NETWORK STRATEGIES
• Telecommunications Strategy •

# Review of issues on geospatial modelling

Final report for Spark New Zealand and Vodafone New Zealand, 1 April 2015

Network Strategies Report Number 34023

## Contents

# 0 Executive summary

Following geospatial analysis Chorus claims to have identified inaccuracies in the Commerce Commission's modelling approach for its Unbundled Copper Local Loop (UCLL) pricing review. The analysis relies on a newly retrieved and updated database together with the Telecommunications Service Obligation (TSO) polygons published by the Commission.

Our review of this analysis revealed that:

- the findings are based on a customer database which cannot be used for TSO boundary definition since it includes non-residential services
- the data is incomplete
- the data also includes potential inactive connections, Customer Multi-Access Radio (CMAR) connections and locations that are non-existent.

We conclude that Chorus' geo-coding process contains flaws. Consequently the result cannot be relied upon as a method of defining TSO boundaries and we recommend that the Commission disregards the new data set offered by Chorus for the price review.

# 1 Introduction

Network Strategies Limited has investigated Chorus' claims that there are material concerns arising from geo-spatial issues that require correction in the Commerce Commission's model to estimate the TSLRIC price for Unbundled Copper Local Loop Services.

Based mainly on Chorus' newly retrieved Telecommunications Service Obligation (TSO) database together with the polygons published by the Commerce Commission, both Chorus[1] and Analysys Mason[2] undertook geographical analysis to identify inaccuracies in

[1] Chorus (2015), *Submission for Chorus in response to Draft Pricing Review Determinations for Chorus' UCLL and UBA Access Services (2 December 2014) and Process and Issues Update Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014)*, 20 February 2015.

the Commission's approach. Using the information made available to us and GIS software we have reviewed this analysis to determine whether there are significant model flaws that should be addressed by the Commission.

This document is structured as follows:

- a review of the TSO footprint definition (Section 2)
- an examination of exchanges outside TSO areas (Section 3)
- other issues, including consideration of overlapping TSO polygons (Section 4)
- our conclusions (Section 5).

Although this report has been commissioned by Spark New Zealand (Spark) and Vodafone New Zealand (Vodafone) the views expressed here are entirely our own.

In keeping with our confidentiality undertakings any CI and RI quoted in this report is marked as such with square brackets. Commerce Commission CI and RI is marked CCNZCI and CCNZRI respectively.

## 2 TSO footprint definition

In regards to the definition of the TSO areas Chorus claims that:

> …the TSO areas identified by the Commission do not include significant numbers of end-user premises which were in fact connected to the copper network in December 2001[3]
>
> The Commission should review the polygons used to define the boundary of TSO areas for accuracy.[4]

---

2 Analysys Mason (2015), *UCLL and UBA FPP draft determination submission – CONFIDENTIAL (CI),* 20 February 2015.

3 Chorus (2015), *Submission for Chorus in response to Draft Pricing Review Determinations for Chorus' UCLL and UBA Access Services (2 December 2014) and Process and Issues Update Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014)*, 20 February 2015, page 10, paragraph 22.

4 *Ibid*, page 100, paragraph 390.

A geographical analysis undertaken by Chorus claims that the TERA model has excluded customers from the TSO-derived boundaries due to an inaccurate geo-coding process – Chorus asserts that 50% of end-user premises have been coded with incorrect locations, with 20% relocated by more than 1 km.[5]

Chorus' analysis is based on its own data set of TSO customer locations which it claims has been developed using a more accurate approach than that of the Commission.[6]

> Chorus has located a file that contains connections data created in 18 December 2001 which we believe was used in the Commission's TSO determination modelling. While that file does not contain geo-code (sic) data for all properties, each property is given a unique connection ID (SAM ID).
>
> The SAM ID can be used together with Chorus' current network database to identify the precise geo-co-ordinates of all end-users in December 2001. This approach is preferable as improvements of geo-coding of premises in Chorus' records has improved significantly since 2001 and, in particular, Chorus now uses CoreLogic to geo-code end-user premises. It is therefore possible, given the SAM IDs provided by the December 2001, to provide much more accurate geo-coding of these premises than was available to either Chorus or the Commission in 2001. Chorus has, in conjunction with external consultants, undertaken this analysis and will provide the corrected data set to the Commission with this submission.

However following our own analysis of the data we question the quality of the Chorus data set. In particular we find that the Chorus data set:

- is incomplete
- does not represent the TSO
- includes inactive connections
- includes Customer Multi-Access Radio (CMAR)
- includes locations that are non-existent.

---

5 *Ibid*, page 7, paragraph 17.

6 *Ibid*, page 103, paragraphs 394 to 395.

These issues are described in more detail below.

## 2.1 Incomplete data set

The data set used in Chorus' analysis does not contain geo-coded data for all the subscribers hence the geo-coding process is incomplete. The Analysys Mason submission states that of the total of 1.82 million customers in the Chorus' database for which the geo-coding was attempted, 1.58 million were successfully associated with a co-ordinate,[7] omitting from the analysis more than 240,000 end-users (Exhibit 1). Note that as at June 2001 Chorus (formerly Telecom) had 1.67 million access lines (including 1.36 million residential lines)[8].

| | *TERA model* | | *Chorus' database* |
|---|---|---|---|
| | *Buildings* | *Dwellings* | |
| Total | [ ]**CCNZRI** | [ ]**CCNZRI** | 1,819,940 |
| within TSO polygons | [ ]**CCNZRI** | [ ]**CCNZRI** | 1,495,630 |
| outside TSO polygons | [ ]**CCNZRI** | [ ]**CCNZRI** | 83,672 |
| not mapped | – | – | 240,638 |

***Exhibit 1:*** *TERA model building / dwellings versus Chorus geo-coded data [Source: CoreLogic, Chorus]*

## 2.2 Chorus data set does not represent the TSO

Chorus has used its own database of buildings served in 2001 as representative of the customers to be included within the TSO-derived boundaries. However, as stated in the Chorus submission, it cannot be confirmed that this database was that used in the TSO determination modelling:

7 Analysys Mason (2015), *UCLL and UBA FPP draft determination submission – CONFIDENTIAL (CI),* 20 February 2015, section 2.13, page 24.

