides for water allocation dealings and the process for seasonal water assignments

> provides for Minister's reporting requirements on water plans

> provides the works requirements for taking or interfering with water

> includes additional prescribed activities where a water entitlement or permit is not required. [9]

3.2 Water Plan and Resource Operations Plan

Under the Water Act, each water supply catchment is governed by a Water Plan. The Longreach LGA sits within the Cooper Creek catchment and therefore surface water use is regulated by the *Water Plan (Cooper Creek) 2011*, which was originally released in 2000 and later amended in 2011.

The purposes of the *Water Plan (Cooper Creek)* are as follows:

> to define the availability of water in the plan area

> to provide a framework for sustainably managing water and the taking of water

> to identify priorities and mechanisms for dealing with future water requirements

> to regulate the taking of overland flow water.

The *Water Plan (Cooper Creek)* was approved by the Governor in Council on 10 November 2011. The *Cooper Creek Resource Operations Plan 2013*, which commenced on 29 November 2013, is the

[9] Source of section: https://www.dnrm.qld.gov.au/water/catchments-planning/planning-process.

implementation of the *Water Plan (Cooper Creek)*. The *Cooper Creek Resource Operations Plan* implements the *Water Plan (Cooper Creek)* by:

> enabling water licence transfer in certain areas of the catchment

> releasing and granting unallocated water

> amending existing water licences to meet requirements in the water plan

> managing overland flow water

> specifying monitoring and reporting requirements.

3.2.1 Restrictions on interference with water and taking of overland flow water

Within the *Water Plan (Cooper Creek) 2011*, there are restrictions on the interference with water in a watercourse, lake or spring, and the taking of overland flow water. For the purposes of Longreach Regional Council, Part 5 of the *Water Plan (Cooper Creek) 2011* ("Interference with water in watercourse, lake or spring") states the following:

> Section 34(1): *An application to interfere with water in a watercourse, lake or spring by impounding the flow of water may only be granted if the purpose of the interference or increase is:*

  - *to store water to be taken under an authorisation for the purpose of town water supply* (Section 34(1)(b)).

> Section 34(2): *The application is not to be granted if:*

  - *the granting of the application would cause an increase in the total licensed in-stream water storage capacity for a sub-catchment mentioned in Schedule 3 [of the Water Plan] of more than the volume stated in Schedule 3 of the Water Plan* (Section 34(2)(a)).

    For the Thomson-Barcoo and Upper Thomson sub-catchments, which the major towns of the Longreach LGA reside in, these are 1,625 ML and 1,870 ML respectively.

  - *the works are to be located on a watercourse mentioned in Schedule 4 [of the Water Plan]* (Section 34(2)(c)).

    Longreach and Isisford are respectively situated on the Thomson and Barcoo Rivers, which are listed as protected watercourses in Schedule 4 of the Water Plan. However, Section 34(3) states that *subsection (2)(c) does not apply to an application for an interference by impounding water for the purpose of accessing water under a water entitlement with its purpose stated as town water supply.*

Part 6 ("Regulating overland flow water") states the following:

> Section 36(2): *A person may only take overland flow water:*

  - *for another purpose, other than irrigation, if the works for taking the overland flow water have a capacity of not more than 10 ML* (Section 36(2)(b)).
  - *under a water licence granted from unallocated water* (Section 36(2)(c)).
  - *of a volume of not more than the amount necessary to satisfy the requirements of: (i) an environmental authority or (ii) a development permit for carrying out an environmentally relevant activity, other than a mining or petroleum activity* (Section 36(2)(d)).
  - *that is contaminated agricultural runoff water* (Section 36(2)(e)).
  - *uses overland flow works that are a reconfiguration of existing overland flow works and do not increase the average annual volume of overland flow water able to be taken above the average annual volume taken using the overland flow works* (Section 36(2)(f) and Section 37(1)).

Unallocated water is discussed further in Section 3.3.

The consequence of the above matters in the Water Plan means that Longreach Regional Council is able to create storages within watercourses for the purposes of town water supply. However, the volume of the storages must be within the upper limits set out in section 34(2), i.e. 1,625 ML within the Thomson-Barcoo sub-catchment and 1,870 ML in the Upper Thomson sub-catchment.

3.3 Great Artesian Basin planning documents

On 2 September 2017, the previous planning documents for the Great Artesian Basin were formally replaced by the *Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017* and the associated Water Management Protocol and Water Entitlement Notice. The new Water Plan for the Great Artesian Basin retains the stated purposes of the superseded Water Resource Plan, with the exception that the new Water Plan also seeks to “provide a framework for reversing, if practicable, the degradation of groundwater-dependent ecosystems”. Other than the regulation of overland flow water, the remaining stated purposes of the Water Plan (Great Artesian Basin and Other Regional Aquifers) are identical to those in the Water Plan (Cooper Creek).

In contrast with the “management areas” that formed the basis of the superseded planning documents for the Great Artesian Basin, the new Water Plan utilises a breakdown of “groundwater units”. Schedule 2 of the new Water Plan reveals that Longreach is located in the following groundwater units (where “groundwater sub-areas” are indicated in brackets):

1. Betts Creek beds (Betts Creek beds North)
2. Clematis (Galilee Clematis)
3. Hooray (Eromanga North Hooray)
4. Hutton (Eromanga Hutton)
5. Precipice (Eromanga Precipice)
6. Rolling Downs (Eromanga Wallumbilla)
7. Springbok Walloon (Adori Injune Creek)
8. Winton Mackunda (Winton Mackunda South)

The following section (Section 3.3) identifies the amount of unallocated water that is available in each of these groundwater units.

3.4 Unallocated water

Unallocated water is reserved under water planning instruments and can be made available for future consumptive use without compromising the security of existing users or the environmental values within a catchment.

Types of unallocated water include:

> general reserve: water that may be granted for any purpose

> strategic or state reserve: water that may be granted for projects that the chief executive considers are of regional significance for the plan area or have been declared to be coordinated projects under the *State Development and Public Works Organisation Act 1971*

> strategic infrastructure: water that may be granted to facilitate the development of particular water infrastructure projects (e.g. new dams) in the relevant water plan

> indigenous reserve: water that may be granted for projects that advance the social and economic aspirations of indigenous people.

> The total unallocated surface water and groundwater in the applicable areas is detailed in Table 3-1.

Table 3-1 Unallocated water in the Great Artesian Basin Water Resource Plan and Water Plan (Cooper Creek)

Catchment/basin	Area	Unallocated water (ML)
Great Artesian Basin (groundwater)	Eromanga Precipice	365 (General reserve)
	Galilee Clematis	455 (General reserve)

Catchment/basin	Area	Unallocated water (ML)
	Eromanga North Hooray (in conjunction with Eromanga Cadna-owie, and the other Eromanga Hooray sub-areas)	1,545 (General reserve)
	Adori Injune Creek and Eromanga Hutton	3,000 (General reserve)
Cooper Creek (surface water)	All	200ML (General reserve) 500 ML (Town and community strategic reserve)

3.5 Regional Planning Interests Act and Regulation

Under Queensland's current land use planning framework, the *Regional Planning Interests Act 2014* and its subordinate regulation (*Regional Planning Interests Regulation 2014*) seek to "manage the impact of resource activities and other regulated activities on areas of the State that contribute, or are likely to contribute, to Queensland's economic, social and environmental prosperity"[10]. These areas of the state are termed "areas of regional interest" for the purpose of these pieces of legislation.

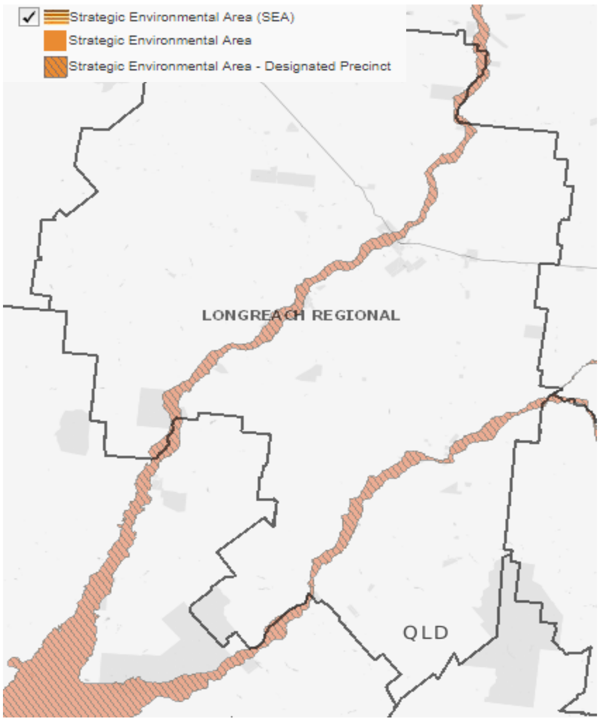
Section 7 of the *Regional Planning Interests Act 2014* defines areas of regional interest as either priority agricultural areas, priority living areas, strategic cropping areas, or strategic environmental areas. In Section 11 of the Act, strategic environmental areas are further defined as:

> Containing one or more environmental attributes for the area and

> Either:

  - Shown on a map in a regional plan as a strategic environmental area, or
  - Prescribed under a regulation.

Section 4 of the subordinate regulation stipulates that part of the Channel Country is a strategic environmental area. Reference is made to the accompanying *Strategic Environmental Area* maps in order to identify the specific area of the Channel Country that is described as a strategic environmental area. In the relevant map (the *Channel Country Strategic Environmental Area map*), which is abridged below in Figure 3-1, the Thomson and Barcoo Rivers are shown to be strategic environmental areas.



[10] Introduction to Regional Planning Interests Act 2014 (p. 7)

Figure 3-1 Strategic environmental areas and designated precincts in the Longreach LGA
Source: Queensland Government: Development Assessment Mapping System[11]

In addition to the Thomson and Barcoo Rivers being strategic environmental areas, Figure 3-1 illustrates that these rivers fall within “designated precincts”. Within designated precincts, the use of water storages (dams) is stated by Section 15 of the Regulation to be unacceptable. This rules out the construction of new dams or weirs on the Thomson or Barcoo Rivers and consequently, means that construction of in-stream or off-stream storage for the towns of Longreach and Isisford is not allowed under this legislation.

3.6 Drought Management Plan

Under the *Water Supply Services Legislation Amendment Bill 2014*[12], Drought Management Plans were removed as a requirement for water service providers. However, Longreach Regional Council chooses to maintain a Drought Management Plan as it sees value in this document. The Water Conservation and Drought Management Plan was last revised by Longreach Regional Council on 10 December 2015 and includes the following:

> An overview of the water supply infrastructure (source, structures and treatment infrastructure) and associated capacities for each township, along with past performance reviews

> Identification of future water sources for each township

> Identification of emergency water sources for each township

> An overview and high-level analysis of water consumption by each township

> An overview of water restriction trigger levels

> Implementation of the Water Conservation and Drought Management Plan.

[11] Accessible at: https://dams.dsdip.esriaustraliaonline.com.au/damappingsystem/.
[12] As per http://www.qldwater.com.au/Regulatory_Plans.

4 Existing water resources and supply infrastructure

Each of the four townships included within this study is supplied with water through separate water schemes. The water resources and infrastructure that comprise each of the supply schemes is described following.

4.1 Longreach

4.1.1 Water resources

Longreach Regional Council holds licence 604058 under the Water Plan which permits it to a nominal entitlement of 2,200ML/yr from the Thomson River system. The maximum daily volumetric limit is 12.5ML/day and the maximum extraction rate is 300L/s.

4.1.2 Water supply infrastructure

The main water source for Longreach is the nearby Thomson River, in which water is impounded through a series of weirs with a combined capacity of around 10,000ML. River water is pumped directly from the Town Weir, which is located 3km north-west of the treatment plant, to the 11ML/day Longreach Water Treatment Plant, where it is distributed throughout the town's reticulation system. Releases from the three remaining weirs (Goodberry Hills, Bimbah and Fairmount) are used to supplement the Town Weir when necessary. Within Longreach there are also two water storage reservoirs; these include a 8,800kL ground level tank and a 500kL elevated reservoir.

Saline non-potable water is also sourced from two bores (RN384 and NR146269), which are able to yield approximately 280ML/year. The allowance in Council's license permits extraction up to 800 ML/year. Non-potable groundwater was previously reticulated but this system has now been abandoned. Total dissolved solids for the bores has been measured at >1,000mg/L which places the water quality in the 'poor' category as defined by the Australian Drinking Water Guidelines[13].

4.2 Ilfracombe

4.2.1 Water resources

Longreach Regional Council holds licence 404314 under the Water Plan which permits it to a nominal entitlement of 770ML/yr from Collumpton Creek. The maximum daily volumetric limit is 120ML/day and the maximum extraction rate is 1,667L/s.

Bore RN371 (Town Bore) is 120 years old and its performance has declined from 22L/s in the year of its construction to 4.3L/s in 1986. The bore was tested again in May 2015 and recorded a flow rate of 5.7L/s. The bore water is saline and falls into the 'poor' category for palatability.

4.2.2 Water supply infrastructure

Ilfracombe township's water is supplied via two dams. Shannon Dam is located to the north of Ilfracombe, while Murray-McMillan Dam is located to the south of Ilfracombe. Each dam is fed by Minor Creek and Collumpton Creek respectively.

Water is harvested from Collumpton Creek by a flume diversion and is pumped into Murray-McMillan Dam. A large flood harvesting pump ("China" pump) is reported to be able to pump at 900L/s. A smaller pump is

[13] The categorisation of the palatability of water for drinking in the Australian Drinking Water Guidelines is as follows:

- 0 – 600 mg/L: Good
- 600 – 900 mg/L: Fair
- 900 -1200 mg/L: Poor
- >1,200 mg/L: Unacceptable

used when the water level is too low for the large pump. The reported volume of Murray-McMillan Dam is 381ML[14].

The Shannon Dam (with a capacity of 96ML) receives overland flow in the Minor Creek catchment. However, it is used as an operational balancing storage by Council with a near constant level being maintained by pumping from Murray-McMillan Dam.

Water from these dams is treated through the Ilfracombe Water Treatment Plant (with a capacity of 12.5L/s) and distributed. The Ilfracombe scheme also incorporates a 228kL elevated reservoir and 350kL ground level reservoir.

