# Attachment C1:

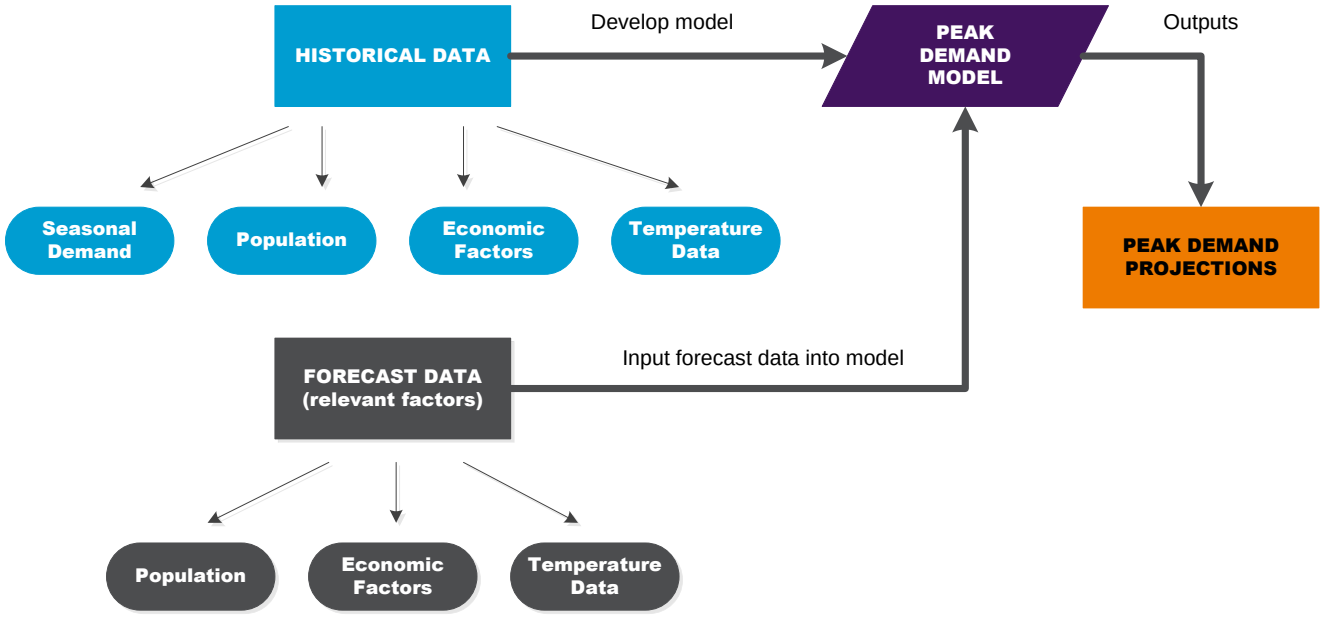
# Peak Demand Forecast

# Contents

# 1. Description of ActewAGL demand forecasting model

Zone demand is forecast using models based on multiple linear regressions. The following figure depicts the demand forecasting process using the model, and the following commentary outlines the step by step process followed in loading the input data, undertaking the regression analysis, identifying correlation of independent variables, and producing the 10% and 50% PoE demand forecasts.

**Figure 1: Overview of ActewAGL Demand Forecasting Model**




This section is a brief summary of the approach taken to forecasting peak demand. More details are in the following sections.

## 1.1 Method – bottom up (trend) forecast

Forecasts for each zone were developed using a bottom-up / trend forecast. Multiple linear regression was used to determine the underlying trend as well as the effect of various weather factors, particularly temperature. Known upcoming new customer block loads were also added into the zone forecasts.

## 1.2 Method – top down (econometric) forecast

The development of the system level forecast followed a similar method as for the zone level forecasts, with the addition of various econometric/demographic variables. It was established that the only statistically significant variables were weather factors and population. Block loads were not considered for the top-down forecast.

# 2. Key features of the ActewAGL demand forecast

Some of the key features and characteristics of the ActewAGL demand forecasting model and techniques are:

- The demand forecast is a weather corrected forecast, with the zone substation forecast reconciled to the system forecast, and with the system demand reconciled to actual and forecast energy consumption, to show the trend in historical and future average annual load factor.
- The model uses about nine years of historical demand data, and about 20-30 years of historical temperature data.
- The input demand data used in the model has recently been changed to the highest three daily maximum demands in Summer, and the lowest 3 maximum demands in Winter
- The impact of temporary load transfers is removed wherever possible from historical demand figures.
- Initially, ActewAGL modelled a wide range of independent variables, including GDP growth, population, temperature variables, and others. Ultimately ActewAGL found that there were no strong correlations, except to one or more of the selected temperature variables
- The model uses several different temperature variables as shown in the table below:

| Variable | Definition |
|---|---|
| Year | Year |
| MaxTemp | The daily maximum temperature |
| CDD | The daily cooling degree days, defined as Max (0, Average daily temperature - CDD Threshold ) |
| 3DayCDD | The sum of the no. of cooling degree days in the previous three days |
| MinTemp | The daily minimum temperature |
| HDD | The daily heating degree days, defined as Max (0, HDD Threshold – Average daily temperature) |
| 3DayHDD | The sum of the no. of heating degree days in the previous three days |

- The final suite of correlation variables may differ from zone substation to zone substation, depending on the strength of the correlation with each variable
- The ActewAGL modelling software internally correlates demand and temperature input variables, and produces a weather corrected demand forecast, but it does not explicitly weather correct the historical demand input data. This is somewhat different to other modelling techniques in which the historical demand data is weather corrected before input into the forecasting model
- Known block load increases are taken into account in the first 18-24 months of the zone substation forecast. However only the extent to which known block load increases exceed the historical trend in annual demand increase (not the whole block load increase), is added to the forecast. No block load increases are taken into account beyond about 2 years.
- The forecasting model produces 10% and 50% PoE demand forecasts based on the 90th percentile, and median weather variables, respectively.

# 3. Detailed forecasting methodology

## 3.1 Modelling principles

The best-practice modelling/forecasting principles that ActewAGL adheres to are described in the table below.

| Principle | Description |
|---|---|
| Data | Obtain reliable and unbiased data from reputable sources, conduct data checks to remove/repair erroneous data and manage data effectively. |
| Model calibration | Use appropriate statistical estimation methods. |
| Parsimony | Use only as many parameters as necessary to fit the model, to minimise unnecessary complexity and allow model to be easily replicable. |
| Fit to theory | Choose models which are supported by relevant theory. |
| Fit to evidence | Show that the model adequately accounts for history used in calibration (conduct back-testing). |
| Logical model | Explanatory variables in the model should have theoretical basis, and have theoretically correct signs. |
| Model validation | Analyse the statistical significance of variables, goodness of fit, diagnostic checking of residuals etc. |
| Model documentation | Detailed and thorough documentation of modelling process to ensure transparency and repeatability. |
| Version source control | Track changes made to models. |

## 3.2 Statistical modelling method

The models chosen for the system/zone level forecasts are based on multiple linear regression. Other methods such as time series modelling were also considered and attempted, but were ultimately rejected. For example, time series modelling did not work well because it weights recent observations much heavier than older observations, which leads to severe distortions due to some exceptionally low demands in 2012.

All statistical modelling and forecasting was performed using the R statistical program.

## 3.3 Segmentation of summer/winter scenarios

Summer and winter forecasts (corresponding to the calendar year seasons) are developed. The other seasons are disregarded in the modelling. This is done because peak demands usually occur in summer and winter where there are severe weather conditions. Moreover, summer and winter demands are modelled separately, as they are observed to have different drivers/patterns of demand.

## 3.4 Determine potential explanatory variables

| Forecast Type | Potential explanatory variables |
|---|---|
| System Level | Economic/demographic variables such as GDP, GSP growth, unemployment rate, population etc. |
| Zone Substation Level | Time trend (implicitly factors in the various possible causes of a change in demand over time), temperature variables: maximum daily temperature, cooling degree days etc. |

This follows the industry best practice load forecasting process which advocates the analysis of top-down econometric variables at the system level, while conducting trend analysis at the zone substation level and below.

## 3.5 Steps taken to develop model/forecast

### 3.5.1 Steps to develop zone level forecast

#### Step 1: Collect historical data

This step involves the collection and verification of historical data – peak demand data from internal databases, as well as historical data for the potential explanatory variables. All external data is obtained from reputable sources such as the ABS, BIS Shrapnel and BOM.

#### Step 2: Adjusting for load transfers/switching

There is currently very limited information available on load transfers/switching. This makes it hard to adjust for any temporary switching/load transfers. However, inter-zone load transfers are not very common/significant in ActewAGL's network, and thus the impact of load switching is generally not material.

Where deemed material, the effects of load transfers/switching are approximated and accounted for – e.g. abnormal historical maximum demands caused by temporary switching will be eliminated, and permanent load transfers will be factored into the model regression.

#### Step 3: Develop model (model selection)

Three daily peak demand points from each year's summer/winter are extracted for the last 10 years for each of the zones. Historical data for potential explanatory variables corresponding to the dates of the peak demand are also obtained. For example, if a peak demand of 50 MVA occurred in Fyshwick Zone on 20/01/2008, then the maximum temperature/CDD for that day is also used.

Using the above data, with peak demand as the dependent variable and the other variables as explanatory variables, separate possible regression models (each with different explanatory variables) are fitted. The model that fits the data "best" is then selected to be the final model used in subsequent forecasting. The way the "best" model is determined is described in the table below.

**Table 3.1: Model Selection: Two Main Approaches**

| | |
|---|---|
| 1 All subsets approach | Fit all possible models and compare them. This is done with consideration given to the principle of parsimony: "Fit the smallest possible model while making the most possible explanation". Compare the models based on various criteria: R-squared adj., PRESSp, Cp. Make value judgment after considering all of the factors.<br>• R-squared adj. is the proportion of variability in response that is explained by the model, penalized by number of variables. A good model has high R-squared adj.<br>• PRESSp is the Prediction Sum of Squares – based on cross-validation. Good models have small PRESSp.<br>• Mallow's Cp - checks if the model is "right" – models that are too small (underfitting) are biased compared with the true model, while models that are too big (overfitting) results in models with inflated variances. GOAL: Values of Cp near p with p as small as possible achieve a satisfactory "bias-variance" trade off.<br>*p refers to the number of explanatory variables in model |
| 2 Stepwise (sequential) procedures | Goal: to find "good" models without necessarily having to check all the bad models. Forward stepwise regression – ensures that the model only includes variables which are significant – meeting a certain F-stat cut-off. |

In ActewAGL's model selection criteria, Method 2 is mainly used, checked against Method 1 to ensure that the right variables are in the model.

*Note 1: *Model selection is conducted for each zone across different seasons. The implication of this is that each zone could have a different model, which only contains the most significant variables specific to it.*

*Note 2: *It may be noted that no explicit weather correction is conducted prior to model fitting and regression. This is due to the fact that multiple linear regression is conducted with temperature variables in the model, implicitly correcting for weather.*

### Step 4: Obtain 10% and 50% PoE weather condition data

In order to forecast future peak demand, 10% and 50% PoE weather condition data are required to be input into the model. This would allow the model to produce the forecast demand given one in 10 year, and one in two year weather conditions. This is obtained by analysing the temperature data since 1990, and picking out the 10$^{th}$ and 50$^{th}$ percentile.

### Step 5: Model validation/derivation of initial forecast (excludes any future block loads)

After an appropriate model has been determined, an initial forecast can be derived. At this point, various checks are conducted on the model to ensure that the model is valid and a good fit for historical data. These checks are described below:

a) Visual check – A graph with the historical demands as well as the 50% and 10% PoE forecasts (including back-fit) shows what maximum demand would have been in the past if 50% and 10% PoE weather conditions had occurred instead of the actual temperatures. To some extent, this graph provides a visual confirmation as to whether the model forecast is reasonable.

b) Statistical model diagnostics are scrutinized to ensure that the model is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF etc. are used.

c) A back-fit (goodness of fit) analysis is conducted to check the model's fit for predicting historical demand. Basically, this involves "forecasting" historical demand using the model, given the historical data of the explanatory variables. A graph, as well as a table which shows the % deviation of the back-fit from actual is used to verify the viability of the model.

### Step 6: Develop final forecast (factoring in possible future block loads)

After the model has been determined to be a good fit in Step 5, a final forecast can then be developed. This step involves adjusting the initial forecast for expected future block loads.

*Note: *ActewAGL currently does not have sufficient data to isolate the effect of historical block customer loads. It is not possible to remove the effect of the embedded historical block loads from the historical trend. An overestimated forecast would therefore result if expected future block loads are simply added on top of the trend. However, it would not be prudent if future block loads are just not accounted for. To minimize the overestimation effect, only the effect of block loads ABOVE the trend is added to the forecast.*

In this step, 10% and 50% PoE forecasts are developed. This corresponds to the one in 10 year, and one in two year weather conditions.

Finally, 90% Prediction Intervals (PI) for each of the 10% and 50% PoE forecasts are generated statistically. This provides the user with a band within which he is 90% confident that demand would fall. For example, the 90% PI for the 50% PoE forecasts is the range within which we can be 90% confident that demand will fall given one in two year weather conditions.

### Step 6: Produce final graph, forecast numbers and document model used

The final step in the modelling/forecasting process is to produce the final graph and generate the forecast numbers. The model is also documented (e.g. model coefficients), so that it can be easily replicable in the future.

### 3.5.2 Steps to develop system level forecast

The development of the system level forecast followed a similar method as for the zone level forecasts, with the addition of various econometric/demographic variables. It was established that the only statistically significant variables were weather factors and population.

# 4. ActewAGL demand forecast

## 4.1 Forecast excluding effect of future augmentation projects

Table 4.1 and Table 4.2 below show the 10 year forecast (2014-2023) of summer and winter maximum demands for both the 50% PoE and 10%PoE forecast scenarios. Also shown in the tables are the existing continuous and emergency ratings of the ActewAGL zone substations, against which the need for any system augmentation can be tested.

