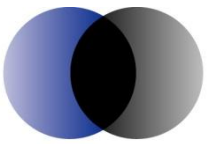
# Independent review of distribution network feeder category definitions

An independent review of distribution network feeder category definitions for the Utilities Commission

**October 2012**



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# 1 Introduction

The Utilities Commission (the Commission) is the independent industry regulator for the Northern Territory (the Territory). It has various responsibilities in the energy, water and sewerage industries. Those responsibilities include regulating the electricity transmission and distribution networks in the Darwin-Katherine, Alice Springs and Tennant Creek regions (the regulated networks).

Electricity supply in the Territory is characterised by Government-owned and vertically integrated generation and transmission and distribution networks. Power and Water Corporation (PWC) is the monopoly operator of the electricity generators and networks in the Territory. Electricity retailing is dominated by PWC, although it has recently been opened to competition and two licences have been issued to other retailers.

Much of the Commission's current work stems from the Territory Government's approval, in 2009, of a reform program to strengthen regulatory oversight of the regulated industries (including electricity) in the Territory. The Commission's projects under that reform program are wide ranging. They include a review of Electricity Standards of Service for the Territory. Standard of Service in the electricity supply industry is governed by the Commission's Electricity Standards of Service Code, which took effect in 2006 (original Code).

The Commission is in the process of revoking the original Code and has been consulting on replacing it with the "Northern Territory of Australia Electricity Standards of Service Code" (the draft Code).

In the draft Code, the Commission proposes that reporting and targets for distribution network reliability performance should be segmented by feeder category. The feeder categories are defined in the draft Code.

Consistent with PWC's submission to the draft Code, the Commission initially proposed to base the feeder category definitions in the draft Code on the same definitions that have been used for distribution network performance reporting around Australia for some time.

However, PWC's recent application of the categories to its networks has revealed that parts of the Territory that would otherwise be considered urban are defined as rural (short). This was an unintended consequence in light of which the Commission is seeking to ascertain whether the application of standard feeder categories is consistent with the objectives of the draft Code.

In particular, the Commission is concerned that the presence of so many rural feeders in areas it regards as urban areas may affect the reliability performance target levels set for each feeder category and any like-for-like comparisons with other Australian distribution networks.

In this report ACIL Tasman has revisited the application of the standard feeder categories to the regulated networks. Three issues were considered:

1. whether the feeder categories have been properly applied or whether the issues the Commission has identified has resulted from error;
2. whether having feeders categorised as 'Rural short' supplying areas that would normally be considered to be 'Urban' has any implications for regulation of service performance in the Territory; and
3. whether adjustments to the feeder category definitions can be made to address those implications.

The remainder of this report is structured as follows.

Section 2 provides an overview of standard of service regulation and the way it is applied to electricity distributors in Australia.

Section 3 provides an overview of electricity networks in the Territory and a more detailed description of the Commission's concern.

Section 4 provides a brief overview of the data used in conducting this analysis.

Section 5 contains our review of PWC's application of the feeder categories to the regulated networks and our analysis of the possibility that the standard feeder categories could be redefined to address the misalignment identified by the Commission.

Section 6 provides a conclusion and recommendation.

# 2 Distribution networks – service standard regulation

Electricity distribution networks in Australia are, without exception, monopolies. This means that, unlike almost every other market in Australia, consumers are unable to choose who 'their' electricity distributor will be. It also means that electricity distributors are not subject to competitive forces when they set the price and quality of the distribution services they provide.

As competition between them is not possible, electricity distributors in Australia are subject to economic regulation. This approach is primarily concerned with the price(s) an electricity distributor may charge, or the revenue it may earn. However, to prevent regulated businesses from cutting reliability and quality of supply to improve profitability, price regulation is usually accompanied by service standard regulation. This forms an important part of the 'regulatory bargain' that a regulator strikes with a regulated business on behalf of customers.

## 2.1 Service quality for a distribution business – reliability of supply

Electricity distribution businesses 'deliver' electricity. The key distinction between 'high' and 'low' quality electricity distribution services is the frequency and duration of supply interruptions (blackouts). This is known as the reliability of supply.[1,2]

Supply interruptions are infrequent in Australian electricity systems and the vast majority of Australian electricity customers enjoy highly reliable electricity supply.

However, supply interruptions still occur. Most of those that do occur are caused on distribution networks.

From a technical perspective the frequency and duration of supply interruptions could be reduced by investing in more network infrastructure. However, this is costly.

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[1] There are also other aspects of service quality, such as a distribution business' responsiveness to customer calls. The focus of this report is on reliability of supply, so these other aspects are not discussed.

[2] This report focuses on feeders, which are a component of an electricity distribution network. Therefore, the term 'supply interruptions' in this report refers only to interruptions caused on the distribution network, supply interruptions caused by generation and transmission network issues are excluded.

The cost of providing improvements in reliability of supply must be traded off against the benefit received, taking into account the number of customers who will receive that benefit and the value they place on improved reliability of supply.

## 2.2 Regulating reliability of supply

Reliability (and other measures of supply quality[3]) is regulated using an incentive based approach.

In this approach a regulator does not specify which improvements the distribution business should (or should not) make. Rather, the regulator creates a system of incentives, often financial bonuses and penalties, intended to encourage the distribution business to provide customers with optimal reliability of supply.

A service standard regime for electricity distribution generally consists of two components:

1. average standards for frequency and duration of outages, supply quality and customer service, some of which may be coupled with a financial incentive to improve service over time or penalty for failing to achieve a target level of service
2. a Guaranteed Service Level (GSL) scheme, designed to compensate individual customers who receive an unacceptable level of service.

S-factor schemes may or may not be accompanied with a financial incentive.[4] GSL schemes routinely include a payment to customers who do not receive the guaranteed level of service.

Between them, average service standards and GSL schemes give electricity distributors an incentive to ensure that, while the service experienced by individual customers will vary, the average level of service is satisfactory and, at the same time, no individual customer experiences service that is far below that average target level.

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[3] See footnote 1.

[4] We understand from the Commission that it has decided not to proceed with a financial incentive scheme for average reliability performance. The Commission considers that PWC is not ready and that it would be premature to apply this type of scheme in the 2014-19 network price determination. It is understood that there will be no other penalty/reward in relation to network performance other than the GSL scheme. For readability, in this report we refer to regulating reliability of supply as a generic reference to regimes including either an s-factor or GSL scheme or both.

Another approach that is used, either with these two methods or on its own, is reporting. Some jurisdictions require electricity distributors to report reliability performance at the individual feeder level for the worst performing feeders.

As discussed in the previous section, it is optimal for a distribution business to invest in improving reliability of supply where the benefit of doing so (to customers) is greater than the cost of the investment

It follows from this that a service standard regime should encourage a distribution business to make investments to improve reliability that meet this test or, in other words, investments that are economically justified. Therefore, the targets for s-factor schemes and the guaranteed service levels for GSL schemes should be set with regard to the cost of providing improvements and customers' willingness to pay for those improvements.

## 2.3 Segmenting performance targets

It is common for electricity distribution networks to be described as if they are a single, homogeneous unit. Performance is often reported and compared at the network level, which assumes that all customers connected to the network receive the same level of service.

In practice, though, networks are not homogeneous. A network consists of a series of feeders that are all connected to one another. The performance of the network is the aggregate of the performance of each feeder, which varies feeder by feeder depending on local conditions, whether the feeder is part of a meshed or radial network, the feeder's length, the number of customers it supplies and other factors.

Distribution networks typically consist of two broad types of feeders:

- meshed feeders, which are characterised by multiple redundant elements
- radial feeders, which are characterised by few, if any, redundant elements.

Regardless of the nature of the network that supplies a particular customer, or group of customers, improving service standards is costly. However, the cost of providing improved service varies substantially for different types of feeders. In particular, it can be much more costly (in absolute terms) to make improvements in reliability of supply on radial as opposed to meshed feeders.

Furthermore, given that radial feeders typically supply fewer customers per kilometre (km) of feeder length than meshed feeders, the cost of improving service on a per customer basis on radial feeders can be substantially higher than the corresponding cost on meshed feeders.

Targets for reliability of supply (or other service standards[5]) could be set across groups of feeders that are characterised by a significantly different cost of providing improvements in reliability of supply (on a per customer basis). If this approach is taken, the targets will tend to be:

- more stringent than economically justifiable for feeders with high 'cost to improve', generally radial feeders on the edge of the network; and
- less stringent than economically justifiable for feeders with low 'cost to improve', generally meshed feeders in the middle of the network.

Therefore, a 'one size fits all' approach to applying reliability standards would typically result in targets that are 'dragged down' by the performance that can reasonably be achieved on the (radial) fringe of the network. These average targets would not reflect the reliability experienced by those customers supplied by feeders in the meshed part of the network. Nor would it reflect the reliability of supply for which those customers are willing to pay (as a group).

Over time a 'one size fits all' approach to applying reliability standards may lead to deterioration in the service standards experienced by the majority of customers.

To prevent this, regulators in most Australian jurisdictions have service standards to reflect the nature of the network in different places. This has been achieved by applying different reliability standards to different feeders.

Rather than assigning performance targets to individual feeders, which would be administratively cumbersome, reliability standards have typically been applied to groups of feeders.

This raises the question of which feeders should be grouped together and which separated. In other words, how feeders should be categorised.

The approach taken in different Australian jurisdictions is discussed in sections 2.3.1 to 2.3.7 below.

### 2.3.1 National level

Feeders were first categorised by Victoria's Office of the Regulator General (ORG). The ORG determined that feeders should be divided into four categories, defined as follows:

1. CBD – a feeder supplying predominantly commercial, high-rise buildings, supplied by a predominantly underground distribution network containing significant interconnection and redundancy when compared to urban areas.

[5] See footnote 1

2. Urban - a feeder, which is not a CBD feeder, with actual maximum demand over the reporting period per total feeder route length greater than 0.3 MVA/km.

.3 Rural short - a feeder which is not a CBD or urban feeder with a total feeder route length less than 200 km.

4. Rural long - a feeder which is not a CBD or urban feeder with a total feeder route length greater than 200 km.

These four feeder categories were later adopted by the Steering Committee on National Regulatory Reporting Reform (SCONRRR).

When the feeder categories were adopted, SCONRRR noted that they were not widely supported. However, with a desire for national consistency and no common theme to the alternative proposals, SCONRRR had no practical alternative.[6]

Distribution networks were not regulated at the national level at that time, so, while the SCONRRR feeder categories were adopted nationally, this was for national reporting purposes only. Service standard regulation was managed by individual State regulators.

This began to change with the inception of the Australian Energy Regulator (AER) in 2007. The AER's approach is discussed in section 2.3.7.

### 2.3.2 Victoria

Since 2001, the Essential Services Commission (ESC) has been responsible for regulating Victoria's distribution and retail energy markets, taking over from the ORG.[7] The establishment of the ESC coincided with the introduction of full retail contestability for domestic and small business customers. In preparation for full retail contestability, the ORG put in place a suite of regulatory protections and, since then, the ESC has amended the regulatory framework, including new guidelines concerning service standards.

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6 SCONRRR, "National regulatory reporting for electricity distribution and retailing businesses", March 2002, p. 7, available at http://www.accc.gov.au/content/index.phtml/itemId/332190/fromItemId/3894, accessed 17 July 2012

7 Review of Regulatory Instruments: Stage 1 Final Decision October 2008 http://www.esc.vic.gov.au/getattachment/1bdc8bfa-4f68-4cde-8982-d56a9193117d/Review-of-Regulatory-Instruments-Stage-1-Final-Dec.pdf

Victorian electricity distributors work to a set of average supply reliability targets based on the SCONRRR feeder categories. They also operate under a GSL scheme which applies equally regardless of feeder category.[8]

Electricity distributors are held to an Electricity Distribution Code which requires that reporting against targets is based on the SCONRRR feeder categories.[9,10]

### 2.3.3 South Australia

In 2003, the Essential Services Commission of South Australia (ESCOSA) adopted the SCONRRR feeder categories for reporting purposes, albeit with some modifications to take account of the limitations of ETSA Utilities' data (namely line lengths were approximations and load estimates were not necessarily up to date).

Service standards have never been set by reference to the SCONRRR categories in South Australia.[11] Rather, in conjunction with ETSA Utilities, ESCOSA undertook an analysis of three years of historical reliability performance data (2000/01 to 2002/03) to assess the degree of volatility within and across the thirteen development regions identified at the time by ETSA Utilities and to form a view on the degree to which it would be reasonable to combine some regions in order to reduce this volatility.

The outcome was to reduce the number of regions from thirteen to seven which were considered to provide a reasonable representation of differences in reliability performance across the State while eliminating more extreme variations arguably attributable to random, severe weather events.

Reliability of supply targets were set for each of these seven regions and these formed the basis of the service standard regime. ETSA Utilities was also required to report its performance against the SCONRRR feeder categories for the purpose of national comparison.

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8 Essential Services Commission Electricity Distribution Code January 2011 http://www.esc.vic.gov.au/getattachment/a6b85585-af03-4a2e-bb17-dfff74bbd886/Electricity-Distribution-Code-January-2011.pdf

9 Electricity Distribution Code May 2012 Version 7 http://www.esc.vic.gov.au/getattachment/c2697e4e-d485-4b6d-a5a5-11149fa3b3df/Electricity-Distribution-Code-May-2012.pdf

10 Electricity Distribution Code May 2012 Version 7 http://www.esc.vic.gov.au/getattachment/c2697e4e-d485-4b6d-a5a5-11149fa3b3df/Electricity-Distribution-Code-May-2012.pdf

11 South Australian Electricity Distribution Service Standards 2010 -2015 Final Decision http://www.escosa.sa.gov.au/library/100617-ServiceStandards2010-2015-FinalDecision.pdf

ESCOSA faced a similar issue in South Australia as does the Commission in the Northern Territory. The strict application of the SCONRRR categories to ETSA Utilities' network would have resulted in approximately 85 feeders (or 110,000 customers) previously classified as urban being reclassified as rural, due to their load density being less than 0.3 MVA per km.[12] ETSA Utilities individually assessed each of the potential "abnormal" feeders and applied a "commonly accepted notion" of urban versus rural.

ETSA Utilities' submission to ESCOSA's draft decision for the 2010-15 determination of service standards reinforced its reluctance to use the regional approach to reliability reporting and its preference for using the SCONRRR categories alone. Notwithstanding this, ESCOSA's Final Decision for the 2010-2015 regulatory period was that reliability of supply standards:

> will continue to be applied on the basis of the seven regions presently established under the Electricity Distribution Code, with an enhanced reporting regime to be established for reporting on performance on the [SCONRRR feeder categories].

### 2.3.4 Tasmania

The approach taken by the Office of the Tasmanian Energy Regulator (OTTER) to distribution performance and reliability standards represents a significant departure from the SCONRRR approach. It is not based on the nature of the distribution network, but on the community that it serves.

This approach was developed by matching standards to the nature of the individual community, the value of electricity supply reliability to the community, and the cost of providing this level of reliability.

In January 2008, OTTER set distribution network reliability standards for Tasmania through a process of determining the boundaries of geographic regions (those that may have different performance standards from neighbouring regions) of which 101were identified.[13] It then grouped these regions into the following five categories:

1. critical infrastructure;
2. high density commercial;
3. urban;
4. higher density rural; and

[12] See footnote 12

[13] The proposed regions have been classified based on electricity consumption density per unit area. *The ability of Aurora Energy to relate sales data to connection points within its geographical information system (GIS) has enabled this approach. In taking this approach, the working group has assumed that in areas where electricity use is higher, reliability will consequently have a higher value. The working group noted that, in reality, the value of reliability is highly variable within areas, between different consumers and even between times of day.*

5. lower density rural.

