



# Whitsunday regional water supply security assessment

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# Introduction

Airlie Beach, Bowen, Cannonvale and Proserpine are the major communities within the Whitsunday Regional Council area. The Whitsunday region, along with many other regional centres in Queensland, is expected to continue experiencing economic and population growth over the coming decades.

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The Whitsunday Regional Council provides water and wastewater services throughout the Whitsunday region, including Airlie Beach, Bowen, Cannonvale and Proserpine. The region extends nearly 24 000 km<sup>2</sup>, with many of the major communities in close proximity sharing the same bulk water supply source. Communities that source water from the Proserpine River Water Supply Scheme (Proserpine River WSS) have been considered under this single Whitsunday assessment. There are a number of other communities that are within the council area that have not been included in this assessment, such as Collinsville and the majority of the Whitsunday Islands, as they have alternative bulk water supply sources.

The *Whitsunday region economic analysis: economic and population study*, commissioned by the council and prepared by Norling Consulting, anticipates that the population of the Whitsunday communities will increase from approximately 33 000 (in 2013) to over 47 000 by the mid 2030s. Safe, secure and reliable water supplies are an essential resource for the Whitsunday communities—not only for the health and wellbeing of the region, but also for supporting economic growth and development. A significant agricultural sector near Proserpine relies on the availability of water for irrigation and other purposes. The area is also a gateway to the Great Barrier Reef and the Whitsunday Islands, supporting regional growth in the tourism industry.

The Department of Energy and Water Supply (DEWS) and council have committed to a partnership to investigate and establish a shared understanding of the existing security of the Whitsunday communities' water supply system and its capacity to support future growth. Arising from this partnership is this regional water supply security assessment (RWSSA), which is valuable in providing a foundation for future water supply planning.

This assessment considers how the current low level of water use for agricultural activity is temporarily benefiting the observed water supply performance of the Whitsunday communities. How council's access to unsupplemented groundwater supplies benefits the Whitsunday's water supply performance is also considered. The scope of this RWSSA is limited to the volume of available water and does not address water quality issues that may affect water supplies.

It is important to note that the information presented in this assessment does not consider any changes to the capacity of the existing water supply system and associated infrastructure, nor does it specifically consider the impact that climate change may have on catchment hydrology. Changes to demand that may be driven by climate change, population growth or other factors have been considered in this assessment by taking into account a wide range of demands, for both medium and high priority water users.

# Water supply sources

The Whitsunday reticulation network is supplied mainly from the Proserpine River WSS, which sources water from Peter Faust Dam.



## Proserpine River Water Supply Scheme

Peter Faust Dam is the primary water storage in the Proserpine River WSS. It is owned by SunWater and operates in accordance with the *Whitsunday resource operations plan: December 2011* (Whitsunday ROP). Located approximately 26 km west of Proserpine, Peter Faust Dam is a 53-metre high earth and rock-fill embankment impounding the Proserpine River with a capacity of 491 400 megalitres (ML).

Council sources supplemented water (i.e. water delivered from infrastructure) from Peter Faust Dam under high priority water allocations managed under the Proserpine River WSS. In addition, Peter Faust Dam supplies irrigated agriculture (primarily sugar cane), the Proserpine Sugar Mill and the township of Midge Point (within the Mackay Regional Council area).

In total, the Proserpine River WSS has 22 000 ML per annum (ML/a) of high priority water allocations. The high priority water allocations are assigned amongst the following water users:

- Council holds 8233 ML/a to supply the Whitsunday community.

- SunWater holds 10 512 ML/a of uncommitted high priority water, which can be leased or traded, as well as 5 ML/a for amenities at Peter Faust Dam.
- Mackay Regional Council holds 2700 ML/a to supply the Midge Point community.
- Wilmar Sugar Australia Ltd holds 550 ML/a to supply the Proserpine Sugar Mill.

In addition, there are 40 876 ML/a of medium priority water allocations managed under the Proserpine River WSS, which are mostly used for agricultural purposes.

Council manages three drinking water schemes, each with its own water treatment plant:

- Bowen Drinking Water Scheme—supplies Bowen, Brisk Bay, Whitsunday Shores and Merinda
- Coastal Drinking Water Scheme—supplies Airlie Beach, Cannonvale, Jubilee Pocket and Daydream Island (connected via an underwater pipeline from Shute Harbour)
- Proserpine Drinking Water Scheme—supplies Proserpine and Mount Julian, and can also supplement the Coastal Drinking Water Scheme.

Each of the three drinking water schemes are primarily supplied with water from the Proserpine River WSS. The Bowen scheme is supplied with water from the Proserpine River via a subsurface intake. Water is treated at the plant located adjacent to the river and then pumped 65 km to the Bowen area. The Coastal and Proserpine schemes are supplied via bore fields that are located adjacent to the Proserpine River. The groundwater from these bore fields is assumed to be hydrologically connected to the Proserpine River.<sup>1</sup> It is therefore considered as

supplemented water within the Proserpine River WSS and is taken under surface water allocations managed under the Whitsunday ROP. Figure 1 provides a map of the Whitsunday water supply system.

## Unsupplemented groundwater

Council also takes groundwater that is considered hydrologically separated from the Proserpine River. This groundwater is considered unsupplemented water (i.e. water outside of the Proserpine River WSS) and is not managed under the Whitsunday ROP.

Council holds water licences to take up to 1693 ML/a of unsupplemented groundwater for the Coastal and Proserpine drinking water schemes. This unsupplemented water is used to supply the daily demands of the Coastal and Proserpine schemes. Council holds an additional 1600 ML/a water licence to take unsupplemented groundwater near the Bowen area. This water is currently used as a contingency source for the Bowen Drinking Water Scheme. It provides a backup supply during operational issues or a supplementary supply during droughts that affect Peter Faust Dam.

The reliability of the unsupplemented groundwater has not been measured. Therefore, in order to provide a conservative assessment of the council's water security position, this RWSSA incorporated scenarios that assumed no contribution from the unsupplemented groundwater. This enabled an estimation of the potential water security benefits of this groundwater source to the Whitsunday communities.