8 Telecom New Zealand (2001), *Annual Report for the year ending 30 June 2001*, see page 30.

> Chorus has located a file that contains connections data created in 18 December 2001 which we believe was used in the Commission's TSO determination modelling.[9]

The obligations prescribed by the TSO deed are for local residential telephone services[10], hence we would not expect the locations of non-residential customers to be used to define TSO boundaries. Both the Chorus[11] and Analysys Mason[12] reports demonstrate a misunderstanding of the scope of the TSO when claiming that the omission of the Auckland War Memorial Museum – a non-residential location – from the Commission's TSO polygons is an 'anomalous' result. An analysis of the set of end-users provided by Chorus illustrates that many of the connections it claims should not be outside the boundaries of TSO polygons are currently non-residential locations (Exhibit 2 and Exhibit 3). In these examples the purple dots represent Chorus' geo-coded end-users which are clearly located in non-residential areas outside the Commission's TSO polygons.

---

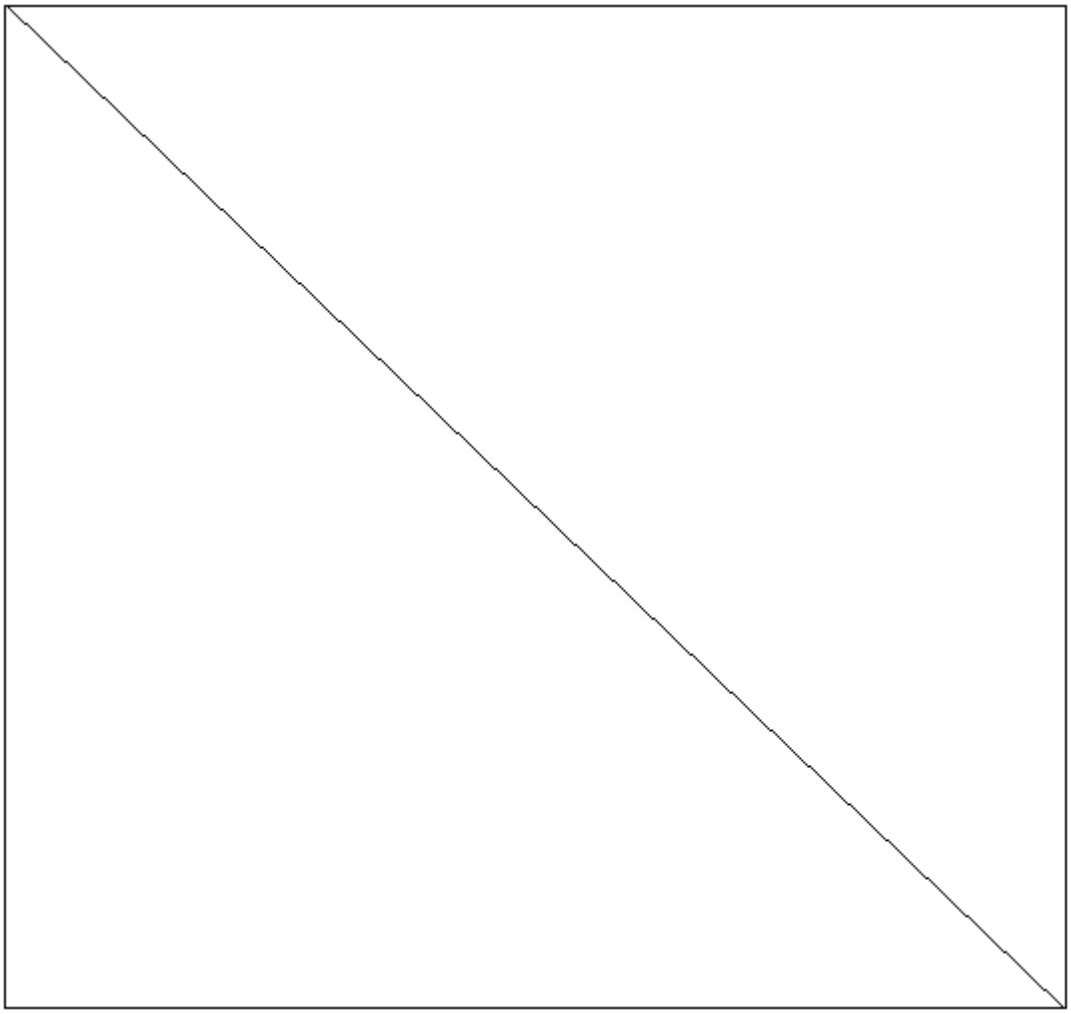
9 Chorus (2015), *Submission for Chorus in response to Draft Pricing Review Determinations for Chorus' UCLL and UBA Access Services (2 December 2014) and Process and Issues Update Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014)*, 20 February 2015, page 103, paragraph 394.

10 Commerce Commission (2009), *Final TSO Cost Calculation Determination for TSO Instrument for Local Residential Telephone Service for period between 1 July 2007 and 30 June 2008*, 7 October 2009, page 5.

11 Chorus (2015), *Submission for Chorus in response to Draft Pricing Review Determinations for Chorus' UCLL and UBA Access Services (2 December 2014) and Process and Issues Update Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014)*, 20 February 2015, page 100, paragraph 393.