**Table 4.1: Forecasts for Zone Substations (50% PoE)**

| | | Zone Substation Rating, MVA | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Zone Substation** | | **Belconnen** | | **City East** | | **Civic** | | **Fyshwick** | | **Gilmore** | | **Gold Creek** | | **Latham** | | **Telopea Park** | | **Theodore** | | **Wanniassa** | | **Woden** | |
| **Season** | | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** |
| Rating | Continuous | 55 | 55 | 95 | 112 | 110 | 110 | 28 | 28 | 45 | 45 | 57 | 57 | 95 | 100 | 100 | 100 | 45 | 45 | 75 | 100 | 95 | 100 |
| | Emergency | 63 | 76 | 95 | 114 | 114 | 143 | 28 | 28 | 62 | 69 | 76 | 76 | 95 | 114 | 114 | 114 | 62 | 69 | 95 | 114 | 95 | 114 |
| | | Zone Substation 50% PoE Load Forecast, MVA | | | | | | | | | | | | | | | | | | | | | |
| **Year** | | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** |
| 2014 | | 59.5 | 56.8 | 78.7 | 70.5 | 60.4 | 56.0 | 40.5 | 34.2 | 22.2 | 26.8 | 49.2 | 55.6 | 54.5 | 70.8 | 107.8 | 102.4 | 29.8 | 30.4 | 73.4 | 80.2 | 81.7 | 79.9 |
| 2015 | | 61.8 | 59.1 | 78.0 | 70.1 | 60.5 | 56.1 | 41.9 | 35.1 | 22.9 | 27.7 | 52.3 | 58.7 | 55.2 | 71.0 | 109.8 | 103.5 | 30.6 | 30.4 | 74.0 | 79.3 | 82.0 | 79.2 |
| 2016 | | 61.8 | 59.1 | 77.2 | 69.7 | 60.5 | 56.1 | 43.3 | 36.0 | 23.6 | 28.6 | 55.4 | 61.8 | 55.9 | 71.0 | 110.9 | 104.7 | 31.4 | 30.4 | 74.6 | 78.3 | 82.0 | 78.2 |
| 2017 | | 61.8 | 59.1 | 76.3 | 69.3 | 60.5 | 56.1 | 44.6 | 36.9 | 24.3 | 29.4 | 58.4 | 64.9 | 56.6 | 71.0 | 112.0 | 105.8 | 32.2 | 30.4 | 75.2 | 77.3 | 82.0 | 77.2 |
| 2018 | | 61.8 | 59.1 | 75.5 | 68.9 | 60.5 | 56.1 | 46.0 | 37.8 | 25.0 | 30.3 | 61.5 | 68.0 | 57.3 | 71.0 | 113.1 | 106.9 | 33.0 | 30.4 | 75.8 | 76.3 | 82.0 | 76.3 |
| 2019 | | 61.8 | 59.1 | 74.7 | 68.5 | 60.5 | 56.1 | 47.4 | 38.8 | 25.7 | 31.2 | 64.6 | 71.1 | 58.0 | 71.0 | 114.2 | 108.1 | 33.9 | 30.4 | 76.4 | 75.3 | 82.0 | 75.3 |
| 2020 | | 61.8 | 59.1 | 73.9 | 68.1 | 60.5 | 56.1 | 48.7 | 39.7 | 26.4 | 32.1 | 67.7 | 74.2 | 58.7 | 71.0 | 115.3 | 109.2 | 34.7 | 30.4 | 77.0 | 74.3 | 82.0 | 74.3 |
| 2021 | | 61.8 | 59.1 | 73.1 | 67.7 | 60.5 | 56.1 | 50.1 | 40.6 | 27.1 | 33.0 | 70.8 | 77.4 | 59.4 | 71.0 | 116.4 | 110.4 | 35.5 | 30.4 | 77.6 | 73.3 | 82.0 | 73.4 |
| 2022 | | 61.8 | 59.1 | 72.3 | 67.3 | 60.5 | 56.1 | 51.5 | 41.5 | 27.8 | 33.8 | 73.8 | 80.5 | 60.1 | 71.0 | 117.5 | 111.5 | 36.3 | 30.4 | 78.2 | 72.3 | 82.0 | 72.4 |
| 2023 | | 61.8 | 59.1 | 71.5 | 66.9 | 60.5 | 56.1 | 52.8 | 42.4 | 28.5 | 34.7 | 76.9 | 83.6 | 60.8 | 71.0 | 118.6 | 112.6 | 37.1 | 30.4 | 78.8 | 71.3 | 82.0 | 71.4 |

Note: The forecasts are based on the historical/current state of the network, i.e. they do not factor in unrealised planned work. For example, the Fyshwick Zone forecast does not account for possible future transfers to East Lake Zone, which could reduce the Fyshwick peak demand. At the time the forecast was developed there was no load connected to East Lake Zone.

**Table 4.2: Forecasts for Zone Substations (10% PoE)**

| | | Zone Substation Rating, MVA | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Zone Substation** | | **Belconnen** | | **City East** | | **Civic** | | **Fyshwick** | | **Gilmore** | | **Gold Creek** | | **Latham** | | **Telopea Park** | | **Theodore** | | **Wanniassa** | | **Woden** | |
| **Season** | | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** |
| Rating | Continuous | 55 | 55 | 95 | 112 | 110 | 110 | 28 | 28 | 45 | 45 | 57 | 57 | 95 | 100 | 100 | 100 | 45 | 45 | 75 | 100 | 95 | 100 |
| | Emergency | 63 | 76 | 95 | 114 | 114 | 143 | 28 | 28 | 62 | 69 | 76 | 76 | 95 | 114 | 114 | 114 | 62 | 69 | 95 | 114 | 95 | 114 |
| | | Zone Substation 50% PoE Load Forecast, MVA | | | | | | | | | | | | | | | | | | | | | |
| **Year** | | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** | **S** | **W** |
| 2014 | | 63.7 | 57.2 | 84.1 | 70.8 | 62.7 | 56.5 | 42.7 | 34.6 | 23.1 | 26.8 | 52.2 | 55.7 | 58.5 | 71.2 | 113.1 | 103.1 | 31.0 | 30.6 | 79.1 | 80.6 | 85.4 | 80.8 |
| 2015 | | 66.0 | 59.5 | 83.4 | 70.5 | 62.7 | 56.6 | 44.1 | 35.5 | 23.8 | 27.7 | 55.3 | 58.9 | 59.2 | 71.4 | 115.2 | 104.2 | 31.8 | 30.6 | 79.7 | 79.6 | 85.7 | 80.2 |
| 2016 | | 66.0 | 59.5 | 82.6 | 70.1 | 62.7 | 56.6 | 45.4 | 36.4 | 24.5 | 28.6 | 58.4 | 62.0 | 59.9 | 71.4 | 116.2 | 105.4 | 32.6 | 30.6 | 80.3 | 78.6 | 85.7 | 79.2 |
| 2017 | | 66.0 | 59.5 | 81.7 | 69.7 | 62.7 | 56.6 | 46.8 | 37.3 | 25.2 | 29.4 | 61.5 | 65.1 | 60.6 | 71.4 | 117.3 | 106.5 | 33.4 | 30.6 | 80.9 | 77.6 | 85.7 | 78.2 |
| 2018 | | 66.0 | 59.5 | 80.9 | 69.3 | 62.7 | 56.6 | 48.2 | 38.2 | 25.9 | 30.3 | 61.4 | 68.2 | 61.3 | 71.4 | 118.4 | 107.7 | 34.3 | 30.6 | 81.5 | 76.6 | 85.7 | 77.3 |
| 2019 | | 66.0 | 59.5 | 80.1 | 68.9 | 62.7 | 56.6 | 49.6 | 39.1 | 26.6 | 31.2 | 67.7 | 71.3 | 62.0 | 71.4 | 119.5 | 108.8 | 35.1 | 30.6 | 82.1 | 75.6 | 85.7 | 76.3 |
| 2020 | | 66.0 | 59.5 | 79.3 | 68.5 | 62.7 | 56.6 | 50.9 | 40.0 | 27.3 | 32.1 | 70.7 | 74.4 | 62.7 | 71.4 | 120.6 | 109.9 | 35.9 | 30.6 | 82.7 | 74.6 | 85.7 | 75.3 |
| 2021 | | 66.0 | 59.5 | 78.5 | 68.1 | 62.7 | 56.6 | 52.3 | 40.9 | 28.0 | 33.0 | 73.8 | 77.5 | 63.4 | 71.4 | 121.7 | 111.1 | 36.7 | 30.6 | 83.3 | 73.7 | 85.7 | 74.3 |
| 2022 | | 66.0 | 59.5 | 77.7 | 67.7 | 62.7 | 56.6 | 53.7 | 41.8 | 28.7 | 33.8 | 76.9 | 80.6 | 64.1 | 71.4 | 122.8 | 112.2 | 37.5 | 30.6 | 83.9 | 72.7 | 85.7 | 73.4 |
| 2023 | | 66.0 | 59.5 | 76.9 | 67.3 | 62.7 | 56.6 | 55.0 | 42.7 | 29.4 | 34.7 | 80.0 | 83.7 | 64.8 | 71.4 | 123.9 | 113.4 | 38.4 | 30.6 | 84.5 | 71.7 | 85.7 | 72.4 |

Notes:

a) Fyshwick main transformer two hour emergency rating has been downgraded to 28MVA in August 2013. When the cause for this down rating is rectified the original two hour emergency rating will be reinstated and the deficit of capacity and demand will reduce to 6MVA from 28MVA.

b) Residential demand growth in Molonglo valley has not been accounted for load forecasting of zone substations (Woden and Civic). A new zone substation (Molonglo) was proposed to take this demand due to the high rate of land releases predicted in 2011/12 and the foreseen supply quality issues associated with significant demand increases when supplied from Woden and Civic zone substations.

c) S = Summer; W = Winter. Summer refers to the months of December, January and February. Therefore December 2012 would be shown as summer 2013.

d) The forecasts are based on the historical/current state of the network, i.e. they do not factor in unrealised planned work. For example, the Fyshwick Zone forecast does not account for possible future transfers to East Lake Zone, which could reduce the Fyshwick peak demand. At the time the forecast was developed there was no load connected to East Lake Zone.

As stated in the notes to the above tables, the forecasts are based on the historical / current state of the network, as existed prior to December 2013, and therefore do not provide an adequate indication of the optimum timing of future system augmentation projects. This is covered in the following section.

## 4.2 Forecast taking account of future augmentation projects

Table 4.3 below provides details of the future 10%PoE and 50%PoE summer and winter load forecasts, including any planned new substations or upgrades, and/or configuration of the networks (e.g. permanent inter-zone load transfers).

These forecasts have been developed using the base forecasts discussed above, and applying known and probable load transfers onto new zone substations, and between existing zone substations, over the period 2014 – 2023. The recent commissioning in December 2013 of East Lake zone substation and the commissioning of Molonglo zone substation by mid-2018 are taken into account.

**Table 4.3: Forecasts for zone substations after accounting for future augmentation projects**

| Zone Substation | | Belconnen | | City East | | Civic | | Eastlake | | Fyshwick | | Gilmore | | Gold Creek | | Latham | | Molonglo | | Telpea Park | | Theodore | | Wanniassa | | Woden | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Season | | S | W | S | W | S | W | S | W | S | W | S | W | S | W | S | W | S | W | S | W | S | W | S | W | S | W |
| Rating | Continuous | 55 | 55 | 95 | 112 | 110 | 110 | 50 | 50 | 50 | 50 | 45 | 45 | 57 | 57 | 95 | 100 | 25/50 | 25/50 | 100 | 100 | 45 | 45 | 95 | 100 | 95 | 100 |
| | Emergency | 63 | 76 | 95 | 114 | 114 | 143 | 0 | 0 | 50 | 50 | 62 | 69 | 76 | 76 | 95 | 114 | 0 | 0 | 114 | 114 | 62 | 69 | 95 | 114 | 95 | 114 |
| Post upgrade | Continuous | 87 | 87 | | | | | 100 | 100 | | | | | | | | | | | | | | | | | | |
| | Emergency | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Zone substation 50%PoE load forecast, MVA** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2014 | | 55.75 | 53.05 | 74.95 | 66.75 | 66.03 | 61.63 | 8.25 | 16.50 | 40.50 | 25.95 | 22.20 | 26.80 | 49.20 | 55.60 | 56.38 | 72.68 | 0.00 | 0.00 | 99.55 | 94.15 | 29.80 | 30.40 | 73.40 | 80.20 | 81.70 | 79.90 |
| 2015 | | 60.30 | 57.60 | 74.25 | 66.35 | 70.63 | 66.23 | 16.58 | 16.67 | 33.65 | 26.858 | 22.90 | 27.70 | 50.05 | 56.45 | 57.08 | 72.88 | 0.00 | 0.00 | 101.55 | 95.25 | 30.60 | 30.40 | 74.00 | 79.30 | 77.50 | 74.70 |
| 2016 | | 60.30 | 57.60 | 73.45 | 65.95 | 70.63 | 66.23 | 16.75 | 34.08 | 35.05 | 18.75 | 23.60 | 28.60 | 53.15 | 59.55 | 57.78 | 72.88 | 0.00 | 0.00 | 102.65 | 88.20 | 31.40 | 30.40 | 74.60 | 78.30 | 77.50 | 73.70 |
| 2017 | | 60.30 | 57.60 | 72.55 | 65.55 | 70.63 | 66.23 | 34.17 | 46.12 | 27.35 | 7.95 | 24.30 | 29.40 | 56.15 | 62.65 | 58.48 | 72.88 | 0.00 | 0.00 | 95.50 | 89.30 | 32.20 | 30.40 | 75.20 | 77.30 | 77.50 | 72.70 |
| 2018 | | 60.30 | 57.60 | 71.75 | 65.15 | 70.63 | 63.98 | 46.21 | 46.58 | 17.05 | 8.85 | 25.00 | 30.30 | 59.25 | 65.75 | 59.18 | 72.88 | 0.00 | 10.4 | 96.60 | 90.40 | 33.00 | 30.40 | 75.80 | 76.30 | 77.50 | 66.10 |
| 2019 | | 60.30 | 57.60 | 70.95 | 64.75 | 68.38 | 63.98 | 46.67 | 47.05 | 18.45 | 9.85 | 25.70 | 31.20 | 62.35 | 68.85 | 59.88 | 72.88 | 10.4 | 10.93 | 97.70 | 91.60 | 33.90 | 30.40 | 76.40 | 75.30 | 71.80 | 65.10 |
| 2020 | | 60.30 | 57.60 | 70.15 | 64.35 | 68.38 | 63.98 | 47.14 | 47.52 | 19.75 | 10.75 | 26.40 | 32.10 | 65.45 | 71.95 | 60.58 | 72.88 | 10.93 | 11.48 | 98.80 | 92.70 | 34.70 | 30.40 | 77.00 | 74.30 | 71.80 | 64.10 |
| 2021 | | 60.30 | 57.60 | 69.35 | 63.95 | 68.38 | 63.98 | 47.61 | 48.00 | 21.15 | 11.65 | 27.10 | 33.00 | 68.55 | 75.15 | 61.28 | 72.88 | 11.48 | 12.02 | 99.90 | 93.90 | 35.50 | 30.40 | 77.60 | 73.30 | 71.80 | 63.20 |
| 2022 | | 60.30 | 57.60 | 68.55 | 63.55 | 68.38 | 63.98 | 48.08 | 48.48 | 22.55 | 12.55 | 27.80 | 33.80 | 71.55 | 78.25 | 61.98 | 72.88 | 12.02 | 12.66 | 101.00 | 95.00 | 36.30 | 30.40 | 78.20 | 72.30 | 71.80 | 62.20 |
| 2023 | | 60.30 | 57.60 | 67.75 | 63.15 | 68.38 | 63.98 | 48.56 | 48.96 | 23.85 | 13.45 | 28.50 | 34.70 | 74.65 | 81.35 | 62.68 | 72.88 | 12.62 | 13.29 | 102.10 | 96.10 | 37.10 | 30.40 | 78.80 | 71.30 | 71.80 | 61.20 |
| **Zone substation 10%PoE load forecast, MVA** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2014 | | 59.95 | 53.45 | 80.35 | 67.05 | 68.33 | 62.13 | 8.25 | 16.50 | 42.70 | 26.35 | 23.10 | 26.80 | 52.20 | 55.70 | 60.38 | 73.08 | 0.00 | 0.00 | 104.85 | 94.85 | 31.00 | 30.60 | 79.10 | 80.60 | 85.40 | 80.80 |
| 2015 | | 64.50 | 58.00 | 79.65 | 66.75 | 72.83 | 66.73 | 16.58 | 16.67 | 35.85 | 27.25 | 23.80 | 27.70 | 53.05 | 56.65 | 61.08 | 73.28 | 0.00 | 0.00 | 106.95 | 95.95 | 31.80 | 30.60 | 79.70 | 79.60 | 81.20 | 75.70 |
| 2016 | | 64.50 | 58.00 | 78.85 | 66.35 | 72.83 | 66.73 | 16.75 | 34.08 | 37.15 | 19.15 | 24.50 | 28.60 | 56.15 | 59.75 | 61.78 | 73.28 | 0.00 | 0.00 | 107.95 | 88.90 | 32.60 | 30.60 | 80.30 | 78.60 | 81.20 | 74.70 |
| 2017 | | 64.50 | 58.00 | 77.95 | 65.95 | 72.83 | 66.73 | 34.17 | 46.12 | 29.55 | 8.35 | 25.20 | 29.40 | 59.25 | 62.85 | 62.48 | 73.28 | 0.00 | 0.00 | 100.80 | 90.00 | 33.40 | 30.60 | 80.90 | 77.60 | 81.20 | 73.70 |
| 2018 | | 64.50 | 58.00 | 77.15 | 65.55 | 72.83 | 64.48 | 46.21 | 46.58 | 19.25 | 9.25 | 25.90 | 30.30 | 62.35 | 65.95 | 63.18 | 73.28 | 0.00 | 11.2 | 101.90 | 91.20 | 34.30 | 30.60 | 81.50 | 76.60 | 81.20 | 67.10 |
| 2019 | | 64.50 | 58.00 | 76.35 | 65.15 | 70.58 | 64.48 | 46.67 | 47.05 | 20.65 | 10.15 | 26.60 | 31.20 | 65.45 | 69.05 | 63.88 | 73.28 | 11.2 | 11.76 | 103.00 | 92.30 | 35.10 | 30.60 | 82.10 | 75.60 | 75.50 | 66.10 |
| 2020 | | 64.50 | 58.00 | 75.55 | 64.75 | 70.58 | 64.48 | 47.14 | 47.52 | 21.95 | 11.05 | 27.30 | 32.10 | 68.45 | 72.15 | 64.58 | 73.28 | 11.76 | 12.34 | 104.10 | 93.40 | 35.90 | 30.60 | 82.70 | 74.60 | 75.50 | 65.10 |
| 2021 | | 64.50 | 58.00 | 74.75 | 64.35 | 70.58 | 64.48 | 47.61 | 48.00 | 23.35 | 11.95 | 28.00 | 33.00 | 71.55 | 75.25 | 65.28 | 73.28 | 12.34 | 12.96 | 105.20 | 94.60 | 36.70 | 30.60 | 83.30 | 73.70 | 75.50 | 64.10 |
| 2022 | | 64.50 | 58.00 | 73.95 | 63.95 | 70.58 | 64.48 | 48.08 | 48.48 | 24.75 | 12.85 | 28.70 | 33.80 | 74.65 | 78.35 | 65.98 | 73.28 | 12.96 | 13.61 | 106.30 | 95.70 | 37.50 | 30.60 | 83.90 | 72.70 | 75.50 | 63.20 |
| 2023 | | 64.50 | 58.00 | 73.15 | 63.55 | 70.58 | 64.48 | 48.56 | 48.96 | 26.05 | 13.75 | 29.40 | 34.70 | 77.75 | 81.45 | 66.68 | 73.28 | 13.61 | 14.29 | 107.40 | 96.90 | 38.40 | 30.60 | 84.50 | 71.70 | 75.50 | 62.20 |