These regions and categories were developed by a working group made up of representatives from OTTER, Aurora Energy (Aurora) and the Office of Energy Planning and Conservation and were based on the following design principles:[14][15]

- that it is equitable to have different reliability standards for distinctly different types of communities;
- that like communities should receive like levels of supply reliability;
- that current average performance is generally acceptable to the community in relation to the community's willingness to pay for improved reliability, noting that there exist areas of poor performance;
- that communities receiving a level of supply reliability lower than that appropriate for the nature of that community should be individually recognised by the standards; and
- that there exists a minimum level of supply reliability that an electricity distributor should provide to all customers.

Despite this approach to the determination of reliability standards, similarly to ETSA Utilities in South Australia, Aurora continues to report performance against the SCONRRR feeder categories for national comparison.[16]

### 2.3.5 Queensland

In May 2001, the Queensland Competition Authority (QCA) noted that the quality and quantity of available data was not sufficient to enable an effective service quality regime to be put in place.[17]

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[14] Joint Working Group Final Report Distribution Network Reliability Standards Volume I- Summary of Recommendations and Overview. http://www.economicregulator.tas.gov.au/domino/otter.nsf/LookupFiles/R%20-%20Dx%20Standards%2007%20Final%20Report%20v1.0%20Volume%201.pdf/$file/R%20-%20Dx%20Standards%2007%20Final%20Report%20v1.0%20Volume%201.pdf

[15] The second volume of the Joint Working Group Final Report contains more technical details on the methodology employed in relation to the above, including the way in which the maps were developed.

[16] Joint Working Group Final Report Distribution Network Reliability Standards Volume I – Summary of Recommendations and Overview.http://www.economicregulator.tas.gov.au/domino/otter.nsf/LookupFiles/R%20-%20Dx%20Standards%2007%20Final%20Report%20v1.0%20Volume%201.pdf/$file/R%20-%20Dx%20Standards%2007%20Final%20Report%20v1.0%20Volume%201.pdf

[17] Final Determination Regulation of Electricity Distribution May 2001 http://www.qca.org.au/files/ACF895.pdf

To address this, the QCA introduced a comprehensive service quality reporting and monitoring regime for the 2001-2005 regulatory period. The intention was that this would support the development of an appropriate incentive regime for the next regulatory period. Electricity distributors were required to report specific service quality measures which would support the development of an appropriate regime in the next regulatory period.

Service quality data were segmented by classifying feeders according to whether they served a CBD, Urban or Rural area using the SCONRRR feeder categories.

The QCA also sought a method of segmenting service quality data, stating service quality measures need to not only reflect the performance of the electricity distributor, but also the basic geographic and demographic characteristics of the region. Its objective was to allow a comparison with distribution systems with broadly similar characteristics.

In its Final Determination Regulation of Electricity Distribution of April 2005[18], the QCA noted the difficulty experienced in developing a set of service quality incentives in 2001 due to the lack of available and comparable service quality data for distributors. A number of service quality initiatives were announced and the QCA released its decision on a service quality incentive scheme to be incorporated into the regulatory arrangements commencing 1 July 2005. This scheme was to be based on a regulatory contract with each distributor and targeting specific service quality outcomes to be achieved by the end of the next regulatory period.

In 2008, the AER published its framework and approach paper for Qld electricity distributors in November 2008, in which it stated that it would apply its Service Target Performance Incentive Scheme for Electricity Distribution Network Service Providers (STPIS) in the next regulatory period (2010-2015).

When the application of the STPIS was imminent, Ergon Energy sought increased capital expenditure for a feeder improvement program to meet it. [19]

However, the AER did not consider that this increased capital expenditure was necessary or prudent. It maintained that Ergon Energy's forecast reliability and quality improvement capital expenditure should remain at current regulatory period levels in the final decision.[20]

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[18] http://www.qca.org.au/files/ACF14.pdf

[19] Ergon Energy, *Revised regulatory proposal,* January 2010.

[20] Queensland Final Distribution Decision, 2011 – 2015, pg 119. http://www.aer.gov.au/sites/default/files/Queensland%20distribution%20decision.pdf

In its Final Decision for the current period, the AER has set STPIS targets based on the SCONRRR classification of feeders with adjustments made on an individual distributor basis which require steady improvements in the reliability of supply provided by Energex and Ergon Energy.

### 2.3.6 New South Wales

The New South Wales Minister for Energy (the Minister) is responsible for the design, reliability and performance licence conditions for electricity distributors operating in New South Wales.

The Independent Pricing and Regulatory Tribunal (IPART) is the independent regulator that determines the maximum prices that can be charged for retail energy and monitors service delivery, and licence compliance.

Effective from 1 December 2007, utilising the SCONRRR feeder classifications, NSW electricity distributors were required to reach minimum average reliability performance standards, measured as System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) by individual feeder type. [21]

These licencing conditions were to be reviewed by the Minister by June 2010 so that any changes or amendments could coincide with the commencement of the 2014-19 regulatory period. To date this has not taken place, however the Australian Energy Market Commission presented its Final Report – NSW Workstream, Review of Distribution Reliability Outcomes and Standards to the New South Wales Government on 31 August 2012 which is currently under review by the Minister.[22]

At present in NSW, the electricity distributors are required to meet and report on the reliability standards on an *average* basis across their network, and also meet and report on reliability performance on an individual feeder basis, which provides a *minimum* level of performance for all customers.

Where an electricity distributor does not meet the individual standard, additional reporting is required, including the cause of exceeding the standard, any action to improve the performance and any operational actions which were identified.[23]

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[21] Design, Reliability and Performance Licence Conditions for Distribution Network Service Providers
http://www.ipart.nsw.gov.au/Home/Industries/Electricity/Licensing/Licence_Conditions

[22] Australian Energy Market Commission *Final Report – NSW Workstream, Review of Distribution Reliability Outcomes and Standards, 31 August 2012*

[23] Australian Energy Market Commission *Final Report – NSW Workstream, Review of Distribution Reliability Outcomes and Standards, 31 August 2012*

### 2.3.7 AER approach

Since its inception in 2007, the AER has made regulatory determinations for electricity distributors in all National Electricity Market (NEM) jurisdictions.[24] Its most recent determination was for Aurora in Tasmania in April 2012.

Generally, the AER's approach to service standard regulation of electricity distribution businesses has been to apply its STPIS, which has four components, namely reliability of supply, GSLs, quality of supply and customer service.

Only the reliability of supply and GSL components of the STPIS are relevant for present purposes.

The reliability of supply component of the STPIS is based on average performance and implemented through a parameter known as the 's-factor'. If a business exceeds an average performance target for a reliability of supply or customer service indicator it receives a payment. If it falls short of the target, it pays a penalty.

The size of the payment or penalty is determined in advance and known as the incentive rate. Any payment or penalty becomes an adjustment in the electricity distribution tariff, so customers ultimately pay more for superior performance or less for inferior performance, though the magnitude for an individual customer will typically be small.

By contrast to the s-factor, under the GSL component of the STPIS an individual customer who receives service that is below a particular level receives a direct payment.

These two components of the STPIS can be varied in their application by changing their parameters. For the s-factor, the average targets and incentive rates can be changed, while for the GSL component, the GSL payments and GSLs can be changed. In setting the parameters, the regulator needs to remain aware that improved service can only be improved at a cost, so increasing these parameters has implications for network costs and therefore tariffs.

The AER has invariably applied the 's-factor' to feeder categories in all jurisdictions other than Tasmania. It has applied the s-factor using the SCONRRR feeder categories. However, it is not clear that this reflects the AER's preference or that the AER has necessarily considered the question of feeder categorisation in detail.

[24] This is all Australian jurisdictions except the Northern Territory and Western Australia.

Under the National Electricity Rules, the AER regulates electricity distribution businesses using a 'propose-respond' model. Electricity distributors begin the process by proposing a regulatory framework which the AER has the choice of either accepting or rejecting entirely. The AER cannot modify an electricity distributor's proposal and can only reject it if it is unreasonable.

In the case of feeder categories, the AER has invariably accepted the electricity distributor's proposed approach. The only exception is that Aurora proposed that the s-factor scheme should not be applied to its business. The AER did not accept Aurora's original regulatory proposal, partly for this reason. In its revised proposal, Aurora proposed that the s-factor scheme be applied to the five categories and 101 regions discussed in section 2.3.4 above. The AER accepted Aurora's revised proposal.

## 2.4 Comparing performance with other jurisdictions

The purpose of this report is, in part, to assist the Commission in considering whether it is appropriate for the Territory to adopt a different approach to feeder categorisation that is currently used in other jurisdictions.

Any change from the standard feeder type definitions will reduce the extent to which comparisons can be made between the Territory and other jurisdictions.

While this is a reason to consider changes carefully, thought should also be given to the value of those comparisons in the first instance.

Broadly, two types of comparison can be made.

First, with standard feeder categories and reporting, it is relatively simple to compare performance in one jurisdiction with another.

Second, the cost of improving performance could be compared between jurisdictions. For example, the cost of reducing SAIDI by a certain amount could be compared between jurisdictions.

The value of the first comparison is unclear. According to the Energy Supply Association of Australia (esaa) SAIDI in the Territory in 2011was 405.6 minutes.[25] This is more than any other State or Territory, and more than double that experienced in some States. In 2011 South Australia experienced the lowest SAIDI, with 155.1 minutes, closely followed by Victoria with 186.8 minutes.

In our view this comparison, in itself, is of little value.

[25] This excludes Indigenous Essential Services.

The Territory has a particular set of characteristics and a particular network. Its SAIDI performance reflects these things. It would not be reasonable to expect that SAIDI performance in the Territory should be the same as in smaller, more densely populated areas such as Victoria or that portion of South Australia connected to ETSA Utilities' main distribution network. However, there is also no way to determine what the relationship between SAIDI performance in those two places should be.

In any case, at the 'whole of network' level reported by esaa, the ability to make these comparisons is unaffected by feeder category.

Similarly, the value of the second comparison is also unclear. From a regulatory point of view, rather than asking whether a reduction in SAIDI could be achieved more cheaply in another jurisdiction a more important question is to ask whether customers are experiencing optimal levels of service. The answer to this question depends on customers' willingness to pay for service improvements and the cost of supplying those improvements.

To analyse this question, it is important to understand the true cost of improving the service experienced by customers on the particular part of the network to which the customer is connected. The cost of improving service in other jurisdictions is not relevant.

## 2.5 Conclusion – how feeders *should* be categorised

The purpose of this report is to consider whether the SCONRRR feeder categories are appropriate for the Territory, or, if they are not, how they should be changed.

Before conclusions can be reached about this, the objective of categorising feeders must be defined.

Sections 2.3.1 to 2.3.7 summarise the approaches taken to feeder categorisation in each of the NEM jurisdictions. It is clear that there are two different objectives for feeder categorisation.

It is also clear the same categorisation is not necessarily applied for both objectives.

The two objectives are to apply feeder categories:

1. to enable nationally consistent reporting; and
2. as the basis of regulating service quality, specifically reliability of supply.

Insofar as jurisdictions require their electricity distributors to report reliability performance for national comparison, the basis is the SCONRRR feeder

categories. [26] However some jurisdictions, such as Queensland, have noted the importance of comparing 'like with like' and contemplated using different feeder categories to enable this comparison.

Insofar as feeder categorisation is intended as the basis for regulating reliability performance, the approaches vary.

Sections 2.3.1 to 2.3.7 above illustrate that where this issue has been considered closely, the approach, and the conclusion, has been broadly similar.

All jurisdictions that have considered the use of feeder categories as the basis of regulating reliability of supply have concluded that it is equitable for customers in *like* areas to receive a similarly reliable supply of electricity. Similarly, it is equitable for the level of supply reliability to be different in different 'types' of area.

The objective of this report is to make recommendations regarding the appropriate feeder categorisation for the draft Code. This aligns closely with the second of the two objectives above. Therefore, for these purposes, our conclusion is that the feeder categories should provide a suitable basis for regulating reliability of supply. In doing this, they should reflect the notion that people in areas that are *alike* should receive like levels of supply reliability.

For the purposes of this report we have assumed that there are two 'types' of areas in the Territory supplied by regulated electricity networks, namely urban and rural areas. In effect, we proceed on the basis that it is reasonable for people in either urban or rural areas to expect to receive the same level of supply reliability as other people living in either urban or rural areas, but that it may be unreasonable to expect the same level of reliability in rural areas as in urban areas.

It should be noted that our analysis excludes those parts of the Territory that are not supplied by regulated electricity networks, notably indigenous settlements and Yulara.

[26] This requirement has now been discontinued in South Australia.

# 3 Feeder categorisation and the Northern Territory

The Territory occupies a significant part of the centre of the Australian continent. However, much of it is barely populated. Outside Darwin, the Territory's capital, there are a few smaller cities, namely Alice Springs, Katherine, Nhulunbuy and Tennant Creek. Outside these, the population is very sparse.

PWC's regulated electricity networks are in Darwin/Katherine, Alice Springs and Tennant Creek.[27] Between them, these networks comprise of approximately 370 feeders. However, only 162 of these supply customers directly. The remainder are excluded from the analysis in this report.[28]

As required under the Commission's GSL Code, PWC applied the SCONRRR feeder categories to the regulated networks. PWC has suggested that the SCONRRR feeder categories should also be adopted in the draft Code.

The categorisation of feeders in the Darwin area is shown in Figure 1, with different feeder types shown in different colours.

Figure 1 also shows, in pink shading, the various parts of the greater Darwin area that satisfy the Australian Bureau of Statistics' (ABS) definition of an urban area.[29]

There is a large area in the middle of this region that does not meet the ABS's definition of an urban area because it is occupied by a Royal Australian Air Force (RAAF) facility, and is thus sparsely populated.

Further, some parts of Darwin south of the RAAF base are primarily industrial, and do not have sufficient population density to satisfy the ABS's definition of an urban area.

For this report the key issue is to distinguish between urban and rural areas. The industrial part of Darwin and the RAAF base are clearly not rural so they were manually added to the urban area shown in Figure 1 notwithstanding their relatively low population density.