**Figure 1:** The Whitsunday water supply system

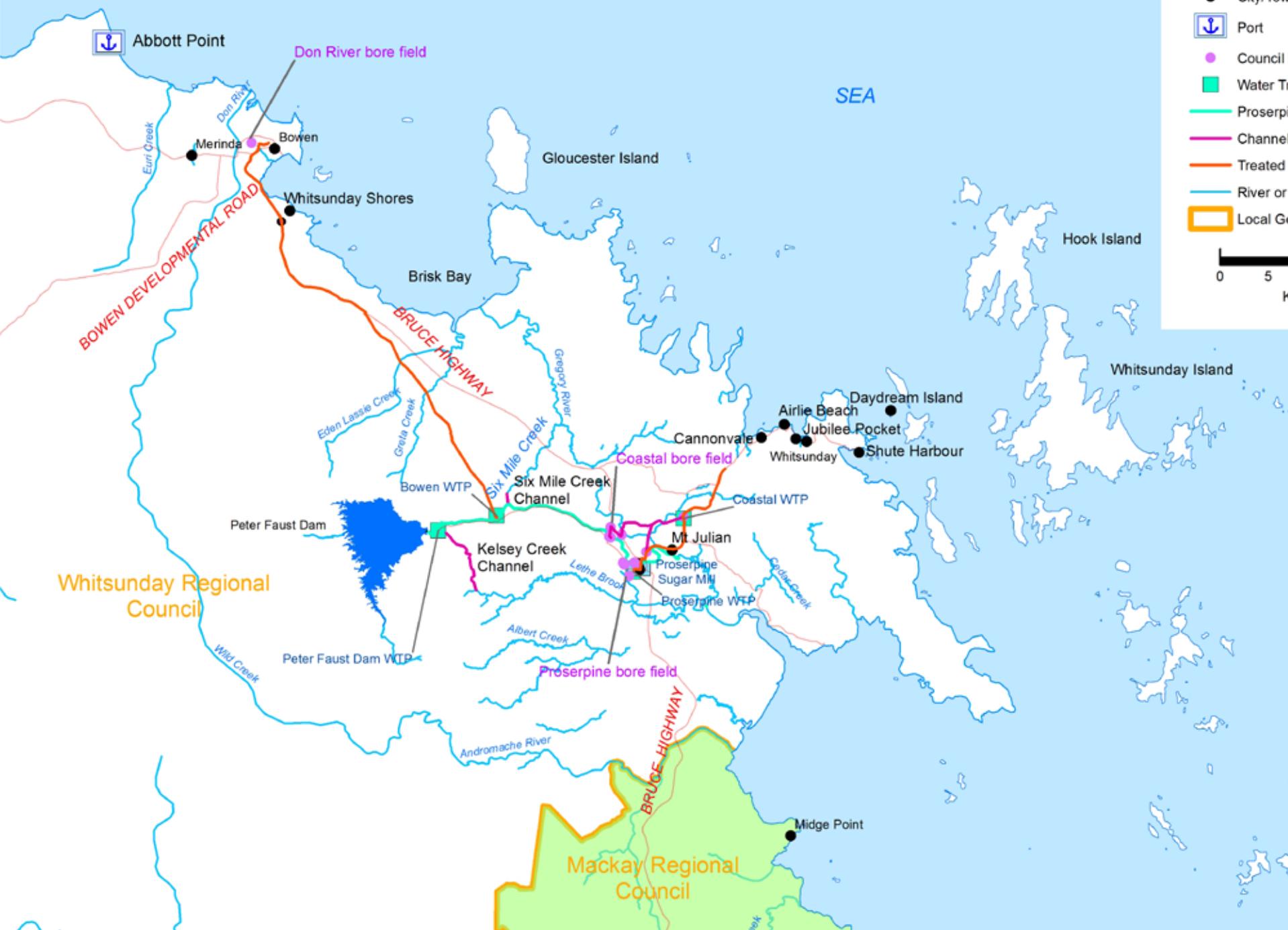
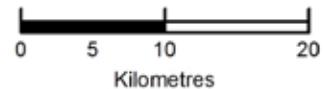
<sup>1</sup> This hydrological connection is recognised in the Water Resource (Whitsunday) Plan 2010.