Key points to note about these forecasts are:

- No account has been taken of potential demand reductions from ActewAGL demand management projects
- No account has been taken of available small scale embedded generation
- No account has been taken of the three large PV array projects planned for ActewAGL's supply area.
- Assumed load transfers have been discounted to 75% of estimated amounts.
- Annual load growth rates of 1% and 5% have been assumed for Eastlake and Molonglo zone substations respectively after commissioning.
- Proposed Mitchell zone substation has been excluded from the forecast, as it is well into the next regulatory period, and no system constraint is evident from the forecast to determine appropriate timing.

## 4.3 Assumed load transfers

The following assumed transfers onto new or uprated zone substations would occur over the period 2014 – 19. Note that all transfers have been discounted to 75% of the estimated values to allow for probable erosion of load transfer capability due to residual load growth on feeders during the intervening period. The figures below are pre-discounted values.

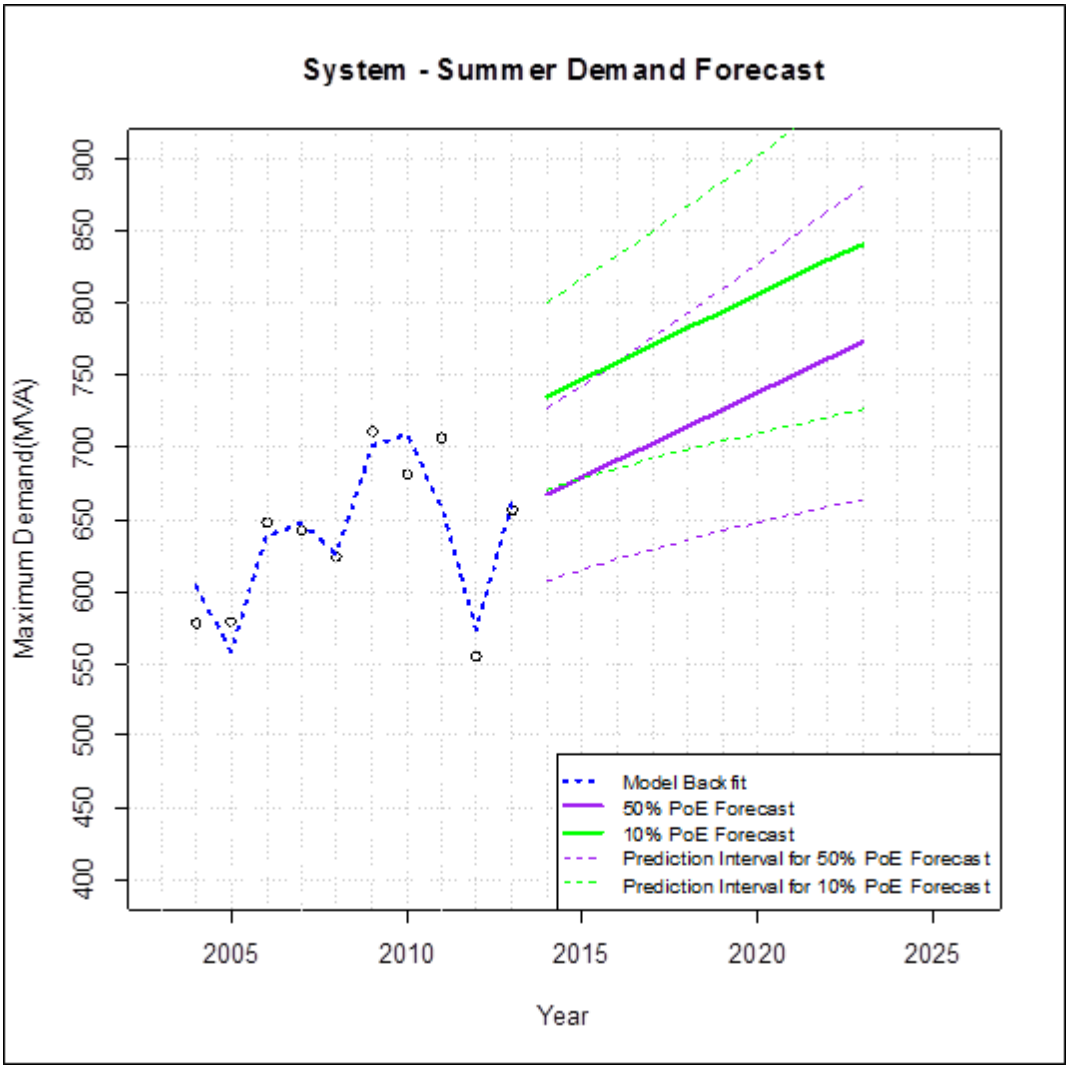
**Table 4.4: Estimated Magnitude and Timing of Load Transfers**

| Transfer from: | To: | Load (MVA) | Assumed capacity available | Assumed transfer date |
|---|---|---|---|---|
| Fyshwick | Eastlake | 11 | 75% | Jul-14 |
| Telopea Park | Eastlake | 11 | 75% | Jan-14 |
| Telopea Park | Eastlake | 11 | 75% | Jul-16 |
| Fyshwick | Eastlake | 12 | 75% | Jul-16 |
| Fyshwick | Eastlake | 15.6 | 75% | Jul-17 |
| Woden | Molonglo | 7.6 | 75% | Jul-18 |
| Civic | Molonglo | 3 | 75% | Jul-18 |
| Belconnen | Civic | 2.5 | 75% | Jan-14 |
| Belconnen | Latham | 2.5 | 75% | Jan-14 |
| City East | Civic | 5 | 75% | Jan-14 |
| Gold Creek | Belconnen | 3 | 75% | Jan-15 |
| Woden | Civic | 6 | 75% | Jan-15 |

# 5. Forecast Outcomes

## 5.1 System Forecast

### 5.1.1 System Summer Forecast




Model Details: Demand = -227.1 + 32.51*MaxCDD + 0.0015 * Population

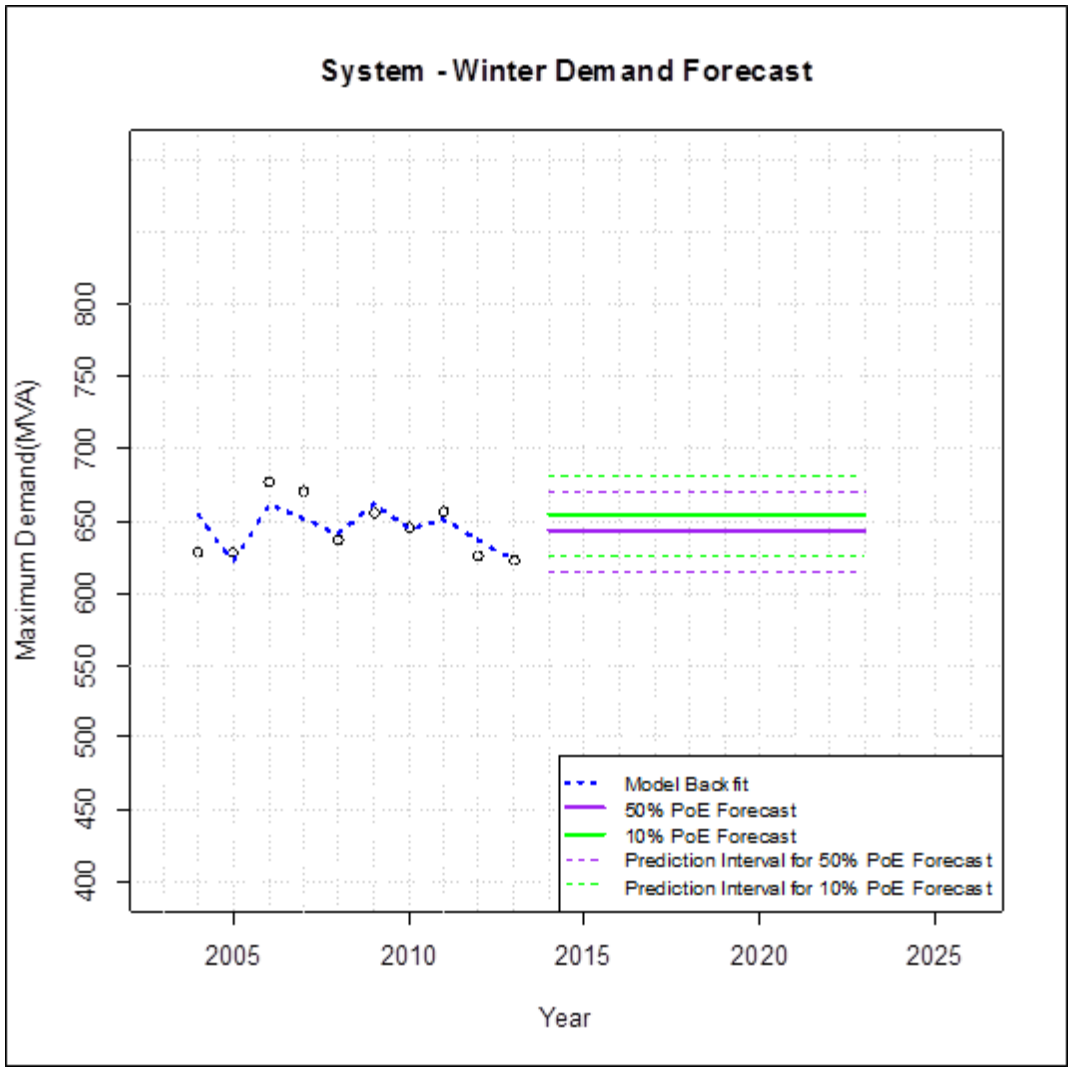
| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -227.1 | 198.5 | -1.144 | 0.29026 |
| MaxCDD | 32.51 | 6.125 | 5.308 | 0.00111 |
| Population | 0.001506 | 0.0004958 | 3.037 | 0.01893 |
| Residual standard error: 26.31 on 7 degrees of freedom | | | | |
| Multiple R-squared: 0.8185, Adjusted R-squared: 0.7666 | | | | |
| F-statistic: 15.78 on 2 and 7 DF, p-value: 0.002548 | | | | |

| Year | System Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 577.4 | 604.27 | 5% | 5% |
| 2005 | 579.2 | 558.37 | -4% | 4% |
| 2006 | 648.2 | 639.18 | -1% | 1% |
| 2007 | 642.7 | 648.14 | 1% | 1% |
| 2008 | 623.5 | 625.99 | 0% | 0% |
| 2009 | 711.2 | 701.43 | -1% | 1% |
| 2010 | 681.5 | 708.36 | 4% | 4% |
| 2011 | 707.1 | 658.72 | -7% | 7% |
| 2012 | 555 | 574.06 | 3% | 3% |
| 2013 | 656 | 663.29 | 1% | 1% |
| | | Average | 0% | 3% |

| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 667.1 | 735.4 |
| 2015 | 678.9 | 747.1 |
| 2016 | 690.9 | 759.1 |
| 2017 | 702.6 | 770.8 |
| 2018 | 714.3 | 782.6 |
| 2019 | 726.1 | 794.3 |
| 2020 | 737.8 | 806.0 |
| 2021 | 749.5 | 817.7 |
| 2022 | 761.1 | 829.4 |
| 2023 | 772.7 | 841.0 |

| | 50% PoE | | | 10% PoE | | |
|---|---|---|---|---|---|---|
| Year | Lower Bound | 50% PoE | Upper Bound | Lower Bound | 10% PoE | Upper Bound |
| 2014 | 606.9853 | 667.0997 | 727.2141 | 670.4908 | 735.3664 | 800.2419 |
| 2015 | 614.8973 | 678.8538 | 742.8104 | 678.0595 | 747.1205 | 816.1816 |
| 2016 | 622.3888 | 690.861 | 759.3332 | 685.2824 | 759.1276 | 832.9729 |
| 2017 | 629.2212 | 702.5654 | 775.9097 | 691.917 | 770.8321 | 849.7472 |
| 2018 | 635.703 | 714.3196 | 792.9361 | 698.2496 | 782.5863 | 866.9229 |
| 2019 | 641.8689 | 726.0602 | 810.2515 | 704.3042 | 794.3269 | 884.3495 |
| 2020 | 647.7718 | 737.7767 | 827.7816 | 710.1246 | 806.0434 | 901.9621 |
| 2021 | 653.4607 | 749.4736 | 845.4865 | 715.7526 | 817.7403 | 919.728 |
| 2022 | 658.9556 | 761.1148 | 863.274 | 721.203 | 829.3815 | 937.56 |
| 2023 | 664.3016 | 772.732 | 881.1623 | 726.5165 | 840.9986 | 955.4807 |