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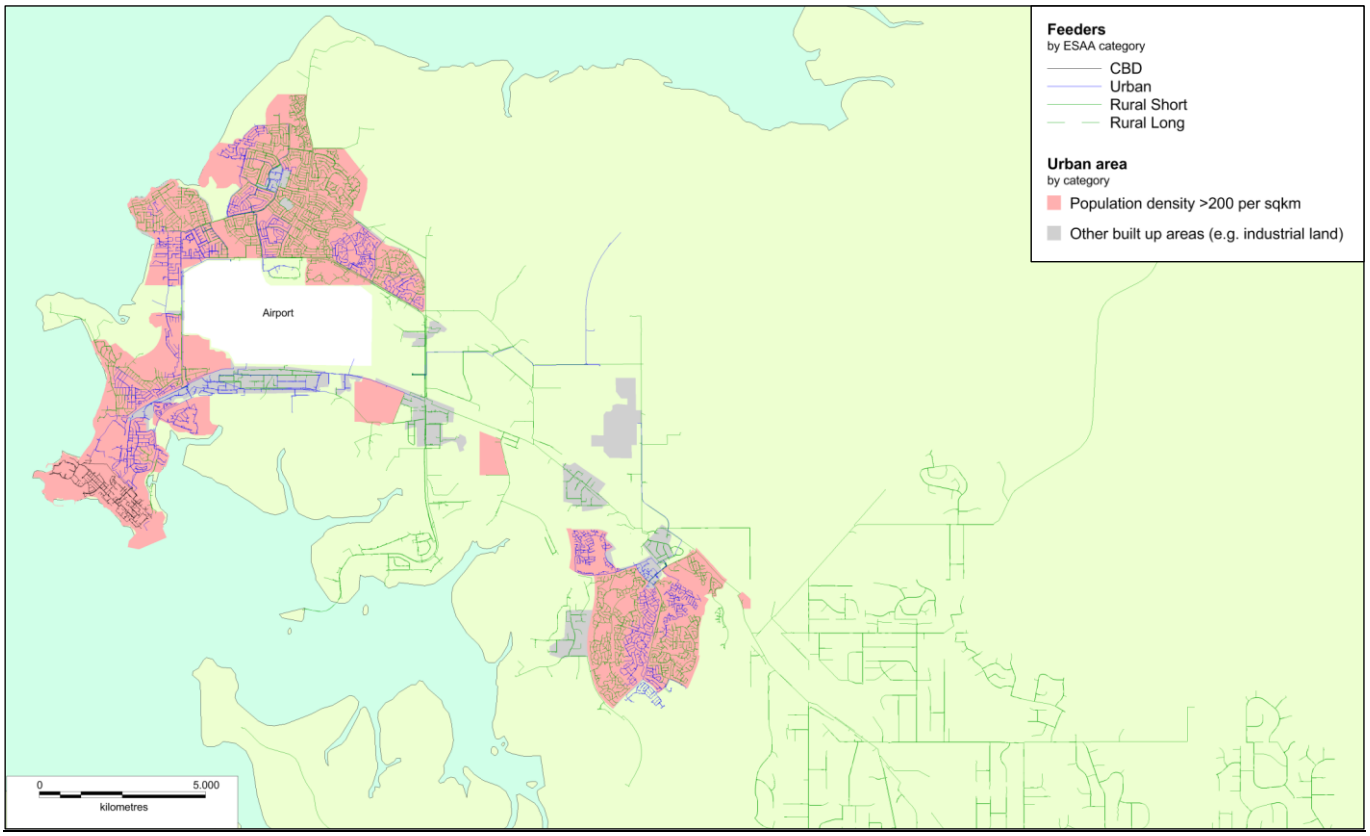
[27] The extent of the draft Code, and therefore the analysis in this report, is limited to the networks in these areas.

[28] Some feeders act as backups for other feeders. These feeders do not supply customers in their own right. Other feeders supply bus bars or transformers rather than customers.

[29] The ABS defines an urban area as a population centre of more than 1,000 people with a population density of at least 200 people per square kilometre

Figure 1 **Darwin – feeder categorisation and population density**

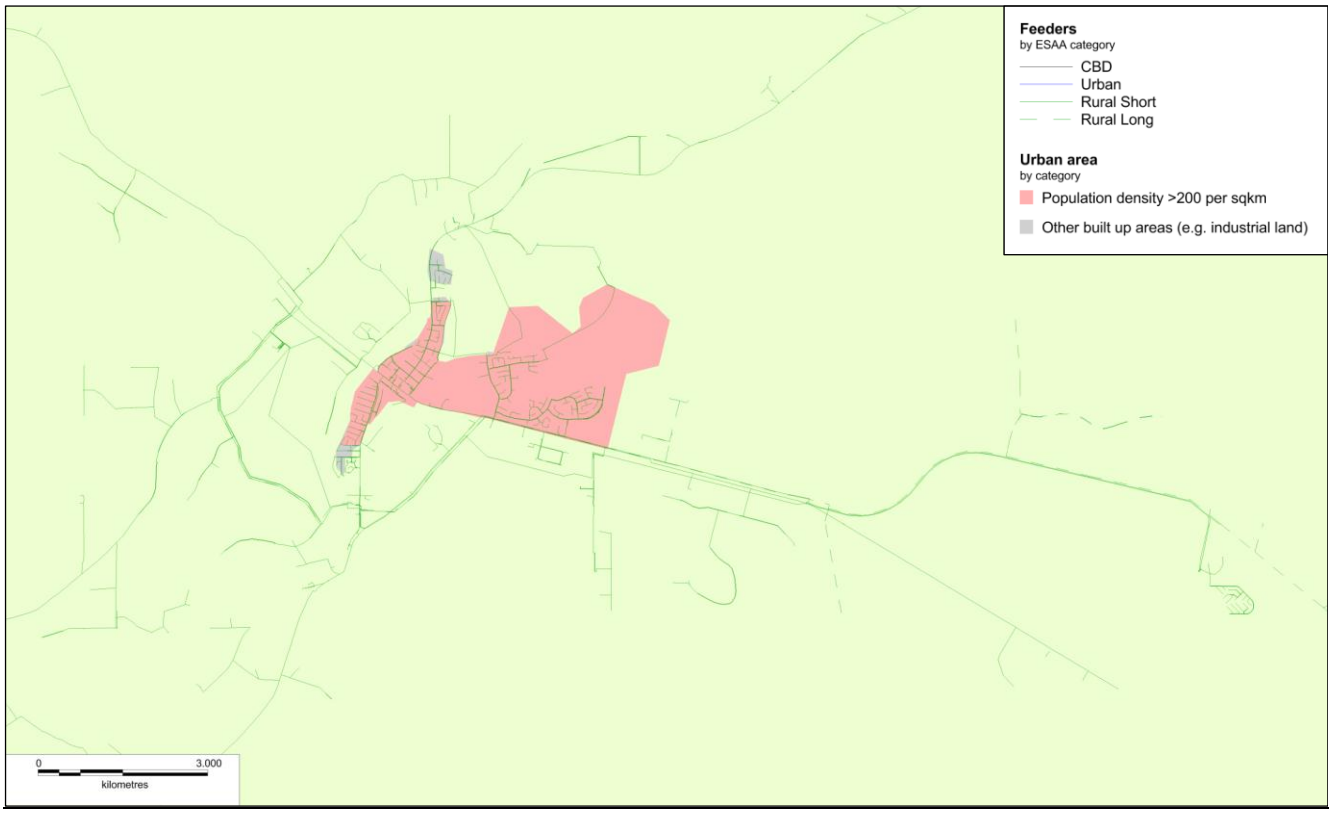



*Source:* Power and Water Corporation (feeder categorisation) and Australian Bureau of Statistics 2011 census (population density)

A clear example of the Commission's concern is seen in the suburbs north of Darwin Airport. Most of that area is supplied by feeders categorised as rural short. However, as the first map shows, this area, which is essentially suburban Darwin, fits entirely within the ABS's definition of 'urban'.

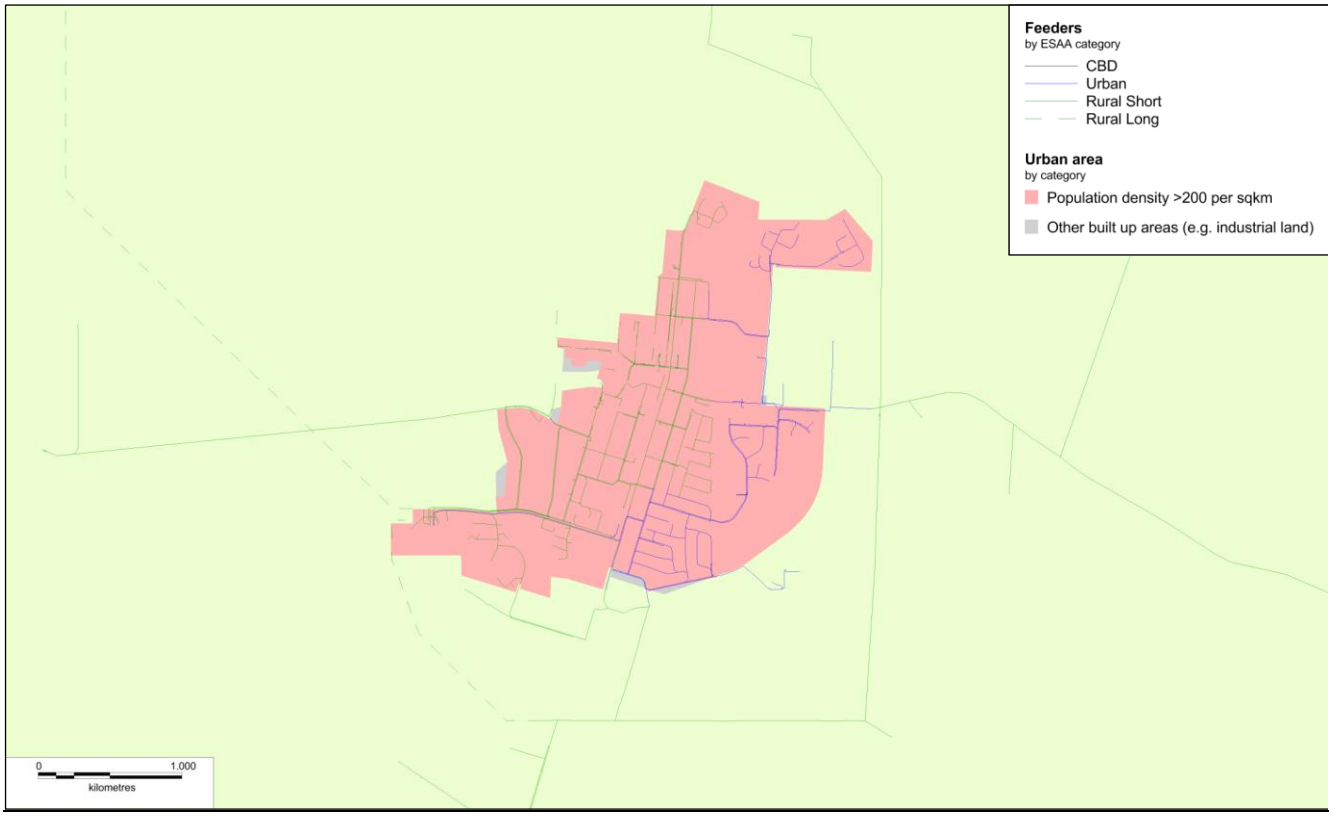
Figure 2, Figure 3 and Figure 4 show the corresponding information for Katherine, Tennant Creek and Alice Springs respectively. They show that a significant proportion of each of these towns is supplied by feeders categorised as rural.

Figure 2 **Katherine – feeder categorisation and population density**



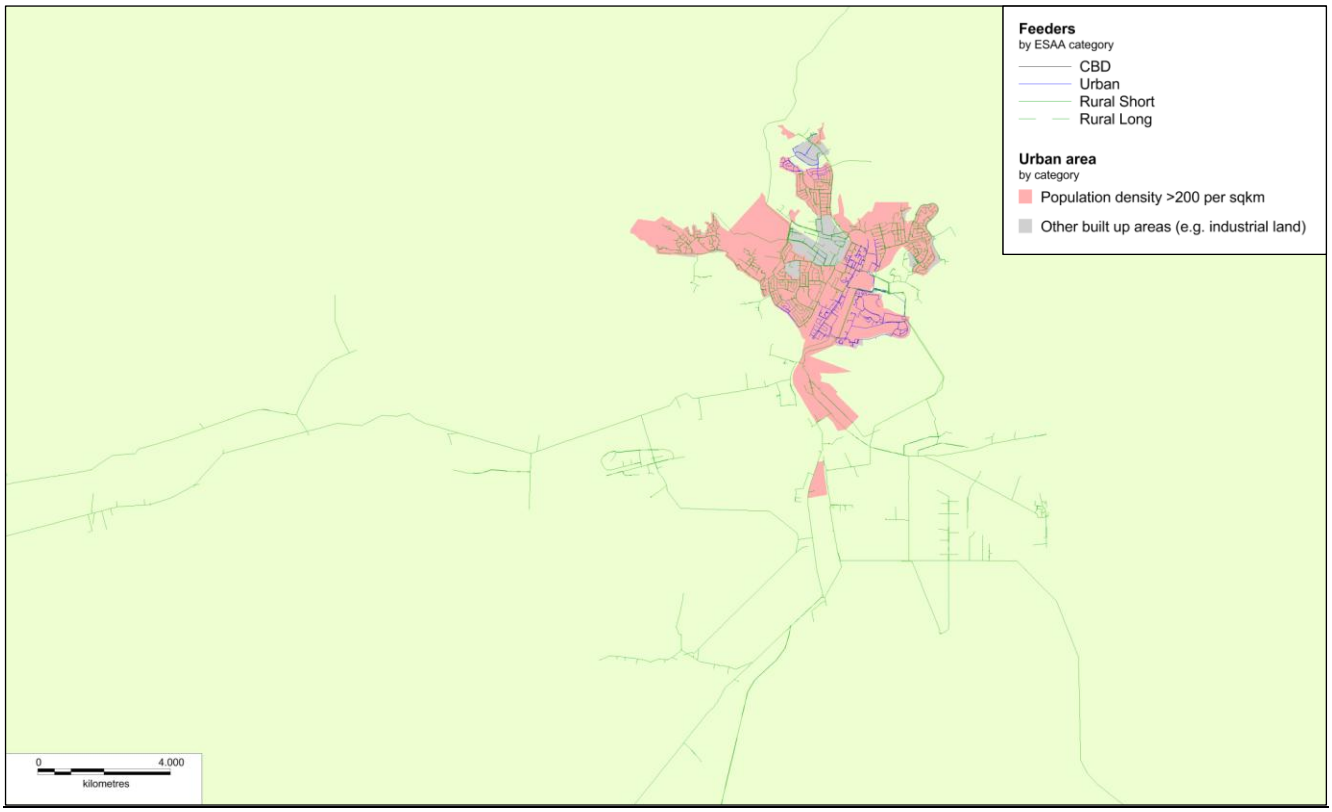

*Source:* Power and Water Corporation (feeder categorisation) and Australian Bureau of Statistics 2011 census (population density)

Figure 3 **Tennant Creek – feeder categorisation and population density**




*Source:* Power and Water Corporation (feeder categorisation) and Australian Bureau of Statistics 2011 census (population density)

Figure 4 **Alice Springs – feeder categorisation and population density**




*Source:* Power and Water Corporation (feeder categorisation) and Australian Bureau of Statistics 2011 census (population density)

Two aspects of the definition of urban should be noted.

First, there is an area on the western edge of Darwin airport, between Ludmilla and Coconut Grove, which is too sparsely populated to meet the ABS definition of urban, though we note that the definition also extends to include areas surrounded by areas with sufficiently dense population. Notwithstanding that this extension may incorporate this area, it is not marked as urban in the maps in this report. However, this makes no difference to the feeder categorisation.

Second, there is an area south of Alice Springs and disconnected from the main township that is sufficiently densely populated to meet the ABS's definition of urban. This is Statistical Area 1 number 7105202. It has an area of 0.86 square kilometres and a population of 561, so it meets the ABS's definition. This said, there does not appear to be a large cluster of homes in this region. In the absence of specific information to the contrary we have trusted the 2011 ABS census data to be correct.

## 3.1 Whether PWC has applied the feeder categorisation correctly

ACIL Tasman applied the SCONRRR feeder categories to PWC's networks based on data supplied by PWC. In some cases we did not have sufficient data to compute the categorisation, though we understand this only affected feeders that do not supply customers. In all other cases, our analysis confirmed PWC's application of the SCONRRR categories. Therefore, we conclude that PWC's application of the categories was correct.

In conducting this check we attempted to reproduce the feeder length data that PWC provided from the GIS data for a sample of feeders in Tennant Creek.

