Longreach
regional water supply security assessment
Introduction

The town of Longreach is located in central-western Queensland and lies adjacent to the Thomson River, approximately 700 km west of Rockhampton. It is both a regional centre for agricultural production and the administrative and commercial centre for the Longreach Regional Council area. The town is named after the ‘long reach’ of the Thomson River at this location.

Longreach's population is currently around 2700 (June 2018), but historically (over the past 85 years) has generally fluctuated between about 3000–3500 people. The main industries in the region are cattle and sheep production, and tourism.

Safe, secure and reliable water is an essential resource for Longreach, not only providing for the health and wellbeing of the community, but also providing opportunities for economic and community development, and supporting tourism. Longreach Regional Council is the registered water service provider for Longreach's urban water supply system, providing both water and wastewater services to Longreach.

The Queensland Government, through the Department of Natural Resources, Mines and Energy (DNRME), and Council committed to a partnership to investigate and establish a shared understanding of the existing security of Longreach's urban water supply system and its capacity to support current demands and future growth. Arising from this partnership, this regional water supply security assessment (RWSSA) provides valuable information to the community and water supply planners about Longreach’s urban water supply security, thereby providing a foundation for future water supply management by Council.

This assessment has considered a number of water demand scenarios for the population of Longreach to identify the timing and magnitude of potential water supply risks. The assessment shows that Longreach’s water supply, drawn from the storage of Town Weir on the Thomson River, is able to meet Longreach’s current and projected urban water requirements until at least 2041 with a moderate degree of reliability—however, at current and projected future demands the system may be at risk of falling to very low water levels during extended periods of severe drought, with the potential for water supply shortfalls occurring, even with water restrictions being imposed.

It is important to note that information presented in the assessment is based on the capacity of the existing water supply system and associated infrastructure.
Water supply sources

Longreach’s primary water supply source is the storage provided by Town Weir, located on the Thomson River about 3.5 km northwest of the town.

Town Weir has a catchment area of approximately 57,590 km², which extends about 350 km north of Longreach, with land use in the catchment area being almost entirely low density cattle and sheep grazing on unimproved pastures. Upstream of Town Weir are three additional weirs on the Thomson River. Releases are made from these upstream weirs to replenish the Town Weir storage when water levels in Town Weir fall more than 1.2 meters below the crest of the weir. The three upstream weirs (in order of proximity to Town Weir) are Fairmont Weir, Bimbah Weir, and Goodberry Hills Weir, the latter of which is about 48 km upstream from Town Weir (Figure 1). All four weirs are owned and operated by Council, and together have a combined storage capacity of about 8,400 megalitres (ML)—the Town Weir storage comprises around 3,300 ML of this, and has a minimum operating volume of about 88 ML.

Town Weir was originally constructed to increase the storage capacity of a naturally-occurring large waterhole in the Thomson River, reported to be one of the relatively few permanent natural waterholes in central outback Queensland. References dating as far back as the early 1900s state that this waterhole has not been known to go dry since European settlement of the area (circa 1870).

Water in the Thomson River catchment area is managed under the Water Plan (Cooper Creek) 2011. Council hold a water licence to extract up to 2,200 ML per annum (ML/a) for town water supply from Town Weir.

Other water supply sources

In addition to the available surface water from Thomson River, Council also hold an entitlement to extract up to 800 ML/a from the Hooray Sandstone unit of the Great Artesian Basin. Until about 10 years ago, some of this water was used to contribute to the total urban water supply for Longreach. However, due to a number of issues, including high fluoride content of the groundwater and the aged condition of the associated infrastructure, this supply source is no longer used.
Figure 1: Location of Longreach and Council’s four weirs on the Thomson River
Water users and water demand

Longreach’s reticulation network extends throughout the entire township and supplies water for urban purposes to about 2700 people (as at June 2018).

Longreach’s reticulation network

Council currently holds an entitlement for 2200 ML/a from the Thomson River. Information reported by Council in the Statewide Water Information Management database shows that the total volume of water sourced by Council for the reticulation network over the 8 years from 2010–11 to 2017–18 averaged about 1800 ML/a (ranging from around 1470 ML/a to 2040 ML/a).

Based on the total volume of water sourced and the serviced population for each year, the average water demand from the Thomson River during this period (2010–11 to 2017–18) was approximately 1690 litres per capita per day (L/c/d). This figure accounts for residential, and non-residential (commercial, municipal and industrial) water supplied from the reticulation network, plus any system losses. It also includes water use by the transient population, such as tourists and temporary workforces. Water use by the transient population is mostly accounted for under the category of commercial use; however, the transient population is not included in the serviced population figures.