### 5.1.2 System Winter Forecast




Model Details: Demand = 469.6 + 13.24*MaxHDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 469.601 | 58.026 | 8.093 | 0.0000402 |
| MaxHDD | 13.243 | 4.376 | 3.026 | 0.0164 |
| Residual standard error: 14.12 on 8 degrees of freedom | | | | |
| Multiple R-squared: 0.5337, Adjusted R-squared: 0.4755 | | | | |
| F-statistic: 9.158 on 1 and 8 DF, p-value: 0.0164 | | | | |

| Year | System Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 627.6 | 654.35 | 4% | 4% |
| 2005 | 628.5 | 621.90 | -1% | 1% |
| 2006 | 677 | 661.63 | -2% | 2% |
| 2007 | 671 | 651.04 | -3% | 3% |
| 2008 | 636.6 | 641.10 | 1% | 1% |
| 2009 | 655.6 | 661.63 | 1% | 1% |
| 2010 | 645 | 644.42 | 0% | 0% |
| 2011 | 656.3 | 651.04 | -1% | 1% |
| 2012 | 626.3 | 637.13 | 2% | 2% |
| 2013 | 622.9 | 622.56 | 0% | 0% |
| | | Average | 0% | 1% |

| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 643.1 | 653.8 |
| 2015 | 643.1 | 653.8 |
| 2016 | 643.1 | 653.8 |
| 2017 | 643.1 | 653.8 |
| 2018 | 643.1 | 653.8 |
| 2019 | 643.1 | 653.8 |
| 2020 | 643.1 | 653.8 |
| 2021 | 643.1 | 653.8 |
| 2022 | 643.1 | 653.8 |
| 2023 | 643.1 | 653.8 |

| | 50% PoE | | | 10% PoE | | |
|---|---|---|---|---|---|---|
| Year | Lower Bound | 50% PoE | Upper Bound | Lower Bound | 10% PoE | Upper Bound |
| 2014 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2015 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2016 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2017 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2018 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2019 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2020 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2021 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2022 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |
| 2023 | 615.5278 | 643.0908 | 670.6538 | 625.6477 | 653.7518 | 681.8558 |

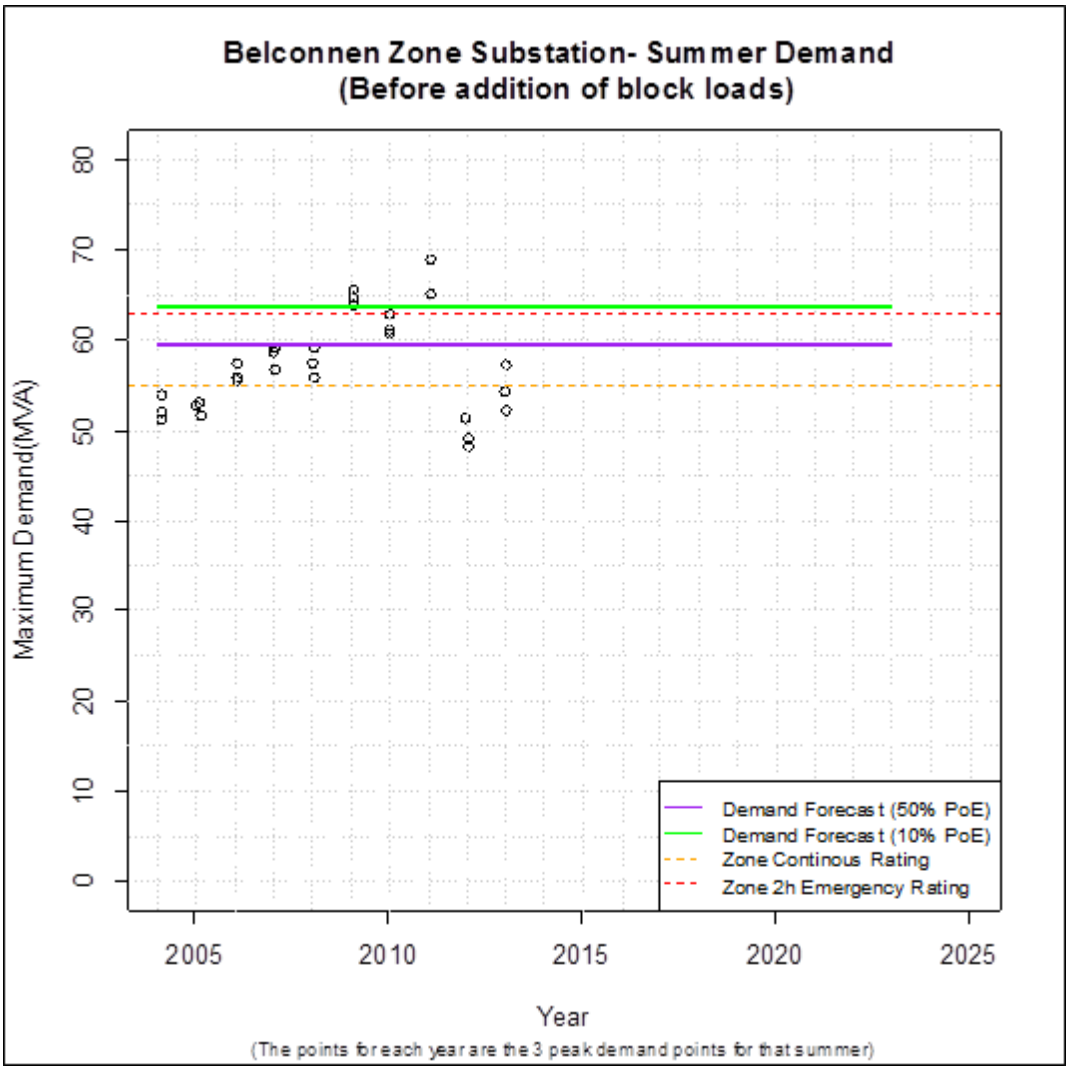
## 5.2 Belconnen Zone

### 5.2.1 Belconnen Zone Summer Forecast

**Model Selection**: Model with variable CDD selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

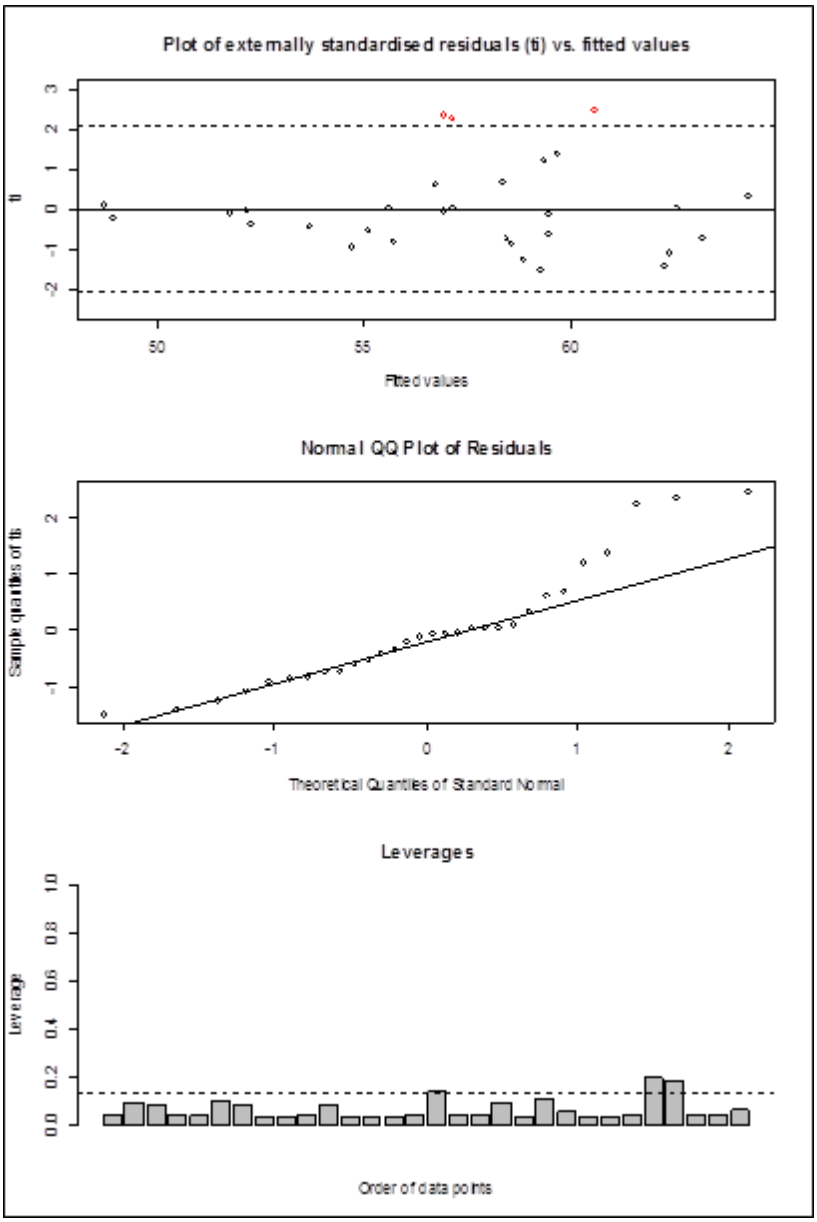
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



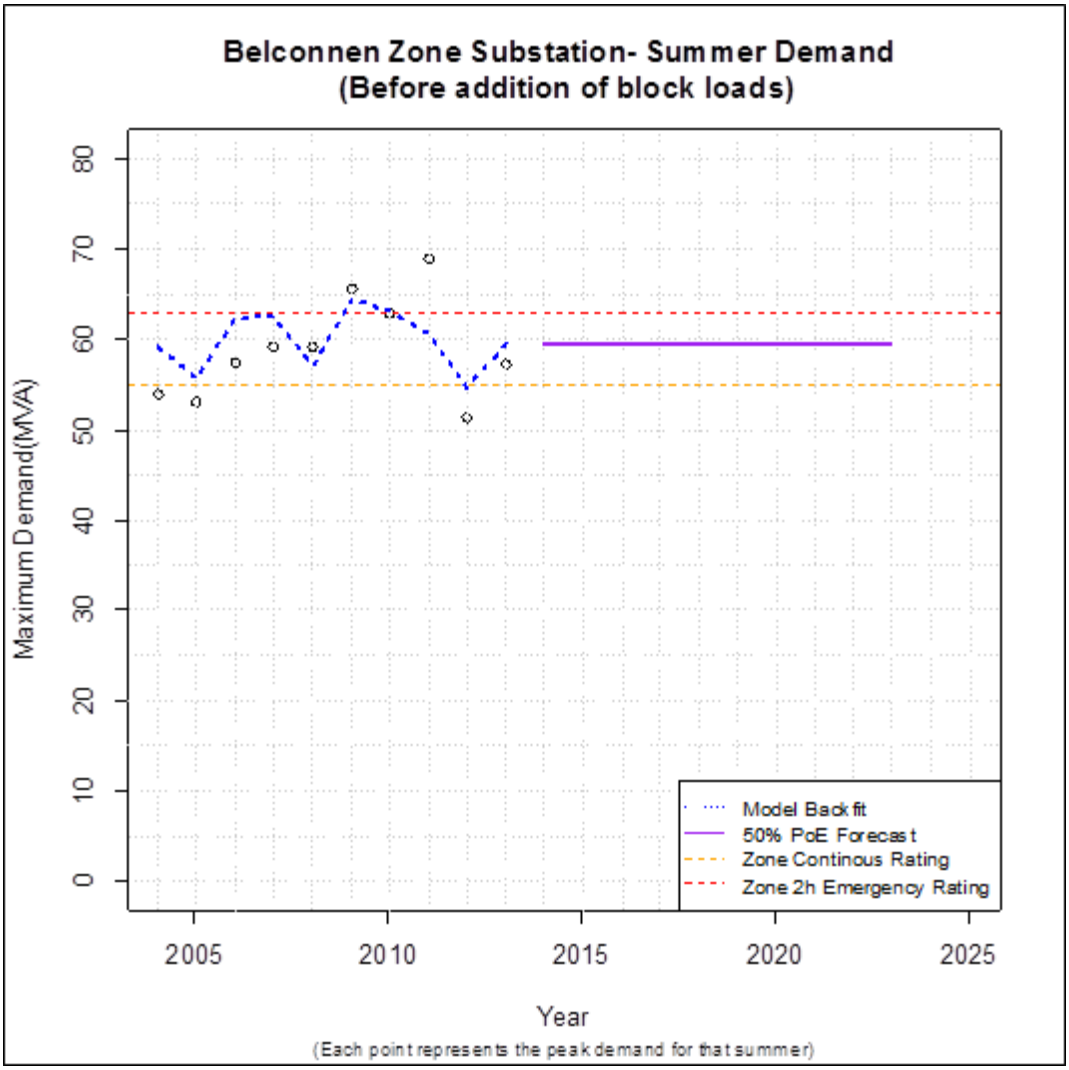

Model Details: Demand = 39.56 + 2.03 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 39.5649 | 3.2346 | 12.232 | 9.47E-13 |
| CDD | 2.03 | 0.3608 | 5.627 | 0.00000502 |
| Residual standard error: 3.819 on 28 degrees of freedom | | | | |
| Multiple R-squared: 0.5307, Adjusted R-squared: 0.5139 | | | | |
| F-statistic: 31.66 on 1 and 28 DF, p-value: 5.018e-06 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



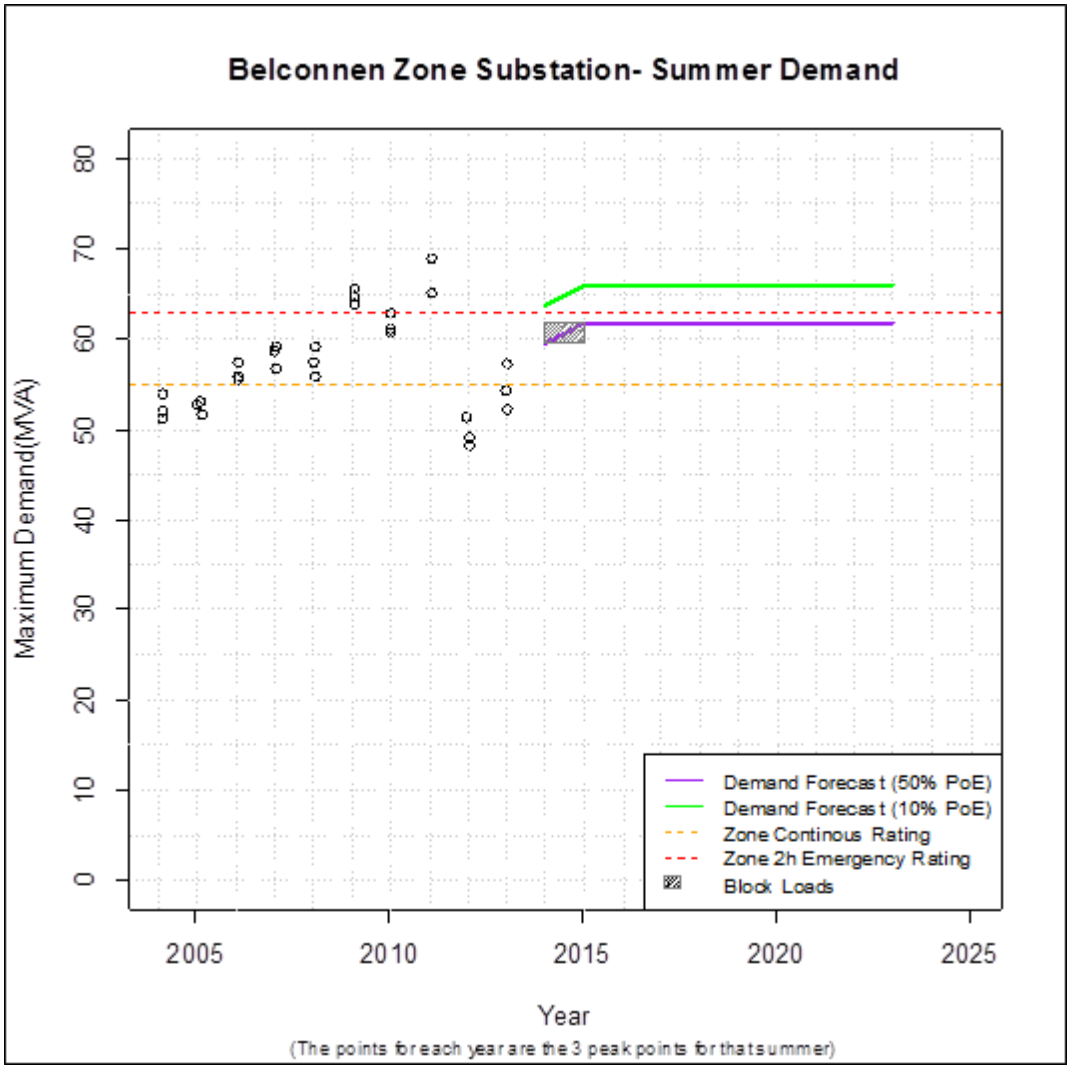
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Belconnen Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 53.89 | 59.26 | 10% | 10% |
| 2005 | 53.13 | 55.70 | 5% | 5% |
| 2006 | 57.34 | 62.30 | 9% | 9% |
| 2007 | 59.15 | 62.40 | 5% | 5% |
| 2008 | 59.11 | 57.12 | -3% | 3% |
| 2009 | 65.61 | 64.33 | -2% | 2% |
| 2010 | 62.78 | 63.21 | 1% | 1% |
| 2011 | 68.99 | 60.58 | -12% | 12% |
| 2012 | 51.27 | 54.69 | 7% | 7% |
| 2013 | 57.28 | 59.46 | 4% | 4% |
| | | Average | 2% | 6% |