We were not able to replicate the feeder lengths. However, this appears to reflect the fact that feeders may comprise several smaller elements, which our approach to estimating feeder length would tend to double count.

We cannot confirm PWC's data regarding the length of its feeders, but nor can we conclude that it is not correct.

## 3.2 Alternative approach to feeder categorisation

Having verified PWC's application of the SCONRRR feeder categories, the next tasks for which ACIL Tasman was engaged were to:

- identify alternatives to the SCONRRR feeder categories that would best serve the objectives of the Code while allowing PWC to report consistently with its peers and minimising reporting costs;
- determine whether it is appropriate for the Commission to use the SCONRRR feeder categories as the basis for setting targets for reliability of supply and, if not, what alternative methods may be more appropriate (including, but not limited to, amendments to the SCONRRR feeder definition categories).

These two items are similar. They are addressed jointly in this section.

The Commission's concern arises from the fact that a number of feeders in urban areas are categorised as rural.[30] We are not aware of any concerns regarding the feeders defined as CBD. Therefore, our analysis was focussed on the distinction between urban and rural feeders.

[30] The distinction between short and long rural feeders is based on the length of the feeder. It is not relevant for present purposes.

We identified three alternative approaches that could be used to categorise feeders in the Territory. These were:

1. apply the same approach as the SCONRRR definitions, but change the threshold MVA/km value to better distinguish urban and rural feeders
2. categorise feeders as 'radial' or 'meshed'
3. set performance targets for specific (geographic) locations.

These three options are discussed in more detail in sections 3.2.1 to 3.2.3. Our recommended approach, which is a hybrid of these three options, is discussed in section 3.3. That approach is applied to the regulated networks in chapter 5.

### 3.2.1 Re-align feeder categories by altering threshold value

The two feeder categories that are central to the Commission's concern are 'rural (short and long)' and 'urban'. The difference between feeders in these two categories, as defined, is that urban feeders serve load above a threshold of 0.3 MVA per km while rural feeders (long or short) serve less load.[31]

Conceptually, the SCONRRR feeder categories could be altered simply by changing the threshold value. All else being equal if the threshold was lowered the number of 'rural' feeders would reduce and the number of 'urban' feeders would increase.

We understand that the threshold value in SCONRRR's definition was selected by taking frequency scatter plots of the maximum demand observed on feeders in Victoria. The threshold value was somewhat arbitrary and inherently reflects Victorian conditions from the late 1990s.

Given the structure of the definitions, the feeder categories could be redefined simply by changing the threshold value. The advantage of this approach is that it may only require a small change from the existing SCONRRR definitions.

There are three disadvantages.

First, categorising feeders by reference to the load they serve is only as accurate as the link between the load served and the type of area the feeder serves. For example, a long feeder that serves a very large load would have the same average MVA/km as a shorter feeder with a smaller load, though the areas they serve may not be alike.

In other words, there may be little or no relationship between the load on a feeder (per km) and the type of area it supplies. In practice we expect that there is a high correlation between the load on a feeder and the type of area it

[31] Rural feeders are then categorised by feeder length using a threshold of 200 km.

supplies, so this may not be a large problem and that it could be addressed by including an element of discretion to override the automatic categorisation of certain feeders.

Second, the approach is inherently arbitrary. Without an additional source of information it would be impossible to know if the 'right' threshold value has been chosen. A method for overcoming this disadvantage is discussed in section 3.3.

Third, as with any change from the standard SCONRRR definitions, changing the threshold would reduce the ability to compare with other jurisdictions.

However, we anticipate that systems could be established to ensure that, if desired, reporting could be based on the standard SCONRRR definition even if the threshold value was changed for the purpose of setting reliability targets.

### 3.2.2 Categorise feeders as radial or meshed

Rather than categorising feeders according to the SCONRRR definitions, it would be possible to categorise them simply as 'radial' or 'meshed'. This approach is applied under the original Code.

The advantage of this approach is that it is more closely related to the nature of the network.

The disadvantage is that there does not appear to be a universally accepted definition of the terms 'radial' and meshed'. Our understanding of these two terms is that a radial network is characterised by few, if any, redundant elements. By contrast, a meshed network is characterised by multiple redundant elements.

We note that the number of redundant elements is a question of degree and this definition may not be sufficiently precise for regulatory purposes.

Contrary to our understanding of the terms, we understand that under the original Code PWC has interpreted these terms such that 'radial' feeders were all feeders operating at 22kV and meshed feeders were all feeders operating at 11kV.

A modification of this approach would be to use these two voltage levels as the basis of feeder categorisation. PWC has traditionally used 22kV feeders in rural areas and 11kV feeders in urban areas.

However, we also understand that PWC now has plans to increase the use of 22kV feeders in urban areas. Therefore, while continuing to rely on this definition of feeder types may address the Commission's concern in the short term, the issue is likely to return in future.

Another disadvantage with this approach is that, as with any departure from the SCONRRR definitions, it would not allow comparison with other jurisdictions. Unlike an approach based on a different threshold value, we anticipate that producing reports based on feeder voltages would require a more substantial redesign of PWC's information systems, though the necessary systems may also be in place given that this approach has been used historically.

### 3.2.3 Set performance targets for identified geographic locations

The third approach we considered to feeder categorisation for the purpose of setting reliability of supply targets was to base them on pre-determined geographic zones.

This is similar to the approach ESCOSA took with its seven regional zones (see section 2.3.3). It is also similar to the approach taken in Tasmania where its 101 regions were identified based on 'likeness' and then assigned to a service category (see section 2.3.4).

This approach has the advantage of allowing a great deal of flexibility, as the Commission could simply apply standards on a 'place by place' basis. It has the advantage that targets can be set to reflect either the actual performance in an area or a reasonable improvement from that level.

However, this approach has two disadvantages.

First, as with the approach discussed in section 3.2.2, the change from the SCONRRR definitions represented by this approach are likely to be such that it would not provide a meaningful comparison with other jurisdictions.

Second, as with the voltage based option discussed in section 3.2.2, producing the necessary reports may require a more substantial redesign of PWC's information systems than a simple change to the threshold value.

## 3.3 Recommended approach – a hybrid

Our recommended approach to categorising feeders in the Territory is a hybrid of options 1 and 3 above.

We recommend that the Commission adopt the principle that customers in like areas can reasonably expect to receive similar levels of reliability performance to one another and set its feeder definitions and GSL scheme accordingly.

To minimise the extent of the change from the SCONRRR definitions, and thus to minimise the change (and cost) required of PWC and to preserve the ability to report on a nationally consistent basis, we recommend that the

Commission defines feeder categories using the SCONRRR definitions and reduce the MVA/km but reduce threshold value used to define urban feeders.

To identify the appropriate threshold value, the Commission will need to identify which parts of the Territory are alike and different. We recommend dividing the Territory into three area types:

- Urban areas – areas that satisfy the ABS's definition of an urban area or are otherwise identified as being urban (industrial) areas
- Rural areas – areas that are supplied by the regulated networks but do not meet the definition of urban
- Unregulated areas – areas that are not supplied by the regulated networks

Having done this, we recommend that the Commission identify the types of areas that each customer feeder supplies and allocate feeders accordingly.

This will provide a 'target' categorisation for each feeder, but not necessarily the final definition.

We recommend that the Commission identifies the threshold value that provides the best match with the 'target' categorisation and adopt this as the threshold value for its feeder categories.

We have applied our recommended approach to PWC's network in chapter 5

# 4 The available data

The analysis in chapter 5 of this report was based on data provided to ACIL Tasman by PWC, through the Commission. That data came in two tranches:

1. feeder data - feeder load, length and connections (customers) data and PWC's application of the SCONRRR feeder categories provided for 372 feeders

2. geographic information system (GIS) data - were provided for 237 items, though these appear to be only 162 unique feeders.[32]

A brief overview of the data PWC supplied is provided below. There are some aspects of the data that require explanation or in relation to which we made certain assumptions. Those aspects are outlined in this section.

We understand that the two tranches of data were drawn from different systems. Data drawn from PWC's Feeder Information System (FIS) were only available for customer feeders, that is, feeders that were included in PWC's calculation of SAIDI and SAIFI.

Generally the data were straightforward and, in our view, appropriate for the analysis required.

The feeder data were provided in an Excel spreadsheet. The columns included in the spreadsheet, along with our understanding of their contents, were:

1. Two Feeder Identifiers:

    a) First, an alphanumeric 'name' for each feeder which appears to provide certain descriptive information, such as voltage and location, e.g. 11AK02 Knuckey St; and

    b) Second, a shorter alphanumeric 'name' for each feeder with no descriptive information, e.g. NR0006.

2. Feeder final – an alphanumeric 'name' for each feeder formatted similarly to the longer form of feeder ID and usually the same as FEEDER_ID though for some feeders it was blank. We understand that feeder final was drawn from the FIS and that the purpose of this column was to link data from the two systems together. It was blank for feeders not modelled in FIS.

[32] There were two additional feeders for which GIS data were provided without identifiers. These feeders were disregarded.

3. Feeder length final – the length of each feeder (in km) based on FIS using data for March 2012. This was 0.0 for (non-customer) feeders which have not been modelled in FIS.
4. Service count – the number of customers connected to each feeder.
5. Meshed/Radial – as discussed in section 3.2.2, we understand that the meshed and radial classification was determined by voltage - 11kV = Meshed, 22kV = Radial.
6. Customer Feeder – certain feeder categories were defined as 'non-customer' feeders, for example feeders that supply capacitor banks, bus bars or transformers.
7. Feeder MVA – the maximum load observed on each feeder in 2010/11.
8. Feeder MVA/km – the quotient of feeder MVA and feeder length.
9. ESAA Category – the feeder category determined in accordance with the SCONRRR definitions.
10. Region – the region where the feeder is located (not used).

Our preliminary analysis of the data revealed a small number of inconsistencies which were discussed with PWC. Some changes were made to the original dataset as a result. Most were immaterial.

There is a slight discrepancy in the timing of the data we were provided. Specifically, feeder lengths were calculated in March 2012 while loads were taken from 2010/11. Conceptually we do not see this as a problem.

A related issue was that load data were not provided for all feeders. Of the 162 feeders for which GIS data were provided a complete set of load and length data were provided for only 115. There were various reasons for the absence of data for the remaining feeders. Some feeders were not in use when load data were collected. Other feeders were in use, but PWC was not able to provide SCADA data.

The 47 feeders for which a complete set of data was not provided were not able to be incorporated in the analysis. The practical implication was that we were unable to compute the impact of changing the threshold MVA/km value on these feeders. This applied to 39 feeders because some were categorised (by PWC) as CBD (which does not rely on length and load data) and others were assigned a target definition that corresponded with the SCONRRR definition.

A list of the 115 feeders for which a full set of feeder and GIS data is provided in Table 1.

Table 1 **Feeders with full set of data**

| # | Feeder |
|---|---|
| 1 | 11AK03 AUSTIN LANE |
| 2 | 11BE01 LEANYER |
| 3 | 11BE03 TDZ |
| 4 | 11BE04 MCMILLANS |
| 5 | 11BE06 KARAMA 1 |
| 6 | 11BE07 NAVY |
| 7 | 11BE09 JAIL |
| 8 | 11BE10 KARAMA 2 |
| 9 | 11BE13 KORMILDA |
| 10 | 11BE14 ROBINSON |
| 11 | 11BE16 ANULA |
| 12 | 11BE18 PORT |
| 13 | 11CA00 NIGHTCLIFF 1 |
| 14 | 11CA03 BRADSHAW |
| 15 | 11CA04 NTU |
| 16 | 11CA06 FAC- LYONS |
| 17 | 11CA07 JINGILI |
| 18 | 11CA10 MILLNER |
| 19 | 11CA12 MARRARA |
| 20 | 11CA13 WANGURI |
| 21 | 11CA15 HOSPITAL |
| 22 | 11CA16 NAKARA |
| 23 | 11CA17 CAS SQUARE |
| 24 | 11CA19 CAS VILLAGE |
| 25 | 11CA23 MOIL |
| 26 | 11CA24 CAZSS BUSTIE 3/4 |
| 27 | 11CA25 BRINKIN |
| 28 | 11CZ02 WEST BENNETT 1 |
| 29 | 11CZ03 AUSTIN KNUCKEY 1 |
| 30 | 11CZ05 WOODS ST 1 |
| 31 | 11CZ06 MOTT ST 1 |
| 32 | 11CZ07 STUART PARK |
| 33 | 11CZ09 AUSTIN KNUCKEY 2 |
| 34 | 11CZ10 MITCHELL ST 1 |
| 35 | 11CZ12 MOTT STREET 2 |
| 36 | 11CZ13 WEST BENNETT 2 |
| 37 | 11CZ14 GARDENS |
| 38 | 11CZ16 WOODS ST 2 |
| 39 | 11CZ17 MITCHELL ST 2 |
| 40 | 11CZ19 CITY VALLEY |

| # | Feeder |
|---|---|
| 41 | 11CZ20 DINAH BEACH |
| 42 | 11FB09 WATERFRONT |
| 43 | 11LG06 BRADSHAW |
| 44 | 11LG07 ARALUEN |
| 45 | 11LG13 ELDER |
| 46 | 11LG15 LARAPINTA |
| 47 | 11LG16 BRAITLING |
| 48 | 11ML09 DALY |
| 49 | 11PA02 WALER |
| 50 | 11PA03 PALM SHOPS |
| 51 | 11PA04 BAKEWELL |
| 52 | 11PA07 GRAY |
| 53 | 11PA08 GUNN |
| 54 | 11PA09 TF T1 |
| 55 | 11PA10 DRIVER |
| 56 | 11PA11 FARRAR |
| 57 | 11PA15 MOULDEN |
| 58 | 11PA17 THORNGATE |
| 59 | 11PA18 WOODROFFE |
| 60 | 11PA19 DURACK |
| 61 | 11PA21 YARRAWONGA |
| 62 | 11PA22 PALM CIVIC |
| 63 | 11PA23 GEORGINA |
| 64 | 11RG01 GAP |
| 65 | 11RG02 GOLF COURSE |
| 66 | 11RG06 SADADEEN |
| 67 | 11RG07 HOSPITAL |
| 68 | 11RG08 CBD |
| 69 | 11RG19 NTHSTUHWY |
| 70 | 11RG20 WILLS |
| 71 | 11RG21 GILLEN |
| 72 | 11SN01 FANNIE BAY |
| 73 | 11SN02 BAGOT |
| 74 | 11SN05 MARANGA |
| 75 | 11SN07 BAYVIEW |
| 76 | 11SN10 GOYDER |
| 77 | 11SN13 BISHOP |
| 78 | 11SN14 COONAWARRA |
| 79 | 11SN16 PARAP |
| 80 | 11SN17 RAAF |

| # | Feeder |
|---|---|
| 81 | 11SN19 LUDMILLA |
| 82 | 11WB08 WHARF PRECINCT |
| 83 | 11WS03 DASHWOOD |
| 84 | 11WS08 CULLEN |
| 85 | 11WS11 KITCHENER |
| 86 | 22BR102 BOREFIELDS |
| 87 | 22HD402 LAMBELLS |
| 88 | 22HD403 MIDDLE POINT |
| 89 | 22KP03 TINDAL 2 |
| 90 | 22KP04 KATH EAST |
| 91 | 22KP06 PINE CREEK |
| 92 | 22KP07 MATARANKA |
| 93 | 22KP11 OPS TIE |
| 94 | 22KP12 FLORINA |
| 95 | 22KP14 GORGE |
| 96 | 22KP15 TINDAL 1 |
| 97 | 22MA02 BATCHELOR |
| 98 | 22MA03 ADELAIDE RIVER |

| # | Feeder |
|---|---|
| 99 | 22MA07 ACACIA |
| 100 | 22MM05 HERBERT |
| 101 | 22MM06 STRANGWAYS |
| 102 | 22MM07 NOONAMAH |
| 103 | 22MM09 MCMINNS PUMPS |
| 104 | 22MM10 VIRGINIA |
| 105 | 22MM11 DARWIN RIVER |
| 106 | 22MM13 DUNDEE |
| 107 | 22MR103 MT BUNDY |
| 108 | 22PA101 HOWARD SPRINGS |
| 109 | 22PC308 PCK TOWNSHIP |
| 110 | 22RG04 BREWER 2 |
| 111 | 22RG09 FARMS |
| 112 | 22RG13 BREWER 1 |
| 113 | 22TC202 FEEDER 2 |
| 114 | 22TC302 FEEDER 3 |
| 115 | 22TC602 FEEDER 6 |

# 5 Application of feeder categories

As discussed in section 3.3, we recommend that the Commission take a three step approach to categorising feeders as follows:

1. Identify areas in the Territory using 'urban', 'rural' and 'unregulated' zones.
2. Determine which of these two zones each feeder supplies.[33]
3. Identify the threshold value that provides the best correspondence between the feeder categorisation developed in step 2 and SCONRRR categorisation based on that threshold.