The average residential water use for this period was approximately 1355 litres per person per day (L/p/d). Non-residential water use for this period was approximately 250 L/p/d (or about 15% of Longreach’s total water consumption, ranging from about 13–20%).

Recycled water

Longreach does not currently recycle water, primarily because the sewage treatment plant does not treat the water to a suitable standard for the water to be re-used.

Water demand affected by climate variations

Urban water demand varies between years and within each year, depending on various factors including climatic conditions such as rainfall, with higher demand usually occurring during hotter, drier periods. However, during extended dry periods water levels in Town Weir may become low and, as a result of water restrictions being applied, water use may be lower than it would otherwise have been.

The long-term historical rainfall data for Longreach (over the 69 year period from January 1950 to December 2018) is summarised in Table 1. Average annual rainfall for Longreach over this period was approximately 437 mm. Also shown in Table 1 is the average rainfall over the recent 2010–11 to 2017–18 period (which is about 18% lower than the average over the longer term), and the average rainfall over the climate change reference period (1986–2005), referred to in the later Climate Change section.
Table 1: Summary rainfall statistics for Longreach

<table>
<thead>
<tr>
<th>Rainfall Station No: 36031 Longreach Aero</th>
<th>Annual rainfall (mm)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lowest</td>
<td>Average</td>
</tr>
<tr>
<td>1950 to 2018</td>
<td>106.8</td>
<td>436.6</td>
</tr>
<tr>
<td>1986 to 2005 (Climate change reference period)</td>
<td>106.8</td>
<td>423.4</td>
</tr>
<tr>
<td>2010–11 to 2017–18</td>
<td>142.4</td>
<td>359.0</td>
</tr>
</tbody>
</table>

Figure 2 illustrates the relationship between the annual (July–June) rainfall recorded at Longreach (Station 36031 Longreach Aero) for the period 2010–11 to 2017–18, and Longreach’s water demand (based on the total volume sourced) for each year over the same period. During this period, Longreach’s annual water demand varied from year to year, ranging from 1248 L/c/d to 1928 L/c/d, with water demand generally higher in years with lower rainfall.

Based on the above information, the water demand may have been higher over the drier 2010–11 to 2017–18 period than in previous wetter periods.
Climate change

The Queensland Government provides climate change projections for Queensland local government areas (LGAs), which are referenced against the historical period 1986–2005 for temperature, evaporation and rainfall (among other climatic variables). The climate change projections are reviewed and revised as new data and improved methodologies become available.

In general, Queensland’s future climate is projected to be warmer and drier, with increased evaporation and a potential increase in the annual and inter-annual variability. These same trends are also projected for the Longreach LGA. Additionally, under an unchanged greenhouse gas emission scenario, the projected climatic changes for Longreach indicate that by 2050 seasonal variations may include:

- slightly wetter summers, with drier winter, autumn, and spring
- warmer temperatures for each season (average, minimum, and maximum)
- higher evaporation rates for each season.

Importantly, one of the key elements of nearly all climate change projections is a change to extreme events—in terms of both frequency and magnitude. This suggests that major events, such as droughts and flooding, may become more extreme. The possibility of more extreme and longer-duration droughts than have previously been recorded for Queensland poses a unique challenge for water service providers, and highlights the need for long-term water supply planning processes to be adopted, implemented, and regularly reviewed.

As shown in Table 1, average annual rainfall during the recent period from 2010–11 to 2017–18 was about 15% below the average rainfall for the climate change reference period (1986–2005). Longreach’s average water demands over the drier recent period may therefore be reflective of water demands during the drier conditions projected for the future.

Other users of the bulk water supply sources

Agriculture

The key agricultural industries in the Longreach region are cattle and sheep production. There are currently nine water licences held by agricultural water users who rely on water from the stretch of the Thomson River in which the four Longreach weirs are located. These nine water licences, combined, authorise the take of up to 940.5 ML/a of water for various agricultural purposes (almost entirely irrigation) along this stretch of the Thomson. In addition, there are five licences that, combined, permit the take of up to 47.2 ML/a for stock and domestic purposes.

To ensure there is available supply to meet Longreach’s urban demand, extraction of water for irrigation ceases from this stretch of the Thomson River when the water level in Town Weir falls more than 1.3 metres below the weir crest (a storage volume of about 2330 ML). However, the five licences (47.2 ML/a) for stock and domestic purposes are not subject to this limitation.