Due to its poor quality, groundwater is only used for stock and domestic purposes and is supplied at a small number of points.

4.3 Isisford

4.3.1 Water resources

Longreach Regional Council holds licence 604057 under the Water Plan which permits it to a nominal entitlement of 100ML/yr from the Barcoo River. The maximum daily volumetric limit is 0.64ML/day and the maximum extraction rate is 10L/s. There are two weirs on the Barcoo River from which Council is able to take water – a weir at Isisford town (190ML volume) and one further downstream at the Oma Waterhole. The transfer pipeline from the Oma waterhole has been decommissioned and therefore water is no longer taken from this point.

4.3.2 Water supply infrastructure

Water is taken from the Barcoo River to the off-stream Isisford Dam (267ML. The river water is pumped to the 11L/s Isisford Treatment Plant and distributed. Isisford's treatment plant compound houses five storage tanks, including three 195kL raw water ground level reservoirs, a 195kL clear water ground level reservoir and a 120kL clear water elevated reservoir. Water is either pumped directly from the three raw water reservoirs to consumers via untreated water reticulation mains, or pumped through the treatment plant where it is stored in the clear water reservoirs. Isisford was formerly also serviced by a groundwater bore; however, this has since been decommissioned due to poor water quality.

4.4 Yaraka

4.4.1 Water resources

There is no authority for Council to take water under the *Water Plan (Cooper Creek)*. Department of Natural Resources and Mines advised that Yaraka would likely be considered a deemed use under the planning arrangements.

4.4.2 Water supply infrastructure

Yaraka's water supply scheme comprises a town bore and two dams (with a combined capacity of 103ML), south of the town, fed by Kiama Creek. The water quality of the town bore, however, limits its use. While potable, the bore water is currently outside the Australian Drinking Water Guidelines aesthetic guidelines for chloride and sodium and the level of total dissolved solids at >3,000mg/L makes the water's palatability "unacceptable" according to the Australian Drinking Water Guidelines. Yaraka's existing distribution system supplies treated and untreated water throughout the town via two separate mains. Three storage tanks are located within the Yaraka Water Treatment Plant compound: a 45kL ground level reservoir holding water from the town bore prior to treatment, a 25kL elevated raw water reservoir and a 25kL elevated reservoir of treated water, gravity feeding the town's distribution system. The 1L/s treatment plant was recommissioned in 2010.

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[14] Note that the Drought Management Plan states a capacity of 369ML

5 Demand

5.1 Historical demand

Figure 5-1 and Figure 5-2 depict, respectively, the total annual water consumption in Longreach from 2003/04 to 2014/15 and the annual per capita water consumption in Longreach from 2010/11 to 2014/15 along with total annual rainfall[15][16]. These figures show total demand in Longreach varying between 1,500ML/year to just over 2,000 ML year for the given period with total usage and per capital usage increasing in lower rainfall years.

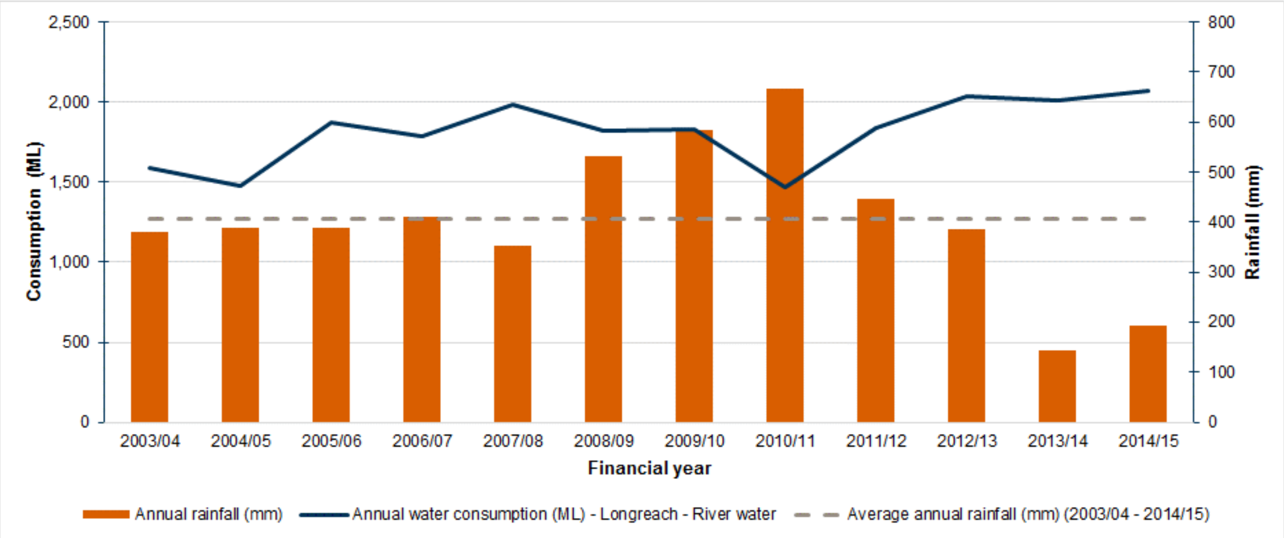

Figure 5-1 Total annual water consumption and annual rainfall in Longreach

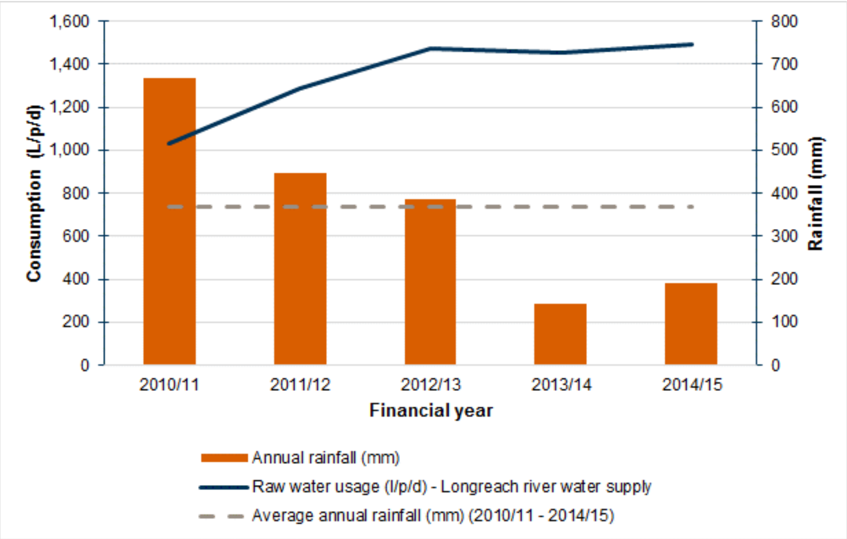

Figure 5-2 Annual per capita water consumption and annual rainfall in Longreach

Detailed rainfall data is not available for the other major towns in the Longreach LGA. However, total annual water consumption is available in Council's 2010 and 2015 *Water Conservation and Drought Management Plans* for each town from 2004/05 to 2014/15, and annual per capita water consumption is available in the same document for each town from 2010/11 to 2014/15 and this data is shown in Figure 5-3 to Figure 5-5.

[15] Consumption figures sources from the 2010 and 2015 Drought Management Plans
[16] Sourced from the Bureau of Meteorology's data for the "Longreach Aero QLD" weather station (station 036031)

While the overall trend of per capita consumption is in line with total consumption for Isisford and Yaraka, per capita consumption for Ilfracombe has generally been increasing over the period for which data is available, while the corresponding total annual consumption has been decreasing. It is possible that this trend is due to anomalous total consumption figures for the years 2008/09 to 2010/11 and 2008/09 in particular which was more than four times typical usage which is around 100 ML per year.

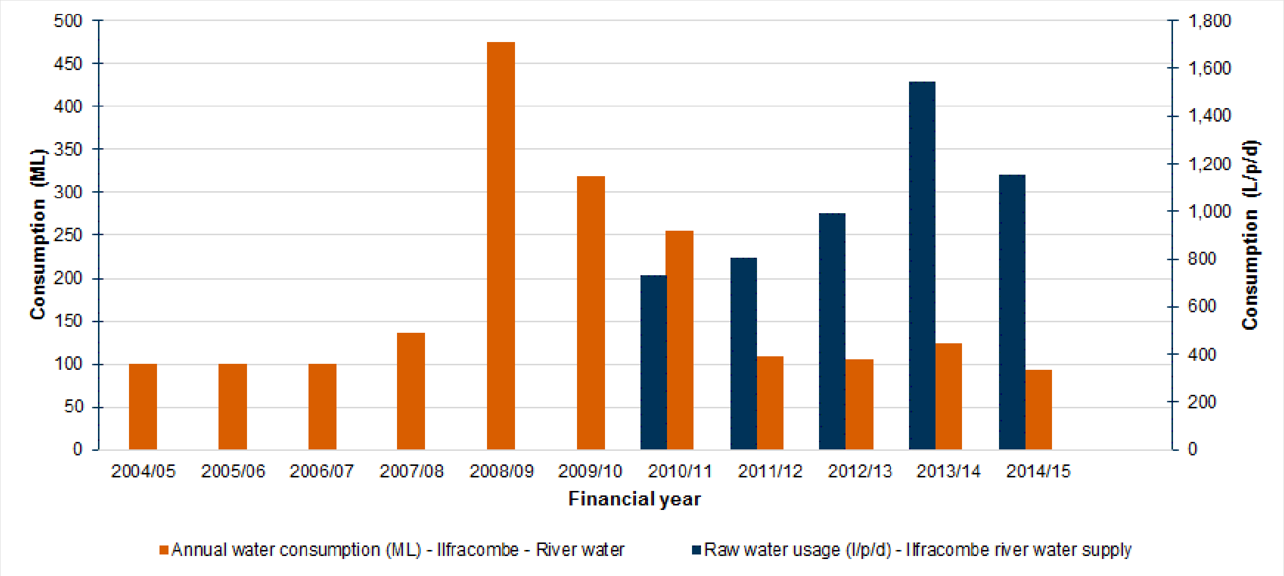

Figure 5-3 Total annual water consumption and annual per capita water consumption in Ilfracombe

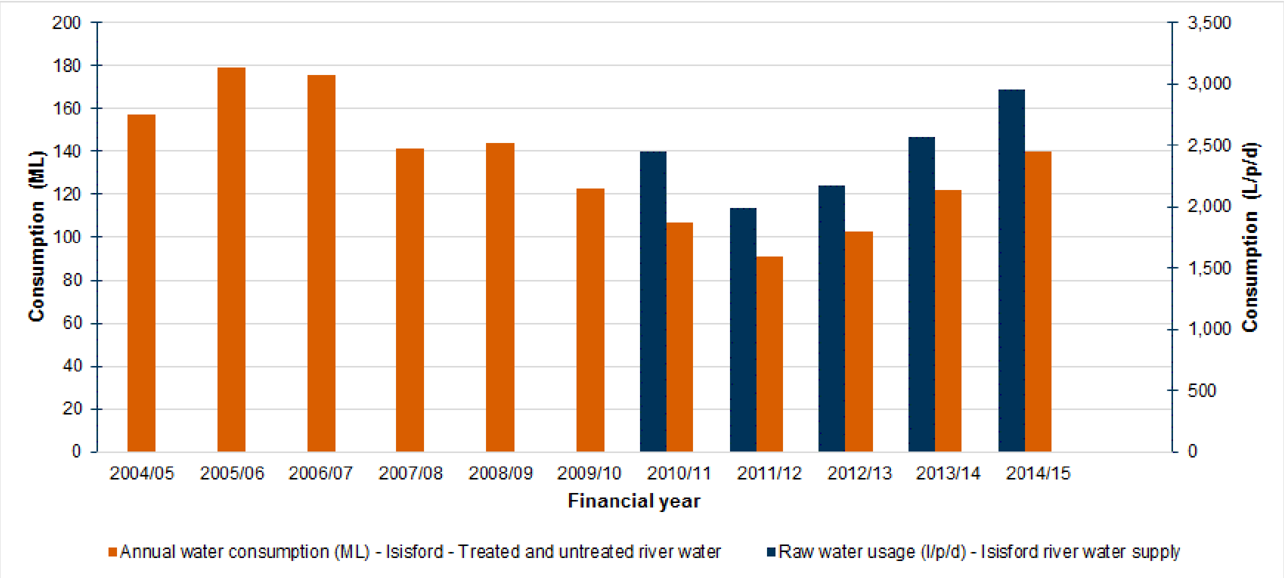

Figure 5-4 Total annual water consumption and annual per capita water consumption in Isisford

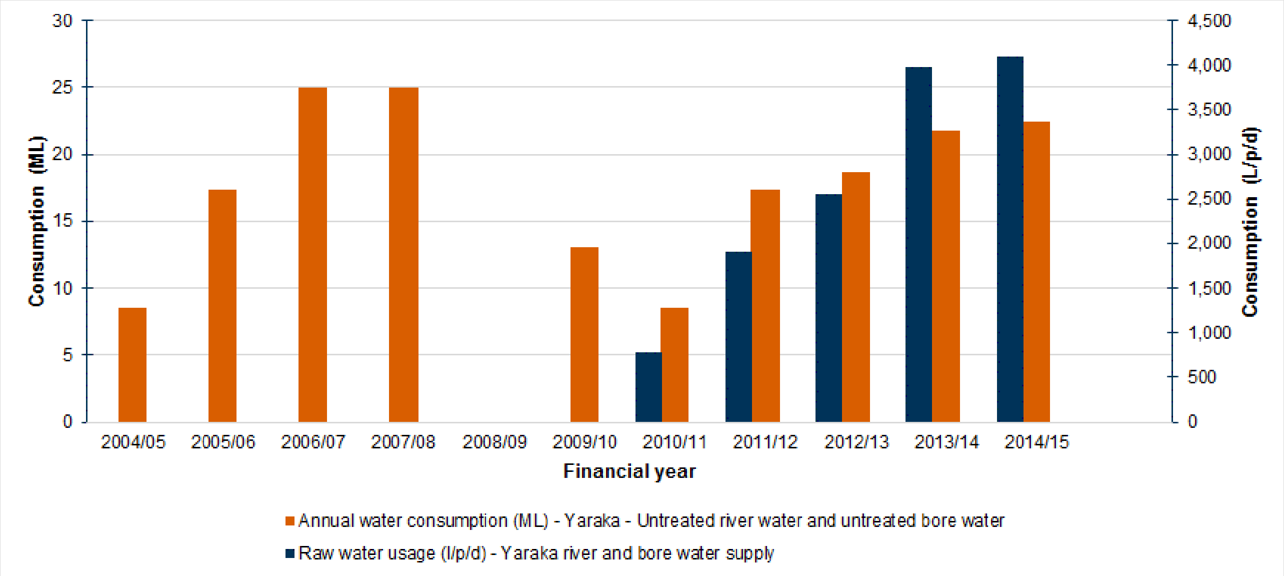

Figure 5-5 Total annual water consumption and annual per capita water consumption in Yaraka

5.2 Understanding consumption

Figure 5-6 compares per capita consumption in Longreach with other regional centres in Queensland.