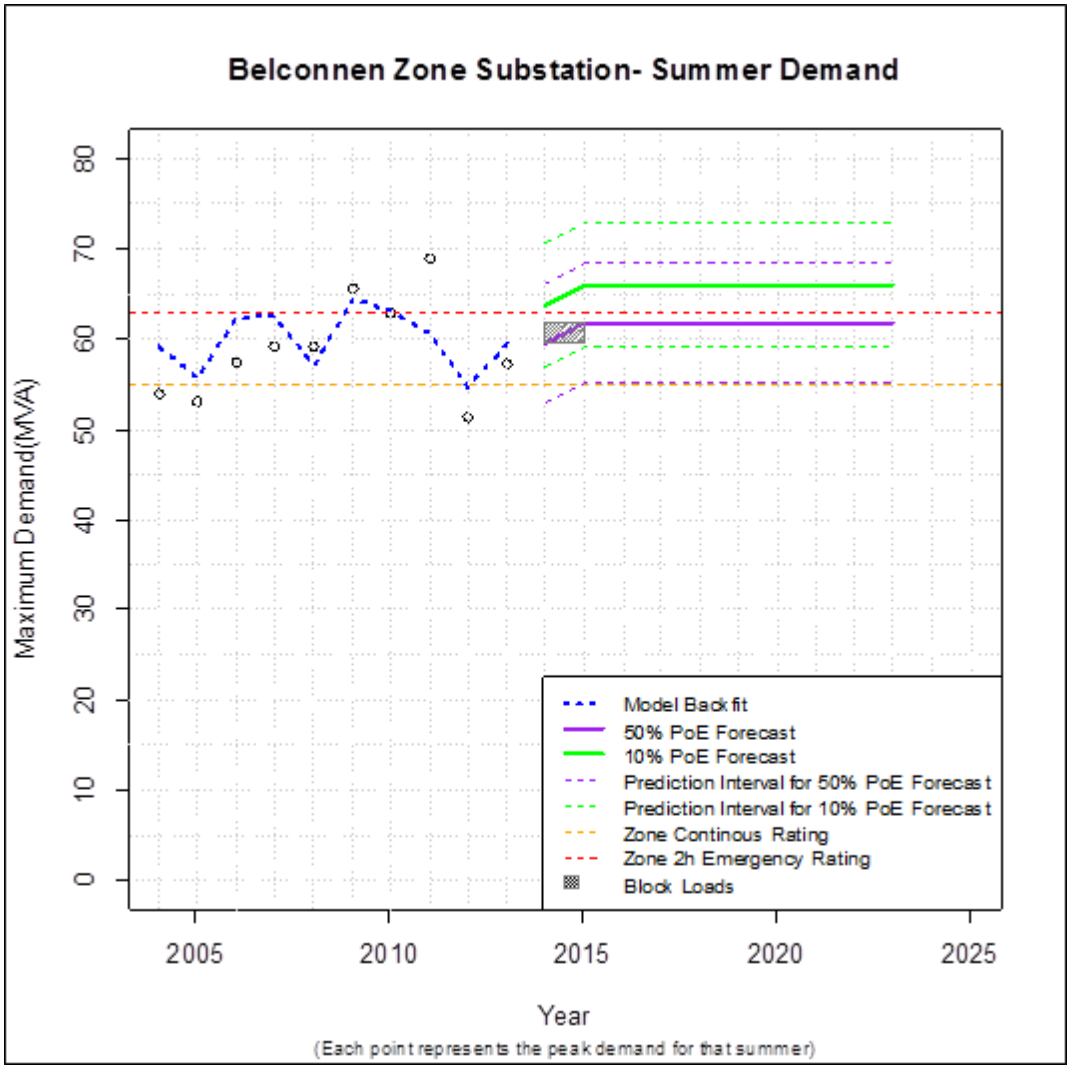
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 59.5 | 63.7 |
| 2015 | 61.8 | 66.0 |
| 2016 | 61.8 | 66.0 |
| 2017 | 61.8 | 66.0 |
| 2018 | 61.8 | 66.0 |
| 2019 | 61.8 | 66.0 |
| 2020 | 61.8 | 66.0 |
| 2021 | 61.8 | 66.0 |
| 2022 | 61.8 | 66.0 |
| 2023 | 61.8 | 66.0 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

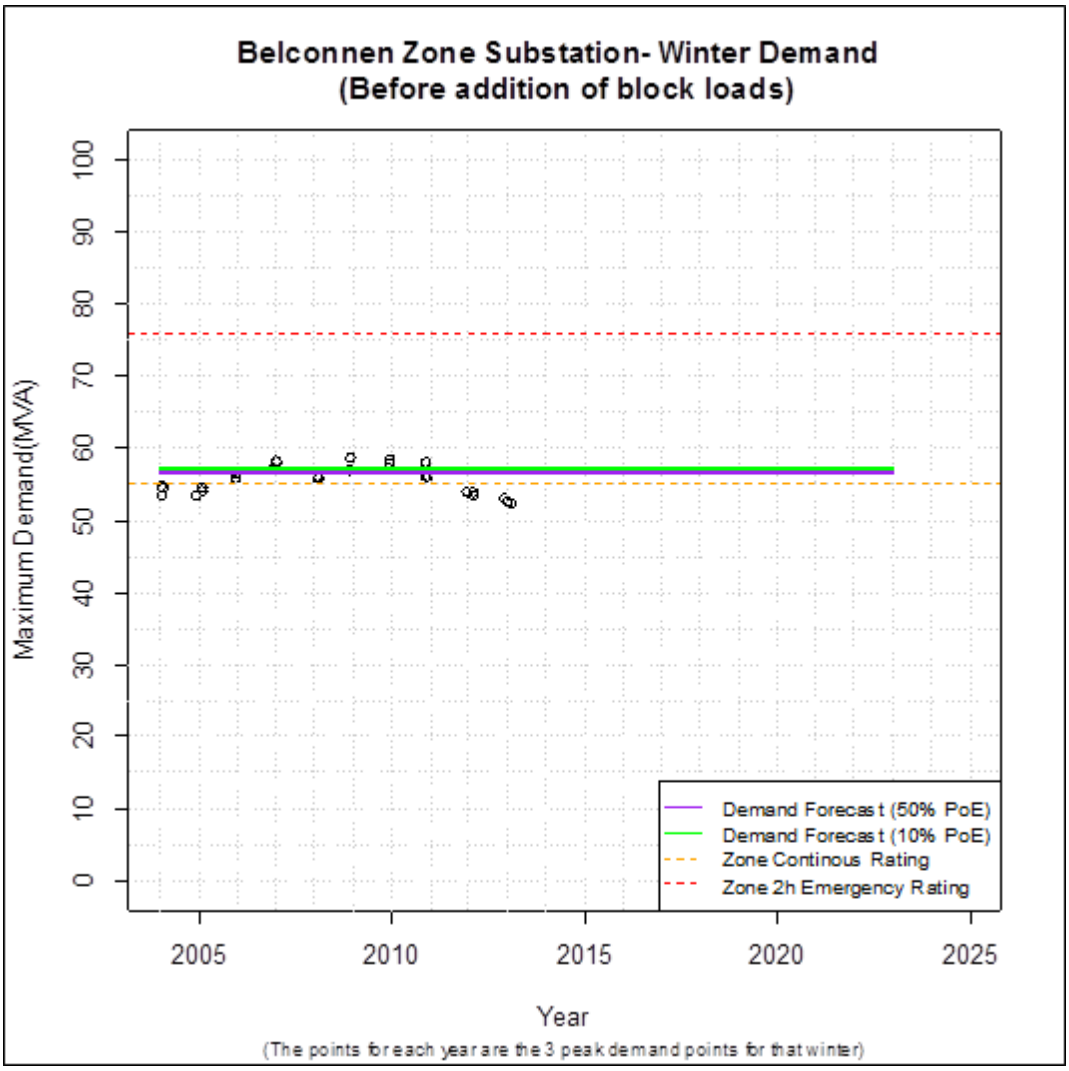
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Residential & Commercial | Eardley Feeder | Belconnen | -0.06 | 17/06/2013 | 100% |
| Residential Development | Meacham Feeder | Belconnen | 0.06 | 17/09/2013 | 100% |
| Commercial Development | Eardley Feeder & Joy Commins Feeder | Belconnen | 3 | 1/01/2015 | 50% |
| Residential & Commercial | Cameron North | Belconnen | 2 | 1/02/2015 | 40% |

### 5.2.2 Belconnen Zone Winter Forecast

**Model Selection**: Model with variable HDD, selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

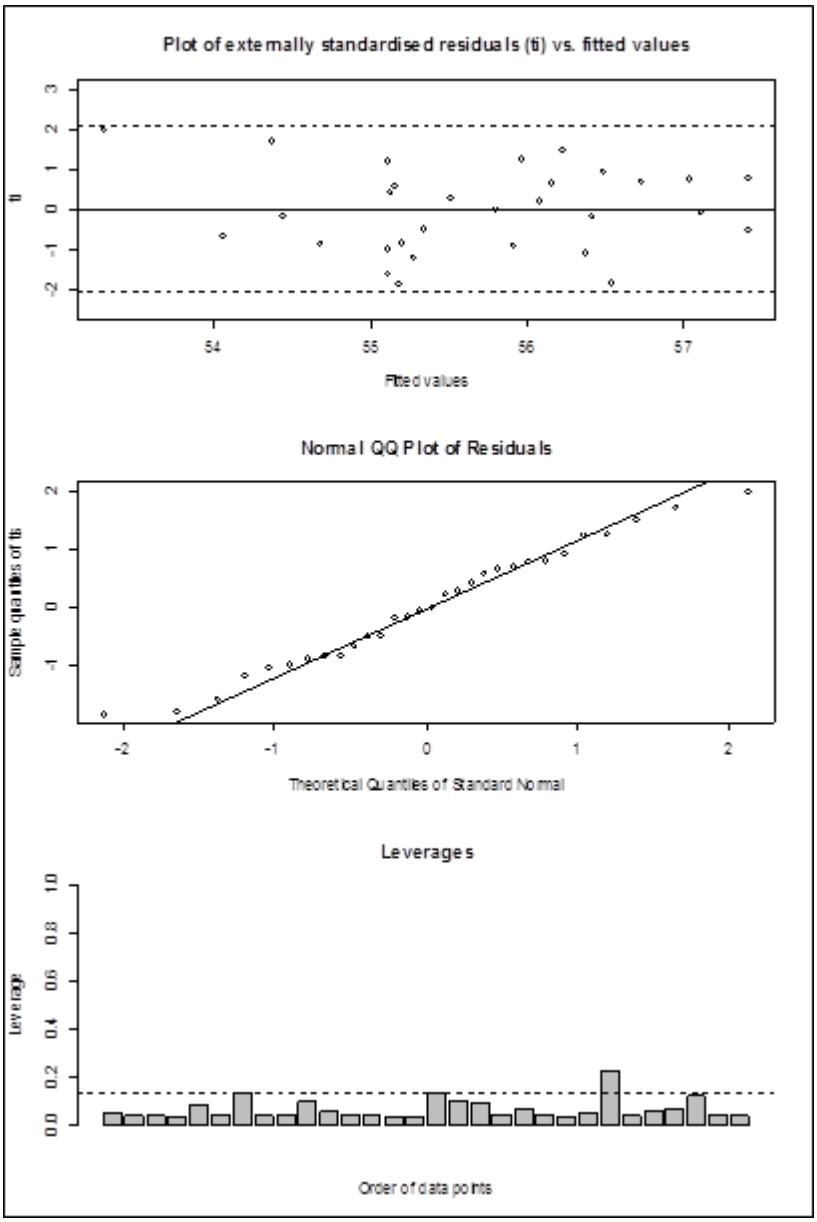
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



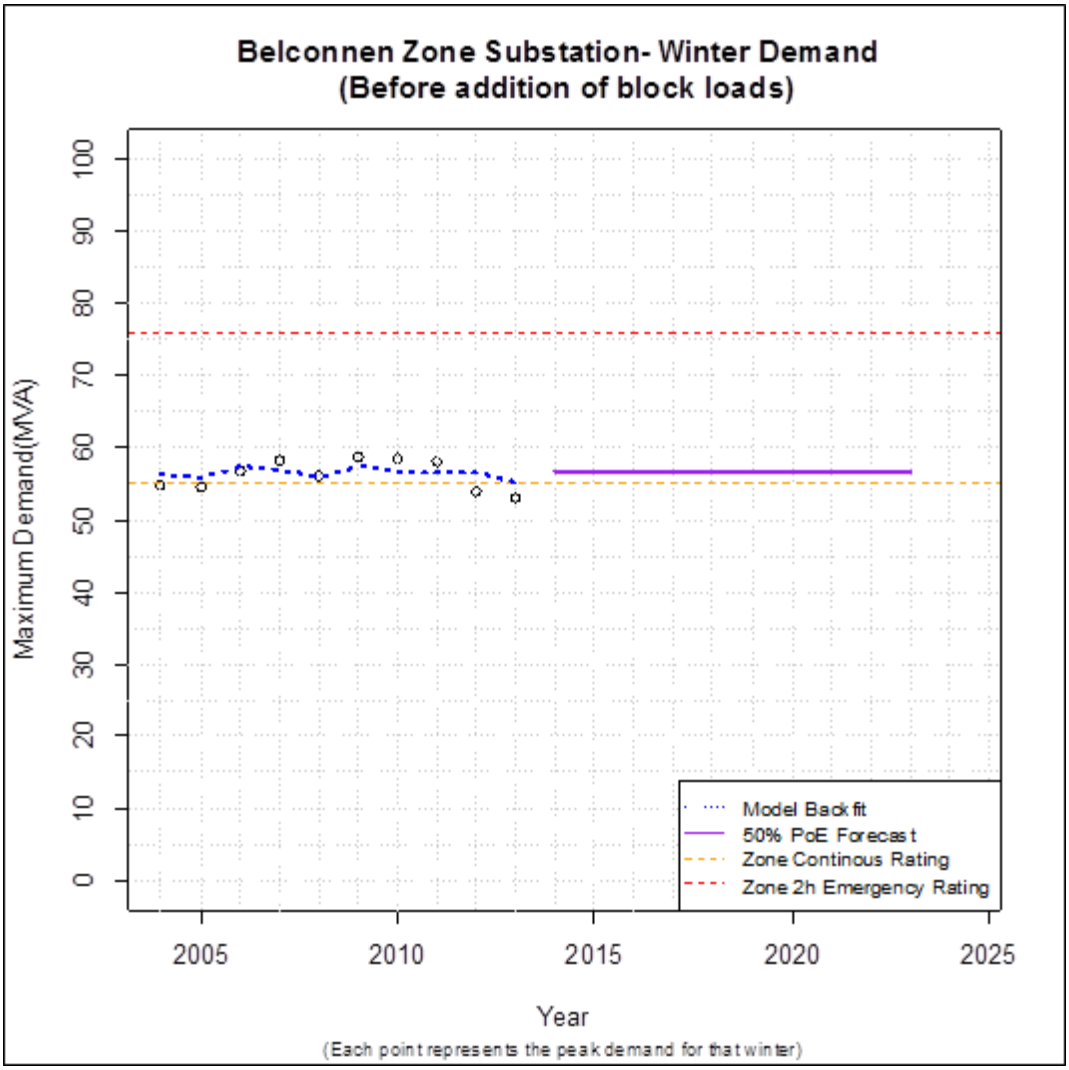

Model Details: Demand = 50.51 + 0.48 * HDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 50.5081 | 1.5982 | 31.602 | < 2e-16 |
| HDD | 0.4762 | 0.1445 | 3.297 | 0.00266 |
| Residual standard error: 1.638 on 28 degrees of freedom | | | | |
| Multiple R-squared: 0.2796, Adjusted R-squared: 0.2539 | | | | |
| F-statistic: 10.87 on 1 and 28 DF, p-value: 0.002663 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