12 Analysys Mason (2015), *UCLL and UBA FPP draft determination submission – CONFIDENTIAL (CI),* 20 February 2015, section 2.13, page 24.

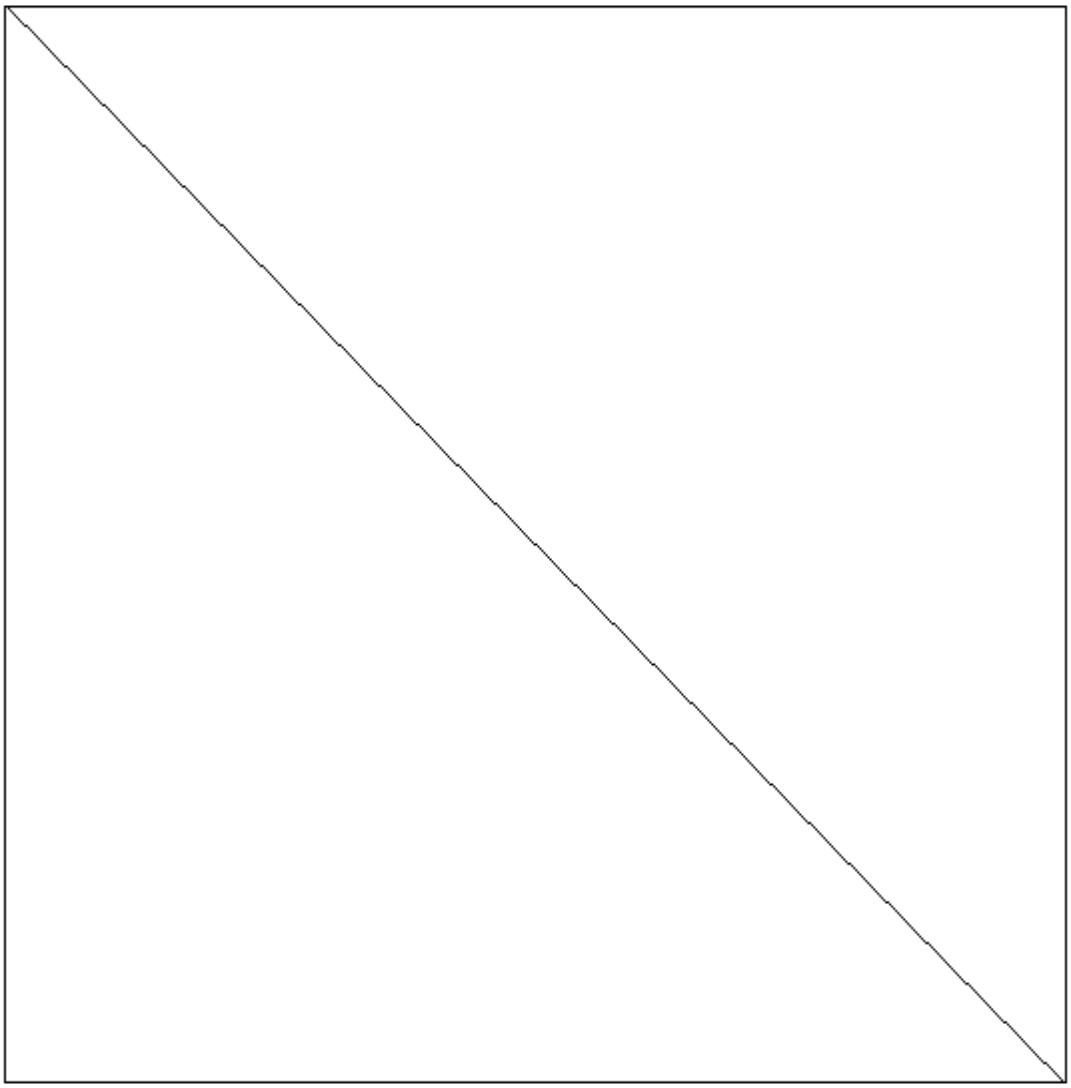
[



]CCNZRI

***Exhibit 2:*** *Non-residential end-user – Auckland Airport [Source: Chorus, Network Strategies Limited]*

[



]CCNZRI

***Exhibit 3:*** *Non-residential end-user - Hamilton [Source: Chorus, Network Strategies Limited]*

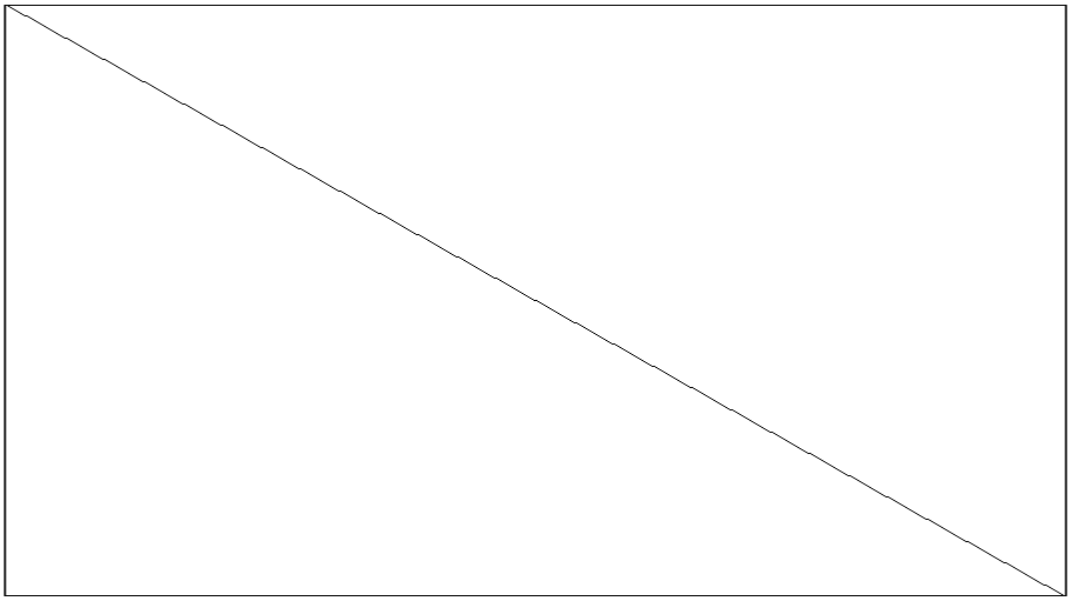
## 2.3 Inactive connections

The result of our geospatial analysis undertaken using Chorus' broadband service availability report[13] shows that a considerable number of the premises claimed by Chorus

13 Chorus (2015), *All Services by SAM ID*, 13 February 2015.