These three steps are applied in the following sections.

## 5.1 Categorise areas in the Territory

As discussed in section 3, the ABS defines an urban centre as one which has:

- a population of more than 1,000 persons.
- a population density of at least 200 persons per square km.

Figure 1 to Figure 4 above show the parts of the Territory that we consider to be urban areas. The areas marked in those figures either satisfy the ABS's definition of urban, based on population density, or have been identified as being industrial in nature, and are thus clearly not rural. The remainder of the area connected to the regulated networks is defined as rural.

## 5.2 Determine which zones each feeder supplies

The next step was to identify the feeders that supply 'urban' areas and those which supply rural areas. For this purpose PWC provided GIS data regarding the location of each of its (customer) feeders.

Theoretically, this analysis should be based on the location of customers supplied by each feeder. However, this is not available. That is, PWC does not have detailed data regarding the location of each of its customers.[34]

In the absence of data concerning the location of customers themselves we assumed that feeders supply the area where they are located. In most cases this was acceptable. However, in a small number of cases we noted that some

[33] By definition the regulated networks do not supply customers in unregulated areas so the feeder with which we are concerned can only be in one of the other two zones.

[34] It is not surprising that a distribution network business does not have this level of data.

feeders passed through urban areas and then extended for a significant distance into rural areas. These feeders are marked here as 'mixed'.[35]

Therefore, each feeder was assigned a target categorisation as shown in Table 2. Note that all 162 feeders are listed in Table 2, though the next section, relating to selecting the threshold value, is limited to the 115 feeders for which a full set of data was available.

[35] We have no way of knowing whether those feeders supply customers in urban areas 'on their way' to rural areas, though it seems likely.

Table 2 **Target feeder categorisations**

| # | Feeder | target |
|---|---|---|
| 1 | 11AK03 AUSTIN LANE | CBD |
| 2 | 11BE01 LEANYER | Urban |
| 3 | 11BE03 TDZ | Urban |
| 4 | 11BE04 MCMILLANS | Urban |
| 5 | 11BE06 KARAMA 1 | Urban |
| 6 | 11BE07 NAVY | Urban |
| 7 | 11BE08 BEZSS BUSTIE 1/2 | Urban |
| 8 | 11BE09 JAIL | Urban |
| 9 | 11BE10 KARAMA 2 | Urban |
| 10 | 11BE11 BEZSS CAP BANK | Urban |
| 11 | 11BE13 KORMILDA | Urban |
| 12 | 11BE14 ROBINSON | Urban |
| 13 | 11BE16 ANULA | Urban |
| 14 | 11BE17 BEZSS BUSTIE 2/3 | Urban |
| 15 | 11BE18 PORT | Urban |
| 16 | 11BE21 BEZSS BUSTIE 3/4 | Urban |
| 17 | 11CA00 NIGHTCLIFF 1 | Urban |
| 18 | 11CA01 CA CAP NO 1 | Urban |
| 19 | 11CA01 CAZSS CAP BANK No 1 | Urban |
| 20 | 11CA03 BRADSHAW | Urban |
| 21 | 11CA04 NTU | Urban |
| 22 | 11CA06 FAC- LYONS | Urban |
| 23 | 11CA07 JINGILI | Urban |
| 24 | 11CA08 NORTH LAKES | Urban |
| 25 | 11CA09 CAZSS BUSTIE 1/2 | Urban |
| 26 | 11CA10 MILLNER | Urban |
| 27 | 11CA11 CAZSS CAP BANK No 2 | Urban |
| 28 | 11CA12 MARRARA | Urban |
| 29 | 11CA13 WANGURI | Mixed |
| 30 | 11CA15 HOSPITAL | Urban |
| 31 | 11CA16 NAKARA | Urban |
| 32 | 11CA17 CAS SQUARE | Urban |
| 33 | 11CA18 CAZSS BUSTIE 2/3 | Urban |
| 34 | 11CA19 CAS VILLAGE | Urban |

| # | Feeder | target |
|---|---|---|
| 35 | 11CA21 NIGHTCLIFF 2 | Urban |
| 36 | 11CA23 MOIL | Urban |
| 37 | 11CA24 CAZSS BUSTIE 3/4 | Urban |
| 38 | 11CA25 BRINKIN | Urban |
| 39 | 11CAZSS BUS 1 | Urban |
| 40 | 11CAZSS BUS 3 | Urban |
| 41 | 11CP4306 WAGAIT | Rural Short |
| 42 | 11CP4307 BELYUEN | Rural Short |
| 43 | 11CZ01 CZZSS CAP BANK No 2 | CBD |
| 44 | 11CZ02 WEST BENNETT 1 | CBD |
| 45 | 11CZ03 AUSTIN KNUCKEY 1 | CBD |
| 46 | 11CZ05 WOODS ST 1 | CBD |
| 47 | 11CZ06 MOTT ST 1 | CBD |
| 48 | 11CZ07 STUART PARK | Urban |
| 49 | 11CZ08 CZZSS BUSTIE 1/2 | CBD |
| 50 | 11CZ09 AUSTIN KNUCKEY 2 | CBD |
| 51 | 11CZ10 MITCHELL ST 1 | CBD |
| 52 | 11CZ12 MOTT STREET 2 | CBD |
| 53 | 11CZ13 WEST BENNETT 2 | CBD |
| 54 | 11CZ14 GARDENS | Urban |
| 55 | 11CZ16 WOODS ST 2 | CBD |
| 56 | 11CZ17 MITCHELL ST 2 | CBD |
| 57 | 11CZ19 CITY VALLEY | Urban |
| 58 | 11CZ20 DINAH BEACH | Urban |
| 59 | 11CZ21 CZZSS CAP BANK No 1 | Urban |
| 60 | 11CZZSS BUS 1 | CBD |
| 61 | 11CZZSS BUS 2 | CBD |
| 62 | 11CZZSS BUS 3 | CBD |
| 63 | 11FB09 WATERFRONT | Urban |
| 64 | 11LG06 BRADSHAW | Urban |
| 65 | 11LG07 ARALUEN | Urban |

| # | Feeder | target |
|---|---|---|
| 66 | 11LG13 ELDER | Urban |
| 67 | 11LG15 LARAPINTA | Urban |
| 68 | 11LG16 BRAITLING | Urban |
| 69 | 11ML09 DALY | CBD |
| 70 | 11PA01 PAZSS BUSTIE 1/2 | Urban |
| 71 | 11PA02 WALER | Urban |
| 72 | 11PA03 PALM SHOPS | Urban |
| 73 | 11PA04 BAKEWELL | Urban |
| 74 | 11PA06 PAZSS CAP BANK No 2 | Urban |
| 75 | 11PA07 GRAY | Urban |
| 76 | 11PA08 GUNN | Urban |
| 77 | 11PA09 TF T1 | Urban |
| 78 | 11PA10 DRIVER | Mixed |
| 79 | 11PA11 FARRAR | Urban |
| 80 | 11PA12 PAZSS AUX TF 1 | Urban |
| 81 | 11PA13 PAZSS BUSTIE 2/3 | Urban |
| 82 | 11PA14 PAZSS AUX TF 2 | Urban |
| 83 | 11PA15 MOULDEN | Urban |
| 84 | 11PA16 PAZSS CAP BANK No 1 | Urban |
| 85 | 11PA17 THORNGATE | Urban |
| 86 | 11PA18 WOODROFFE | Urban |
| 87 | 11PA19 DURACK | Urban |
| 88 | 11PA21 YARRAWONGA | Urban |
| 89 | 11PA22 PALM CIVIC | Urban |
| 90 | 11PA23 GEORGINA | Urban |
| 91 | 11RG01 GAP | Urban |
| 92 | 11RG02 GOLF COURSE | Urban |
| 93 | 11RG06 SADADEEN | Urban |
| 94 | 11RG07 HOSPITAL | Urban |
| 95 | 11RG08 CBD | Urban |
| 96 | 11RG19 NTHSTUHWY | Urban |
| 97 | 11RG20 WILLS | Urban |
| 98 | 11RG21 GILLEN | Urban |
| 99 | 11SN01 FANNIE BAY | Urban |
| 100 | 11SN02 BAGOT | Urban |
| 101 | 11SN04 SNZSS CAP BANK No 2 | Urban |
| 102 | 11SN05 MARANGA | Urban |
| 103 | 11SN07 BAYVIEW | Urban |
| 104 | 11SN10 GOYDER | Urban |
| 105 | 11SN13 BISHOP | Urban |
| 106 | 11SN14 COONAWARRA | Urban |
| 107 | 11SN16 PARAP | Urban |
| 108 | 11SN17 RAAF | Urban |
| 109 | 11SN19 LUDMILLA | Urban |
| 110 | 11SN20 SNZSS CAP BANK No 1 | Urban |
| 111 | 11WB01 PARLIAMENT | CBD |
| 112 | 11WB08 WHARF PRECINCT | Urban |
| 113 | 11WS03 DASHWOOD | CBD |
| 114 | 11WS08 CULLEN | Urban |
| 115 | 11WS11 KITCHENER | CBD |
| 116 | 11YU04 No.1 FEEDER | Rural Short |
| 117 | 11YU10 No.2 FEEDER | Rural Short |
| 118 | 11YU17 No.3 FEEDER | Rural Short |
| 119 | 22BR102 BOREFIELDS | Rural Short |
| 120 | 22HD402 LAMBELLS | Rural Short |
| 121 | 22HD403 MIDDLE POINT | Rural Short |
| 122 | 22KP01 AUX TF 1 | Rural Short |
| 123 | 22KP03 TINDAL 2 | Rural Short |
| 124 | 22KP04 KATH EAST | Urban |
| 125 | 22KP06 PINE CREEK | Rural Short |
| 126 | 22KP07 MATARANKA | Rural Long |
| 127 | 22KP11 OPS TIE | Rural Short |
| 128 | 22KP12 FLORINA | Rural Short |
| 129 | 22KP14 GORGE | Rural Short |
| 130 | 22KP15 TINDAL 1 | Rural Short |
| 131 | 22KP17 AUX TF 2 | Rural Short |

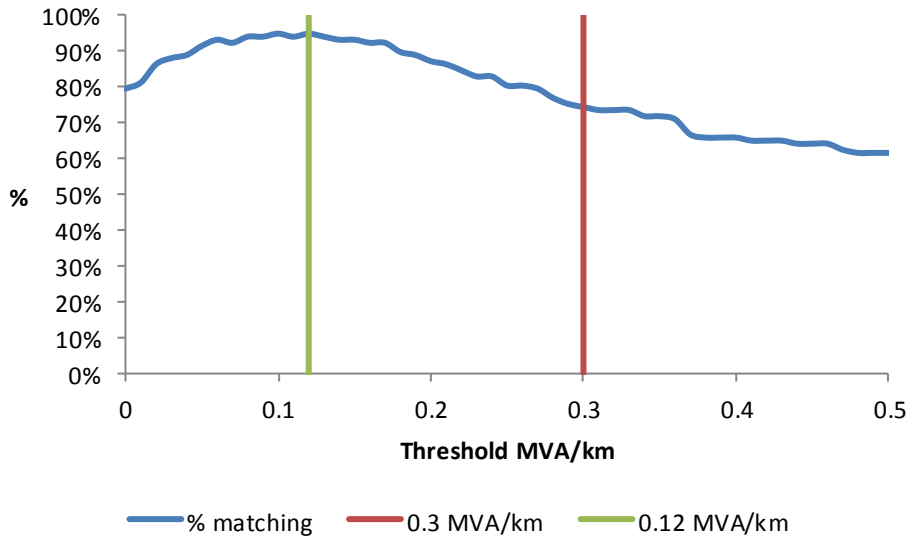
| # | Feeder | target |
|---|---|---|
| 132 | 22KP19 KATHERINE TOWN | Urban |
| 133 | 22MA02 BATCHELOR | Rural Short |
| 134 | 22MA03 ADELAIDE RIVER | Rural Short |
| 135 | 22MA04 NTP | Rural Short |
| 136 | 22MA05 LAKE BENNETT | Rural Short |
| 137 | 22MA07 ACACIA | Rural Short |
| 138 | 22MM02 MMZSS CAP BANK | Rural Short |
| 139 | 22MM05 HERBERT | Rural Short |
| 140 | 22MM06 STRANGWAYS | Rural Short |
| 141 | 22MM07 NOONAMAH | Rural Short |
| 142 | 22MM09 MCMINNS PUMPS | Rural Short |
| 143 | 22MM10 VIRGINIA | Rural Short |
| 144 | 22MM11 DARWIN RIVER | Rural Short |
| 145 | 22MM13 DUNDEE | Rural Short |
| 146 | 22MR103 MT BUNDY | Rural |
| | | Short |
| 147 | 22MR303 TOMS GULLY | Rural Short |
| 148 | 22PA101 HOWARD SPRINGS | Rural Short |
| 149 | 22PC306 MOLINE | Rural Short |
| 150 | 22PC308 PCK TOWNSHIP | Rural Short |
| 151 | 22RG04 BREWER 2 | Rural Short |
| 152 | 22RG09 FARMS | Mixed |
| 153 | 22RG13 BREWER 1 | Mixed |
| 154 | 22TC202 FEEDER 2 | Rural Short |
| 155 | 22TC302 FEEDER 3 | Urban |
| 156 | 22TC402 FEEDER 4 | Urban |
| 157 | 22TC502 FEEDER 5 | Mixed |
| 158 | 22TC602 FEEDER 6 | Rural Long |
| 159 | CZ-CP | Rural Short |
| 160 | LOVEGROVE EXPRESS FDR 1 | Urban |
| 161 | LOVEGROVE EXPRESS FDR 2 | Mixed |
| 162 | PINE CK - COSMO HOWLEY | Rural Short |

## 5.3 Select the threshold value

The third step in our approach was to select a threshold value that, when used in the SCONRRR definition, would provide the best possible match with the target categorisation.