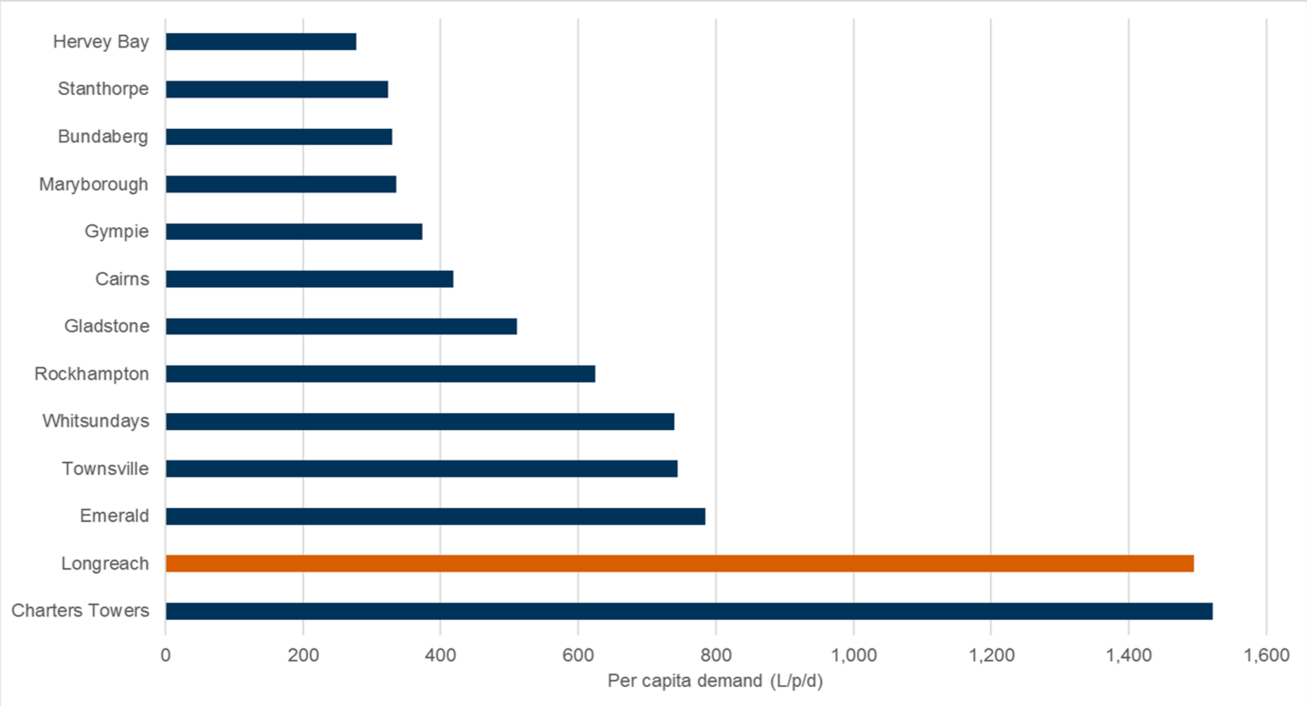

Figure 5-6 Benchmarking of per capita consumption

While per capita consumption data is a useful comparator, demand has many variables not captured by this aggregate data. These include:

> Climate – towns in higher rainfall climates will generally use lower water per capita than towns in drier climates as there is increased use of water to sustain landscaping and open spaces. Notably, Emerald, Charters Towers and Longreach have the lowest average annual rainfall of the towns benchmarked and also the highest per capital consumption.

> Urban density – more densely settled towns will typically use less water per capita than less densely settled towns as there will typically be less residential garden area and open spaces per person to support.

> Varying impact of other end users – a per capita measure will typically divide total consumption by the population (or number of connections) unless different end users (e.g. residential, commercial, industrial) can be distinguished adequately. Significant non-residential end uses may skew the results. This may be the case for Longreach where commercial premises (particularly for tourism) may impact the results.

> Prevalence of rainwater tanks – the prevalence of rainwater tanks will impact demand and also lead to increased variability from year to year, increasing demand in drier years.

The above discussion highlights that there is benefit in understanding the different end uses for potable water to inform a long term strategy. For water security planning, a distinction can be made between residential use that is ‘indoor’ and use that is ‘outdoor’. Indoor use will typically involve activities that are important for hygiene. Beal and Stewart (2011) undertook an end-use study of residential water consumption for south-east Queensland that determined the water consumed by each residential end use and compared the resulting proportions of total use to the results of similar past studies across Australia. This breakdown comparison is summarised below in Table 5-1.

Table 5-1 Residential water consumption breakdown by end use from various Australian studies

Use	Proportion of total use (%)						
	Gold Coast	Toowoomba	Melbourne	Perth	Auckland	SEQ	Average
Indoor							
Toilet	13.0	12.3	13.0	10.0	19.0	16.5	**14.0**
Shower / bath	37.0	45.2	23.0	16.0	30.0	30.5	**30.3**
Clothes washer	19.0	22.7	19.5	13.0	24.0	21.0	**19.9**
Dish washer	1.0	2.1	1.0	-	1.0	2.0	**1.4**
Taps	17.0	16.8	12.0	7.0	14.0	19.0	**14.3**
Leaks	1.0	0.4	6.0		4.0	6.0	**3.5**
Outdoor							
Irrigation	12.0	0.3	25.0	54.0	8.0	5.0	**17.4**

While end use data is not available for Longreach, it is reasonable to assume that the relatively dry climate will lead to a proportion of water being used for outdoor use at the high end of the cities included in the study, and very likely higher. For the purposes of this initial assessment, we have assumed that 50% of all residential use is for outdoor purposes. We have conducted analysis of usage data for Longreach to identify residential, commercial and open space end uses. Based on this analysis and the assumption of 50% of residential use being for outdoor purposes, the simple water balance shown in Figure 5-7 has been developed.

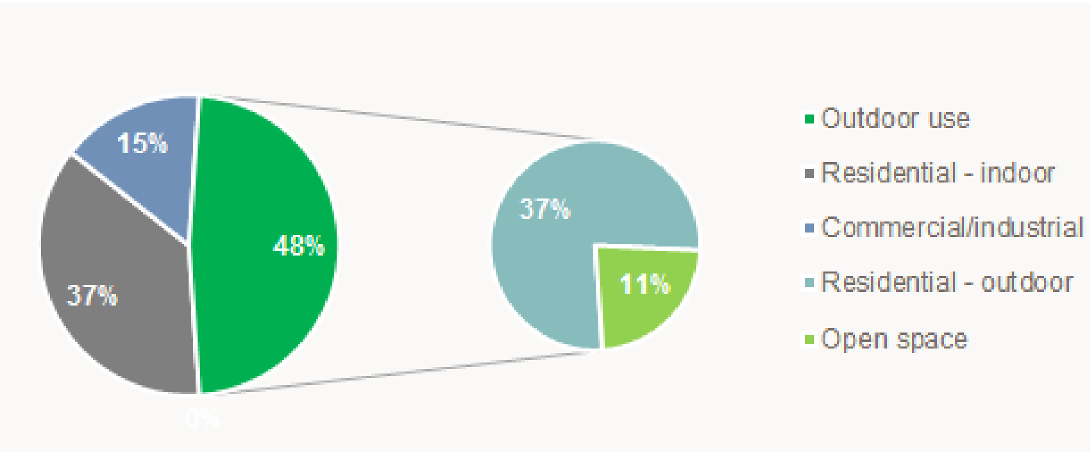

Figure 5-7 Assumed breakdown of water use in Longreach

This is a high level analysis that may guide decision making by identifying the relevant significance of each end use.

5.3 Future demand

As part of its 2010 and 2015 *Water Conservation and Drought Management Plans* (WC&DMP), Longreach Regional Council produced 20-year demand projections for each of its water supply schemes at five-year intervals. These projections are replicated in Table 5-2.

Table 5-2 20-year water demand projections by scheme in the Longreach LGA

Scheme name	Water demand (ML/yr): 2010 WC&DMP					Water demand (ML/yr): 2015 WC&DMP				
	Current (2010)	5 years (2015)	10 years (2020)	15 years (2025)	20 years (2030)	Current (2014)	5 years (2019)	10 years (2024)	15 years (2029)	20 years (2034)
Longreach river water	1,862	1,814	1,860	1,907	1,955	2,015	2,065	2,116	2,166	2,217
Longreach bore water	104	202	207	212	217	0.02	0.02	0.02	0.02	0.02
Ilfracombe river water	132	135	139	142	146	125	128	131	134	138
Ilfracombe bore water	*	*	*	*	*	0.05	0.05	0.05	0.05	0.05
Isisford river water	138	138	138	138	138	122	122	122	122	122
Yaraka river water	25^	25^	25^	25^	25^	25	25	25	25	25
Yaraka bore water	-	-	-	-	-	7.5	7.5	7.5	7.5	7.5

Notes:
* Not metered
^ Includes bore water

When comparing the water demand forecasted in the 2010 *Water Conservation and Drought Management Plan* with the demand forecasted in the 2015 version of the same document, it is evident that demand was underestimated for Longreach in the 2010 plan. This underestimation is underlined by the “Target Water Consumption to be achieved by 2012” that was set in the 2010 plan (1,250 L/p/d), which has since been exceeded in all financial years.

Although there are opportunities to reduce demand through physical means (e.g. water-saving devices), some of the factors potentially contributing to past underestimation of demand are unavoidable or related to the community uptake of water restrictions. As examples, two of the annual rainfall totals observed since the preparation of the 2010 plan (those for 2013/14 and 2014/15) are the lowest in 10 years, and the implementation of Level 1 and 2 water restrictions has been shown by George Bourne & Associates (2015) to be ineffectual in reducing Longreach’s water demand. This highlights the need for water security planning for Longreach and the other centres to account for the variability in demand resulting from varying rainfall from year to year.

Population projections are available from the Queensland Government Statistician’s Office[17], which uses data from the Australian Bureau of Statistics *Regional population growth, Australia, 2013-14* catalogue (catalogue number 3218.0). Although these projections are only available at the LGA level/statistical area level 2 (i.e., for our purposes, the entirety of Longreach), projections are offered for three growth scenarios – low, medium and high. These projections are summarised in Table 5-3.

[17] Queensland Government Statistician’s Office 2015, *Projected population, by local government area, Queensland, 2011 to 2036*

Table 5-3 Population projections for Longreach

Scenario	Population						Growth					
	2011	2016	2021	2026	2031	2036	2011	2016	2021	2026	2031	2036
Low	4,296	4,160	3,965	3,798	3,635	3,480	-0.6%	-0.9%	-0.8%	-0.9%	-0.9%	-0.8%
Medium	4,296	4,173	4,056	3,953	3,853	3,762	-0.6%	-0.6%	-0.5%	-0.5%	-0.5%	-0.5%
High	4,296	4,187	4,149	4,112	4,080	4,059	-0.5%	-0.2%	-0.2%	-0.2%	-0.1%	-0.2%
Average	**4,296**	**4,173**	**4,057**	**3,954**	**3,856**	**3,767**	**-0.6%**	**-0.6%**	**-0.5%**	**-0.5%**	**-0.5%**	**-0.5%**

Despite the population "baseline"[18] being similar in both projections, the Queensland Government Statistician's Office assumes negative population growth across Longreach, while the Drought Management Plan assumes a small growth in demand over the forecast period.

5.4 Possible future demand for meat processing

In 2012, the Department of Agriculture, Fisheries and Forestry published a study of potential abattoir locations across northern outback Queensland. Among other outback towns, this study evaluated the commercial viability of locating an abattoir in Longreach. The study assumed a throughput of between 400 and 800 cattle head/day and a water usage of 2.22 kL/head/day. For the high-level purposes of this strategy, we have made the assumptions detailed in Table 5-4 in order to derive the demand for two (medium and high throughput) abattoir scenarios.

Table 5-4 Assumptions and total annual water consumption for medium- and high-throughput abattoir scenarios

Parameter	Medium scenario	High scenario
Daily throughput (head/day)	500	1,000
Daily water usage (kL/head/day)	2	2
Operating days/week	7	7
Operating weeks/year	50	50
Total annual water consumption	**350 ML/year**	**700 ML/year**

The preceding demand forecasts for a potential abattoir when considered alongside the existing demand for water in Longreach (2,015 ML) suggests that a development of this scale could not be supplied through Longreach Regional Council's existing licence allowance of 2,200ML/year. Water could be accessed through another source such as a purchase of the licence held by another party.

5.5 Demand and existing entitlements

The nominal entitlements held by Longreach Regional Council for each town are set out in Section 4. Figure 5-8 compares current demand (2014) and that projected for 2034 with the nominal entitlement for Longreach, Ilfracombe and Isisford. There is no nominal entitlement defined within the Cooper Creek Resource Operation Plan for Yaraka. DNRM advised during consultation that this would likely be considered a deemed use under the planning framework. We recommend that Longreach Regional Council confirms this formally with DNRM. The comparison of demand and nominal entitlement shows that:

> Ilfracombe's current demand is much less than its existing nominal entitlement and this is forecast to still be the case in 2034

> The demand for Longreach in 2014 is 90% of the nominal entitlement meaning that there is little headroom under the existing nominal entitlement. The Drought Management Plan demand forecasts suggest that demand may exceed the nominal entitlement in the long term

[18] The baseline is interpreted as the population as at the 2015 *Water Conservation and Drought Management Plan*, and the 2016 population according to the Queensland Government Statistician's Office

> Current and forecast demand in Isisford exceeds the nominal entitlement by around 20%.