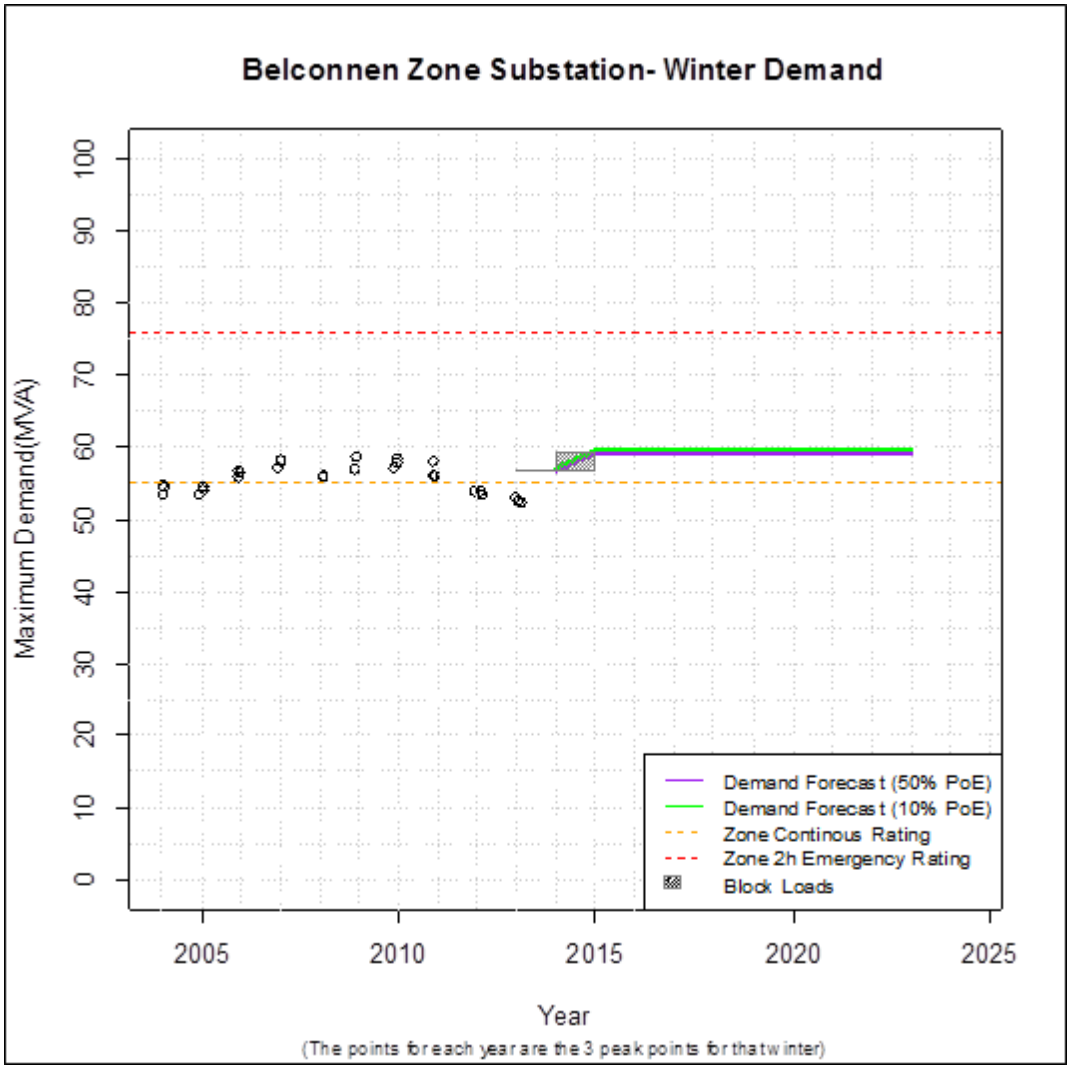
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Belconnen Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 54.69 | 56.37 | 3% | 3% |
| 2005 | 54.5 | 55.91 | 3% | 3% |
| 2006 | 56.65 | 57.41 | 1% | 1% |
| 2007 | 58.27 | 57.03 | -2% | 2% |
| 2008 | 56.13 | 55.79 | -1% | 1% |
| 2009 | 58.66 | 57.41 | -2% | 2% |
| 2010 | 58.57 | 56.72 | -3% | 3% |
| 2011 | 57.96 | 56.41 | -3% | 3% |
| 2012 | 53.86 | 56.53 | 5% | 5% |
| 2013 | 53.04 | 55.18 | 4% | 4% |
| | | Average | 1% | 3% |

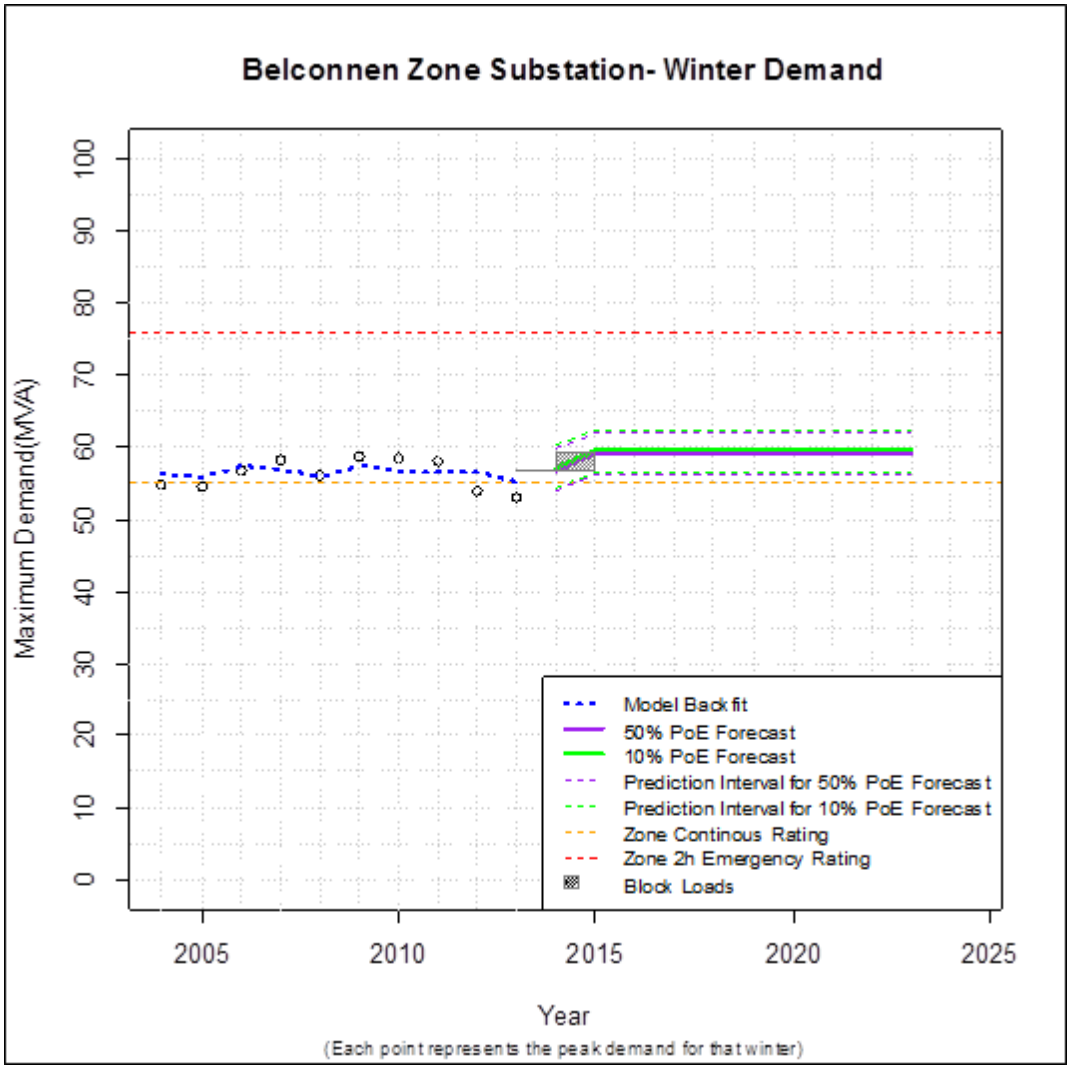
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 56.8 | 57.2 |
| 2015 | 59.1 | 59.5 |
| 2016 | 59.1 | 59.5 |
| 2017 | 59.1 | 59.5 |
| 2018 | 59.1 | 59.5 |
| 2019 | 59.1 | 59.5 |
| 2020 | 59.1 | 59.5 |
| 2021 | 59.1 | 59.5 |
| 2022 | 59.1 | 59.5 |
| 2023 | 59.1 | 59.5 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Residential Development | Meacham Feeder | Belconnen | 0.06 | 17/09/2013 | 100% |
| Commercial Development | Eardley Feeder & Joy Commins Feeder | Belconnen | 3 | 1/01/2015 | 50% |
| Residential & Commercial | Cameron North | Belconnen | 2 | 1/02/2015 | 40% |