Feeder categorisation for PWC's customer feeders was re-calculated with thresholds ranging from 0.05 MVA/km to 1.0 MVA/km. The resulting categories were compared with the standard SCONRRR categorisations of PWC's customer feeders. The degree to which the two definitions matched is shown in Figure 5.[36]

Figure 5 **'Fit' between categorisations with different thresholds**




*Source:* ACIL Tasman analysis

As Figure 5 shows, the best match, approximately 95 per cent of the 117 feeders for which the necessary data were provided,[37] is achieved with a threshold of 0.12 MVA/km. That is, if the SCONRRR definition is modified so that the distinction between rural and urban feeders is drawn at a load of 0.12 MVA/km, rather than 0.3 MVA/km, 95 per cent of PWC's feeders would be categorised in accordance with our view based on the feeder locations.

With the standard SCONRRR threshold the match is 75 per cent. The lower threshold provides a significantly better match between the two definitions. In fact, any value less than 0.3 MVA/km provides a better match than the SCONRRR threshold of 0.3 MVA/km.

[36] Percentages are shown based on 117 feeders. Feeders for which a full set of data was not provided are excluded unless they were categorised as CBD. Mixed feeders are excluded.

[37] See footnote 36.

This process identified a hierarchy of feeder 'groups' as follows. The details of which feeders fall into which group are shown in the following tables:

1. 87 feeders for which the SCONRRR definition corresponds with our 'target' definition and thus required no further analysis (Table 3).
2. 75 feeders for which the SCONRRR definition does not correspond with our target definition comprising:
   a) 30 feeders which would be re-categorised from rural to urban based on a threshold value of 0.12 MVA/km (Table 4)
   b) 45 feeders for which we cannot make a firm recommendation, comprising:
      i 6 feeders defined as rural using the SCONRRR definition that cross from urban to rural areas (mixed feeders) (Table 5); amd
      ii 39 feeders for which we received incomplete data and thus cannot compute the impact of a 0.12 MVA/km threshold (Table 6).
   c) 6 feeders which would be 'mis-matched' with our target categorisation at a threshold of 0.12 MVA/km.[38]

[38] Three of these feeders are among the 30 that would be re-categorised at the identified threshold as well as the 87 whose initial and target categorisations align. Therefore the numbers here do not add to 162 due to double counting. To reconcile to 162, sum:

- 84 feeders with 'matching' definitions that are not also identified as mismatches
- 6 feeders with mismatched definitions (three that are changed incorrectly and three that are not changed)
- 27 feeders whose categorisation is recommended to change that are not also identified as mismatches
- 6 mixed feeders and
- 39 feeders with incomplete data.

Table 3 **PWC definition matched target definition – no further analysis**

| # | Feeder |
|---|---|
| 1 | 11AK03 AUSTIN LANE |
| 2 | 11BE07 NAVY |
| 3 | 11BE10 KARAMA 2 |
| 4 | 11BE14 ROBINSON |
| 5 | 11CA00 NIGHTCLIFF 1 |
| 6 | 11CA04 NTU |
| 7 | 11CA12 MARRARA |
| 8 | 11CA15 HOSPITAL |
| 9 | 11CA17 CAS SQUARE |
| 10 | 11CA24 CAZSS BUSTIE 3/4 |
| 11 | 11CA25 BRINKIN |
| 12 | 11CZ01 CZZSS CAP BANK No 2 |
| 13 | 11CZ02 WEST BENNETT 1 |
| 14 | 11CZ03 AUSTIN KNUCKEY 1 |
| 15 | 11CZ05 WOODS ST 1 |
| 16 | 11CZ06 MOTT ST 1 |
| 17 | 11CZ07 STUART PARK |
| 18 | 11CZ08 CZZSS BUSTIE 1/2 |
| 19 | 11CZ09 AUSTIN KNUCKEY 2 |
| 20 | 11CZ10 MITCHELL ST 1 |
| 21 | 11CZ12 MOTT STREET 2 |
| 22 | 11CZ13 WEST BENNETT 2 |
| 23 | 11CZ14 GARDENS |
| 24 | 11CZ16 WOODS ST 2 |
| 25 | 11CZ17 MITCHELL ST 2 |
| 26 | 11CZ19 CITY VALLEY |
| 27 | 11CZZSS BUS 1 |
| 28 | 11CZZSS BUS 2 |
| 29 | 11CZZSS BUS 3 |
| 30 | 11FB09 WATERFRONT |
| 31 | 11LG06 BRADSHAW |
| 32 | 11LG07 ARALUEN |
| 33 | 11LG13 ELDER |
| 34 | 11LG16 BRAITLING |
| 35 | 11ML09 DALY |
| 36 | 11PA02 WALER |
| 37 | 11PA03 PALM SHOPS |
| 38 | 11PA07 GRAY |
| 39 | 11PA08 GUNN |
| 40 | 11PA09 TF T1 |

| # | Feeder |
|---|---|
| 41 | 11PA18 WOODROFFE |
| 42 | 11PA19 DURACK |
| 43 | 11PA22 PALM CIVIC |
| 44 | 11RG01 GAP |
| 45 | 11RG02 GOLF COURSE |
| 46 | 11RG07 HOSPITAL |
| 47 | 11RG08 CBD |
| 48 | 11RG20 WILLS |
| 49 | 11SN07 BAYVIEW |
| 50 | 11SN10 GOYDER |
| 51 | 11SN13 BISHOP |
| 52 | 11SN14 COONAWARRA |
| 53 | 11SN16 PARAP |
| 54 | 11SN17 RAAF |
| 55 | 11SN19 LUDMILLA |
| 56 | 11WB01 PARLIAMENT |
| 57 | 11WB08 WHARF PRECINCT |
| 58 | 11WS03 DASHWOOD |
| 59 | 11WS08 CULLEN |
| 60 | 11WS11 KITCHENER |
| 61 | 22BR102 BOREFIELDS |
| 62 | 22HD402 LAMBELLS |
| 63 | 22HD403 MIDDLE POINT |
| 64 | 22KP03 TINDAL 2 |
| 65 | 22KP06 PINE CREEK |
| 66 | 22KP07 MATARANKA |
| 67 | 22KP11 OPS TIE |
| 68 | 22KP12 FLORINA |
| 69 | 22KP14 GORGE |
| 70 | 22KP15 TINDAL 1 |
| 71 | 22MA02 BATCHELOR |
| 72 | 22MA03 ADELAIDE RIVER |
| 73 | 22MA07 ACACIA |
| 74 | 22MM05 HERBERT |
| 75 | 22MM06 STRANGWAYS |
| 76 | 22MM07 NOONAMAH |
| 77 | 22MM09 MCMINNS PUMPS |
| 78 | 22MM10 VIRGINIA |
| 79 | 22MM11 DARWIN RIVER |
| 80 | 22MM13 DUNDEE |

| # | Feeder |
|---|---|
| 81 | 22MR103 MT BUNDY |
| 82 | 22PA101 HOWARD SPRINGS |
| 83 | 22PC308 PCK TOWNSHIP |
| 84 | 22RG04 BREWER 2 |

| # | Feeder |
|---|---|
| 85 | 22TC202 FEEDER 2 |
| 86 | 22TC302 FEEDER 3 |
| 87 | 22TC602 FEEDER 6 |

*Data source:* ACIL Tasman analysis

Table 4 **Feeders recommended to be re-categorised as urban**

| # | Feeder |
|---|---|
| 1 | 11BE01 LEANYER |
| 2 | 11BE03 TDZ |
| 3 | 11BE06 KARAMA 1 |
| 4 | 11BE09 JAIL |
| 5 | 11BE13 KORMILDA |
| 6 | 11BE16 ANULA |
| 7 | 11CA03 BRADSHAW |
| 8 | 11CA06 FAC- LYONS |
| 9 | 11CA07 JINGILI |
| 10 | 11CA10 MILLNER |
| 11 | 11CA16 NAKARA |
| 12 | 11CA19 CAS VILLAGE |
| 13 | 11CA23 MOIL |
| 14 | 11CZ20 DINAH BEACH |
| 15 | 11LG15 LARAPINTA |

| # | Feeder |
|---|---|
| 16 | 11PA04 BAKEWELL |
| 17 | 11PA11 FARRAR |
| 18 | 11PA15 MOULDEN |
| 19 | 11PA17 THORNGATE |
| 20 | 11PA21 YARRAWONGA |
| 21 | 11PA23 GEORGINA |
| 22 | 11RG06 SADADEEN |
| 23 | 11RG19 NTHSTUHWY |
| 24 | 11RG21 GILLEN |
| 25 | 11SN01 FANNIE BAY |
| 26 | 11SN05 MARANGA |
| 27 | 22BR102 BOREFIELDS |
| 28 | 22KP03 TINDAL 2 |
| 29 | 22KP04 KATH EAST |
| 30 | 22MM09 MCMINNS PUMPS |

[a] *the McMinns pumps feeder may require special consideration, see below.*

*Data source:* ACIL Tasman analysis

Table 5 **Mixed feeders**

| # | Feeder |
|---|---|
| 1 | 11CA13 WANGURI |
| 2 | 11PA10 DRIVER |
| 3 | 22RG09 FARMS |
| 4 | 22RG13 BREWER 1 |
| 5 | 22TC502 FEEDER 5 |
| 6 | LOVEGROVE EXPRESS FDR 2 |

*Data source:* ACIL Tasman analysis

Table 6 **Feeders with incomplete data**

| # | Feeder |
|---|---|
| 1 | 11BE08 BEZSS BUSTIE 1/2 |
| 2 | 11BE11 BEZSS CAP BANK |
| 3 | 11BE17 BEZSS BUSTIE 2/3 |
| 4 | 11BE21 BEZSS BUSTIE 3/4 |
| 5 | 11CA01 CA CAP NO 1 |
| 6 | 11CA01 CAZSS CAP BANK No 1 |
| 7 | 11CA08 NORTH LAKES |
| 8 | 11CA09 CAZSS BUSTIE 1/2 |
| 9 | 11CA11 CAZSS CAP BANK No 2 |
| 10 | 11CA18 CAZSS BUSTIE 2/3 |
| 11 | 11CA21 NIGHTCLIFF 2 |
| 12 | 11CAZSS BUS 1 |
| 13 | 11CAZSS BUS 3 |
| 14 | 11CP4306 WAGAIT |
| 15 | 11CP4307 BELYUEN |
| 16 | 11CZ21 CZZSS CAP BANK No 1 |
| 17 | 11PA01 PAZSS BUSTIE 1/2 |
| 18 | 11PA06 PAZSS CAP BANK No 2 |
| 19 | 11PA12 PAZSS AUX TF 1 |
| 20 | 11PA13 PAZSS BUSTIE 2/3 |

| # | Feeder |
|---|---|
| 21 | 11PA14 PAZSS AUX TF 2 |
| 22 | 11PA16 PAZSS CAP BANK No 1 |
| 23 | 11SN04 SNZSS CAP BANK No 2 |
| 24 | 11SN20 SNZSS CAP BANK No 1 |
| 25 | 11YU04 No.1 FEEDER |
| 26 | 11YU10 No.2 FEEDER |
| 27 | 11YU17 No.3 FEEDER |
| 28 | 22KP01 AUX TF 1 |
| 29 | 22KP17 AUX TF 2 |
| 30 | 22KP19 KATHERINE TOWN |
| 31 | 22MA04 NTP |
| 32 | 22MA05 LAKE BENNETT |
| 33 | 22MM02 MMZSS CAP BANK |
| 34 | 22MR303 TOMS GULLY |
| 35 | 22PC306 MOLINE |
| 36 | 22TC402 FEEDER 4 |
| 37 | CZ-CP |
| 38 | LOVEGROVE EXPRESS FDR 1 |
| 39 | PINE CK - COSMO HOWLEY |

*Data source:* ACIL Tasman analysis

The 0.12MVA/km threshold does not provide a perfect match with our target categorisations. At this threshold the six feeders listed in Table 7 would be mis-categorised by reference to their target categorisation.

Table 7 **Mismatched feeders**

| Feeder | Initial categorisation | Target categorisation | MVA/km | Recommended categorisation at 0.12 MVA/km |
|---|---|---|---|---|
| 11BE04 MCMILLANS | Rural Short | Urban | 0.07 | Rural Short |
| 11BE18 PORT | Rural Short | Urban | 0.07 | Rural Short |
| 11SN02 BAGOT | Rural Short | Urban | 0.11 | Rural Short |
| 22BR102 BOREFIELDS | Rural Short | Rural Short | 0.23 | Urban |
| 22KP03 TINDAL 2 | Rural Short | Rural Short | 0.13 | Urban |
| 22MM09 MCMINNS PUMPS | Rural Short | Rural Short | 0.26 | Urban |

*Note:* Three of the feeders in this table are also in Table 3, so the total number of feeders does not add correctly.

For three of these feeders, the load is not high enough to 'cross' even the lower threshold. In other words, while our recommended approach resolves some of the Commission's concerns, it does not resolve all of them.

For the remaining three mismatched feeders, adopting a threshold of 0.12 causes them to be defined as urban even though they are not in urban areas.

That is, the change in threshold creates the reverse issue to that identified by the Commission in the first place.

This is a counter-intuitive result that should ideally be avoided. However, we understand that none of these feeders could be described as a typical rural feeder. Rather, we understand that one supplies a water pumping station owned by PWC and no other services, which makes it an unusual feeder that is not truly a customer feeder. Another of these feeders appears to supply a borefield, making it different from a typical rural feeder. The third, 22KP03 TINDAL 2, appears to supply a Royal Australian Air Force Base.

Given the unusual nature of these feeders, we do not see this result as a reason to modify our recommended approach. However, it underscores the importance of retaining a discretionary element in the final approach to feeder categorisation. Therefore, our final recommendation is that the 162 feeders for which a full set of data was provided should be categorised as per Table 8 (details for each feeder are in Appendix A):

Table 8 **Recommended feeder categories**

| Feeder categorisation | Number of feeders |
|---|---|
| CBD | 20 |
| Urban (based on threshold) | 68 |
| Urban (based on location alone) | 3 |
| Rural Short | 21 |
| Rural Long | 2 |
| Mixed | 9 |
| Subtotal | 123 |
| Local Judgement | 39 |
| Total | 162 |

Figures 6, 7, 8 and 9 provide maps showing the effect of re-categorising the regulated networks using a threshold of 0.12 MVA/km. Feeders that were categorised as rural under the standard SCONRRR approach and are categorised as urban with this lower threshold are identified separately from feeders whose categorisation is not changed.