We recommend that Longreach Regional Council investigates and confirms current usage in Isisford and sources. It is possible that the current demand includes groundwater. If surface water usage is found to typically exceed 100ML/year or be close to this figure, Council should consult with DNRM regarding appropriate regulatory mechanisms to align demand and entitlement. The discussions should also extend to Longreach given that demand is near the nominal entitlement.

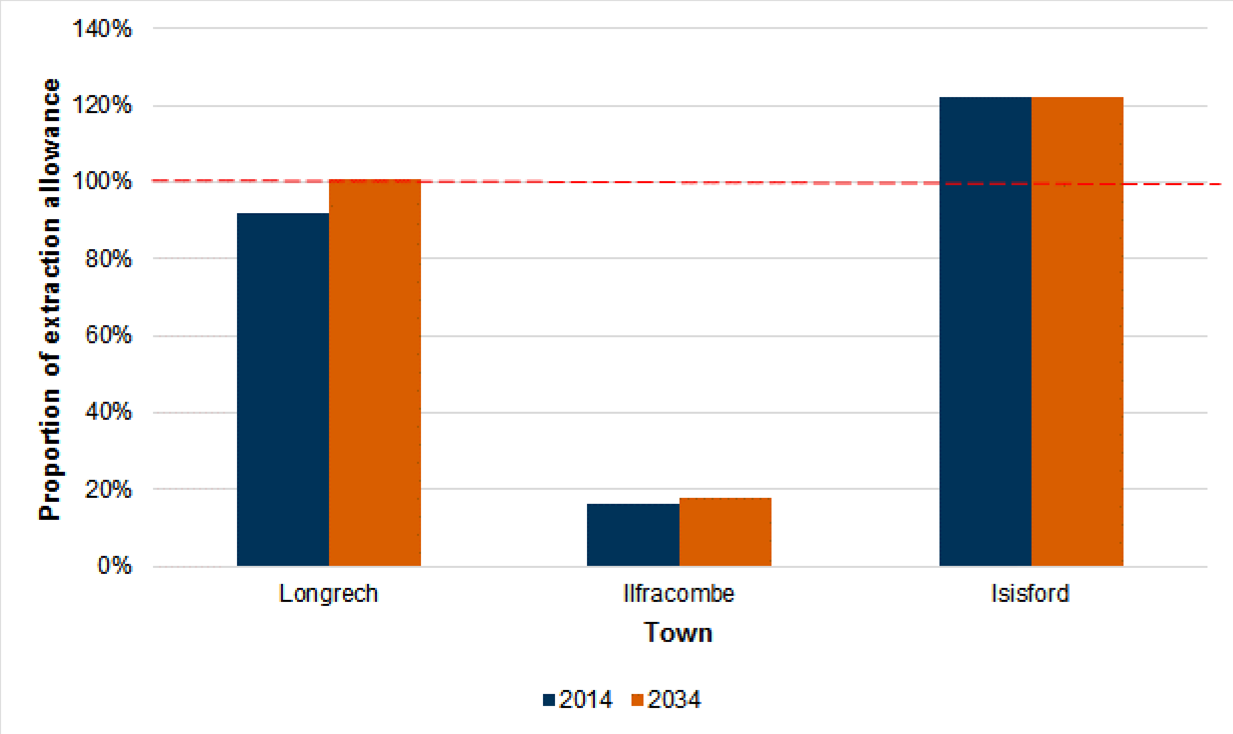

Figure 5-8 Comparison of demand and nominal entitlement

6 Level of service for water security

6.1 Overview[19]

Water security level of service objectives set out the long-term water supply security for a community. Level of service objectives commonly include statements about:

> how much water the water supply system will typically be able to supply

> how often and for how long water restrictions might occur

> the possibility of needing an emergency water supply due to a prolonged drought.

The Level of service approach helps make sure that the 'bucket of water' available for treatment and distribution is big enough to supply the community's water needs into the future. Level of service objectives provide a basis for water supply security planning, helping to balance the need for water with the cost of supplying it. Outside of South-East Queensland, local councils and water service providers are encouraged by the State Government to develop their own level of service objectives. Level of service objectives are usually developed on a town/community basis. This is so the objectives are relevant to the local water supply, conditions and community values.

6.2 Water Services Association of Australia – Occasional Papers Number 14 (2005) and 29 (2014)

In 2005, Erlanger and Neal published an occasional paper through the Water Services Association of Australia (WSAA) that outlined a framework for urban water resource planning. In this paper, three main components of a water utility's primary objective were established, namely:

1. Adequate supply over most periods in the long-term
2. During drought periods, short-term protection against the unavailability of water through the preparation of a drought response plan and implementation of water restrictions
3. In cases of extreme drought, meeting a community's basic water needs through the preparation and implementation of a contingency or emergency plan.

The approach for determining the desirable level of service objectives is to firstly determine the current level of service through the development of a water resources model running at the current level of demand, and secondly identify the qualitative and quantitative consequences of restriction and shortfalls. With current levels of service and consequences of adopting a particular level of service objectives understood, the desired level of service objectives can then be determined.

The 2005 WSAA paper advises the daily amount of water needed by each person can be based on either:

> the minimum amount required to sustain life and hygiene – (60 L/p/day), or

> the minimum amount that can be supplied with no outdoor use – (120 – 130 L/p/day)

How much water is reliably supplied above 130 L/p/day should depend upon what the community is willing to pay. The minimum supply required for non-residential use (public, commercial and industrial) depends upon the ability and desirability to restrict or close down these uses as and when required.

In 2014, WSAA published an additional occasional paper with the intent of updating the earlier 2005 WSAA paper. The overarching framework described in this paper is built on the same underlying principles as those used in the 2005 WSAA paper, but places further emphasis on the integration of water resource planning with land use planning and community and stakeholder engagement. This is highlighted through the summary diagram produced by WSAA and reproduced in Figure 6-1 below.

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[19] This discussion is adapted from the Department of Energy and Water Supply, see: https://www.dews.qld.gov.au/water/supply/security/los

Figure 6-1 Summary diagram for the "Broaden Organisational Vision" phase of the framework
Source: WSAA 2014

Longreach Regional Council's existing restriction arrangements have not been determined in consultation with the community.

6.3 Restriction arrangements for Longreach Regional Council

While water security levels of service have not been directly prescribed in the Drought Management Plan, the plan does specify restrictions trigger levels for each of the major towns in the Longreach LGA, along with the restriction details (e.g. times when sprinkler usage is allowed), target town consumption (L/p/day) and remaining months of water supply at each of these trigger levels. Table 6-1 details the restrictions trigger levels, target town consumptions and remaining months of water supply for each of the major towns in the Longreach LGA.

Table 6-1 Restriction trigger levels for each major town in the Longreach LGA[20]

Restriction level	Longreach		Ilfracombe		Isisford		Yaraka	
	Target town consumption	Remaining months (with restriction levels)	Target town consumption	Remaining months (with restriction levels)	Target town consumption	Remaining months (with restriction levels)	Target town consumption	Remaining months (with restriction levels)
1: Water conservation	4.9 ML/day 1.310 L/p/day	20	0.31ML/day (2015) 1,395 L/p/day	22	0.30 ML/day 2,314 L/p/day (2015)	22	54.2 kL/day 3,616 L/p/day	21

[20] Appendix E of the Drought Management Plan

Restriction level	Longreach Target town consumption (2015)	Longreach Remaining months (with restriction levels)	Ilfracombe Target town consumption (2015)	Ilfracombe Remaining months (with restriction levels)	Isisford Target town consumption	Isisford Remaining months (with restriction levels)	Yaraka Target town consumption (2015)	Yaraka Remaining months (with restriction levels)
2: Demand management	4.3 ML/day 1,133 L/p/day	14	0.26ML/day 1,196 L/p/day	8	0.24 ML/day 1,886 L/p/day	15	43kL/day 2,862 L/p/day	8
3: Demand management	3.6 ML/day 955 L/p/day	11	0.22ML/day 997 L/p/day	5	0.19 ML/day 1,457 L/p/day	11	31.6kL/day 2,108 L/p/day	6
4: Drought management	3.0 ML/day 778 L/p/day	9	0.18ML/day 799 L/p/day	1	0.13 ML/day 1,028 L/p/day	7	20.3kL/day 1,354 L/p/day	1
5: Critical water supply	2.3 ML/day 600 L/p/day	5	0.13ML/day 600 L/p/day	0	0.08ML/day 600 L/p/day	3	9.0kL/day 600 L/p/day	0

6.4 Levels of service in other jurisdictions

As an example, the water security levels of service used in South-East Queensland, Cairns and Townsville are outlined in Table 6-2, Table 6-3 and Table 6-4.

Table 6-2 Water security levels of service in South-East Queensland[21]

Category	Sub-category	Level of service
Water restrictions	Frequency	▪ Medium-level water restrictions on <u>residential water use</u> will not happen > <u>once every 10 years on average</u> ▪ Medium-level water restrictions on <u>non-residential water use</u> that is incidental to the purpose of a business will not happen > <u>once every 10 years on average</u>
	Severity	▪ Medium-level water restrictions on <u>residential water use</u> will not restrict the average water use for the South-East Queensland region to < <u>140 L/p/day</u>
	Duration	▪ Medium level water restrictions on residential and non-residential water use are expected to last no longer than one year on average
Water supply	Frequency	▪ Baroon Pocket Dam, Hinze Dam and Wivenhoe Dam will not reach its minimum operating level <u>> once in every 10,000 years on average</u>
	Magnitude	▪ The bulk water supply system will be able to supply the essential minimum supply volume (<u>100 L/p/day for residential and non-residential use</u>)

Table 6-3 Water security (restrictions) levels of service in Cairns[22]

Severity		Target frequency	Estimated frequency under LoS yield of 26,000 ML/annum
Level 1 (80% storage)	10% use reduction	1.5-year ARI	1.5-year ARI
Level 2 (70% storage)	15% use reduction	5-year ARI	5-year ARI
Level 3	20% use	10-year ARI	40-year ARI

[21] Sections 80 and 81 of the Water Regulation 2016
[22] Table 3 (p. 17) of Cairns Regional Council's *Water Security Strategy – Final Report* (March 2015): http://www.cairns.qld.gov.au/__data/assets/pdf_file/0019/133552/Separate-Attachment_Clause-No-3_Water-Security-Strategy.pdf

Severity		Target frequency	Estimated frequency under LoS yield of 26,000 ML/annum
(60% storage)	**reduction**		
Level 4 (50% storage)	**25% use reduction**	25-year ARI	110-year ARI
Emergency (40% storage)	**Planned response**	100-year ARI	300-year ARI
Supply storage (dead storage)	**Supply shortfall**	>1000-year ARI (no simulated events)	>1000-year ARI (no simulated events)

Table 6-4 Water security (restrictions) levels of service in Townsville[23]

Sub-category	Level of service
Frequency based on severity	▪ Level 3 restrictions are not to occur > 1 in 10 year time period ▪ Level 4 restrictions are not to occur > 1 in 25 year time period
Duration	▪ Level 3 restrictions are to occur for a duration of < 2 months ▪ Level 4 restrictions are to occur for a duration of < 4 months

6.5 Benefits and costs of water restrictions

As mentioned in Section 6.3, Longreach Regional Council's water restrictions are set out in its Drought Management Plan. However, the benefits and costs of water restrictions are not evaluated beyond security-of-supply calculations (e.g. estimated remaining months of water supply with restrictions enforced). The Productivity Commission's 2011 *Inquiry Report into Australia's Urban Water Sector*[24] provides insight into the relative merits of water restrictions. This inquiry found that water restrictions have the following benefits:

> Restrictions are effective in reducing the demand for water

> Restrictions are valued by the community (e.g. instil a sense of solidarity)

> Restrictions are argued by some to be good for the environment. However, the Commission's report suggests that environmental objectives are best pursued directly, outside of the urban water sector.

The costs of water restrictions identify by the Productivity Commission are summarised in Table 6-5.

Table 6-5 Costs of water restrictions by user category

Households (outdoor water use)	Businesses	Community	Government
▪ Time and inconvenience costs associated with restricted garden watering ▪ Loss of amenity ▪ Private property damage from dry soil causing cracking and movement of houses ▪ Loss of real estate value ▪ 'Over watering' of gardens during the allowable watering times to compensate for restricted times of use	▪ Increase in production costs for intense water users as alternative sources are sought ▪ Reduction in sales for retailers of water-intensive products	▪ Reduced welfare associated with loss of amenity ▪ Increased health issues associated with loss of amenity ▪ Negative environmental impacts ▪ Building and infrastructure damage associated with dry soil	▪ Cost of advertising campaigns ▪ Cost of monitoring and enforcement

[23] Executive Summary (p. 17) of Townsville City Council's *Integrated Water Supply Strategy* (2012): https://www.townsville.qld.gov.au/__data/assets/pdf_file/0026/26288/IWSSExecSummary.pdf
[24] http://www.pc.gov.au/inquiries/completed/urban-water/report/urban-water-volume1.pdf

Households (outdoor water use)	Businesses	Community	Government
▪ Confusion over the complexity of restricted garden watering arrangements ▪ Costs associated with purchasing and installing new watering systems as changes occur in allowed methods of watering ▪ Sacrifice of water-based relaxation activities			

The predominance of water usage in the four towns for residential use and open spaces highlights the costs to the community incurred through water restrictions. Table 6-6 outlines the constraints imposed by Council on residential water uses at each restriction level.