to be included within the TSO areas do not have broadband services, It is therefore possible that these locations are potentially inactive premises. In Exhibit 4 the blue dots represent Chorus' geo-coded end-users which do not have broadband services.

[



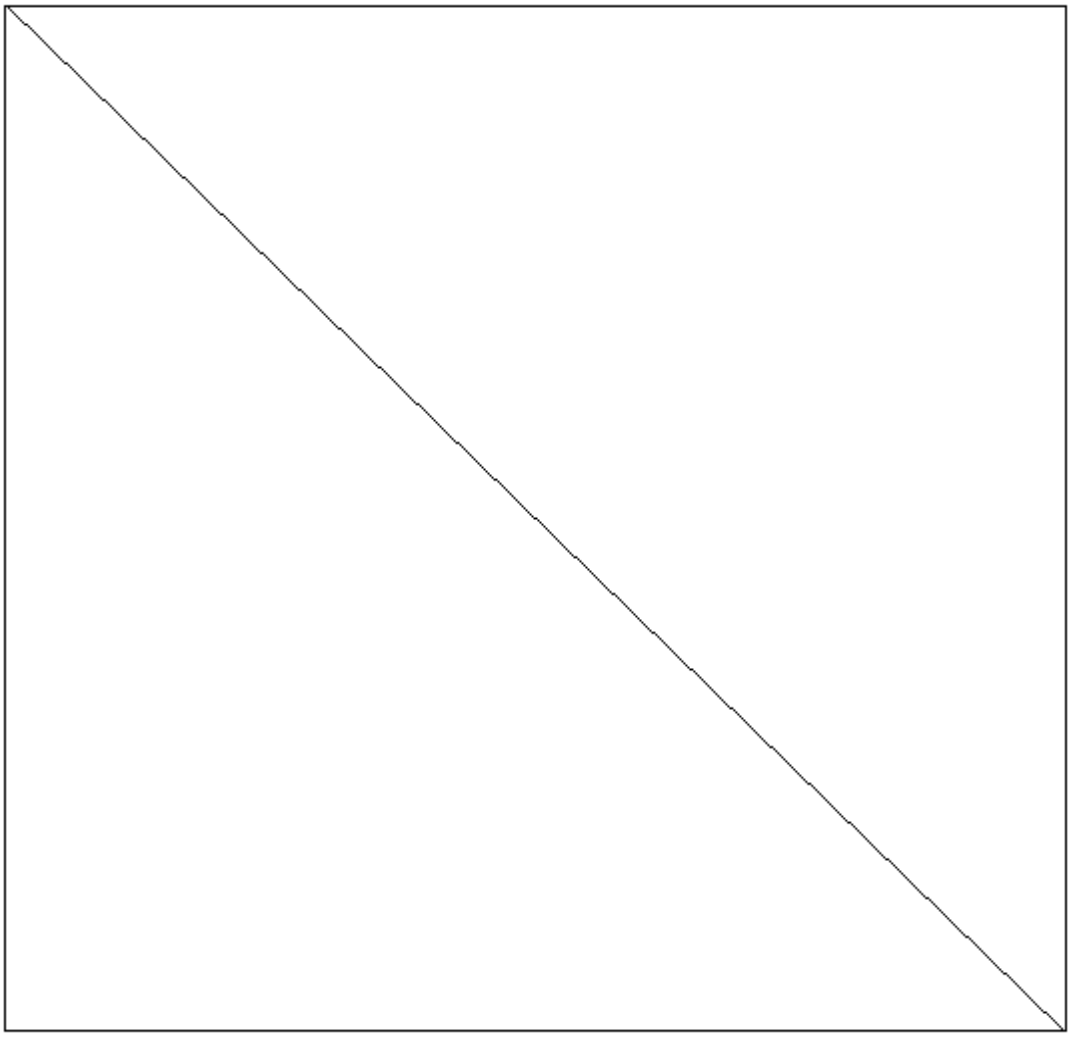
]**CCNZRI**

***Exhibit 4:*** *Active and potential inactive end-user connections outside TSO areas [Source: Chorus, TERA and Network Strategies Limited]*

## 2.4 Inclusion of Multi-Access Radio

Further analysis based on information sourced by Spark shows that a number of the end-users presented in Chorus' database are served by customer multi-access radio (CMAR). The following exhibits (Exhibit 5 to Exhibit 7) illustrate several examples of Chorus' TSO 2001 connections which are currently being served by CMAR. Our analysis estimated that more than [ ]**CCNZRI** of Chorus' connections are CMAR.