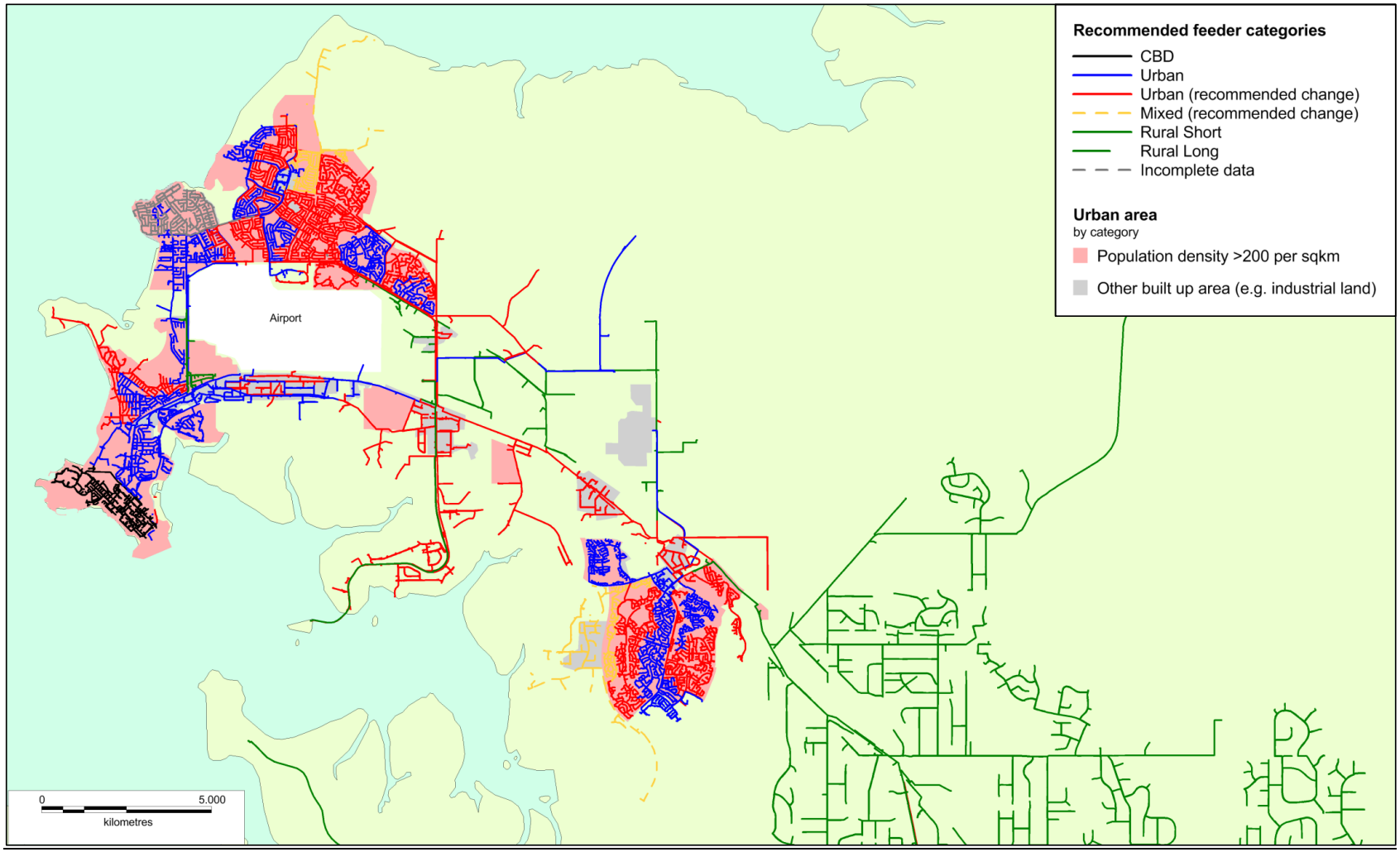
The figures show that, for the most part, when feeders are categorised using a threshold of 0.12 MVA/km to distinguish between urban and rural feeders, the urban areas of the Territory are supplied by feeders categorised as urban.

There is an area between Darwin and Palmerston where the feeder categorisation is varied (see Figure 6). Some feeders in this area are categorised

as urban and others rural. This may reflect the specific nature of this area, or it may be reason to examine the appropriate categorisation of these feeders more closely.

It is clear from the maps that a number of feeders for which a full set of data was not available, that is, those listed in Table 6, are in urban areas. As with the six mismatched feeders listed in Table 7 our recommendation is that these feeders be categorised based on the best available information as to where the customers they supply are located.

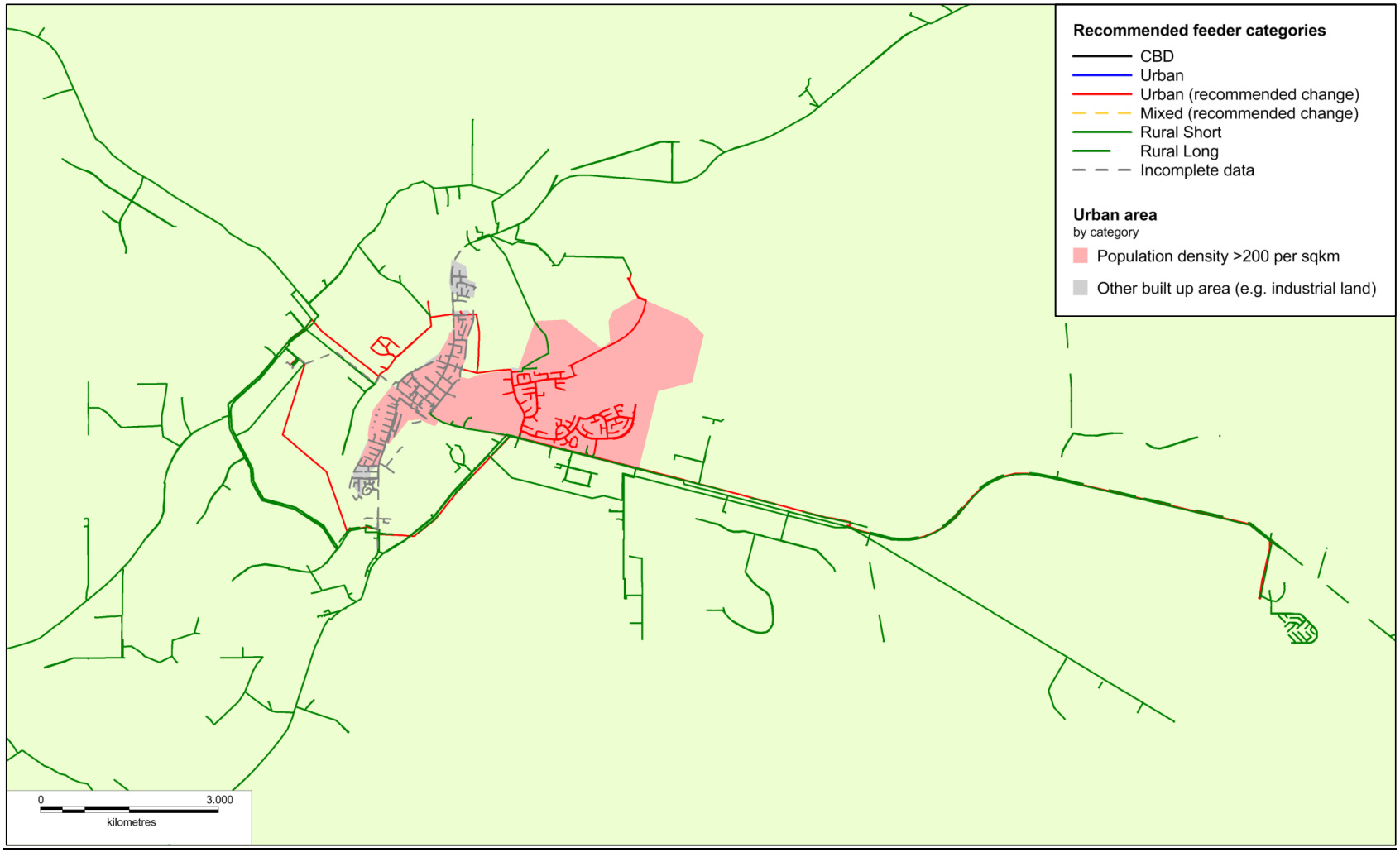
Figure 6 **Darwin – recommended feeder categorisation and population density**




*Note:* *the urban (blue) feeder largely on its own in approximately the middle of the map is 11BE14 ROBINSON. The urban (blue) feeder continuing to the north of Palmerston is 11PA02 WALER. These were both originally categorised as Urban and remained so in our target categorisation.*

*Data source:* Power and Water Corporation (feeder categorisation) and Australian Bureau of Statistics 2011 census (population density)

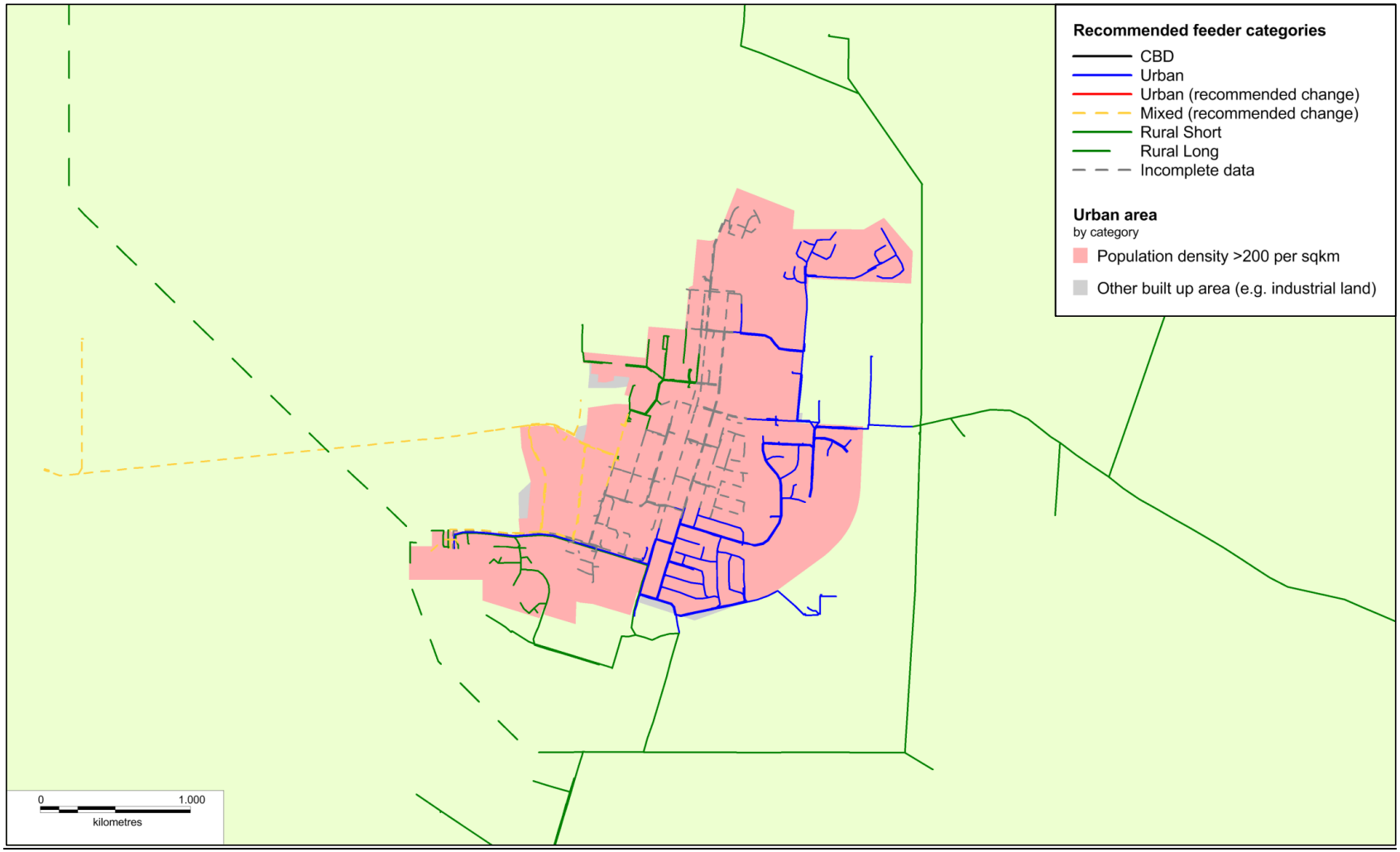
Figure 7 **Katherine – recommended feeder categorisation and population density**




*Note:* *the two Urban (red) feeders outside the urban area are 22KP04 KATH East (upper) and 22KP03 Tindal 2 (lower). The former is marked Urban because a significant portion of it is within the urban area. It has an MVA/km of 0.27, very close to the SCONRRR threshold. The latter is identified as a 'mismatched feeder' in Table 7.*

*Data source:* Power and Water Corporation (feeder categorisation) and Australian Bureau of Statistics 2011 census (population density)

Figure 8 **Tennant Creek – recommended feeder categorisation and population density**




*Data source:* Power and Water Corporation (feeder categorisation) and Australian Bureau of Statistics 2011 census (population density)

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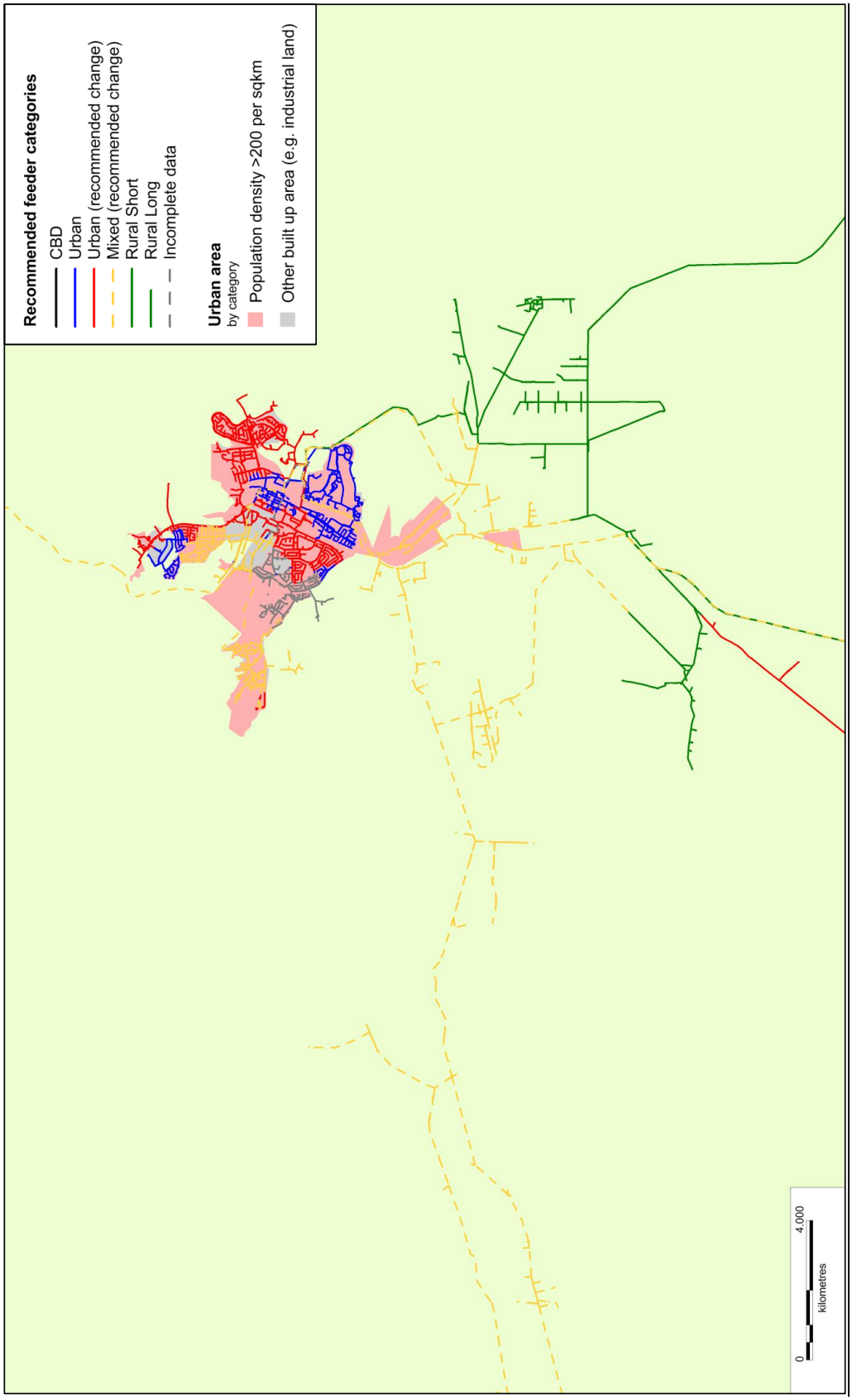
Figure 9 **Alice Springs – recommended feeder categorisation and population density**




*NOTE: the urban (red) feeder that extends off the map to the south is 22BR102 BOREFIELDS, see Table 7*

*Data source:* Power and Water Corporation (feeder categorisation) and Australian Bureau of Statistics 2011 census (population density)

# 6 Conclusion and recommendations

Based on the analysis presented above we have identified a number of preliminary recommendations for the Commission's consideration. The Commission should note that these recommendations might, if adopted, require PWC to make changes to its databases and other information systems. These recommendations are based, in part, on our expectation that it would be simpler for PWC to make some changes to its systems than others. However, these expectations have not been tested by PWC.