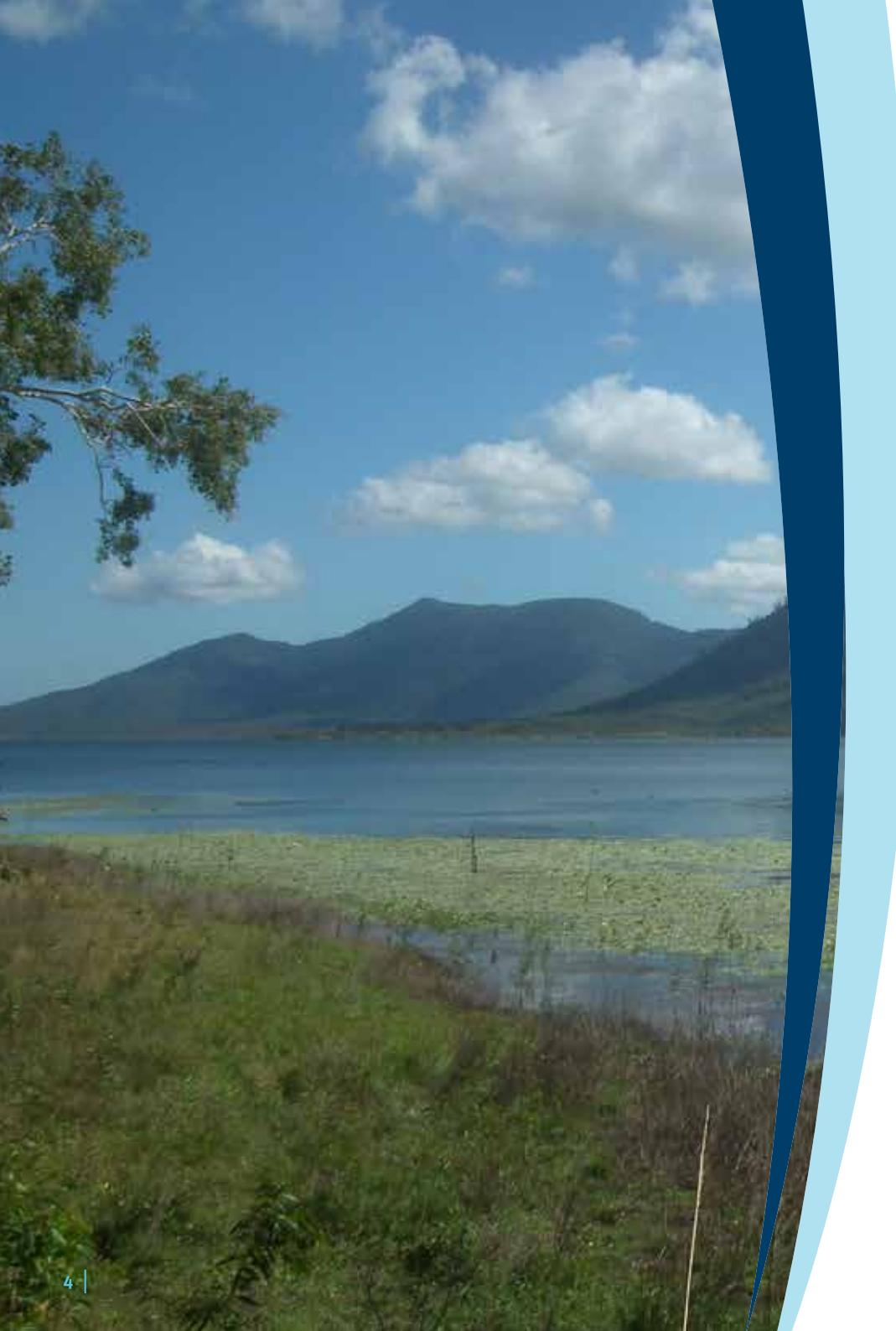


## CORAL SEA

### Legend

- City/Town
- Port
- Council bore field
- Water Treatment Plant
- Proserpine River Water Supply Scheme
- Channel/Untreated water pipeline
- Treated water pipeline
- River or Stream
- Local Government Area





# Water users and water use

## Whitsunday's reticulation network

The Whitsunday reticulation network supplies water for residential, commercial, municipal and industrial purposes. It is estimated that the reticulation network currently delivers water to approximately 23 000 people, which is about 68% of the population in the Whitsunday local government area.

The total volume of water sourced for the Whitsunday's reticulation network between 2010–11 and 2014–15 averaged approximately 6100 ML/a.<sup>2</sup> To understand the water use better, DEWS and council looked into the average daily water use and average residential water use.

The average daily water use is expressed as litres per capita per day (L/c/d) and is calculated by dividing the average daily total volume of water sourced for the reticulation network by the serviced population.<sup>3, 4</sup> This water includes all residential, commercial, municipal and industrial water use, as well as water losses associated with treatment and distribution. It also includes water use associated with Whitsunday's non-resident population within the region (e.g. tourists). For 2010–11 and 2014–15, the average daily water use was approximately 740 L/c/d.

<sup>2</sup> Data sourced from the Statewide Water Information Management (SWIM) database.

<sup>3</sup> The serviced population includes only permanent residents connected to the council's reticulation network. It does not include the transient population, such as tourists and temporary workforces.

<sup>4</sup> Council generally measures infrastructure planning demands in terms of 'equivalent persons' or 'EP' rather than per capita. The measure involves quite different planning and assessment methods to the RWSSA, assigning demand associated with parks, commercial premises etc. and an EP value. Therefore, the EP is not a direct measure of actual population (as it results in a larger population measure).

The average residential water use relates only to the water used by residents within the region divided by the serviced population.<sup>5</sup> Between 2011–12 and 2013–14, it was approximately 670 litres per person per day (L/p/d) for the Whitsunday communities.

Based on the information available, water use within the Bowen Drinking Water Scheme is higher than that within the Coastal and Proserpine schemes. The higher water use of the Bowen area could be partly due to the differences in climate and soil types. As shown in Table 1 below, Proserpine has significantly higher rainfall compared to Bowen. Historically, the urban water use in the Coastal and Proserpine schemes has tended to be inversely correlated to rainfall (i.e. decreased water use during periods of increased rainfall).

**Table 1:** Whitsunday rainfall 1989–2015 (water years)

Rainfall station	Annual average	Historic low	Historic high
Proserpine airport	1624 mm	688 mm	5275 mm
Bowen airport	891 mm	366 mm	2362 mm

## Other users of bulk water supply sources

Aside from a thriving tourism industry, the Whitsunday region hosts a strong agricultural sector, which contributes to the prosperity of the region and supports its population. The Whitsunday region also indirectly depends on mining as a source of economic activity and employment, with two large coalmines and a coal terminal in the vicinity and many drive-in drive-out workers residing within the council area.

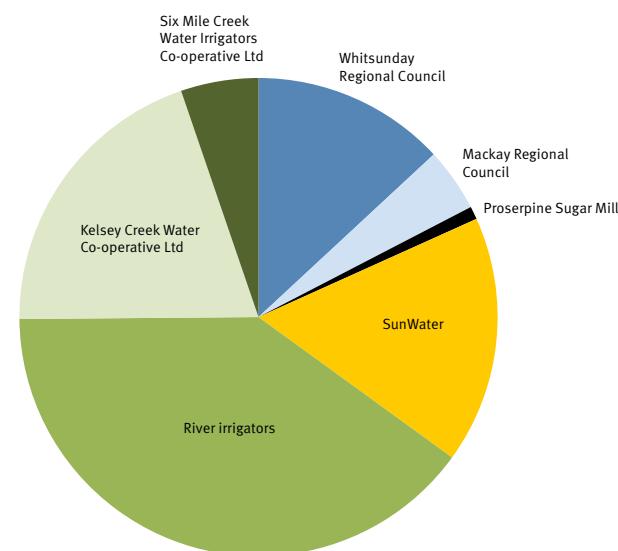
<sup>5</sup> The serviced population includes only permanent residents connected to the council's reticulation network. It does not include the transient population, such as tourists and temporary workforces.

## Mining

Currently, no water from Proserpine River WSS is supplied to mines. However, two large coalmines, Collinsville and Sonoma, operate in the council area and export the coal via the Abbot Point Coal Terminal. While the mines and coal terminal are currently supplied with water from outside the Proserpine River WSS, the coal terminal has previously needed to supplement its supplies, trucking potable water from Bowen.

## Agriculture

Approximately two-thirds of the water allocations from the Proserpine River WSS are associated with agriculture (see Figure 2). Horticulture, sugar cane and grazing are the main agricultural sectors in the Whitsunday region.