There are also other licenced entitlements even further upstream. However, these are a significant distance from Longreach (around 200 km) and have a relatively small combined volume (234 ML/a), and are therefore not considered to have any significant impact on the availability of water supplies for Longreach.

Industry

There is no significant industrial water demand on Longreach’s water supply sources from outside of Longreach’s urban area. The main industries within Longreach’s urban area are associated with agribusiness, construction, transport, and tourism. The water use by these businesses is accounted for within the total water demand figures for the network, generally under the category of ‘non-residential’ water use.

Historical performance of Town Weir

The Thomson River generally only flows on a seasonal basis. Flows are often very significant when they do occur, and regularly result in widespread flooding. As a result of the seasonal flows in the Thomson River, combined with the extraction of water for town water and other supplies, the water level in Town Weir fluctuates significantly on an annual basis. Figure 3, below, shows the daily water level at the Thomson River gauging station (03202A) at Longreach, located about 600 metres upstream of Town Weir. It can be seen that the water level regularly drops to around 1–1.3 m below the weir crest. Also shown in Figure 3 is the frequency that water levels in the weir have historically fallen below the trigger level for various water restrictions (water restrictions are discussed further in a later section).

Figure 3: Town Weir—Recorded storage behaviour from 1969 to 2018
Future water demand

An understanding of likely and possible changes in water demand in the future is required for well-founded water supply planning.

Council and DRNME agreed on key assumptions, such as rates of water use and population growth, in developing a projection of Longreach’s future water demand. The projections will remain subject to ongoing monitoring of actual population growth and variations in water use trends (e.g. changes in water use practices may increase or decrease consumption).

Longreach’s reticulation network

As mentioned earlier, over the past 85 years the population of Longreach has generally centred around the range of 3000–3500 people (averaging approximately 3270). During this historical period there have only been two census dates on which the recorded population was below 3000—in 1981 and in 2016. Although the population of Longreach is currently slightly lower than this historical average, at around 2700 people (June 2018), for the purpose of this assessment it is assumed that over the next 20 years (to around 2041) the population of Longreach may return to its historical range of around 3000–3500.

Based on Longreach’s average daily water demand of approximately 1690 L/c/d over the 8-year period from 2010–11 to 2017–18, with a future population of 3000–3500 people Longreach’s average future water demand would be in the range of 1850–2160 ML/a (refer to Figure 4).

It is important to note that this projection represents average demand rather than high demand, and average demand levels may often be exceeded (e.g. during hotter dry periods). However, the use of average demand figures provides a means of directly comparing future demand projections to determine when demand is likely to exceed available supply. For planning purposes, this also means an appropriate balance can be reached between the cost of water supply and the demand for available water. These demand projections are based on historical demands during a period of relatively dry climatic conditions, and are therefore likely to conservatively be representative of demands during the drier conditions projected for the future.
Other users of the bulk water supply sources

Agriculture

Although agriculture is a key industry for the Longreach region, the availability of surface water to support expansion of the agricultural industry in the area around Longreach is very limited (not only in terms of consistent supply, but also the number and volume of entitlements that could be permanently or seasonally traded). Any future development to expand the agricultural industry in the Longreach area is likely to require access to alternative water supply sources, such as groundwater, and therefore would have no noticeable impact on the security of Longreach’s water supply. It is therefore considered that there is no real scope for any increased impact from agricultural activities on Longreach’s future urban water security.

Industry

Industry in Longreach is primarily associated with its role as an administrative and commercial centre for the surrounding region, as well as tourism. Any future growth in Longreach’s industry, and associated industrial water demand, is therefore expected to be largely subject to changes in population, and the continued provision of tourism facilities. These factors are considered to be relatively stable and, at this stage, there are no anticipated large-scale industrial developments or changes that are considered likely to significantly increase water demand on the water supply sources used for Longreach.
Water supply system capability

Hydrologic assessments have been undertaken to assess the capability of Longreach’s existing bulk water supply system to meet current and projected future water demands.

Hydrologic assessment of Longreach’s water supply system

Historical modelling techniques were used to simulate the performance of Longreach’s water supply from Town Weir. Historical modelling was used to demonstrate how the water supply would have performed under historical climatic conditions for a range of demand levels and operating arrangements.

Where feasible, Regional Water Supply Security Assessments (RWSSAs) have also included stochastic modelling\(^2\). However, due to a variety of factors (including a lack of good spatial coverage of rainfall stations and stream gauging stations, long term data availability on water extraction from the weir, and other factors), stochastic analysis was not considered appropriate for the Longreach RWSSA.