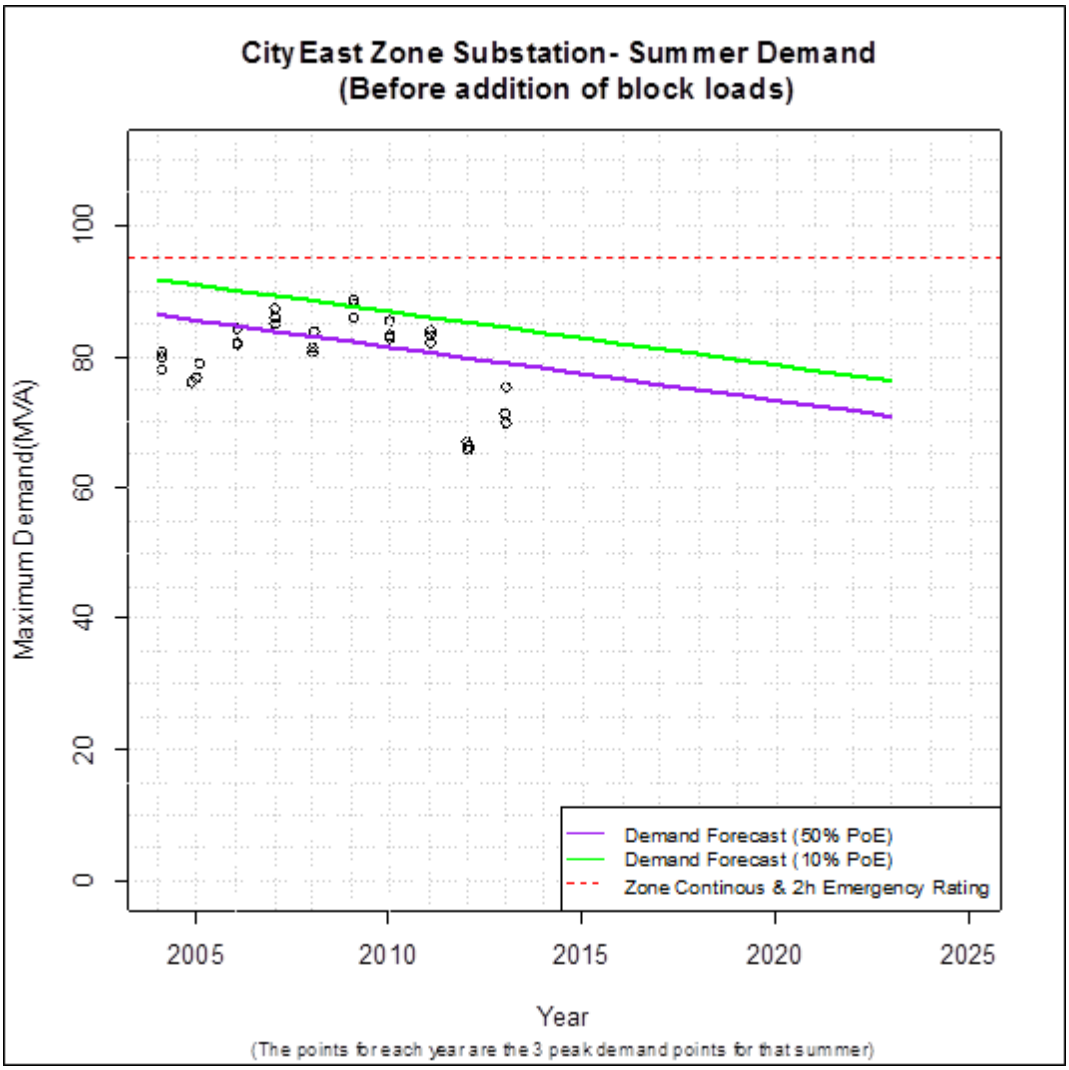
## 5.3 City East Zone

### 5.3.1 City East Zone Summer Forecast

**Model Selection**: Model with variables Year and CDD selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

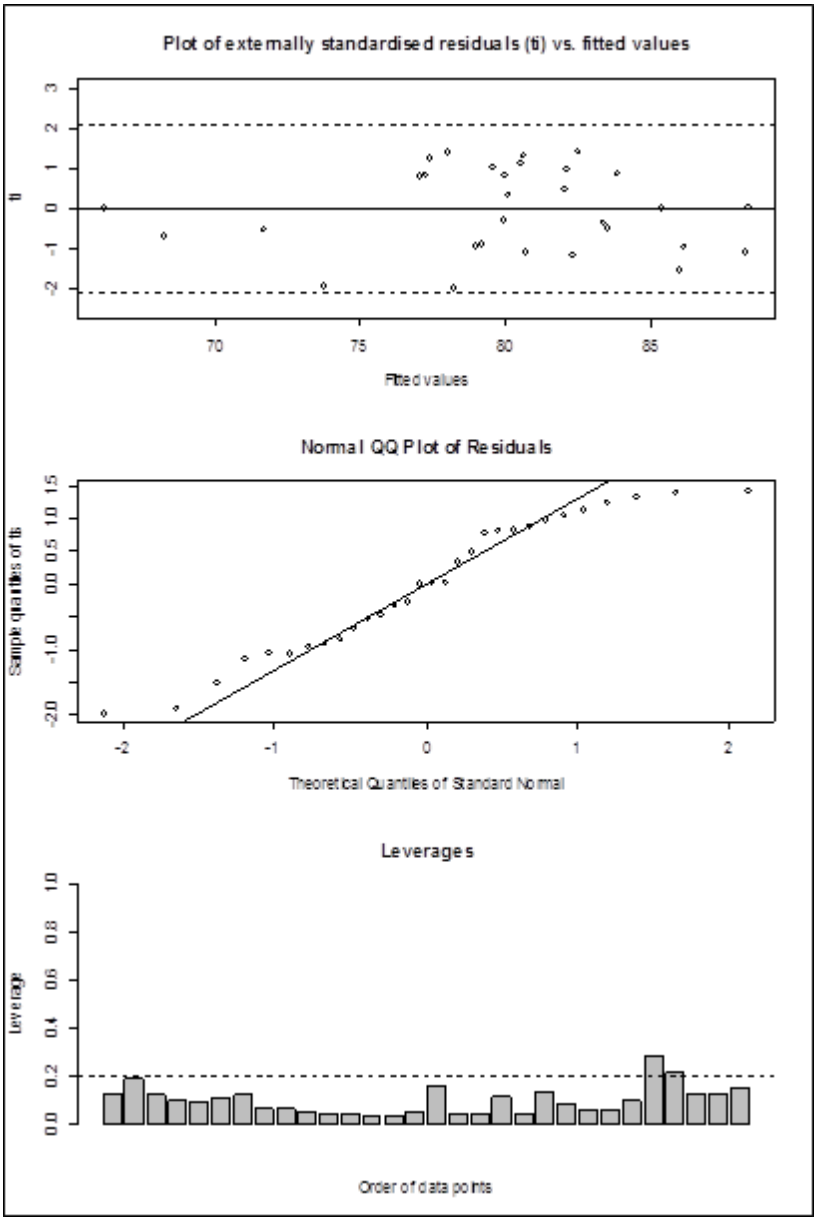
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



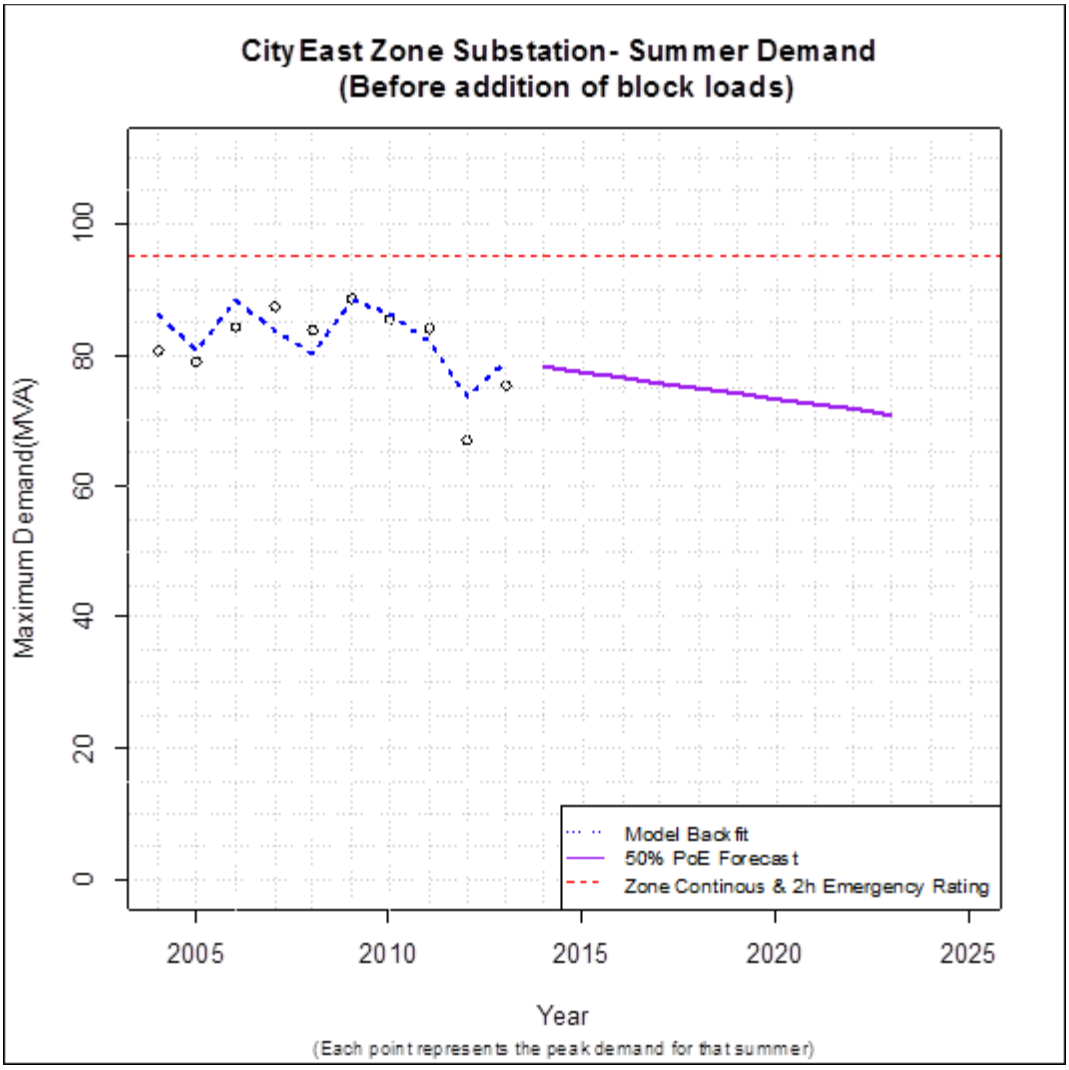

Model Details: Demand = 1691.78 – 0.81 * Year + 2.57 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 1691.7755 | 510.9408 | 3.311 | 0.00265 |
| Year | -0.8137 | 0.2543 | -3.199 | 0.0035 |
| CDD | 2.5706 | 0.4226 | 6.082 | 1.70E-06 |
| Residual standard error: 4 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.6417, Adjusted R-squared: 0.6152 | | | | |
| F-statistic: 24.18 on 2 and 27 DF, p-value: 9.594e-07 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



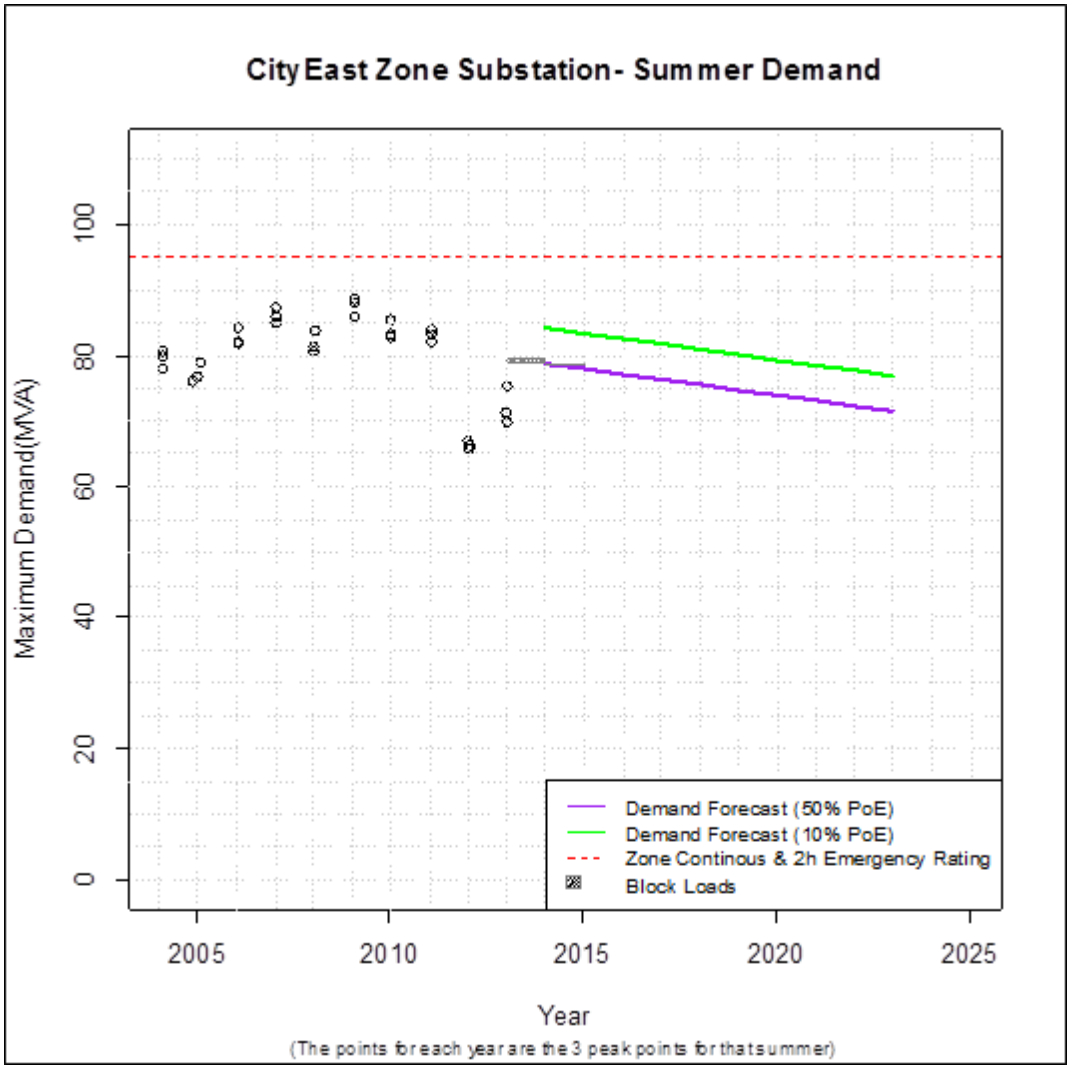
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | City East Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 80.56 | 86.04 | 7% | 7% |
| 2005 | 78.92 | 80.73 | 2% | 2% |
| 2006 | 84.35 | 88.27 | 5% | 5% |
| 2007 | 87.35 | 83.85 | -4% | 4% |
| 2008 | 83.7 | 80.08 | -4% | 4% |
| 2009 | 88.55 | 88.40 | 0% | 0% |
| 2010 | 85.51 | 86.17 | 1% | 1% |
| 2011 | 83.99 | 82.01 | -2% | 2% |
| 2012 | 66.9 | 73.74 | 10% | 10% |
| 2013 | 75.48 | 78.97 | 5% | 5% |
| | | Average | 2% | 4% |

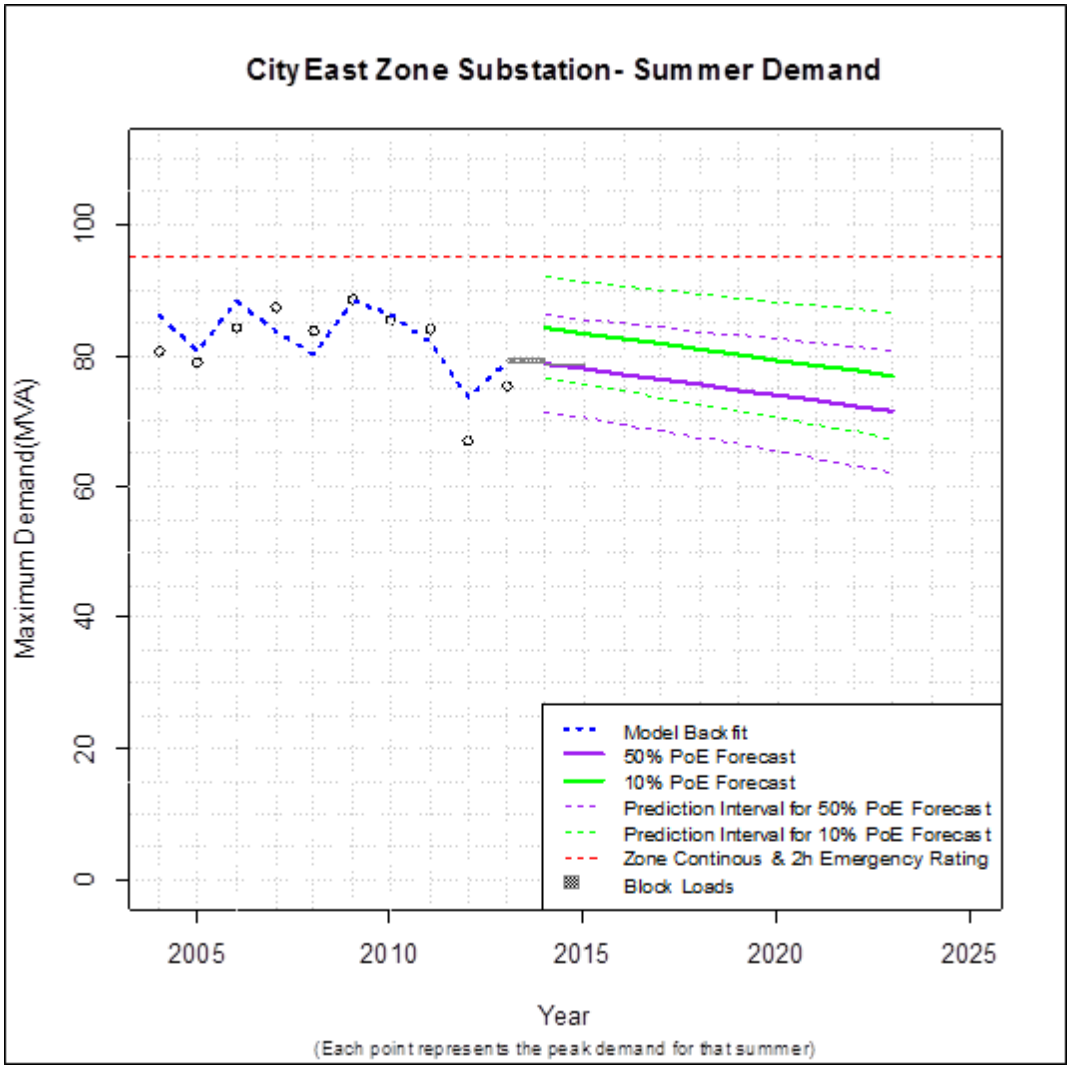
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 78.7 | 84.1 |
| 2015 | 78.0 | 83.4 |
| 2016 | 77.2 | 82.6 |
| 2017 | 76.3 | 81.7 |
| 2018 | 75.5 | 80.9 |
| 2019 | 74.7 | 80.1 |
| 2020 | 73.9 | 79.3 |
| 2021 | 73.1 | 78.5 |
| 2022 | 72.3 | 77.7 |
| 2023 | 71.5 | 76.9 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