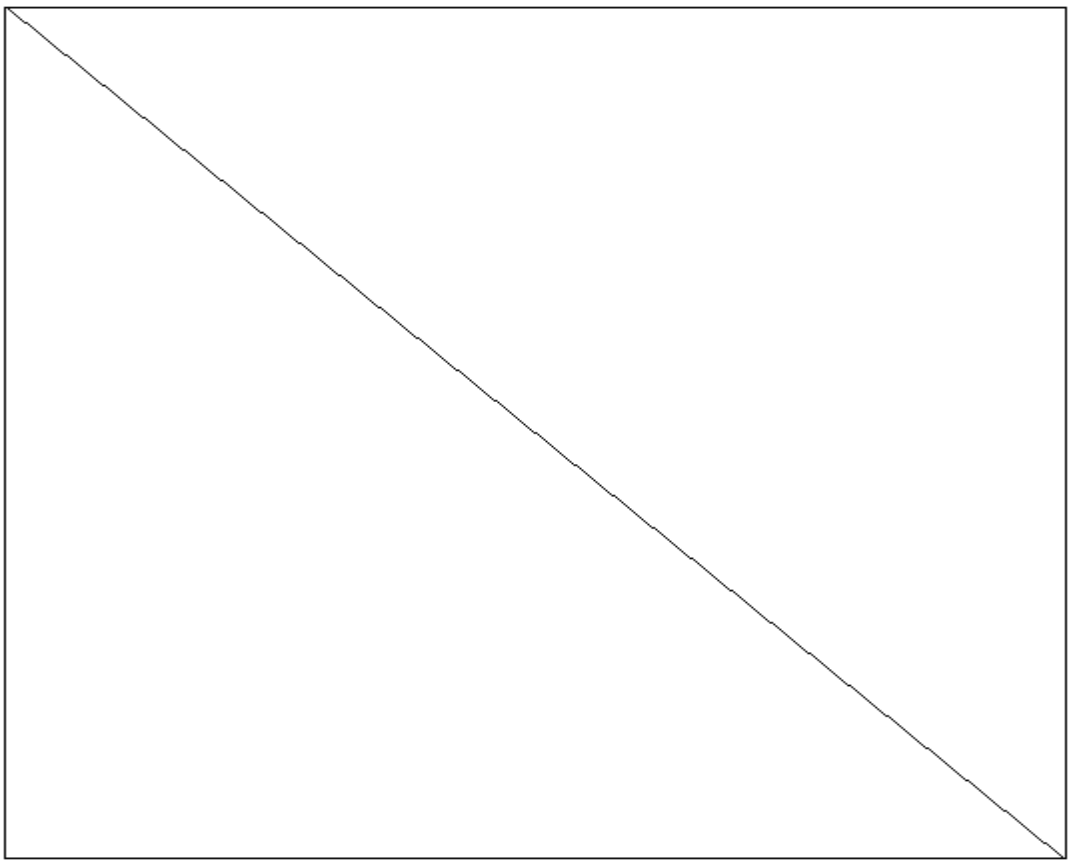
[



]CCNZRI

***Exhibit 5:*** *CMAR end-user connections outside TSO areas – Marlborough region [Source: Chorus, Spark, TERA and Network Strategies Limited]*

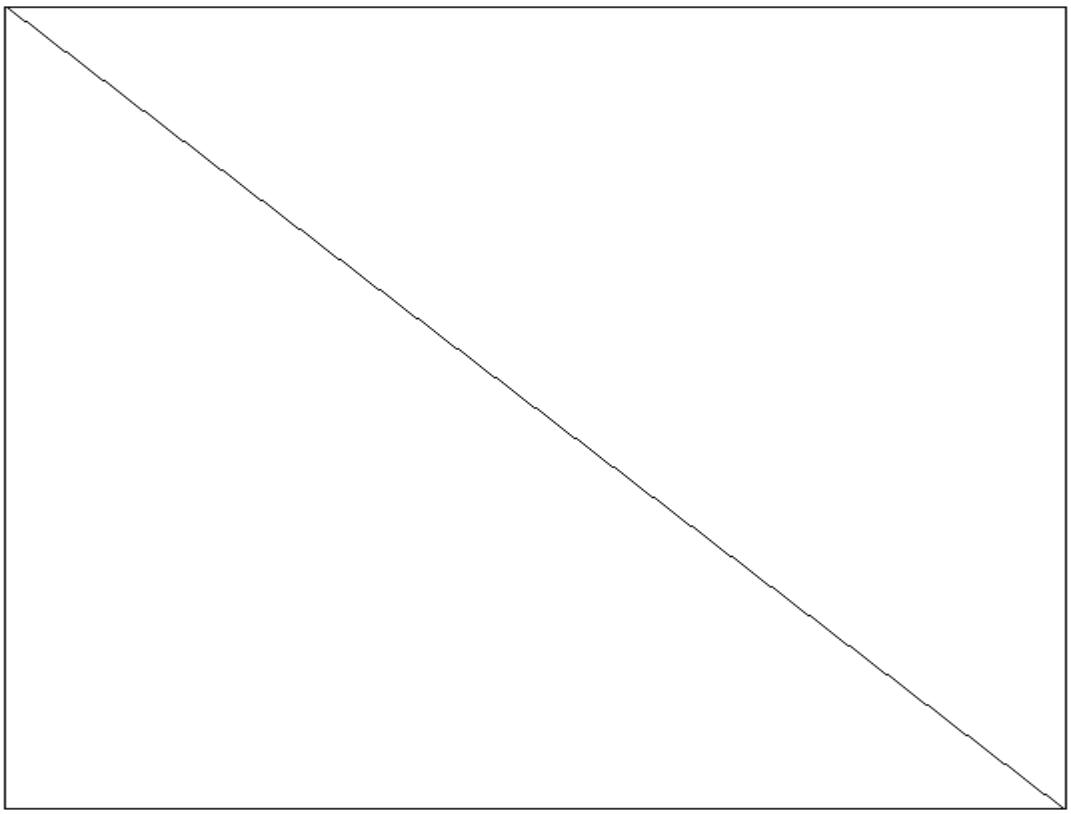
[



]CCNZRI

***Exhibit 6:*** *CMAR end-user connections outside TSO areas – Manawatu-Wanganui and Wellington regions [Source: Chorus, Spark, TERA and Network Strategies Limited]*