The historical hydrologic assessments assume that all existing water entitlements from the weirs or watercourses that support the system are fully developed and operational, with the exception of Council’s water entitlements used to supply the Longreach community. Longreach’s water demands were represented at various total annual demand levels, reflecting the impact of population growth (Table 2, page 11).

\(^2\) Stochastic modelling involves generating data sequences for much longer periods (e.g. 10,000 years) that incorporate key statistical indicators from the historical record, and can be used to demonstrate how the water supply might perform under a wider variation of potential climatic scenarios, including during more severe droughts than those in the historical period of record.
In an effort to reduce water consumption and extend the duration of the available water supply during extended dry periods, Council has established a water restriction regime for Longreach based on the water levels (and storage volumes) in Town Weir. The water restrictions primarily target outdoor water uses including watering of gardens, washing cars, hosing or washing paved or concreted areas, and swimming pool use.

Table 3 shows the water levels and storage volumes in Town Weir that trigger the various water restrictions, and the corresponding targeted urban demand levels. The hydrologic assessment assumes that targeted savings from the water restrictions will be achieved, with the exception of the Level 2 restrictions for which it was conservatively assumed that there would be no reduction.

Table 2: Longreach’s water restriction levels

<table>
<thead>
<tr>
<th>Demand modelled (ML/a)</th>
<th>Water demands</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>Reduced (low) average demand</td>
</tr>
<tr>
<td>1800</td>
<td>Around current average annual demand</td>
</tr>
<tr>
<td>2000</td>
<td>Intermediate demand</td>
</tr>
<tr>
<td>2200</td>
<td>Council’s full entitlement</td>
</tr>
</tbody>
</table>

Table 3: Longreach’s water restriction levels

<table>
<thead>
<tr>
<th>Restriction Level</th>
<th>Volume in Town Weir (ML)</th>
<th>Distance below weir crest (m)</th>
<th>Percent of full demand</th>
<th>Daily demand example (L/c/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Above 2,331</td>
<td>Less than 1.3</td>
<td>100.0 %</td>
<td>1690</td>
</tr>
<tr>
<td>Level 2</td>
<td>Below 2,331—Above 1,698</td>
<td>1.3—2.3</td>
<td>87.8 %</td>
<td>1484</td>
</tr>
<tr>
<td>Level 3</td>
<td>Below 1,698—Above 1,165</td>
<td>2.3—3.3</td>
<td>73.5 %</td>
<td>1242</td>
</tr>
<tr>
<td>Level 4</td>
<td>Below 1,165—Above 732</td>
<td>3.3—4.3</td>
<td>61.2 %</td>
<td>1034</td>
</tr>
<tr>
<td>Level 5</td>
<td>Below 732</td>
<td>More than 4.3</td>
<td>47.0 %</td>
<td>794</td>
</tr>
</tbody>
</table>

Note: Trigger levels and targeted reductions are subject to review and amendment as determined by Longreach Regional Council from time to time. Further details on water restriction rules are available on Council’s website.
Frequency of water supply shortfalls and water restrictions

For this assessment, Longreach is considered to have experienced a water supply shortfall when its water supply system (the storage of Town Weir, supported by the upstream weirs) is unable to meet the water demands placed on the system by Longreach’s community. This could, for example, occur as a result of the weir reaching minimum operating volume due to severe or extended drought, or as a result of the demand on the available supply source exceeding the entitlement volume.

Historical modelling assessment

The historical modelling undertaken (for the period 1890–2017) indicates that Town Weir would have met a demand of 1500 ML/a for Longreach without experiencing any supply shortfalls, assuming water restrictions were imposed and the targeted reductions in water use were achieved. Modelling results also showed that without water restrictions, Town Weir would have fallen below its minimum operating volume (resulting in a water supply shortfall) during one ‘water year’ (July to June, 1902–03) of the historical period for a total period of around 6 months.

At a demand of 2200 ML/a for Longreach (representing Council’s current allocation from Town Weir, and exceeding Longreach’s projected average 2041 demands) modelling results showed that, with restrictions in place, Town Weir would have fallen below its minimum operating level on three occasions, with one of these lasting longer than six months (and one of the other occasions lasting longer than one month).

Figure 5 shows the indicative performance of Longreach’s water supply system under water restrictions, including the likelihoods that water restrictions could be triggered and water supply shortfalls experienced, for a range of annual water demands.