**Figure 2:** Water allocations in the Proserpine River WSS

The sugar cane growing area is centred near Proserpine, with water being supplied from the Proserpine River WSS. The horticultural industry, located mainly near Bowen, sources water from the unsupplemented groundwater sources of the Don River and Euri Creek aquifers, as well as small local surface water supplies. The Don River aquifer is also used as a contingency source for Bowen urban water supplies (see ‘Unsupplemented groundwater’ section).

A number of irrigators have contracts with council to take water from offtakes along the 65 km pipeline that takes water from the Bowen water treatment plant, near Peter Faust Dam, to Bowen. Council supplies these irrigators with potable water through leased water allocations from the Proserpine River WSS.

Agricultural water use in the Whitsunday region seems to be greatly affected by seasonal factors, such as high rainfall. Agricultural water use has recently been fairly low, with an average of 44% of entitlements being used between 2002 and 2014. Council considers that economic factors, including sugar (and other crops) prices and other agricultural input costs (such as electricity), may have affected the level of agricultural activity and the associated water use in the area.

As the Whitsunday region’s agricultural industry holds the majority of water allocations from the Proserpine River WSS, the level of agricultural water use can impact on the performance of the other allocations. This RWSSA therefore considered the performance of council’s water allocations assuming the full amount of agricultural water allocations is taken.

## Other towns

Mackay Regional Council has a 2700 ML/a high priority water allocation from the Proserpine River WSS. This allocation is used as the main supply for the small coastal community of Midge Point and was used to supply the

Laguna Quays Resort when it was operational. During 2014–15, less than 350 ML/a of this water allocation was accessed.

## Historical performance of Peter Faust Dam

Peter Faust Dam is a large storage that relies on the high rainfalls in the Proserpine area to maintain supply. The storage has a long drawdown period. Since being completed in December 1990, water levels in Peter Faust Dam have not declined to critical levels that would result in an urban water supply shortfall, despite six years (1991–1997) of low inflows (see Figure 3). An urban water supply shortfall is defined as an event where water supply is unable to meet water demand. Therefore, if water demand

is 10 ML for a particular day and the system is only able to supply 8 ML due to limited availability or operational constraints, this would be defined as a supply shortfall.

While the historical performance of a water supply system offers an indication of supply security, its application to future performance is limited. The historical performance does not take into account trends in demand patterns, climate variability or variation in historical inflows. Historical performance is dependent on the water use at the time, with urban water use typically increasing proportionately with population growth. A period of low inflows that did not result in a failure to meet urban water demands in the past may have failed under a higher urban water demand. More sophisticated tools, such as demand forecasting and stochastic modelling, are needed to account for a wider range of potential scenarios.

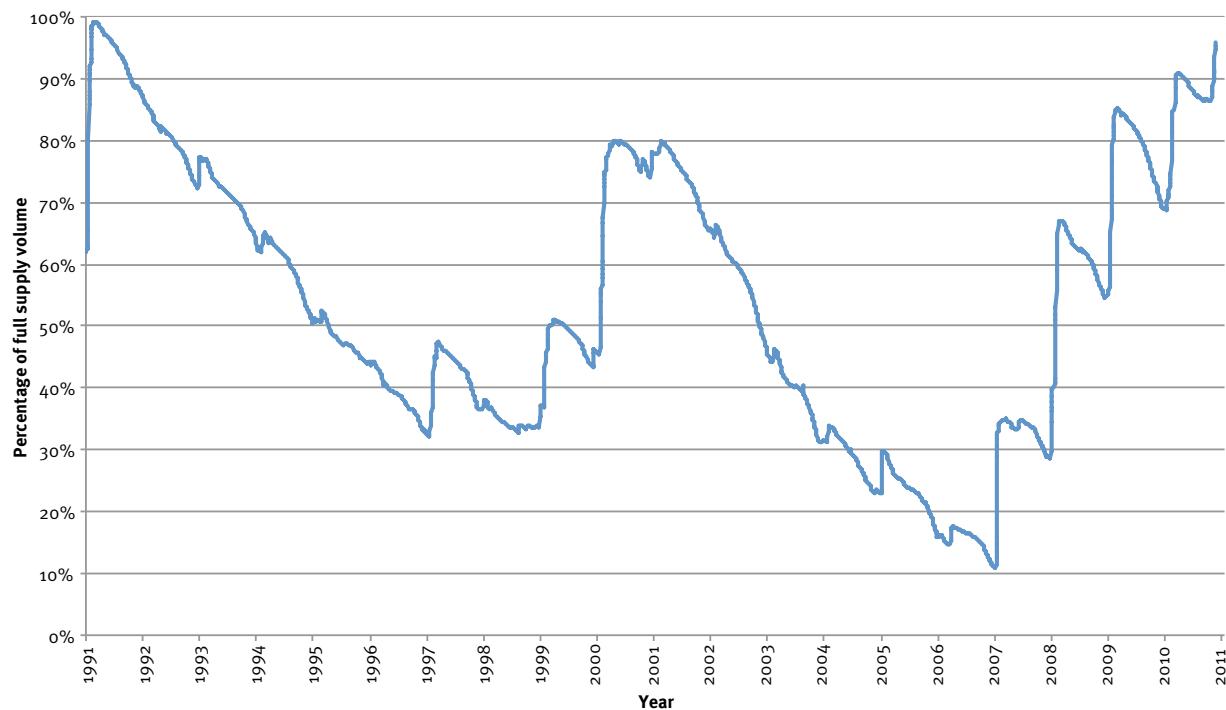


Figure 3: Historical storage behaviour of Peter Faust Dam

# Future water use

Effective water supply planning must be evidence-based and consider likely and possible changes in future water demand.

A forecast of Whitsunday's future urban water demand was collaboratively developed between DEWS and council. It is based on existing water sources, water use rates and population projections. The population projections were developed by council as part of the *Whitsunday region economic analysis: economic and population study* prepared by Norling Consulting (the Norling study). These water demand projections will, of course, remain subject to ongoing monitoring of actual population growth and variations in water use trends (e.g. education and provision of more timely personal water consumption data may reduce consumption).