Table 6-6 Details of each restriction level in the Longreach LGA

Level 1: Water conservation	▪ No limitations on manual watering devices and internal water uses ▪ Use of automatic watering devices is limited to specific times ▪ New turf is to be maintained as per supplier's recommendations ▪ Topping-up of swimming pools, spas and water features is allowed ▪ High-pressure cleaners may be used for external building cleaning ▪ Hoses with trigger nozzles may be used for construction activities
Level 2: Demand management	▪ As per Level 1 with the following exceptions: – Use of automatic watering devices is limited to shorter durations – Approval is required for new turf maintenance
Level 3: Demand management	▪ As per Level 2 with the following exceptions: – Use of manual watering devices is limited to specific times – Further limitations are imposed on the use of automatic watering devices – Emptying / filling and topping-up of swimming pools, spas and water features is banned – Only buckets may be used for washing
Level 4: Drought management	▪ All uses are banned with the following exceptions: – Only buckets may be used for washing. Buckets/watering cans may only be used at specific times – Evaporative air conditioners may only be used while the building is occupied – Only windows of buildings may be cleaned
Level 5: Critical water supply	▪ All uses are banned with the following exceptions: – Only mirrors and windscreens may be cleaned (buckets only) – No external building cleaning – Council approval is required for construction activities

6.6 Observations and recommendations regarding level of service

This section has sought to compare Longreach Regional Council's current approach to providing water security to industry best practice. The following observations can be drawn:

1. Longreach Regional Council does not have a stated level of service for water security. The water restrictions include elements of what would be expected to be included within a water security level

of service (as set out in WSAA Occasional Paper No. 14). However, the following elements are missing:

   a. Allowance for an adequate supply over most periods
   b. Stated minimum supply during extreme drought (emergency response)

2. The existing restrictions have not been determined in consultation with the community and with regard to the community's willingness and ability to pay for the costs of increased water security.
3. The critical water supply target level (600L/p/day) is well above the minimum requirements for emergency situations (e.g. up to 130L/p/day cited in WSAA Occasional Paper No. 14 and the 100L/p/day essential minimum the south east Queensland level of service. However, this figure also captures the large proportion of outdoor use by Council and is not necessarily directly comparable to these benchmarks. Nevertheless, a lower minimum supply volume for emergency situations agreed with the community may enable the triggers for prior restriction levels to be eased.
4. Level 1 water restrictions are always in place. In practice, Level 1 water restrictions only limit the times at which automatic sprinklers can be used. There is a conflict in the message of restrictions always being in place and Council's aim to promote liveability.
5. The current restrictions levels are linked to estimates of the time that supply can be sustained for at the target consumption level. However, there is currently no consideration of the probability that restriction levels will be in force given estimated consumption and the reliability of existing supply sources. Including anticipated frequency and duration that restrictions levels will be in place within stated levels of service may provide more certainty to some water users (particularly businesses) for decision making relating to their water use.

Considering the preceding observations, it is recommended that Longreach Regional Council develop a water security level of service that:

1. Is developed in consultation with the community
2. Outlines an expectation of what adequate supply will be in most years
3. Includes a stated minimum supply to be provided in extreme drought
4. Considers whether the permanent Level 1 water restrictions are valued by the community or perceived as in conflict with promoting liveability in the towns
5. Sets out the expected frequency and duration of restriction levels (at least for Longreach)

Level of service objectives should be developed separately for each town given the different supply options, end uses and possible community preferences in each town. However, for the smaller towns there will likely be benefit in a simpler statement of the level of service objectives.

7 Stakeholder consultation

Consultation was undertaken with Longreach Regional Council staff and external stakeholders from 15 May 2017 to 17 May 2017. Notes from the stakeholder consultation meetings are summarised in Table 7-1.

Table 7-1 Notes from stakeholder consultation

	Longreach	Ilfracombe	Isisford	Yaraka
Existing supplies	▪ Longreach town weirs (3 No.) on the Thomson River (3,300ML) ▪ Groundwater bore (saline)	▪ Murray-McMillan Dam (381ML) receives flows diverted from Collumpton Creek. This is the major storage ▪ Murray-McMillan Dam filled by gravity diversion, a large flood harvesting pump (China pump) (900L/s) and small diameter pump to take remaining flows out of the Bywash ▪ Shannon Dam has small local catchment but primarily used as an operational storage. Flows pumped here daily from Murray-McMillan Dam before going to water treatment plant. Shannon Dam provides settling and balancing for operational purposes. ▪ Groundwater bore – saline. Able to be taken into treatment plant but this doesn't remove salt (Note Council currently has funding to refurbish bore and is undertaking a study looking at the potential for geothermal power from the bore)	▪ Series of weirs on the Barcoo River – Isisford Town Weir (Big Weir) and Oma Waterhole ▪ Oma waterhole no longer used, transfer main from there to town now decommissioned ▪ Pump harvests flows from Barcoo River and pumps water into storage. ▪ Provide both potable and untreated/raw water to houses. Raw water only able to be used for outside use ▪ Groundwater bore now decommissioned. Poor quality	▪ Surface water: earth dams with 94ML, capacity, WTP and 25kL storage ▪ Groundwater: 0.63L/s and 45kL storage. Saline ▪ Bore water is supplied to a trough in the cattle yard. Dual reticulation also to houses
Demand and performance	▪ Bore water had 872 reticulated connections. This reticulation network has now been decommissioned due to cost to renew/refurbish. Only used for Council construction	▪ Shannon Dam has a leak above 14m, therefore keeping at 12m. Under current operational mode where this is used for operational balancing, this is not critical ▪ Opportunity for operational	▪ No records of having run out of water in the past. Reliability increased because of multiple catchments contributing to Thornleigh Creek and Barcoo River	▪ Demand is typically 3-4kL per day. But can be up to 11kL/day when caravans are in town ▪ Rainfall anecdotally less reliable. Smaller rainfall events with less runoff

	Longreach	Ilfracombe	Isisford	Yaraka
	▪ Council has two working bore water systems. One decommissioned at the power house. Show ground has one and still operational. Second working bore is on top of the hill. ▪ Discussion on lack of groundwater in region due to local geology / geomorphology. Low volumes and saline. DNRM previously only allowed bores to abstract from the Hutton Sandstone ▪ Greater volumes and better quality water available further east ~60km across fault line. E.g. Barcaldine has a high quality supply ▪ Very high evaporation (3.5m). Could evaporation be reduced? ▪ Need to also consider what water demand is and should be. Are we using too much or can we be more efficient?	improvements for reticulation network ▪ Very dry a few years ago. Manually pumping water out of bottom of dam ▪ Non-return valve broken at Murray-McMillan Dam. Waiting for water level to get lower to access better. This needs to be fixed to allow full storage volume to be used	▪ Water only harvested when water flowing over weir. Note that ROP appears to have no limitations on when water can be harvested ▪ Big weir built in the 1930s. Nearing the end of its useful life ▪ Decommission Oma waterhole if no longer needed? But still used for recreation.	▪ Lowest level in dams was 1m left. Would then cart water ▪ Surface water treatment plant performs well ▪ Groundwater does have some discolouration and sulphur. Causes corrosion of fittings. ▪ Kiama Creek flows more reliably than creek on which existing storages are on
Potential future options	▪ Groundwater transfer from east (e.g. Glen Arris) (via Ilfracombe) ▪ Raise the height of the weirs ▪ Off-stream storage – depending on topography. Alternatively, an artificial aquifer could be considered. ▪ Temporary or permanent desalination of groundwater ▪ Efficiency and education. Potential for reduced water use by moving to refrigerated air conditioning (but increased power use?) ▪ Recycled water from sewage treatment plant	▪ Additional surface water storage adjacent to existing storages to increase harvest from Collumpton Creek ▪ Temporary or permanent desalination of groundwater ▪ Covers ▪ Transfer water from Gin Creek (10-12km away). A feasibility study on this was previously completed (?) ▪ Groundwater transfer from east (Glen Arris)	▪ Covers to dam previously investigated ($1.7M capex) but funding not approved. Should be considered again. ▪ Additional off-stream storage to provide greater capacity. Depression adjacent to existing dams could be used.	▪ Desilting of dams (operational) ▪ Covers for dams to reduce evaporation ▪ Dam/storage in different location to capture flows in Kiama Creek ▪ Diversion from Kiama Creek into existing storages ▪ Desalination of saline groundwater (permanent or temporary for drought conditions)

8 Supply options identified

Table 8-1 identifies and evaluates potential future supply options for Longreach Regional Council. This options have been identified in past reports as well as through stakeholder consultation.

Table 8-1 Supply options identified

Township	Category	Option	Description	Outcomes/ Benefits achieved	Infrastructure requirements	Non-infrastructure requirements	Stakeholders affected	Timeframe	Scalability	Potential adverse impacts
All	All	Water use efficiency	Network and residential end use water efficiency measures including, leakage reduction, efficient appliances and refrigerated air conditioning	Reduced demand on existing supplies	▪ Varying depending on options but typically end user measures ▪ Leakage reduction may involve new or renewed mains	▪ Educational and marketing material and strategies	▪ End users	▪ Immediate to medium term	▪ Scalable based on end uses	▪ For refrigerated air conditioning, increased power consumption
Longreach	Surface water	Raise the level of the town weir(s)	Increase the level of one or more of the town weirs to increase the amount of water stored. *Note – constructing a storage on the Thomson River is not permissible under the Regional Planning Interests regulation 2014*	Increased reliability of supply	▪ New or modified weir	▪ Revisit environmental management arrangements caused by higher water levels ▪ Revisit flood management arrangements caused by higher water levels	▪ Cultural and recreational users of the river banks that may now be inundated ▪ Possibly nearby properties for stormwater management	▪ 1-4 years for planning, approval, design and construction	▪ Potential to have an adjustable height weir to vary storage volume	▪ Potentially significant impacts on environmental flows, aquatic ecosystem and riparian habitat

Township	Category	Option	Description	Outcomes/ Benefits achieved	Infrastructure requirements	Non-infrastructure requirements	Stakeholders affected	Timeframe	Scalability	Potential adverse impacts
Longreach	Surface water	Construct a new storage	Construct a new off-stream storage facility (dam) – depending on topography. *Note – constructing an off -stream storage near to the Thomson River is not permissible under the Regional Planning Interests regulation 2014*	Increased yield and reliability of supply	▪ New dam	▪ Storage to be within the limits set out in the Water Plan ▪ Revisit environmental management arrangements caused by higher water levels ▪ Revisit flood management arrangements caused by higher water levels	▪ Cultural and recreational users of the river banks that may now be inundated ▪ Possibly nearby properties for stormwater management	▪ 1-4 years for planning, approval, design and construction	▪ Unallocated water required	▪ Potentially significant impacts on environmental flows, aquatic ecosystem and riparian habitat
Longreach	Surface water	Source water from Gin Creek	Create new in-stream or off-stream storage to harvest water from Gin Creek. Transfer water to Longreach WRP *Note – storage would need to be outside of the defined regional planning interest area. This area is to the north and west of the Longreach town area so there should be no conflict as Gin Creek is to the south*	Increased yield and reliability of supply	▪ Instream storage or off-stream storage ▪ For off-stream storage, require diversion or harvesting pump ▪ Pipeline to water treatment plant (~4km)	▪ Storage to be within the limits set out in the Water Plan ▪ Revisit environmental management arrangements caused by higher water levels ▪ Revisit flood management arrangements caused by higher water levels	▪ Existing water harvesters from Gin Creek ▪ Cultural and recreational users of the river banks that may now be inundated ▪ Possibly nearby properties for stormwater management	▪ 1-4 years for planning, approval, design and construction	▪ Unallocated water required	▪ Potentially significant impacts on environmental flows, aquatic ecosystem and riparian habitat

Township	Category	Option	Description	Outcomes/ Benefits achieved	Infrastructure requirements	Non-infrastructure requirements	Stakeholders affected	Timeframe	Scalability	Potential adverse impacts
Longreach	Recycled water	Use recycled water for potable or non-potable supply	Transfer recycled water from sewage treatment plant	Increased yield and reliability of supply	▪ Further treatment to allowable water quality standard Transfer pipeline ▪ Reticulation for recycled water	▪ Recycled Water Management Plan and management arrangements ▪ Mitigation of any negative perceptions amongst end users of the use of recycled water	▪ End users ▪ General public depending on end use	▪ 1-4 years for planning, approval, design and construction	▪ Scalable to output of sewage treatment plant	▪ End user perceptions
Longreach	Groundwater	Desalination of saline groundwater	Provide permanent or temporary desalination of existing groundwater supply	Increased yield and reliability of potable water (using existing supplies)	▪ Desalination plant ▪ Brine treatment and disposal ▪ Power supply	▪ None specific	▪ None specific	▪ Temporary desalination can be deployed fairly rapidly. ▪ Permanent desalination 1-4 years	▪ Fully scalable depending on desired output	▪ High energy consumptio n leading to high operating costs ▪ Brine needs to be disposed of appropriatel y
Longreach, Ilfracombe	Groundwater	Transfer groundwater from the east (via Ilfracombe)	Construct bore and transfer main to transfer high quality water from a unit of the Great Artesian Basin to the east	Increased yield and reliability of potable water supply	▪ Bore ▪ Transfer pipeline and pump station	▪ None	▪ Landholders along potential pipeline route ▪ Community and road users during construction phase	▪ 1-4 years	▪ Some potential for scalability, e.g. through dual mains and through varying pump operating times	▪ Abstraction needs to be managed through GAB Water Plan rules

Township	Category	Option	Description	Outcomes/ Benefits achieved	Infrastructure requirements	Non-infrastructure requirements	Stakeholders affected	Timeframe	Scalability	Potential adverse impacts
Ilfracombe	Groundwater	Construct a new bore	Construct a new bore to provide an alternative potable water source	Increased yield and reliability of supply	▪ Desalination plant ▪ Brine treatment and disposal ▪ Power supply	▪ None specific	▪ DNRM as groundwater regulator	▪ 1-4 years for planning, approval, design and construction	▪ Fully scalable depending on desired output ▪ Unallocated water required	▪ High energy consumptio n leading to high operating costs ▪ Brine needs to be disposed of appropriatel y
Ilfracombe	Groundwater	Temporarily or permanently desalinate groundwater	Provide permanent or temporary desalination of existing groundwater supply	Increased yield and reliability of potable water (using existing supplies)	▪ Desalination plant ▪ Brine treatment and disposal ▪ Power supply	▪ None specific	▪ None specific	▪ Temporary desalination can be deployed fairly rapidly. ▪ Permanent desalination 1-4 years	▪ Fully scalable depending on desired output	▪ High energy consumptio n leading to high operating costs ▪ Brine needs to be disposed of appropriatel y
Ilfracombe	Surface water	Construct a new storage facility	Increase water harvest from Collumpton Creek by constructing additional surface water storage(s) adjacent to existing storages. Confirm the harvest potential of Collumpton Creek.	Increased yield and reliability of supply	▪ New dam or weir	▪ Revisit environmental management arrangements caused by higher water levels ▪ Revisit flood management arrangements caused by higher water levels	▪ Cultural and recreational users of the river banks that may now be inundated ▪ Possibly nearby properties for stormwater management	▪ 1-4 years for planning, approval, design and construction	▪ Potential to have an adjustable height weir to vary storage volume	▪ Potentially significant impacts on environmen tal flows, aquatic ecosystem and riparian habitat