[



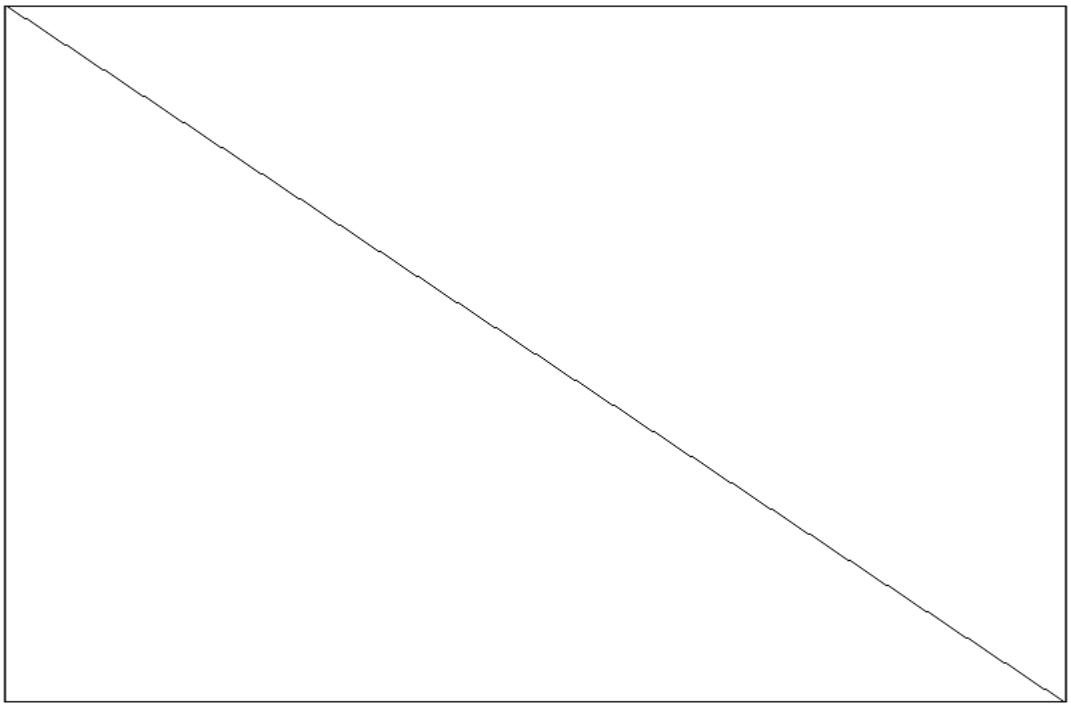
]CCNZRI

***Exhibit 7:*** *CMAR end-user connections outside TSO areas – Gisborne and Hawke's Bay regions [Source: Chorus, Spark, TERA and Network Strategies Limited]*

## 2.5 Missing premises

We have identified cases of end-users which are situated in locations where there is no indication of the existence of actual premises or buildings of any nature. The following exhibits are examples of Chorus' geo-coded end-users outside the TSO polygons which are located close to main roads with no buildings in the immediate vicinity (Exhibit 8 and Exhibit 9).