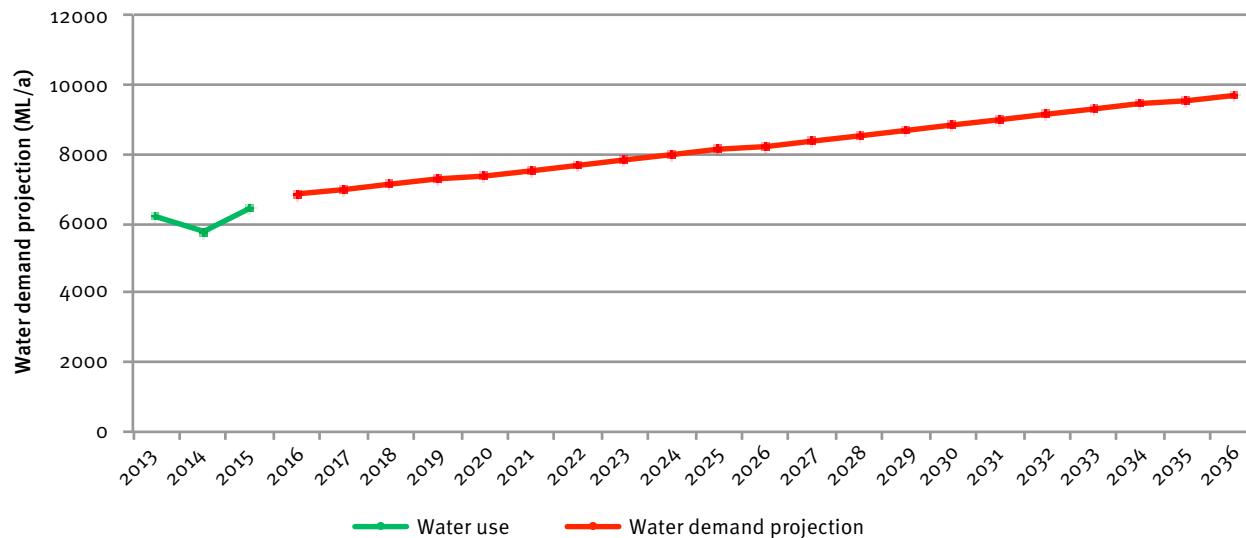
Image courtesy Tourism and Events Queensland

## Whitsunday's reticulation network

It is anticipated that the total Whitsunday population will increase from approximately 33 000 to over 47 000 by 2036. By this time, it is expected that urban water demand will increase over 25% above the council's water use in 2014–15 (see Figure 4). This increase is driven by a combination of residential water use and anticipated population growth. The Norling study suggests that the majority of population growth will occur in the coastal communities of Airlie Beach and Cannonvale. A slight increase in the proportion of the Whitsunday population connected to the reticulation network is expected to occur over this 20-year period (from approximately 69% in 2015 to 74% in 2036).

While it is difficult to predict, recent trends suggest that moderate growth in tourist numbers may continue. The Heart Hotel (currently under construction in Airlie Beach's Main Street), along with a number of other tourism accommodation proposals (both in Airlie Beach and on the Whitsunday Islands), looks set to increase tourist activity in the region. The proposed development of Shute Harbour Marina Resort has been given conditional approval from the Queensland Coordinator-General and the federal Minister for the Environment, and could support further tourism growth in the area. This assessment assumed that the water use associated with tourism is captured as non-residential demand and is expected to grow in proportion to the serviced residential population (at an average of 1.9% per annum).

The current average daily water use of 740 L/c/d for the Whitsunday communities was assumed to represent the average daily water demands into the future. This average daily demand level will sometimes be exceeded, as it is based on an average demands on the system over a number of years rather than the maximum daily demand. However, the use of average demand provides a means of indicating when demand is likely to exceed available supply.



**Figure 4:** Projected water demand for the Whitsunday communities



Image courtesy Tourism and Events Queensland

## Other users of bulk water supply sources

### Mining

Some coalmining development is progressing in the area, including the planned expansion of the Abbot Point Port. The expansion of the port is proposed to cater for coalmining developments in the region and the Galilee Basin. There is a possibility that some high priority water may be requested from within the Proserpine River WSS should the expansion proceed.

It is not anticipated that any of the other mining developments will have any impact on water supply security for the Whitsunday communities.

### Agriculture

Council considers that the recent low sugar prices and the sharp increase in electricity costs may have reduced agricultural activity within the Whitsunday region. While these factors may have kept agricultural activity and its associated water use low, it is considered that the region is capable of supporting agricultural expansion, with the Proserpine Sugar Mill steadily increasing its production over the last few years. With irrigators historically using close to their full allocation during times of low rainfall, and the possibility of the sugar industry expanding in the area, the trend of low water use for agriculture may not continue. Therefore, this RWSSA considered the impacts to council's water supply security, both with agricultural water use continuing to be low and with it increasing to match irrigator's entitlements. If required, the agricultural sector could source additional water (i.e. on top of their existing entitlements) by entering into short-term water leasing contracts with SunWater for its uncommitted water allocation.

### Other towns

It is not anticipated that future water use by Mackay Regional Council from the Proserpine River WSS will significantly affect the water supply security of the Whitsunday communities. This is mainly due to the low demand that Mackay Regional Council places on the Proserpine River WSS. However, the Laguna Quays Resort area may be redeveloped and result in a modest increase in this demand.

# Water supply system capability

## Hydrologic assessment of Whitsunday's water supply system

Hydrologic assessments have been undertaken to ascertain the capability of Whitsunday's existing water supply system (including existing operational arrangements and water entitlements) to meet current and projected future water demands. In particular, the hydrologic modelling tested the potential improvements to water supply security resulting from implementing water restrictions and using unsupplemented groundwater supplies, as well as from low levels of utilisation (i.e. 50%) of agricultural water allocations.