Township	Category	Option	Description	Outcomes/ Benefits achieved	Infrastructure requirements	Non-infrastructure requirements	Stakeholders affected	Timeframe	Scalability	Potential adverse impacts
Ilfracombe	Surface water	Harvest water from additional water sources	Harvest water from Gin Creek (10-12km away). A feasibility study on this was previously completed (?)	Increased yield and reliability of supply	▪ New dam or weir ▪ Transfer pipeline	▪ Use of unallocated water ▪ Revisit environmental management arrangements caused by higher water levels ▪ Revisit flood management arrangements caused by higher water levels	▪ Existing water harvesters from Gin Creek ▪ Cultural and recreational users of the river banks that may now be inundated ▪ Possibly nearby properties for stormwater management	▪ 1-4 years for planning, approval, design and construction	▪ Unallocated water required ▪ Potential to have an adjustable height weir to vary storage volume	▪ Potentially significant impacts on environmental flows, aquatic ecosystem and riparian habitat
Ilfracombe, Yaraka	Surface water	Explore evaporation reduction devices (e.g. covers) for town dams	Covers for the Shannon Dam and Murray Macmillan Dam	Increased reliability of supply	▪ Evaporation reduction devices (e.g. suspended or floating covers)	▪ Testing required to confirm absence of chemical leakage from covers if floating covers used	▪ Recreational users	▪ Short to medium term	▪ Not recommended for use near dam gates (where covers can become caught by gates)	▪ Reduction in water quality (inhibition of oxygen flow) and resulting decrease in recreational values
Isisford	Surface water	Explore evaporation reduction devices (e.g. covers) for town dams	Covers to dam were previously investigated ($1.7M capex) but funding was not approved. This option could be considered again.	Increased reliability of supply	▪ Evaporation reduction devices (e.g. suspended or floating covers)	▪ Testing required to confirm absence of chemical leakage from covers if floating covers used ▪	▪ Recreational users	▪ Short to medium term	▪ Not recommended for use near dam gates (where covers can become caught by gates)	▪ Reduction in water quality (inhibition of oxygen flow) and resulting decrease in recreational values

Township	Category	Option	Description	Outcomes/ Benefits achieved	Infrastructure requirements	Non-infrastructure requirements	Stakeholders affected	Timeframe	Scalability	Potential adverse impacts
Isisford	Surface water	Construct a new storage facility	Construct additional off-stream storage to provide greater capacity. Depression adjacent to existing dams could be used.	Increased yield and reliability of supply	▪ New dam or weir	▪ Revisit environmental management arrangements caused by higher water levels ▪ Revisit flood management arrangements caused by higher water levels	▪ Cultural and recreational users of the river banks that may now be inundated ▪ Possibly nearby properties for stormwater management	▪ 1-4 years for planning, approval, design and construction	▪ Potential to have an adjustable height weir to vary storage volume	▪ Potentially significant impacts on environmental flows, aquatic ecosystem and riparian habitat
Yaraka	Surface water	New storage or increased capacity of existing storages	Construct additional off-stream storage to provide greater capacity. Depression adjacent to existing dams could be used.	Increased reliability of supply	▪ New or modified dams	▪ Revisit environmental management arrangements caused by higher water levels ▪ Revisit flood management arrangements caused by higher water levels	▪ Cultural and recreational users of the river banks that may now be inundated ▪ Possibly nearby properties for stormwater management	▪ 1-4 years for planning, approval, design and construction	▪ Specific to dam	▪ Potentially significant impacts on environmental flows, aquatic ecosystem and riparian habitat
Yaraka	Surface water	Harvest water from additional water sources	Investigate the possibility of harvesting water from nearby waterways, particularly Kiama Creek	Increased yield and reliability of supply	▪ New dam or weir ▪ Transfer channel or pipeline	▪ Use of unallocated water ▪ Revisit environmental management arrangements caused by higher water levels ▪ Revisit flood management arrangements caused by higher water levels	▪ Cultural and recreational users of the river banks that may now be inundated ▪ Possibly nearby properties for stormwater management	▪ 1-4 years for planning, approval, design and construction	▪ Unallocated water required ▪ Potential to have an adjustable height weir to vary storage volume	▪ Potentially significant impacts on environmental flows, aquatic ecosystem and riparian habitat

Township	Category	Option	Description	Outcomes/ Benefits achieved	Infrastructure requirements	Non-infrastructure requirements	Stakeholders affected	Timeframe	Scalability	Potential adverse impacts
Yaraka	Groundwater	Desalinate saline groundwater (permanently or temporarily for drought conditions)	Provide permanent or temporary desalination of existing groundwater supply	Increased yield and reliability of potable water (using existing supplies)	▪ Desalination plant ▪ Brine treatment and disposal ▪ Power supply	▪ None specific	▪ None specific	▪ Temporary desalination can be deployed fairly rapidly. ▪ Permanent desalination 1-4 years	▪ Fully scalable depending on desired output	▪ High energy consumption leading to high operating costs ▪ Brine needs to be disposed of appropriately

9 Options assessment

9.1 Emergency options v long term supply options

For the purpose of assessing the identified options, distinction is made between options that can provide water in times of emergency (i.e. very low water availability) and options that provide increased yield or reliability for long term supply. This aligns with the distinctions made in the discussion on Level of Service in Section 6 where the Level of Service should identify expected minimum supply in times of extreme drought.

9.2 Assessment of options for emergency supply

Options for emergency supply identified in this report, in the Drought Management Plan and through stakeholder consultation include:

1. Temporary desalination of saline groundwater
2. Tankering of water by road from a nearby town
3. Tankering of water by rail.

The costs of temporary desalination of saline groundwater have been assessed based on current market rates and assuming that a desalination package plant is leased from a supplier for a 12-month period. The costs for temporary desalination assume the following:

> A minimum supply of 200 L per person per day
> 12-month lease period
> There is an existing electricity supply of sufficient capacity
> There are existing interconnections into the potable water distribution network
> Brine is disposed of locally in evaporation ponds. Note that brine from the Dalby reverse osmosis treatment plant is disposed of in this manner
> The existing bores are operational and produce sufficient water to meet the demand. This is an issue for Isisford where the groundwater bore has been decommissioned
> Operating costs include electricity costs and chemicals.

Based on above assumptions, Table 9-1 compares temporary desalination as an emergency supply option for a period of 12 months with the alternative of tankering by road. Costs for tankering by road are based on rates provided by suppliers in western Queensland.

Table 9-1 Assessment of options for emergency supply for a 12 month period

Town	Population	Annual consumption at 200 L/p/d (ML)	Total cost desalination for one year	Total cost of tankering by road	No. of 25 kL tankers per week
Longreach	3,800	277.4	$200 - $300k	$6,000 - 9,000k	213
Ilfracombe	220	16.1	$75 - $150k	$350 - 500k	13
Isisford	130	9.5	$75 - $150k	$218 - 320k	8
Yaraka	15	1.1	$50k	$25-35k	1

The comparison of options demonstrates that under the assumed conditions:

> Temporary desalination is financially favourable for all towns except Yaraka

> Tankering by road to supply Longreach in an emergency situation while being significantly less favourable financially than temporary desalination is also likely to face logistical challenges in there being enough tankers available to supply the required volume[25].

Longreach Regional Council advised that it has previously considered tankering water by rail to supply Longreach in emergency situations. It is recommended that Council document potential arrangements and likely costs for tankering water by rail. This would include consideration of the source of water (potentially Toowoomba), the transport vessels required, filling arrangements and indicative transport costs.

The assumptions made for temporary desalination demonstrate that preparatory work including capital expenditure will be needed to enable this as an emergency supply option. This preparatory work and expenditure may not realise a return on the investment if temporary desalination is not used required or pursued in future. However, this investment would be an insurance policy for emergency situations. We recommend that Council completes a planning study to confirm the technical and financial viability of temporary desalination and the investments needed to enable this as an emergency supply option.

9.3 Initial options filter for long term supply options

Table 9-2 provides an initial filtering of options based on the preceding discussion of constraints relating to regulatory considerations and source availability. The reasons for not progressing options is noted in the discussion column.

Table 9-2 Initial options filter for long term supply options

Town	In-stream or off-stream storage	New groundwater source (low salinity)	Storage covers	Permanent desalination	Discussion
Longreach	✗ (Thomson River) ✓ (Gin Creek)	✓	✗	✓	▪ Cannot construct storage in Channel country strategic environment area ▪ Cover not practical in river due to flood damage and environmental nuisance
Ilfracombe	✓	✓	✓	✓	
Isisford	✗	✗	✓	✗	▪ Cannot construct storage in Channel country strategic environment area ▪ Permanent desalination requires refurbishment of the decommissioned bore or a new bore
Yaraka	✓	✗	✓	✓	

[25] For example, assume that one tanker load requires a six-hour round trip to fill, travel, unload and travel back to source. This means that there is 1,278 hours of effort per week required to deliver 213 No. 25 kL tanker loads. Assume that for safety, tankers only operate 14 hours per day but operate seven days of the week. This makes 98 working hours available in the week and therefore, a minimum of 13 No. 25kL tankers would be required to meet minimum demand.

9.4 Technical assessment of long term supply options

9.4.1 Water harvesting from Gin Creek (Longreach)

Water harvesting from Gin Creek would require construction of an in-stream or off-stream storage at Gin Creek and for an off-stream storage, water harvesting pumps or a diversion. The water would then need to be transferred to the water treatment plant which would include a crossing of the railway line. Preliminary review of land use along Gin Creek suggests that a storage may be located in state reserve land However, some of the state reserve land has been designated as conservation land and would therefore be unlikely to be a suitable site (see Figure 9-1). A pipeline route should be feasible through the town road reserves. The appropriate crossing point for the railway would need to be determined in consultation with Queensland Rail. Further planning for this option needs to consider:

> The potential yield and reliability for water from this option. This requires hydrological modelling of the Gin Creek catchment

> Existing land uses along Gin Creek including State reserves and conservation reserves

> Appropriate sizing of harvesting pumps and the transfer pipeline to match the potential yield and reliability of water sourced from Gin Creek

> Impact of a storage on those stakeholders that currently harvest water from Gin Creek

> The environmental impact of impeding flows in Gin Creek

> Existing water quality and potential sources of pollution into Gin Creek including the cemetery and town wastewater treatment plant.

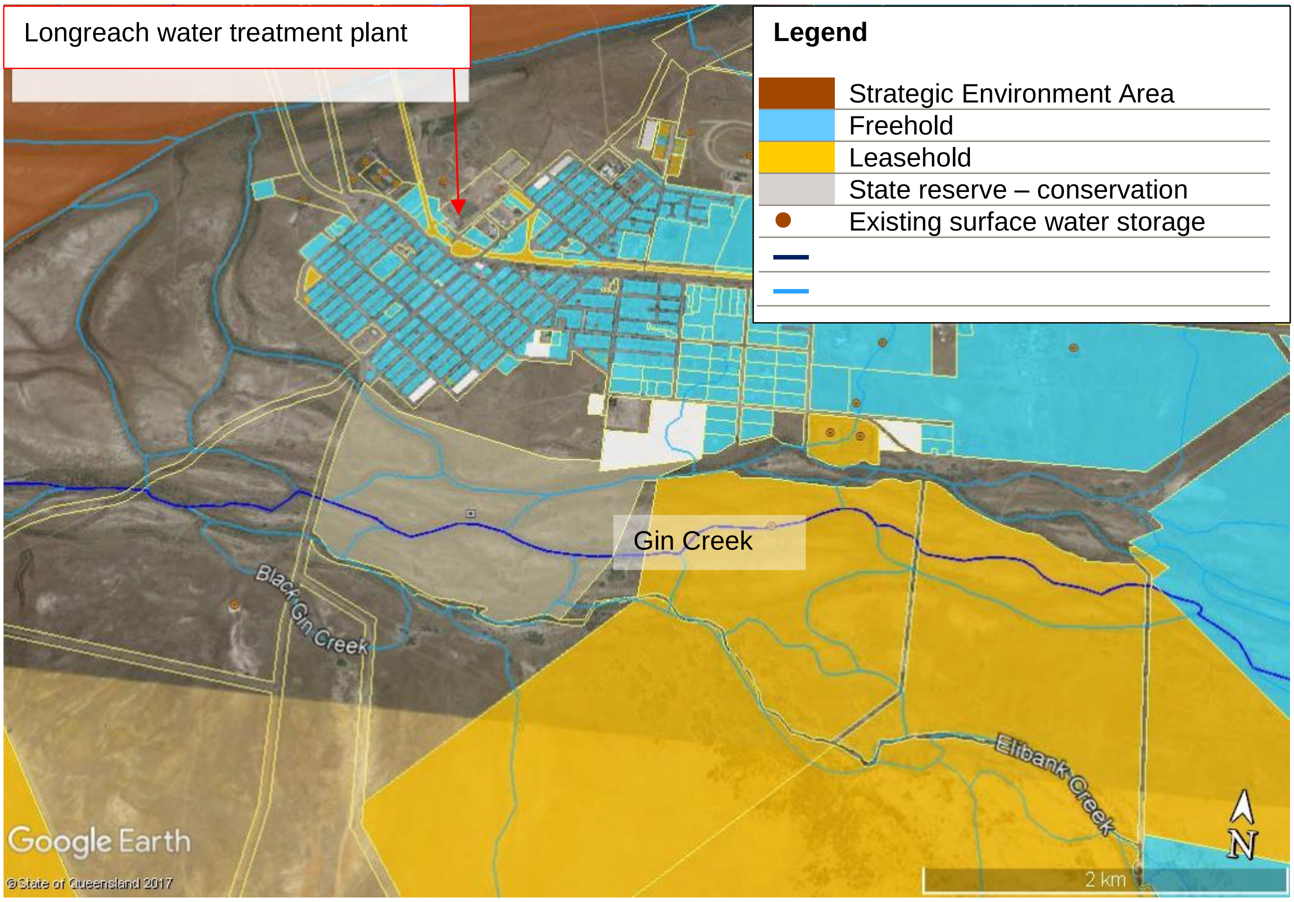

Figure 9-1 Overview of land use surrounding Gin Creek
Source: QGlobe

9.4.2 Pipeline to transfer non-saline groundwater to Longreach and Ilfracombe

Due to the underlying geology, the aquifers below the Longreach area are relatively saline and have lower yield and pressure than aquifers in other areas of the Great Artesian Basin. This is due to the presence of a fault line. To the east of the fault line, water quality and yield improves. This is shown in analysis of borehole data provided by DNRM. Figure 9-2 shows the approximate demarcation between good quality water (as defined by total dissolved solids content being <600mg/L) and poorer quality water.