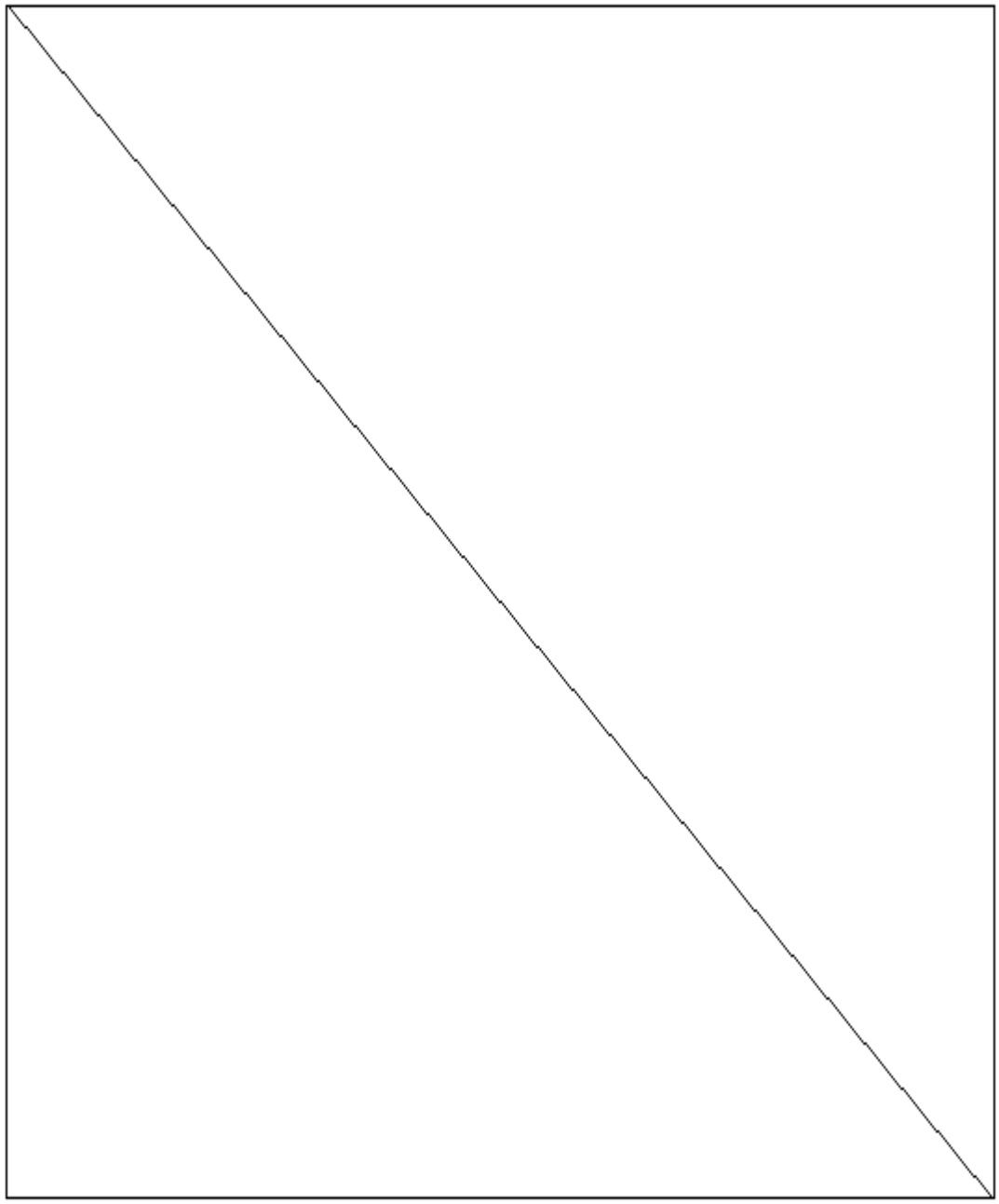
[



]CCNZRI

***Exhibit 8:*** *End-user connections outside TSO area – Meremere Waikato [Source: Chorus, Network Strategies Limited]*

[



]CCNZRI

***Exhibit 9:*** *End-user connections outside TSO area - Hamilton [Source: Chorus, Network Strategies Limited]*

### 2.6 Implications

We conclude that Chorus' geo-coding process contains flaws. Consequently the result cannot be relied upon as a method of defining TSO boundaries. Chorus' database simply does not represent the current geographical distribution of TSO customers.

## 3 Exchanges outside TSO areas

Analysys Mason presents a list of 46 exchange locations which appear to be outside the TSO polygons[14], in support of its claim that the TSO boundaries defined in the Commission's modelling are incorrect:

> The counter-intuitive exclusion of the MDF locations suggests that the TSO polygons may not properly represent the extent of the premises served in 2001.[15]

Using GIS analysis we found that Analysys Mason incorrectly included seven exchanges in its list which are actually within the TSO polygons – namely, GTN, PNY, RS, THS, TRV, TUB, and WGH. We have confirmed that the remaining 39 ESAs are outside the TSO polygons.

Furthermore, we disagree with Analysys Mason's view that the location of exchanges outside the TSO boundaries is indicative of an incorrect definition of the TSO areas. The TSO polygons reflect the location of connections rather than location of the exchange, hence it is not a necessary condition that the exchange is located within the TSO area. While we would expect that in general TSO customers may be located close to the exchange and the exchange may therefore be within the TSO polygon, it would also be feasible that there may be some cases where this does not occur.

Further analysis shows that the location of exchanges outside the TSO boundary does not have any impact on the modelling calculations for road length. The fact that the exchange

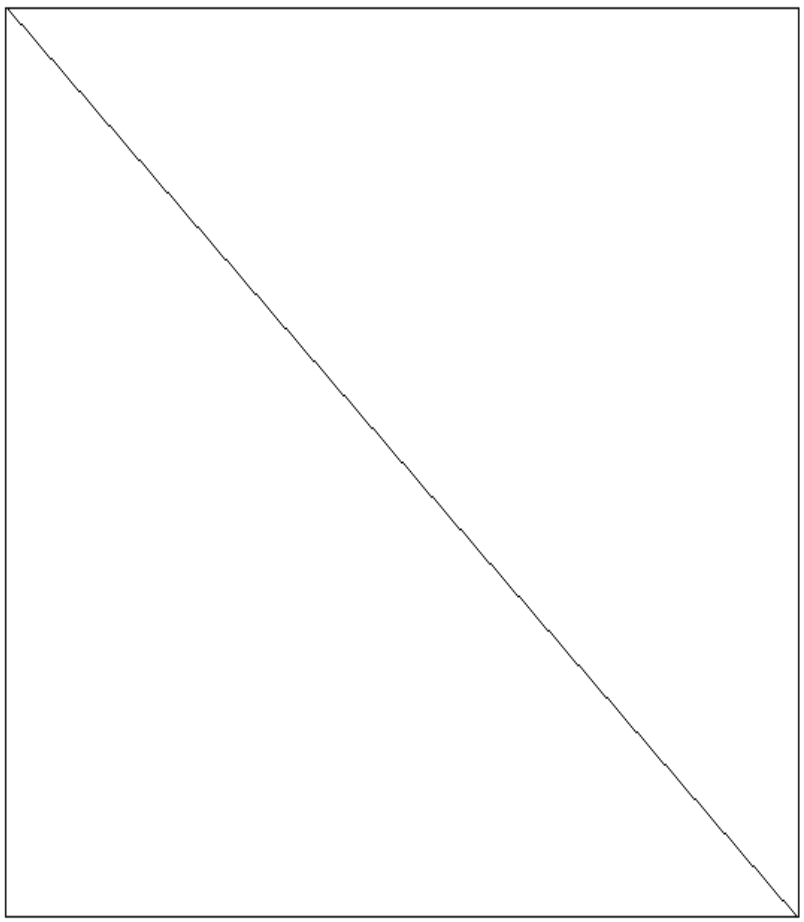
---

14 Analysys Mason (2015), *UCLL and UBA FPP draft determination submission – CONFIDENTIAL (CI),* 20 February 2015, section 2.13, page 23.