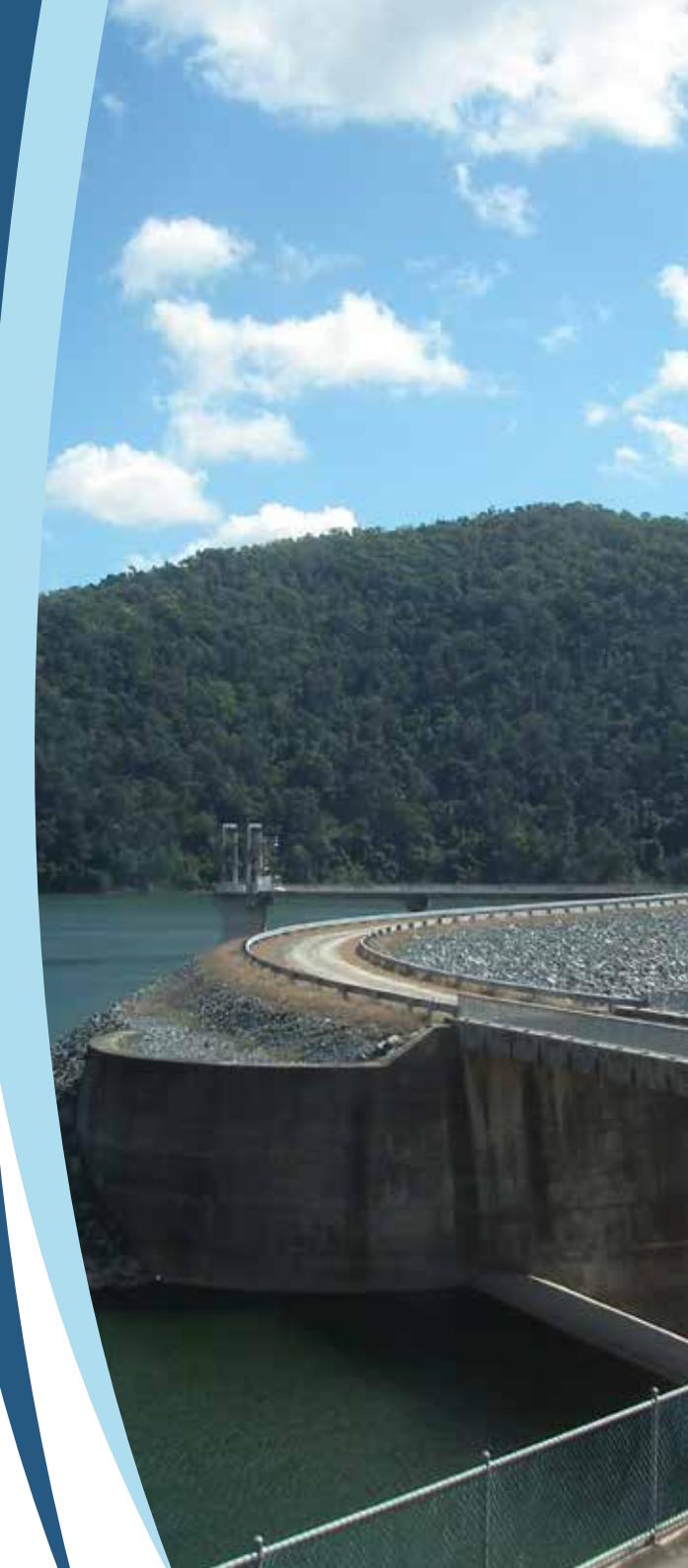
Both historical and stochastic modelling techniques were used to simulate the performance of Whitsunday's water supply. The stochastic modelling involved generating 100 replicates of 10 000 years of stochastic data, which incorporated key statistical indicators from the historical record. This accounts for a wider variation of potential climatic scenarios than the historical record. The hydrologic assessments used a number of total high priority demand levels for the Whitsunday communities and SunWater's uncommitted water allocation to reflect the impact of population growth (or other causes) on increasing demand.

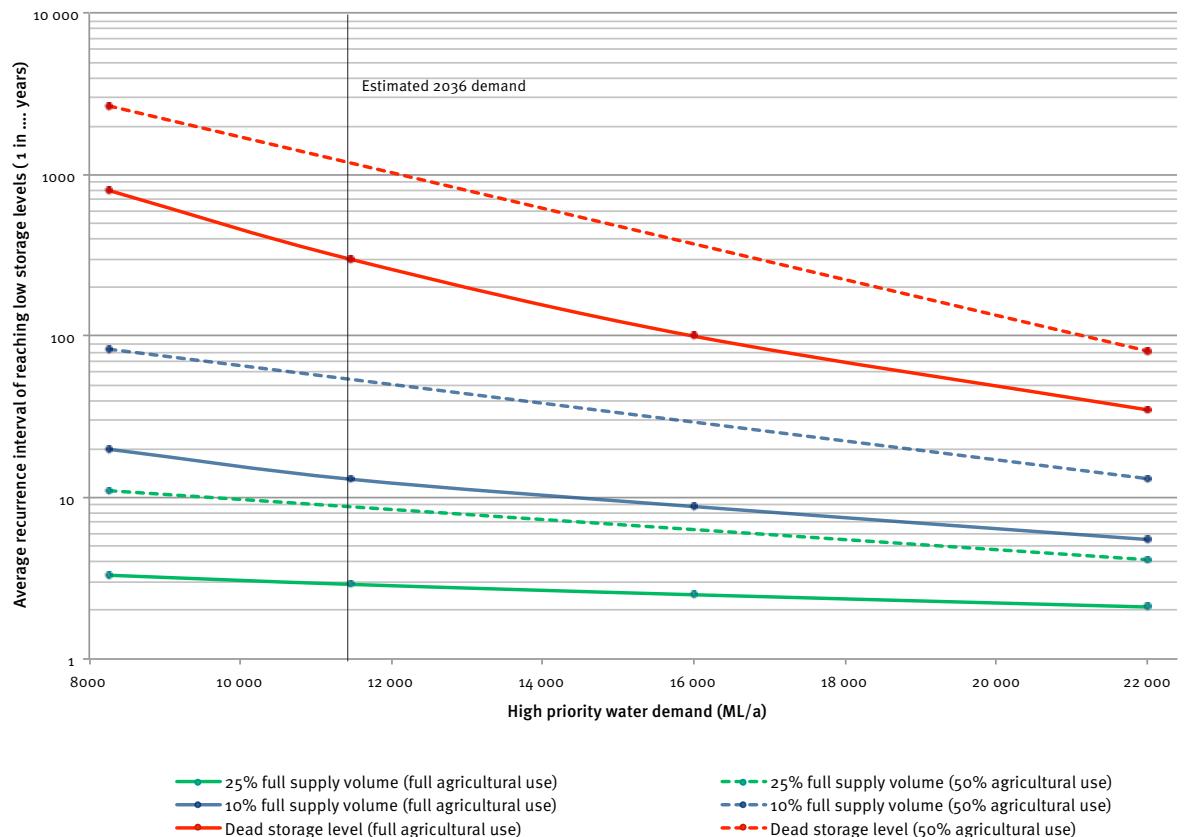
Stochastic modelling results indicate that the level of agricultural water use can significantly affect the observed water supply performance of the Whitsunday communities. Figure 5 presents the estimated frequency of reaching low water levels in Peter Faust Dam under a range of demands.<sup>6</sup>

At current high priority demand levels<sup>7</sup>, the frequency of reaching low water levels in Peter Faust Dam more than doubles when agricultural allocations are fully utilised compared to 50% use. With 50% use of agricultural allocations and current high priority demands of 8255 ML/a<sup>7</sup>, the frequency at which Peter Faust Dam reaches 25% of full supply volume is expected to be once every 11 years. With full use of agricultural allocations, it is estimated that the frequency at which the dam reaches this level would increase to nearly once every 3 years.