This good quality groundwater could be transferred to Longreach via Ilfracombe to augment existing supplies for both towns in the long term. Through analysis of DNRM borehole records, a nominal pipeline route has been selected as shown in Figure 9-2. While there is good quality water east of the nominated line, the indicative borehole location is to the north because the monitoring records shown higher flows and standing water levels in this location when compared to the southern area. The pipeline route follows road corridors generally.

For this study, different options for the pipeline have been considered, namely:

> Varying supply volumes (2,000 ML/yr, 1,000 ML/year and 500ML/year)

> Network power supplied or solar power supplied for pumping

> Varying pipe diameters at each supply option – larger pipes having a higher capital cost but lower operating cost due to reduce friction losses.

The options considered are summarised in Table 9-3. A detailed technical assessment of the options is included in Appendix B.

Table 9-3 Summary of pipeline options to transfer groundwater to Longreach and Ilfracombe

Option	Annual supply (ML)	Power source	Infrastructure Details	Capital Cost ($M 2017)			Annual O&M ($M 2017)
				Pipeline	Pump Station	Total	
1A	2,000	Network	Pipeline – DN450/560 Pump – 280 kW	$139	$1.3	$141	$0.77
1B	2,000	Network	Pipeline – DN500/560 Pump – 177 kW	$156	$1.0	$157	$0.63
1C	2,000	Network	Pipeline – DN560 Pump – 114 kW	$167	$0.7	$168	$0.54
1D	2,000	Solar	Pipeline – DN710/800 Pump – 465 kW	$320	$1.8	$322	$0.68
2A	1,000	Network	Pipeline – DN355/450 Pump – 120 kW	$102	$0.8	$103	$0.42
2B	1,000	Network	Pipeline – DN400/450 Pump – 72 kW	$114	$0.6	$114	$0.36
2C	1,000	Network	Pipeline – DN450 Pump – 46 kW	$121	$0.5	$122	$0.33
2D	1,000	Solar	Pipeline – DN500/630 Pump – 322 kW	$173	$1.4	$175	$0.37
3A	500	Network	Pipeline – DN280/355 Pump – 52 kW	$66	$0.5	$67	$0.23
3B	500	Network	Pipeline –	$73	$0.4	$74	$0.21

Option	Annual supply (ML)	Power source	Infrastructure Details	Capital Cost ($M 2017)			Annual O&M ($M 2017)
				Pipeline	Pump Station	Total	
			DN315/355 Pump – 32 kW				
3C	500	Network	Pipeline – DN355/355 Pump – 20 kW	$89	$0.3	$89	$0.22
3D	500	Solar	Pipeline – DN400/500 Pump – 130 kW	$125	$0.8	$126	$0.27

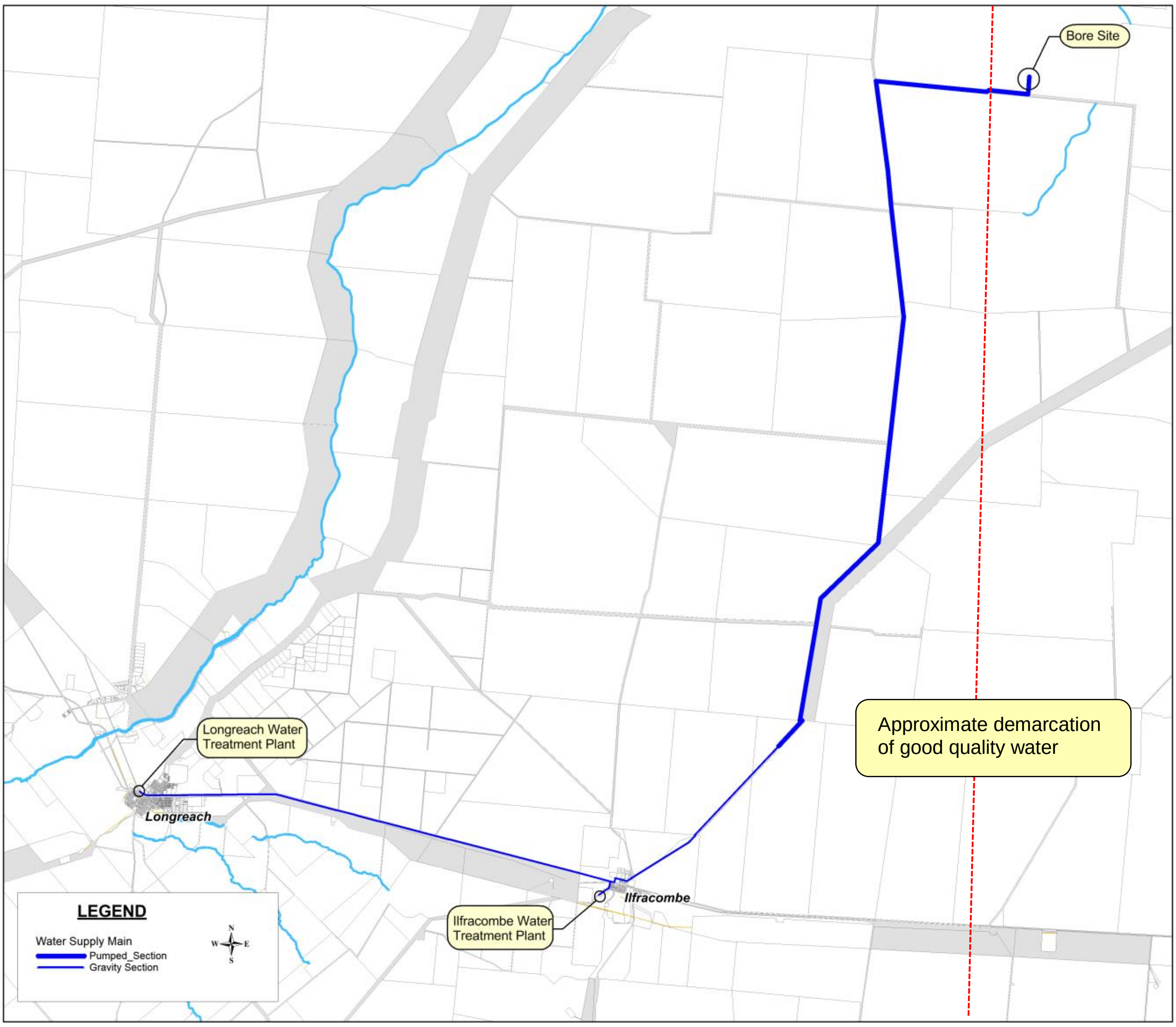

Figure 9-2 Nominal route for pipeline to transfer groundwater to Ilfracombe and Longreach

9.4.3 New storages

New storages may be constructed at Ilfracombe and Yaraka or at Longreach and Isisford if outside of the Strategic Environmental Areas identified in the Regional Planning Interests Act. The volume of the storages need to be within the storage limits for the catchments as identified in the Coopers Creek Water Plan - 1,625 ML within the Thomson-Barcoo sub-catchment and 1,870 ML in the Upper Thomson sub-catchment. The potential yield and reliability of water sourced from new storages would need to be carefully considered through hydrological modelling.

9.4.4 Covers for storages

There is a wide range of suppliers and types of covers available for water storages. We have conducted a literature review supplemented with information from specific suppliers to arrive at the technical and financial parameters for storage covers detailed in Table 9-4. A 'good case' and 'bad case' value for each parameter has been included in the financial analysis. The justification for adoption of the parameter values in detailed in Appendix C.

Table 9-4 Assumed technical and financial parameters for storage covers

Parameter	Good case	Bad case
Efficiency	90%	70%
Construction cost	$20/m^2$	$50/m^2$
Annual maintenance cost	$0.01/m^2$	$0.05/m^2$
Useful life	15 years	10 years

9.4.5 Permanent desalination

The technical parameters for permanent desalination have been provided by an equipment supplier based on the water quality at each town and the size of unit needed to match the groundwater bore production. Capital and operating costs have also been provided. Operating costs included in the financial analysis include an annual allowance for anti-scalant and membrane replacement. The technical parameters are summarised in Table 9-5.

Table 9-5 Technical parameters for permanent desalination

Town	Bore name	Free flow rate (L/s)	Capital cost to purchase	Power consumption (kW)	Energy demand (based on 24 hour/day operation)	Brine produced vol per ML produced
Longreach	Wonga Street Bore (RN 384)	5.10	$312,255	18	432	0.25 -0.30ML
Longreach	Water Treatment Plant Bore (NR 146269)	3.5	$240,300	12	288	0.25 -0.30ML
Ilfracombe	Town Bore (RN 371)	8.5	$432,360	29.5	708	0.3-0.35ML
Yaraka	Town Bore (RN 118167)	0.63	$73,971	2.5	60	0.25 -0.30ML

9.5 Financial assessment of long term supply options

A financial assessment of the water security options for each town is provided in Table 9-6. The financial assessment is based on the following assumptions:

> Capital and operating cost estimates are preliminary only and have a +/- 50% level of confidence

> An allowance of 20% for owner's costs has been assumed. No allowance has been made for land acquisition costs or for environmental approvals other than typical planning and environmental approvals.

> Levelised costs have been calculated over a 50-year period with a real discount rate of 4% per annum

> It is not possible to determine Levelised cost for the surface water options as the yield and reliability of these options have not yet been determined.

> Permanent desalination is assumed to be always reliable. This may be an optimistic assumption as groundwater yield may decline over time. The reliability of the groundwater resources over the long term should be confirmed before permanent desalination is pursued.

> The yield from permanent desalination is based on the yield from the existing bores. Increased yield could be provided through construction of new bores. The Levelised cost for increased yield is likely to be similar or somewhat less than in Table 9-6.

Table 9-6 Financial assessment of long term supply options

	Climate dependent?	Yield and reliability	Capital cost	Annual O&M	Levelised cost
Longreach					
Water harvesting from Gin Creek	Yes	To be determined	$6 M	To be determined	To be determined
New groundwater source (low salinity)	No	2,374 ML/year	$141 M	$0.7 M	$3,254/ML
New groundwater source (low salinity)	No	594 ML/year	$89 M	$0.6 M	$4,325/ML
Permanent desalination	No	239 ML/year	$0.75 M	$0.1 M	$700/ML
Ilfracombe					
New storage	Yes	Yield to be determined Dam capacity 100ML	$8 M	To be determined	To be determined
New groundwater source (low salinity)	Refer Longreach option				
Permanent desalination	No	236 ML/year	$0.70 M	$0.1 M	$600/ML
Storage covers	Partially	200 ML/year	$1.7 – 6M	$2-4k	$700 – 3,000 /ML
Isisford					
Storage covers	Partially	90 ML/year	$0.56 – 1.4M	$0.5 - 1k	$700 – 3,000 /ML
Permanent desalination	Requires abandoned bore to be refurbished first				
Yaraka					
New storage	Yes	To be determined	$2 M	To be determined	To be determined
Storage covers	Partially	70 ML/year	$0.56 – 1.4M	$0.5 - 1k	$700 – 3,000 /ML

	Climate dependent?	Yield and reliability	Capital cost	Annual O&M	Levelised cost
Permanent desalination	No	18 ML/year	$0.15	$0.03	$1,900/ML

This initial assessment shows that:

> Permanent desalination and storage covers have the lowest levelised costs of the options considered

> However, the Levelised cost for storage covers varies widely between the best case and worst case. This demonstrates that this option needs to be robustly procured and appropriate performance guarantees provided by suppliers.

> The potential for a new groundwater water source to the east of Longreach provides the largest yield of water and is likely to be a reliable source. However, it requires significant capital investment and has levelised cost much higher than that for permanent desalination.

10 Conclusions

This report has sought to establish a strategy for securing the urban water security for Longreach, Ilfracombe, Isisford and Yaraka with due consideration of the benefit water provides to the liveability of these communities. The report has considered the existing regulatory framework, current and future demand for water for urban uses, potential levels of service for water security for the communities, options to address both emergency situations and long term demand and the technical and financial feasibility of these options.

The following are the main conclusions drawn from the preceding analysis:

Regulatory framework

In addition to the general provisions for managing surface water and groundwater under the *Water Act 2000,* and its associated instruments, the following are important considerations for planning long term water security in the Longreach local government areas:

1. Under the Cooper Creek Water Plan, any new storages constructed within the Water Plan area must be within the upper limits for storage set out in the Plan, i.e. 1,625 ML within the Thomson-Barcoo sub-catchment and 1,870 ML in the Upper Thomson sub-catchment.
2. The Thomson and Barcoo Rivers and their floodplains are designated strategic environmental areas under the *Regional Planning Interests Regulation*. Consequently, construction of in-stream or off-stream storages for the towns of Longreach and Isisford is not permissible under this legislation.

Demand and existing allocations

Figure 5-1 shows the total annual water consumption in Longreach from 2003/04 to 2014/15 along with total annual rainfall. This figures shows total demand in Longreach varying between 1,500ML/year to just over 2,000 ML per year for the given period with total usage increasing in lower rainfall years. Similar patterns are observable for the other towns although there is some possibly anomalous data for Isisford.

The State Government forecasts flat or declining population for the Longreach local government area while the Drought Management Plan includes an allowance for minor growth in urban demand for water. Water security in Longreach, Ilfracombe, Isisford and Yaraka is therefore better considered with respect to the end uses that water use supports rather than needing to support a growing demand.

Based on an assessment of water use data for Longreach and research papers, the simple water balance shown in Figure 10-1 has been developed.