15 *Ibid.*

is outside the TSO polygon does not mean that the model excludes the capex of all the sections associated with the exchange. Exhibit 10 and Exhibit 11 show two exchanges listed by Analysys Mason (OIA and RGW) which are currently outside of the TSO polygons. The exchanges are located beyond the TSO area (green shaded area) but the capex for the sections inside the TSO area (blue lines) are included in the cost calculations.

[

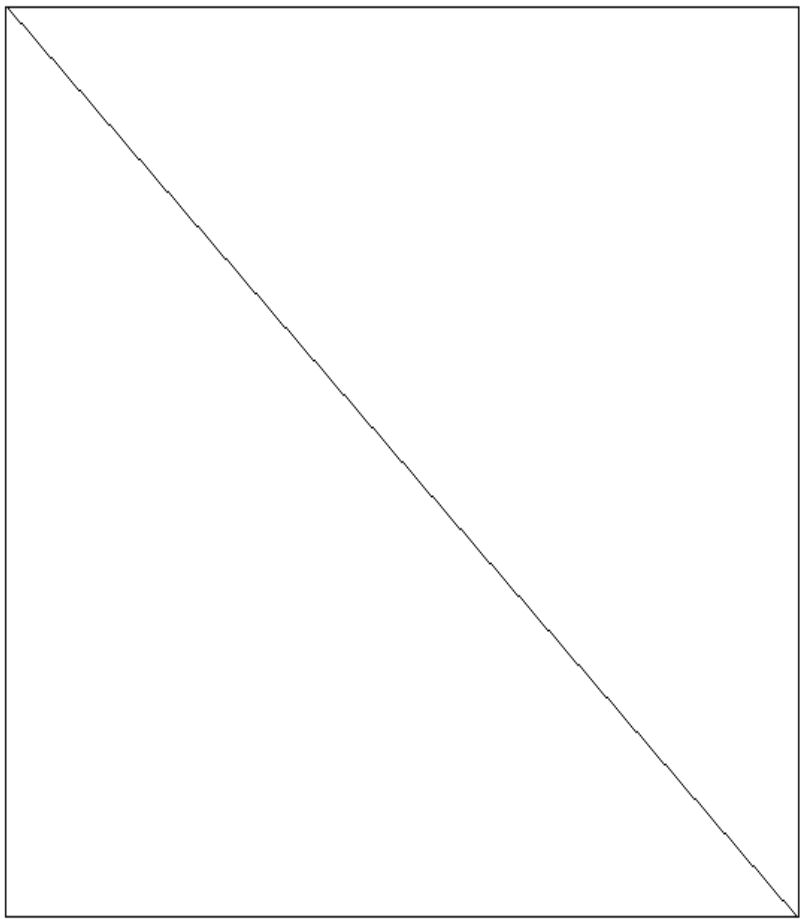


] **CCNZRI**

***Exhibit 10:***

*Sections inside and outside TSO area for OIA exchange [Source: TERA and Network Strategies Limited]*

[



] **CCNZRI**

***Exhibit 11:*** *Sections inside and outside TSO area for RGW exchange [Source: TERA and Network Strategies Limited]*

# 4 Other issues

## 4.1 Overlapping TSO polygons

Figure 2.8 of the Analysys Mason report shows that there is an existing overlapping of TSO polygons in the Auckland ESA (AK).[16] This is not an isolated case as it is replicated

16 Analysys Mason (2015), *UCLL and UBA FPP draft determination submission – CONFIDENTIAL (CI),* 20 February 2015, section 2.13, page 24.

in other ESAs. Our analysis of the modelling approach indicates that this issue does not have any impact on the results – there is no double counting of assets despite the overlapping of TSO polygons. The 'SOURCE_SECTIONS' table in TERA's access network model contains an unique record for each of the sections included in the modeling process – each section is identified by an unique identification number (Id_section) and contains a field (TSO) which indicates if the sections are within or outside the TSO polygons.[17] The geospatial analysis that determines which sections are within the TSO polygons is performed as offline calculations and this feeds into the access network cost model, hence there is no double counting of assets caused by the overlapping of polygons.

### 4.2 Potential modelling issues

In the course of our geospatial analysis we did observe that there are some modelling issues in the Commission's model that may produce anomalous results, namely:

- buildings not allocated to the closest road section
- for some of the buildings the horizontal lengths often appear to be measured to the wrong end of the road segment.

## 5 Conclusions

We find that Chorus and Analysys Mason's criticisms of the Commission's TSO defined polygons are not supported by geographical analysis. In particular:

- the findings are based on a customer database which cannot be used for TSO boundary definition since it includes non-residential services
- the data is incomplete
- the data includes potential inactive connections, CMAR connections and locations that are non-existent.

---

17 TERA (2014), *TSLRIC price review determination for the UCLL and UBA services*, November 2014, section 4.2.11, pages 54 and 55.

On this basis we recommend that the Commission disregards the new data set that has been provided by Chorus.

Nevertheless in the course of our geospatial analysis we noted that there are some modelling issues that may produce anomalous results, namely:

- buildings not allocated to the closest road section
- for some of the buildings the horizontal lengths often appear to be measured to the wrong end of the road segment.

We recommend that the Commission provide further details concerning the underlying access network modelling process so that these issues may be appropriately reviewed.