<sup>6</sup> The stochastic modelling results were aggregated and the median output used to identify the likelihood of low water levels and water supply shortfalls. The median represents the 'centre' of the data, as half of the sequences had a lower likelihood and half had a higher likelihood of an event occurring.

<sup>7</sup> High priority demands include the demands of Whitsunday communities, as well as that of other users of high priority water such as SunWater and the Proserpine Sugar Mill.





**Figure 5:** Frequency of reaching low storage levels in Peter Faust Dam (based on full and 50% utilisation of agricultural allocations and assuming no urban water restrictions)

Figure 5 also illustrates that as high priority demands increase, the frequency of reaching low storage levels in Peter Faust Dam and having a supply shortfall increases. This is an important consideration under a high demand scenario resulting from, for example, a high level of population growth or a significant increase in the region's tourism industry. For example, based on a projected

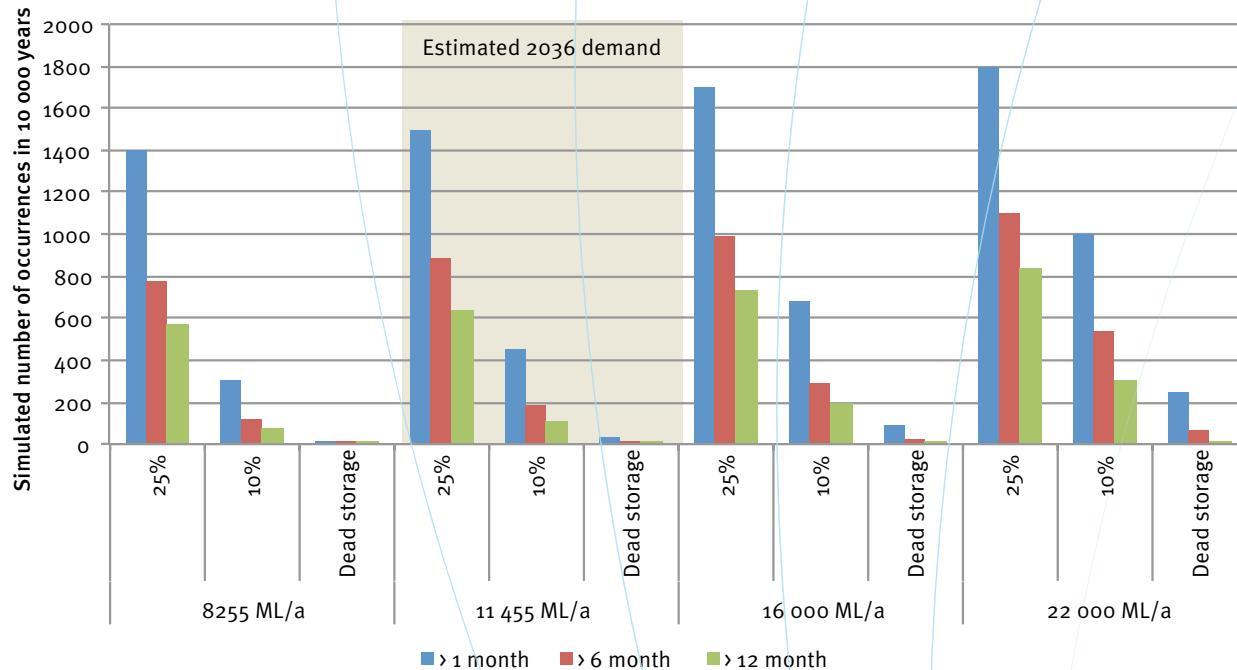
2036 demand of 11 455 ML/a<sup>8</sup>, the average recurrence interval of Peter Faust Dam falling to dead storage level is approximately once every 300 years. Under a high demand scenario that assumes a projected 2036 demand of 16 000 ML/a, this frequency increased to once every 100 years. These results are based on no urban water restrictions being imposed with declining water levels.

<sup>8</sup> High priority demands include the demands of Whitsunday communities, as well as that of other users of high priority water such as SunWater and the Proserpine Sugar Mill.