Our recommendations are:

1 That the Commission adopt the view that:

   d) customers who are in *like* areas can reasonably expect to receive a similarly reliable supply of electricity; and

   e) it is reasonable for the level of supply reliability to be different in different 'types' of area.

2. That, for these purposes, parts of the Territory supplied by the regulated networks can be divided into two types of areas, namely urban and rural and that the maps presented in this report are a reasonable approximation of where these types of areas are.

3. That the Commission adopt the view that:

   a) the purpose of feeder categorisation in the draft Code is to provide a reasonable basis for regulating reliability of supply

   b) alternative feeder categorisations may be adopted for other reporting purposes.

4. That, for the impending regulatory period:

   a) it would be appropriate to use the standard SCONRRR definitions as a guide to feeder categorisation with the modification that the threshold for distinguishing between urban and rural feeders should be 0.12 MVA/km

   b) in cases where this method leads to unintended or unacceptable categorisations, such as mixed feeders which run through urban areas into rural areas, those categorisations should be amended by agreement between PWC and the Commission based in part on PWC's detailed knowledge of the regulated networks

   c) the column in Table A1 headed final recommendation should form the basis of feeder categorisations for the impending regulatory period. Feeders marked there as 'local judgement' should be categorised based on the nature and location of customers they supply

5. That, the objectives of the draft Code would be best served by preserving a degree of discretion over feeder categorisation by making decisions

regarding feeder categorisation in the Commission's determinations rather than in the draft Code itself. In practice:

a) the draft Code may indicate that feeder categorisation would be determined through the regulatory process

b) the regulatory determination, or associated documents, may specify the categorisation of each feeder.

6. That the Commission make a separate decision as to the basis, if any, on which it would require reliability of supply to be reported for the purpose of making comparisons with other jurisdictions.

# Appendix A Compiled feeder categorisations

Table A1 **Type table title here**

| feeder | Initial categorisation (PWC) | Target categorisation | Categorisation at threshold of 0.12 MVA/km | Final recommendation |
|---|---|---|---|---|
| 11AK03 AUSTIN LANE | CBD | CBD | CBD | CBD |
| 11BE01 LEANYER | Rural Short | Urban | Urban | Urban |
| 11BE03 TDZ | Rural Short | Urban | Urban | Urban |
| 11BE04 MCMILLANS | Rural Short | Urban | Rural Short | Urban (based on location alone) |
| 11BE06 KARAMA 1 | Rural Short | Urban | Urban | Urban |
| 11BE07 NAVY | Urban | Urban | Urban | Urban |
| 11BE08 BEZSS BUSTIE 1/2 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11BE09 JAIL | Rural Short | Urban | Urban | Urban |
| 11BE10 KARAMA 2 | Urban | Urban | Urban | Urban |
| 11BE11 BEZSS CAP BANK | Rural Short | Urban | Incomplete data | Local Judgement |
| 11BE13 KORMILDA | Rural Short | Urban | Urban | Urban |
| 11BE14 ROBINSON | Urban | Urban | Urban | Urban |
| 11BE16 ANULA | Rural Short | Urban | Urban | Urban |
| 11BE17 BEZSS BUSTIE 2/3 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11BE18 PORT | Rural Short | Urban | Rural Short | Urban (based on location alone) |
| 11BE21 BEZSS BUSTIE 3/4 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CA00 NIGHTCLIFF 1 | Urban | Urban | Urban | Urban |
| 11CA01 CA CAP NO 1 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CA01 CAZSS CAP BANK No 1 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CA03 BRADSHAW | Rural Short | Urban | Urban | Urban |
| 11CA04 NTU | Urban | Urban | Urban | Urban |
| 11CA06 FAC- LYONS | Rural Short | Urban | Urban | Urban |
| 11CA07 JINGILI | Rural Short | Urban | Urban | Urban |
| 11CA08 NORTH LAKES | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CA09 CAZSS BUSTIE 1/2 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CA10 MILLNER | Rural Short | Urban | Urban | Urban |
| 11CA11 CAZSS CAP BANK No 2 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CA12 MARRARA | Urban | Urban | Urban | Urban |
| 11CA13 WANGURI | Rural Short | Mixed | mixed | mixed |
| 11CA15 HOSPITAL | Urban | Urban | Urban | Urban |
| 11CA16 NAKARA | Rural Short | Urban | Urban | Urban |

| feeder | Initial categorisation (PWC) | Target categorisation | Categorisation at threshold of 0.12 MVA/km | Final recommendation |
|---|---|---|---|---|
| 11CA17 CAS SQUARE | Urban | Urban | Urban | Urban |
| 11CA18 CAZSS BUSTIE 2/3 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CA19 CAS VILLAGE | Rural Short | Urban | Urban | Urban |
| 11CA21 NIGHTCLIFF 2 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CA23 MOIL | Rural Short | Urban | Urban | Urban |
| 11CA24 CAZSS BUSTIE 3/4 | Urban | Urban | Urban | Urban |
| 11CA25 BRINKIN | Urban | Urban | Urban | Urban |
| 11CAZSS BUS 1 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CAZSS BUS 3 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CP4306 WAGAIT | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 11CP4307 BELYUEN | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 11CZ01 CZZSS CAP BANK No 2 | CBD | CBD | CBD | CBD |
| 11CZ02 WEST BENNETT 1 | CBD | CBD | CBD | CBD |
| 11CZ03 AUSTIN KNUCKEY 1 | CBD | CBD | CBD | CBD |
| 11CZ05 WOODS ST 1 | CBD | CBD | CBD | CBD |
| 11CZ06 MOTT ST 1 | CBD | CBD | CBD | CBD |
| 11CZ07 STUART PARK | Urban | Urban | Urban | Urban |
| 11CZ08 CZZSS BUSTIE 1/2 | CBD | CBD | CBD | CBD |
| 11CZ09 AUSTIN KNUCKEY 2 | CBD | CBD | CBD | CBD |
| 11CZ10 MITCHELL ST 1 | CBD | CBD | CBD | CBD |
| 11CZ12 MOTT STREET 2 | CBD | CBD | CBD | CBD |
| 11CZ13 WEST BENNETT 2 | CBD | CBD | CBD | CBD |
| 11CZ14 GARDENS | Urban | Urban | Urban | Urban |
| 11CZ16 WOODS ST 2 | CBD | CBD | CBD | CBD |
| 11CZ17 MITCHELL ST 2 | CBD | CBD | CBD | CBD |
| 11CZ19 CITY VALLEY | Urban | Urban | Urban | Urban |
| 11CZ20 DINAH BEACH | Rural Short | Urban | Urban | Urban |
| 11CZ21 CZZSS CAP BANK No 1 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11CZZSS BUS 1 | CBD | CBD | CBD | CBD |
| 11CZZSS BUS 2 | CBD | CBD | CBD | CBD |
| 11CZZSS BUS 3 | CBD | CBD | CBD | CBD |
| 11FB09 WATERFRONT | Urban | Urban | Urban | Urban |
| 11LG06 BRADSHAW | Urban | Urban | Urban | Urban |
| 11LG07 ARALUEN | Urban | Urban | Urban | Urban |
| 11LG13 ELDER | Urban | Urban | Urban | Urban |

| feeder | Initial categorisation (PWC) | Target categorisation | Categorisation at threshold of 0.12 MVA/km | Final recommendation |
|---|---|---|---|---|
| 11LG15 LARAPINTA | Rural Short | Urban | Urban | Urban |
| 11LG16 BRAITLING | Urban | Urban | Urban | Urban |
| 11ML09 DALY | CBD | CBD | CBD | CBD |
| 11PA01 PAZSS BUSTIE 1/2 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11PA02 WALER | Urban | Urban | Urban | Urban |
| 11PA03 PALM SHOPS | Urban | Urban | Urban | Urban |
| 11PA04 BAKEWELL | Rural Short | Urban | Urban | Urban |
| 11PA06 PAZSS CAP BANK No 2 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11PA07 GRAY | Urban | Urban | Urban | Urban |
| 11PA08 GUNN | Urban | Urban | Urban | Urban |
| 11PA09 TF T1 | Urban | Urban | Urban | Urban |
| 11PA10 DRIVER | Rural Short | Mixed | mixed | mixed |
| 11PA11 FARRAR | Rural Short | Urban | Urban | Urban |
| 11PA12 PAZSS AUX TF 1 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11PA13 PAZSS BUSTIE 2/3 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11PA14 PAZSS AUX TF 2 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11PA15 MOULDEN | Rural Short | Urban | Urban | Urban |
| 11PA16 PAZSS CAP BANK No 1 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11PA17 THORNGATE | Rural Short | Urban | Urban | Urban |
| 11PA18 WOODROFFE | Urban | Urban | Urban | Urban |
| 11PA19 DURACK | Urban | Urban | Urban | Urban |
| 11PA21 YARRAWONGA | Rural Short | Urban | Urban | Urban |
| 11PA22 PALM CIVIC | Urban | Urban | Urban | Urban |
| 11PA23 GEORGINA | Rural Short | Urban | Urban | Urban |
| 11RG01 GAP | Urban | Urban | Urban | Urban |
| 11RG02 GOLF COURSE | Urban | Urban | Urban | Urban |
| 11RG06 SADADEEN | Rural Short | Urban | Urban | Urban |
| 11RG07 HOSPITAL | Urban | Urban | Urban | Urban |
| 11RG08 CBD | Urban | Urban | Urban | Urban |
| 11RG19 NTHSTUHWY | Rural Short | Urban | Urban | Urban |
| 11RG20 WILLS | Urban | Urban | Urban | Urban |
| 11RG21 GILLEN | Rural Short | Urban | Urban | Urban |
| 11SN01 FANNIE BAY | Rural Short | urban | Urban | Urban |
| 11SN02 BAGOT | Rural Short | Urban | Rural Short | Urban (based on location alone) |
| 11SN04 SNZSS CAP BANK No 2 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11SN05 MARANGA | Rural Short | Urban | Urban | Urban |
| 11SN07 BAYVIEW | Urban | Urban | Urban | Urban |

| feeder | Initial categorisation (PWC) | Target categorisation | Categorisation at threshold of 0.12 MVA/km | Final recommendation |
|---|---|---|---|---|
| 11SN10 GOYDER | Urban | Urban | Urban | Urban |
| 11SN13 BISHOP | Urban | Urban | Urban | Urban |
| 11SN14 COONAWARRA | Urban | Urban | Urban | Urban |
| 11SN16 PARAP | Urban | Urban | Urban | Urban |
| 11SN17 RAAF | Urban | Urban | Urban | Urban |
| 11SN19 LUDMILLA | Urban | Urban | Urban | Urban |
| 11SN20 SNZSS CAP BANK No 1 | Rural Short | Urban | Incomplete data | Local Judgement |
| 11WB01 PARLIAMENT | CBD | CBD | CBD | CBD |
| 11WB08 WHARF PRECINCT | Urban | Urban | Urban | Urban |
| 11WS03 DASHWOOD | CBD | CBD | CBD | CBD |
| 11WS08 CULLEN | Urban | Urban | Urban | Urban |
| 11WS11 KITCHENER | CBD | CBD | CBD | CBD |
| 11YU04 No.1 FEEDER | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 11YU10 No.2 FEEDER | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 11YU17 No.3 FEEDER | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 22BR102 BOREFIELDS | Rural Short | Rural Short | Urban | mixed |
| 22HD402 LAMBELLS | Rural Short | Rural Short | Rural Short | Rural Short |
| 22HD403 MIDDLE POINT | Rural Short | Rural Short | Rural Short | Rural Short |
| 22KP01 AUX TF 1 | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 22KP03 TINDAL 2 | Rural Short | Rural Short | Urban | mixed |
| 22KP04 KATH EAST | Rural Short | Urban | Urban | Urban |
| 22KP06 PINE CREEK | Rural Short | Rural Short | Rural Short | Rural Short |
| 22KP07 MATARANKA | Rural Long | Rural Long | Rural Long | Rural Long |
| 22KP11 OPS TIE | Rural Short | Rural Short | Rural Short | Rural Short |
| 22KP12 FLORINA | Rural Short | Rural Short | Rural Short | Rural Short |
| 22KP14 GORGE | Rural Short | Rural Short | Rural Short | Rural Short |
| 22KP15 TINDAL 1 | Rural Short | Rural Short | Rural Short | Rural Short |
| 22KP17 AUX TF 2 | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 22KP19 KATHERINE TOWN | Rural Short | urban | Incomplete data | Local Judgement |
| 22MA02 BATCHELOR | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MA03 ADELAIDE RIVER | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MA04 NTP | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 22MA05 LAKE BENNETT | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 22MA07 ACACIA | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MM02 MMZSS CAP BANK | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 22MM05 HERBERT | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MM06 STRANGWAYS | Rural Short | Rural Short | Rural Short | Rural Short |

| feeder | Initial categorisation (PWC) | Target categorisation | Categorisation at threshold of 0.12 MVA/km | Final recommendation |
|---|---|---|---|---|
| 22MM07 NOONAMAH | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MM09 MCMINNS PUMPS | Rural Short | Rural Short | Urban | mixed |
| 22MM10 VIRGINIA | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MM11 DARWIN RIVER | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MM13 DUNDEE | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MR103 MT BUNDY | Rural Short | Rural Short | Rural Short | Rural Short |
| 22MR303 TOMS GULLY | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 22PA101 HOWARD SPRINGS | Rural Short | Rural Short | Rural Short | Rural Short |
| 22PC306 MOLINE | Rural Short | Rural Short | Incomplete data | Local Judgement |
| 22PC308 PCK TOWNSHIP | Rural Short | Rural Short | Rural Short | Rural Short |
| 22RG04 BREWER 2 | Rural Short | Rural Short | Rural Short | Rural Short |
| 22RG09 FARMS | Rural Short | Mixed | mixed | mixed |
| 22RG13 BREWER 1 | Rural Short | Mixed | mixed | mixed |
| 22TC202 FEEDER 2 | Rural Short | Rural Short | Rural Short | Rural Short |
| 22TC302 FEEDER 3 | Urban | Urban | Urban | Urban |
| 22TC402 FEEDER 4 | Rural Short | Urban | Incomplete data | Local Judgement |
| 22TC502 FEEDER 5 | Rural Short | Mixed | mixed | mixed |
| 22TC602 FEEDER 6 | Rural Long | Rural Long | Rural Long | Rural Long |
| CZ-CP | Rural Short | Rural Short | Incomplete data | Local Judgement |
| LOVEGROVE EXPRESS FDR 1 | Rural Short | Urban | Incomplete data | Local Judgement |
| LOVEGROVE EXPRESS FDR 2 | Rural Short | Mixed | mixed | mixed |
| PINE CK - COSMO HOWLEY | Rural Short | Rural Short | Incomplete data | Local Judgement |

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