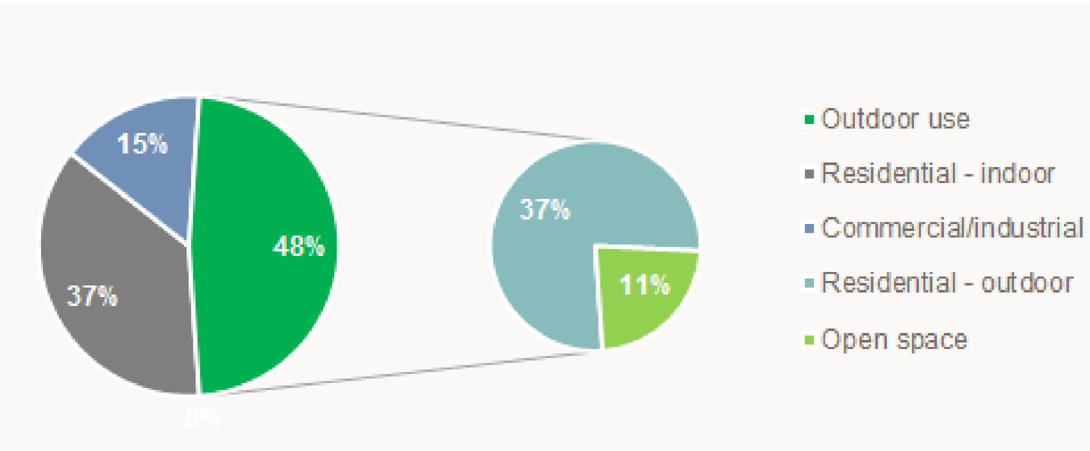

Figure 10-1 Assumed breakdown of water use in Longreach

This figure shows that around half of all water use is for outdoor purposes (residential, showgrounds, sporting fields etc.). This highlights the importance of water to the liveability of Longreach, and by extension, the other towns.

This report has considered the potential increased demand that would result from a large scale commercial or industrial development, in particular, an abattoir. A medium scenario was found to demand around 350ML/year and a high scenario 700 ML/year. These are significant volumes compared with current total use of around 2,000ML/year. A development of this scale could not be supplied through Longreach Regional Council’s existing licence allowance of 2,200ML/year. Water could be accessed through another source such as a purchase of the licence held by another party.

Demand and existing entitlements

Section 5.5 compares the nominal entitlements held by Longreach Regional Council for each town compared with current demand (2014) and that projected for 2034. There is no nominal entitlement defined within the Cooper Creek Resource Operation Plan for Yaraka. DNRM advised during consultation that this would likely be considered a deemed use under the planning framework. The comparison of demand and nominal entitlement shows that:

> Ilfracombe’s current demand is much less than its existing nominal entitlement and this is forecast to still be the case in 2034

> The demand for Longreach in 2014 is 90% of the nominal entitlement meaning that there is little headroom under the existing nominal entitlement. The Drought Management Plan demand forecasts suggest that demand may exceed the nominal entitlement in the long term

> Current and forecast demand in Isisford exceeds the nominal entitlement by around 20%.

Level of service for water security

Water security level of service objectives set out the long-term water supply security for a community. Level of service objectives commonly include statements about:

> how much water the water supply system will typically be able to supply

> how often and for how long water restrictions might occur

> the possibility of needing an emergency water supply due to a prolonged drought.

The Level of service approach helps make sure that the 'bucket of water' available for treatment and distribution is big enough to supply the community's water needs into the future. Level of service objectives provide a basis for water supply security planning, helping to balance the need for water with the cost of supplying it. Outside of South-East Queensland, local councils and water service providers are encouraged by the State Government to develop their own level of service objectives.

Longreach Regional Council does not have a stated level of service for water security for any of its communities. The water restrictions include elements of what would be expected to be included within a water security level of service (as set out in WSAA Occasional Paper No. 14). However, the following elements are missing:

a. Allowance for an adequate supply over most periods

b. Stated minimum supply during extreme drought (emergency response)

Further:

> the existing restrictions have not been determined in consultation with the community and with regard to the community’s willingness and ability to pay for the costs of increased water security.

> The critical water supply target level (600L/p/day) is well above the minimum requirements for emergency situations (e.g. up to 130L/p/day cited in WSAA Occasional Paper No. 14 and the 100L/p/day essential minimum the south east Queensland level of service. However, this figure also captures the large proportion of outdoor use by Council and is not necessarily directly comparable to these benchmarks. Nevertheless, a lower minimum supply volume for emergency situations agreed with the community may enable the triggers for prior restriction levels to be eased.

> Level 1 water restrictions are always in place. In practice, Level 1 water restrictions only limit the times at which automatic sprinklers can be used. There is a conflict in the message of restrictions always being in place and Council’s aim to promote liveability.

> The current restrictions levels are linked to estimates of the time that supply can be sustained for at the target consumption level. However, there is currently no consideration of the probability that restriction levels will be in force given estimated consumption and the reliability of existing supply sources. Including anticipated frequency and duration that restrictions levels will be in place within stated levels of service may provide more certainty to some water users (particularly businesses) for decision making relating to their water use.

Options for emergency supply

The options considered for supply of water in periods of extreme drought were tankering by road and temporary desalination of existing saline groundwater sources. The comparison of options demonstrates that under the assumptions made:

> Temporary desalination is financially favourable for all towns except Yaraka

> Tankering by road to supply Longreach in an emergency situation while being significantly less favourable financially than temporary desalination is also likely to face logistical challenges in there being enough tankers available to supply the required volume.

Longreach Regional Council advised that it has previously considered tanking water by rail as an emergency supply option.

Options for long terms supply

A long list of options for water security for all towns was developed through stakeholder consultation and review of past reports. Table 10-1 provides an initial filtering of options based on regulatory considerations and source availability. The reasons for not progressing options is noted in the discussion column.

Table 10-1 Initial options filter for long term supply options

Town	In-stream or off-stream storage	New groundwater source (low salinity)	Storage covers	Permanent desalination	Discussion
Longreach	✗ (Thomson River) ✓ (Gin Creek)	✓	✗	✓	▪ Cannot construct storage in Channel country strategic environment area ▪ Cover not practical in river due to flood damage and environmental nuisance
Ilfracombe	✓	✓	✓	✓	
Isisford	✗	✗	✓	✗	▪ Cannot construct storage in Channel country strategic environment area ▪ Permanent desalination requires refurbishment of the decommissioned bore or a new bore
Yaraka	✓	✗	✓	✓	

A technical and financial assessment of the shortlisted options was undertaken. This initial assessment shows that:

> Permanent desalination and storage covers have the lowest levelised costs of the options considered
> However, the Levelised cost for storage covers varies widely between the best case and worst case. This demonstrates that this option needs to be robustly procured and appropriate performance guarantees provided by suppliers.
> The potential for a new groundwater water source to the east of Longreach provides the largest yield of water and is likely to be a reliable source. However, it requires significant capital investment and has levelised cost much higher than that for permanent desalination.

11 Recommendations

The following recommendations are made to progress formulation of a strategy for securing the supply of water for urban use in Longreach, Ilfracombe, Isisford and Yaraka:

Regulatory framework

1. Longreach Regional Council should formally confirm the regulatory arrangements for Yaraka to access surface water
2. Longreach Regional Council should investigate and confirm current usage in Isisford and sources given that current usage possibly exceeds the nominal entitlement
3. If surface water usage in Isisford is found to typically exceed 100ML/year or be close to this figure, Council should consult with DNRM regarding appropriate regulatory mechanisms to align demand and entitlement. The discussions should also extend to Longreach given that demand is near the nominal entitlement.

Level of service for water security

4. Longreach Regional Council develop a water security level of service that:
   - Is developed in consultation with the community
   - Outlines an expectation of what adequate supply will be in most years
   - Includes a stated minimum supply to be provided in extreme drought
   - Considers whether the permanent Level 1 water restrictions are valued by the community or perceived as in conflict with promoting liveability in the towns
   - Sets out the expected frequency and duration of restriction levels (at least for Longreach)

   Level of service objectives should be developed separately for each town given the different supply options, end uses and possible community preferences in each town. However, for the smaller towns there will likely be benefit in a simpler statement of the level of service objectives.

Options for emergency supply

5. Longreach Regional Council should document potential arrangements and likely costs for tankering water by rail. This would include consideration of the source of water (potentially Toowoomba), the transport vessels required, filling arrangements and indicative transport costs.
6. Longreach Regional Council should complete a planning study to confirm the technical and financial viability of temporary desalination and the investments needed to enable this as an emergency supply option. This study should consider address:
   a. The minimum amount to be provided to the community in times of severe drought (this may be determined through engagement by Council on the levels of service for water security). The minimum amount is likely to be between 60 – 200 L/p/d
   b. The ability of existing groundwater bores in each town to meet minimum supply volumes and whether new bores may be needed or if yield may be increased by pumping. Note that the groundwater bore in Isisford is decommissioned. The costs of refurbishing this bore or constructing a new bore should be identified.
   c. The sustainability of the existing bores over extended periods of time, i.e. whether their yield will diminish with consistent use and if so, what period of time.
   d. Options for lease or purchase of desalination units and the likely lead time for units
   e. The availability of power at each town to meet the requirements of temporary desalination

f. Interconnection to supply the desalinated water into the existing potable water networks
g. Disposal of brine locally to each town and regionally
h. Any ancillary infrastructure required such as access roads and hardstand
i. Capital costs for preparatory works
j. Operating costs including lease costs, chemical usage and other operating and maintenance costs.

The planning study should provide confidence over the viability of temporary desalination to meet emergency supply conditions and fully assess costs to enable temporary desalination as well as costs to provide supply from this source.

Options for long terms supply

7. Longreach Regional Council should communicate to the community the potential options for improving long term water security in each of the towns when developing its water security level of service. The costs and potential benefits of the options should be used to inform decision making regarding the levels of service. Further investigation of long term supply options should await the outcomes of development of the water security levels of service.

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Report

APPENDIX

A

FEASIBILITY REPORT FOR PIPELINE TO LONGREACH (VIA ILFRACOMBE)

Report

APPENDIX

B

LEASING OPTIONS FOR TEMPORARY DESALINATION OF BORE WATER

Town	Bore name	Free flow rate (L/s)	Static pressure (m)	Size/make/model	Option 1: Typical lease period	Option 1: Lease cost (per month)	Option 2: Typical lease period	Option 2: Lease cost (per month)	Option 3: Typical lease period	Option 3: Lease cost (per month)
Longreach	Wonga Street Bore (RN 384)	5.10	41.5	300 m3/day MAK Water BWRO-0300-XX-X-C-X-X	6 months	$21,050	12 months	$18,215	24 months	$15,585
Longreach	Water Treatment Plant Bore (NR 146269)	3.5	25	200 m3/day MAK Water BWRO-0000-XX-X-C-X-X	6 months	$16,199	12 months	$14,018	24 months	$11,994
Ilfracombe	Town Bore (RN 371)	8.5	16.8	500 m3/day MAK Water BWRO-0500-XX-X-C-X-X	6 months	$29,146	12 months	$25,221	24 months	$21,580
Yaraka	Town Bore (RN 118167)	0.63	0	25 m3/day MAK Water BWRO-0025-XX-X-C-X-X	6 months	$4,986	12 months	$4,315	24 months	$3,692

Legend:

	Option selected for levelised cost model

Report

APPENDIX

C

JUSTIFICATION OF PARAMETERS SELECTED FOR EVAPORATION COVERS

Parameter	Good case	Bad case	Justification for good case	Justification for bad case	Overall justification/notes
Efficiency	90%	70%	Roughly the lowest claimed floating cover efficiency in Table 1 of Yao et al 2010. Supported by studies referenced in this document.	Roughly the highest claimed floating cover efficiency in Table 1 of Yao et al 2010. Supported by studies referenced in this document.	• 80% efficiency is assumed in the DMP • 70 – 80% efficiency is quoted for suspended covers in DEEDI 2011 • Potential evaporation savings are stated to average 80% in NSW I&I 2009 • 90% efficiency is quoted for suspended plastic sheeting in Fairweather, Austin and Hope al n.d. • 90 – 95% efficiency is recommended for impermeable covers in Heinrich and Schmidt 2006 • 70 – 75% efficiency is recommended for shade cloths in Heinrich and Schmidt 2006 • Assuming 80% coverage, AquaCaps are stated in NPSI 2005 to potentially reduce evaporation by an average of 70% • 100% efficiency is stated for E-VapCaps in NPSI 2005 • Up to 75% efficiency is estimated for shade cloths in NPSI 2005 • Physical evaporation reduction methods are stated in Benzaghta 2009 to save 70 – 100% of water • Commercial floating objects are summarised in Elba 2016 to be from 70% to 90% efficient • 88% efficiency is stated for AquaArmour in Elba 2016 • 95% efficiency is stated for Hexprotect tiles in Elba 2016 • 90% efficiency is stated for ECC floating ball blankets in Elba 2016 • Floating covers are summarised in SA EPNRMB 2010 to be up to 95% efficient • Shade structures are summarised in SA EPNRMB 2010 to be from 75% to 84% efficient • Modular covers are summarised in SA EPNRMB 2010 to be from 70% to 95% efficient
Construction cost	**$20/m2**	**$50/m2**	Lowest floating cover unit rate in Appendix L (Table 41) of GBA 2015	• Highest floating cover unit rate in Appendix L (Table 41) of GBA 2015	• The resulting good-case construction cost is $1.7 M, while the resulting bad-case construction cost is $4.2 M. This roughly aligns with the range provided in the DMP ($1.4 - $4.3 M). • Note that some literature report unit rates as low as ~ $5/m2 (Craig et al 2005, NSW I&I 2009, Yao et al 2010 and DEEDI 2011)
Annual maintenance cost	**$0.01/m2**	**$0.05/m2**	Lower bound in DEEDI 2011	Upper bound in Craig et al 2005	• N/A

Parameter	Good case	Bad case	Justification for good case	Justification for bad case	Overall justification/notes
Useful life	**15 years**	**10 years**	Lowest floating cover useful life in Table 1 of Yao et al 2010	Greatest floating cover useful life in Table 1 of Yao et al 2010	• Assumes no anchorage (greater useful life for support structures) • DEEDI 2011 suggests a 15-year useful life for suspended cloths, and 30 years for the structure • Baldwin 2010 provides a design minimum life of 10 years for floating hard covers, while useful lives of up to 20 years are stated to be anticipated • Elba 2016 suggests a useful life of 20 years for AquaCaps and AquaArmour • Elba 2016 suggests a useful life of 25 years for Hexprotect tiles and ECC floating ball blankets