Figure 5 shows the extent that the frequency of reaching the water restriction trigger levels generally increases as water demand increases (i.e. the average recurrence interval reduces). For example, at an average annual demand of about 1500 ML/a, Level 3 water restrictions are estimated to occur about once every 10.5 years on average (see label ‘A’ on graph). At a demand of about 2200 ML/a, the frequency of Level 3 restrictions increases to about once every 6.5 years on average (see label ‘B’ on graph).
Duration and severity of water restrictions

Although the frequency of water restrictions is an important consideration, the duration and severity of each restriction period is also important for many water users. For example, it may be more acceptable to experience less severe and shorter periods of water restrictions more frequently, than to experience more severe and longer periods of water restrictions less frequently.

Figure 6 shows the median number of occurrences of storage volumes falling below the trigger for Level 3 water restrictions and remaining below that volume for longer than 1 month, 3 months, 6 months and 12 months over the 127-year historical simulation period. Figure 6 shows that less than one-third of restrictions that last for more than one month continue for longer than 6 months. For example, over this period, at a water demand of 1800 ML/a there were 9 occurrences of the storage volumes falling below the trigger for Level 3 water restrictions and remaining below that volume for longer than 1 month, of which 6 last longer than 3 months, 2 last longer than 6 months and 1 lasts longer than 12 months. Figure 6 also shows the extent that, with an increasing level of water demand, there is an increase in the number of occurrences of water restrictions being triggered.

Figure 7 shows the number of occurrences that the storage volumes continue to fall and trigger Level 5 water restrictions, and the durations that storage volumes remain below this trigger level. Figure 7 shows that while the number of restrictions increases with increasing demand, most of these additional restriction periods last less than three months.

Together, the frequency, severity and duration of water restrictions, along with the ability to maintain a minimum supply volume during drought, are fundamental parts of water supply planning and form part of the ‘level of service’. The level of service for Longreach is a matter for Council to determine, in discussion with the community.
Figure 7: Number and duration of events where storage volumes fall below the trigger for Level 5 water restrictions at various annual water demands

Water supply system capability outcomes

Longreach’s future urban water demand is anticipated to be in the range of 1850–2160 ML/a across the period to 2041, and may be higher during prolonged hot, dry periods.

The assessment showed that Town Weir is able meet Longreach’s urban water requirements for demands up to Council’s existing allocation from Town Weir of 2200 ML/a with a moderate degree of reliability—however, the system may be at risk of falling to very low water levels during extended periods of severe drought, with the potential for water supply shortfalls occurring, even with water restrictions being imposed. Based on historical performance and current average demands of about 1800 ML/a, Level 3 restrictions are expected to be triggered about once in 8 years. Modelling also shows that when there is a drought it can be extreme with extreme Level 5 restrictions lasting longer than 12 months.

Modelling showed that performance of the supply system was improved at lower demand levels, suggesting that supply security may be improved through demand management measures such as the implementation of restrictions or through voluntary reductions in water use through, for example, further community education.
Moving forward

This regional water supply security assessment represents a collaborative approach between the Queensland Government and Longreach Regional Council to establish a shared understanding of the existing security of Longreach’s water supply and its capacity to support future growth.

Longreach Regional Council recognises that a secure and reliable water supply is essential for supporting Longreach’s current and future population, as well as local businesses, industry and tourism. Council is committed to undertaking the steps required to achieve this outcome for the community, and is planning for the long-term water supply needs of the community.

Council has worked closely with the Queensland Government to collate detailed data and undertake hydrologic modelling based on historical records, to better ascertain the potential water supply security risks that council and the community currently face.

Council will continue to proactively investigate, develop and implement solutions to maintain water supply security for the Longreach community. Some of the areas of ongoing investigation may include:

- Continuing and improving work to monitor, detect and reduce water losses within the town’s supply network.
- Demand management through optimisation of the reticulation system, maintaining and improving water efficiency for residential gardens and industry, and community education on water saving measures.

Council acknowledges that it has an important role to play in educating the community, businesses and the agricultural sector regarding water conservation and ensuring that the available water resources are effectively managed. Council will work with the community to identify an appropriate level of service for water supply security in Longreach, which will involve balancing an acceptable level of water availability with the lifestyle and expectations of residents. The viability of any water supply options will, among other things, consider the economic, environmental, hydrologic and community outcomes, as well as statutory requirements.

By continuing to pursue an appropriate level of water supply security for Longreach, Council is working to ensure that the right environment exists for the community, businesses, industry and tourism to continue to thrive in Longreach.
For more information on the Regional Water Supply Security Assessment program please visit

dnrme.qld.gov.au