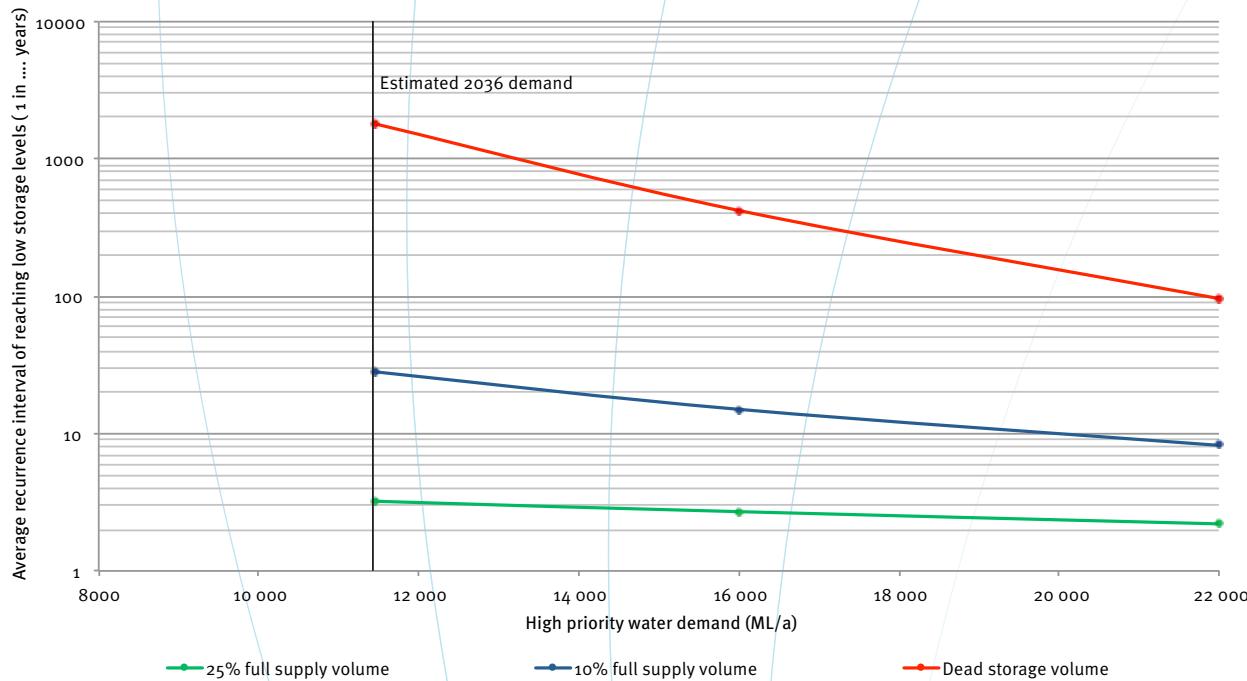
Figure 6 shows, for a range of urban water demand levels, the predicted frequency of Peter Faust Dam being below specified low storage levels for longer than 1 month, 6 months and 12 months. The frequency and duration of Peter Faust Dam falling to low levels is a key indicator of the long-term reliability of the water supply system.

An increased level of water demand increases both the predicted number of occurrences of the dam water storage capacity falling to low levels, and the relative proportion of occurrences that last for longer than 6 and 12 months. It could impact on the duration and the severity of water restrictions that may be imposed by council to manage water demand during periods of low rainfall. The results of all scenarios suggest that about 1 in 6 instances of Peter Faust Dam being below 25% will be longer than 12 months, indicating that restrictions could be imposed for a prolonged period of time. Council is currently evaluating their water conservation measures, including the triggers for imposing water restrictions.

Stochastic modelling was also undertaken for scenarios where council is using its water licences to take unsupplemented groundwater. This modelling assumed groundwater is available for council to use its unsupplemented groundwater licence for the Bowen Drinking Water Scheme when Peter Faust Dam falls to 25% of full supply volume, as well as to use its unsupplemented groundwater licence to supply the daily demands of the Coastal and Proserpine drinking water schemes. The unsupplemented groundwater licence volume for the Coastal and Proserpine schemes meets about half of the current demand and a quarter of the projected 2036 demand.



**Figure 6:** Frequency and duration of reaching low storage levels in Peter Faust Dam at various high priority demands (assuming full use of agricultural allocations and no urban water restrictions)



**Figure 7:** Frequency of reaching low storage levels (based on full use of agricultural allocations, accessing unsupplemented groundwater and regionally consistent urban water restrictions)

As seen in Figure 7, having access to these unsupplemented groundwater supplies significantly enhances the long-term reliability of the system, with considerably lower frequency of water levels falling to 10% and dead storage. Stochastic modelling results also indicate that with unsupplemented groundwater supplies available, the duration of low storage levels in Peter Faust Dam is reduced.

## Conclusion

As highlighted above, the assessment results illustrate the benefit that council's unsupplemented groundwater licences may provide to the water security of the Whitsunday communities. The assessment results in this section also demonstrate that the current under-utilisation of agricultural allocations is significantly enhancing the observed water supply security of the Whitsunday communities. Considerations such as the acceptable frequency of reaching low water levels in Peter Faust Dam, the associated frequency of imposing water restrictions and the underlying likelihood of not being able to meet demand are fundamental parts of the water supply planning currently being undertaken by Whitsunday Regional Council and generally by councils across Queensland.

# Moving forward

This RWSSA represents a collaborative approach between DEWS and the Whitsunday Regional Council to establish a shared understanding of the existing performance of Whitsunday's water supply and its capacity to support future growth.

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Council has adopted this RWSSA as part of the development of its regional water supply strategy for the greater Bowen and Whitsunday regions. Council has identified a number of actions to be undertaken in the short term, with the following actions of particular relevance to this RWSSA:

- Initiate discussions with SunWater regarding the purchase of additional high priority water allocations to support system reliability, prior to the Whitsunday communities' total demand exceeding high priority allocation nominal values.
- Roll out a revised water restrictions policy inclusive of permanent demand management measures, which include education, more timely water consumption data provision to customers and a greater focus on reducing non-revenue water.
- Undertake a groundwater reliability assessment of council's un-supplemented groundwater entitlements.
- Initiate discussions with Department of Natural Resources and Mines regarding water resource planning outcomes when the Water Resource (Whitsunday) Plan 2010 is scheduled for review in 2020, to ensure they address the long-term security of the high priority water allocation from Peter Faust Dam or alternative supplies from the region are properly assessed at appropriate times.

This RWSSA is the first step towards addressing these actions. This report shows that the storage performance recently observed is due, in large part, to the efficient practices of the other water users of Peter Faust Dam and the relatively small demand from urban communities. Over the next 20 years, with the anticipated population growth, future dry periods may manifest themselves as droughts of real consequence. Modelling can show that previous dry periods would have significantly impacted the community had demands been at a higher level. Council is motivated to ensure the community is able to prepare for and actively manage demand and supplies for this eventuality, so that water security is maintained and the desirable lifestyle enjoyed in this region is protected.

The council's regional water supply strategy development process is ongoing and current and future work includes:

- determination of what is an appropriate level of service for water supply security for the Whitsunday region, consistent with the concepts described within this RWSSA
- assessment of the cumulative impacts of future population growth and water demand, including significant projects such as the proposed Abbott Point/Shute Harbour development

- investigating water substitution options, such as recycled water to public open space and parklands, to maintain lifestyle outcomes while reducing council's total demand on Peter Faust Dam
- updating the strategy regularly as the performance of council's demand management program is known
- finalising levels of service, demand management and drought management strategies for the provision of long-term water supply security for the Whitsunday region.

It is anticipated that council will release its regional water supply strategy report by the end of 2016.



Image courtesy Tourism and Events Queensland

**For more information on the  
Regional Water Supply Security Assessment program  
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