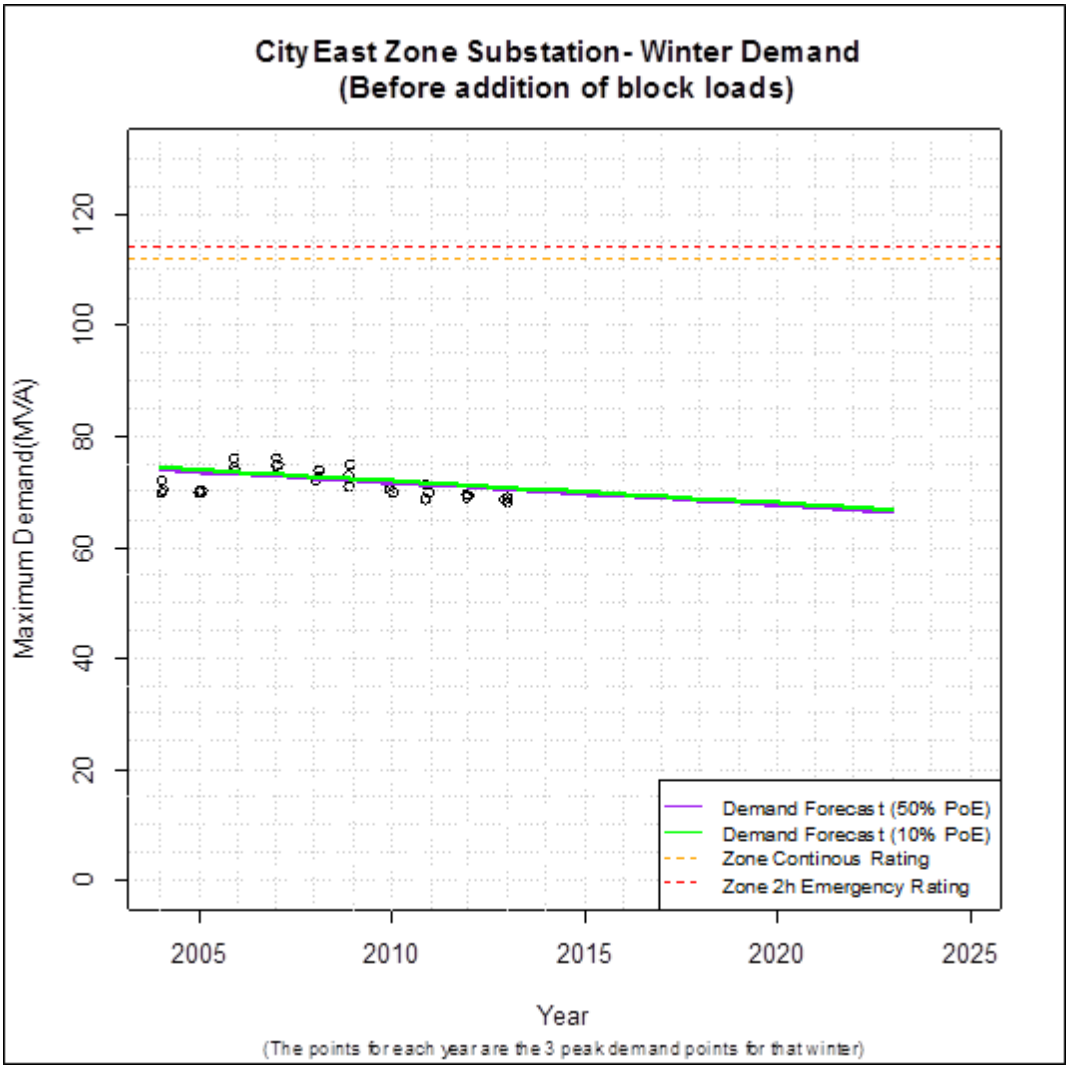
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial Development | Lonsdale Feeder | CityEast | 0.1 | 13/06/2013 | 100% |
| Residential & Commercial | Wolseley Feeder | CityEast | 0.5 | 12/12/2013 | 90% |
| Community development | Chisholm Feeder | CityEast | 0.125 | 1/02/2014 | 10% |
| Residential Development | Wakefield Feeder | CityEast | 0.07 | 1/01/2015 | 90% |

### 5.3.2 City East Zone Winter Forecast

**Model Selection**: Model with variable HDD, selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

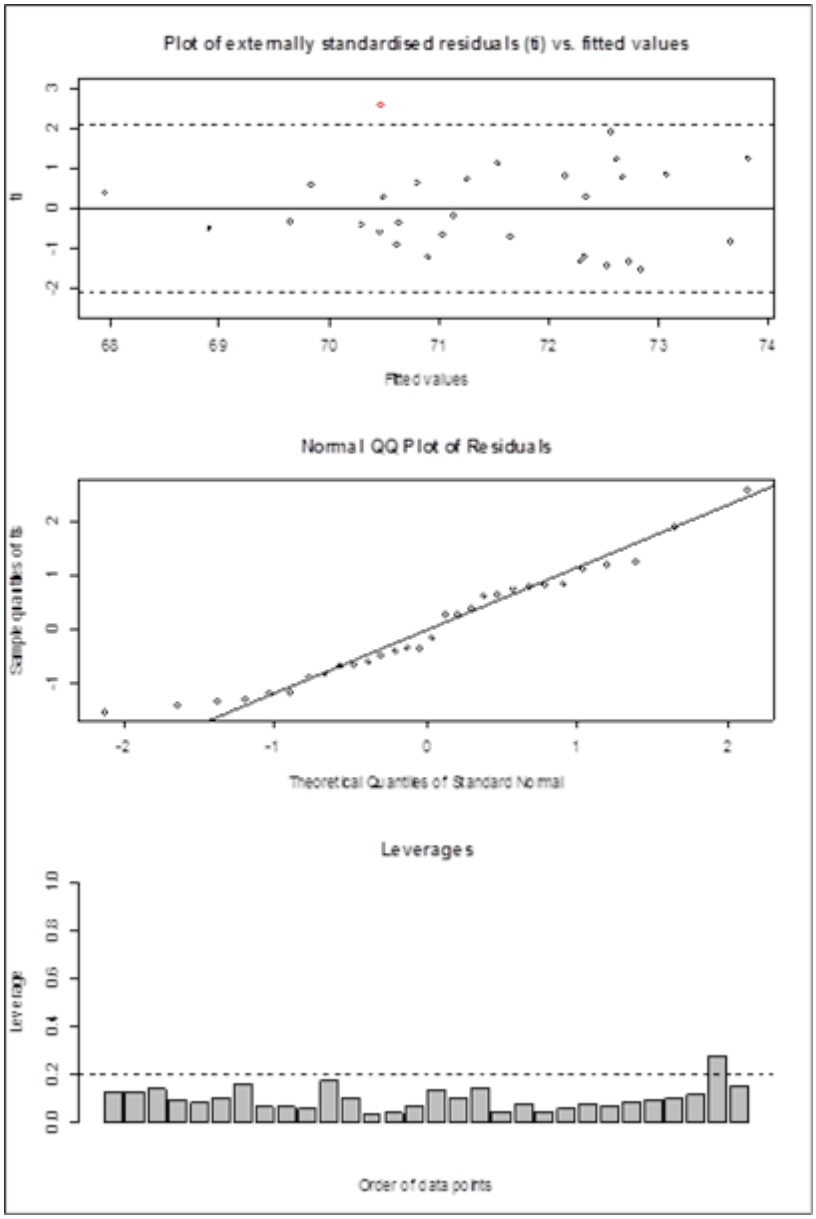
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



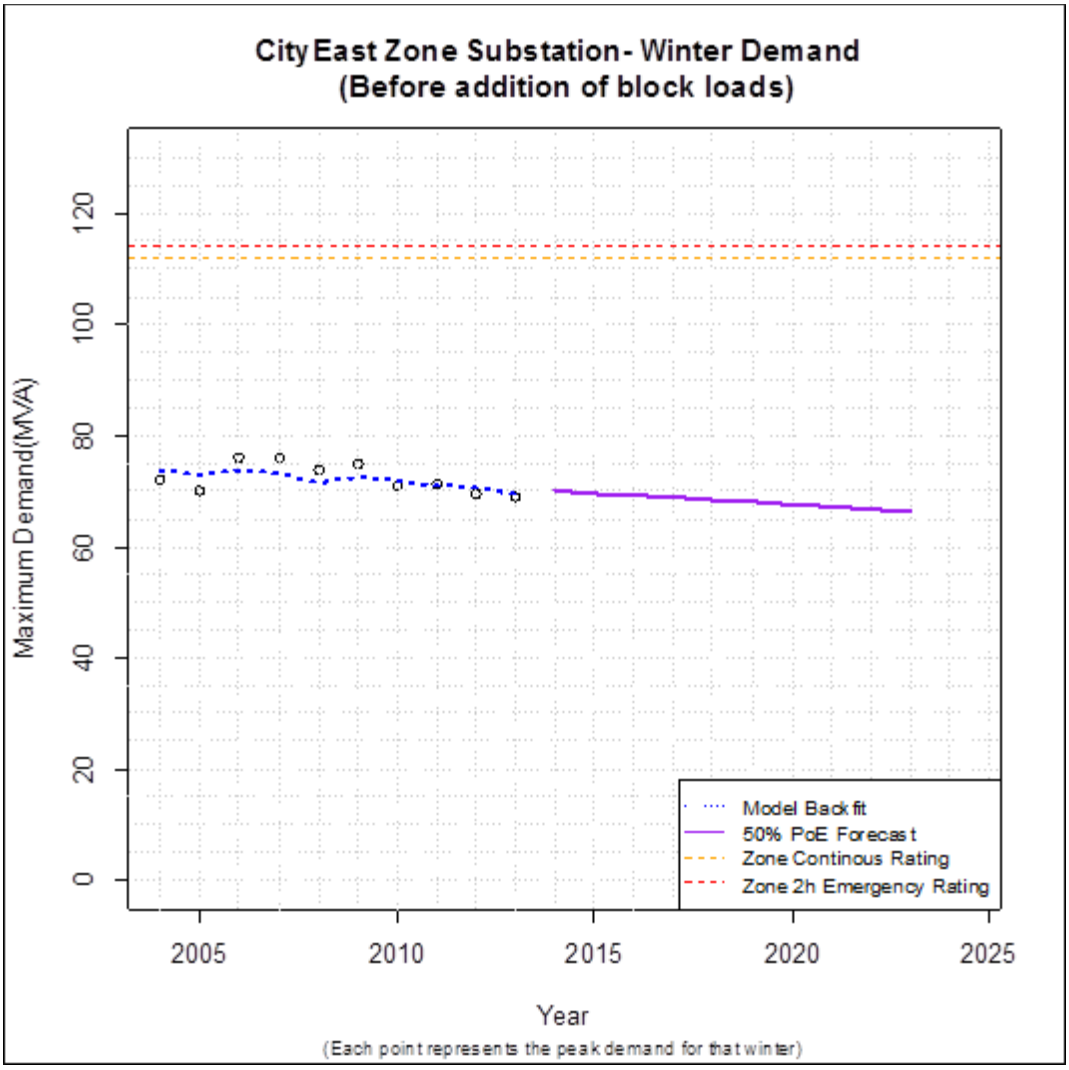

Model Details: Demand = 869.77 – 0.40 * Year + 0.43 HDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 869.7652 | 259.1582 | 3.356 | 0.00236 |
| Year | -0.3999 | 0.1291 | -3.098 | 0.00451 |
| HDD | 0.4338 | 0.2045 | 2.121 | 0.04324 |
| Residual standard error: 2.029 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.3344, Adjusted R-squared: 0.285 | | | | |
| F-statistic: 6.781 on 2 and 27 DF, p-value: 0.00411 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



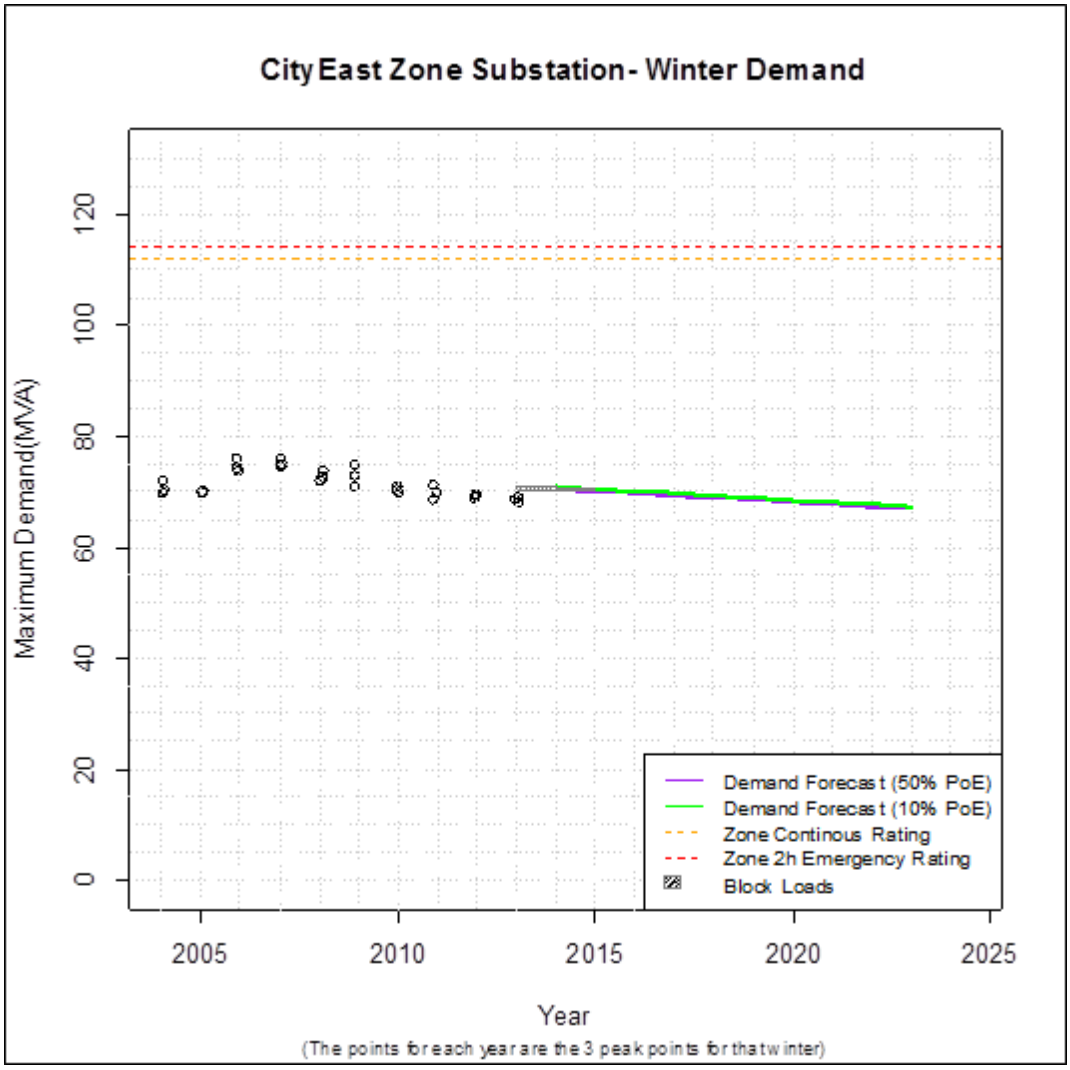
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | City East Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 72.07 | 73.66 | 2% | 2% |
| 2005 | 70.1 | 72.84 | 4% | 4% |
| 2006 | 76.12 | 73.81 | -3% | 3% |
| 2007 | 76.15 | 73.06 | -4% | 4% |
| 2008 | 73.79 | 71.54 | -3% | 3% |
| 2009 | 74.88 | 72.61 | -3% | 3% |
| 2010 | 70.83 | 71.65 | 1% | 1% |
| 2011 | 71.07 | 71.03 | 0% | 0% |
| 2012 | 69.51 | 70.61 | 2% | 2% |
| 2013 | 68.97 | 69.65 | 1% | 1% |
| | | Average | 0% | 2% |

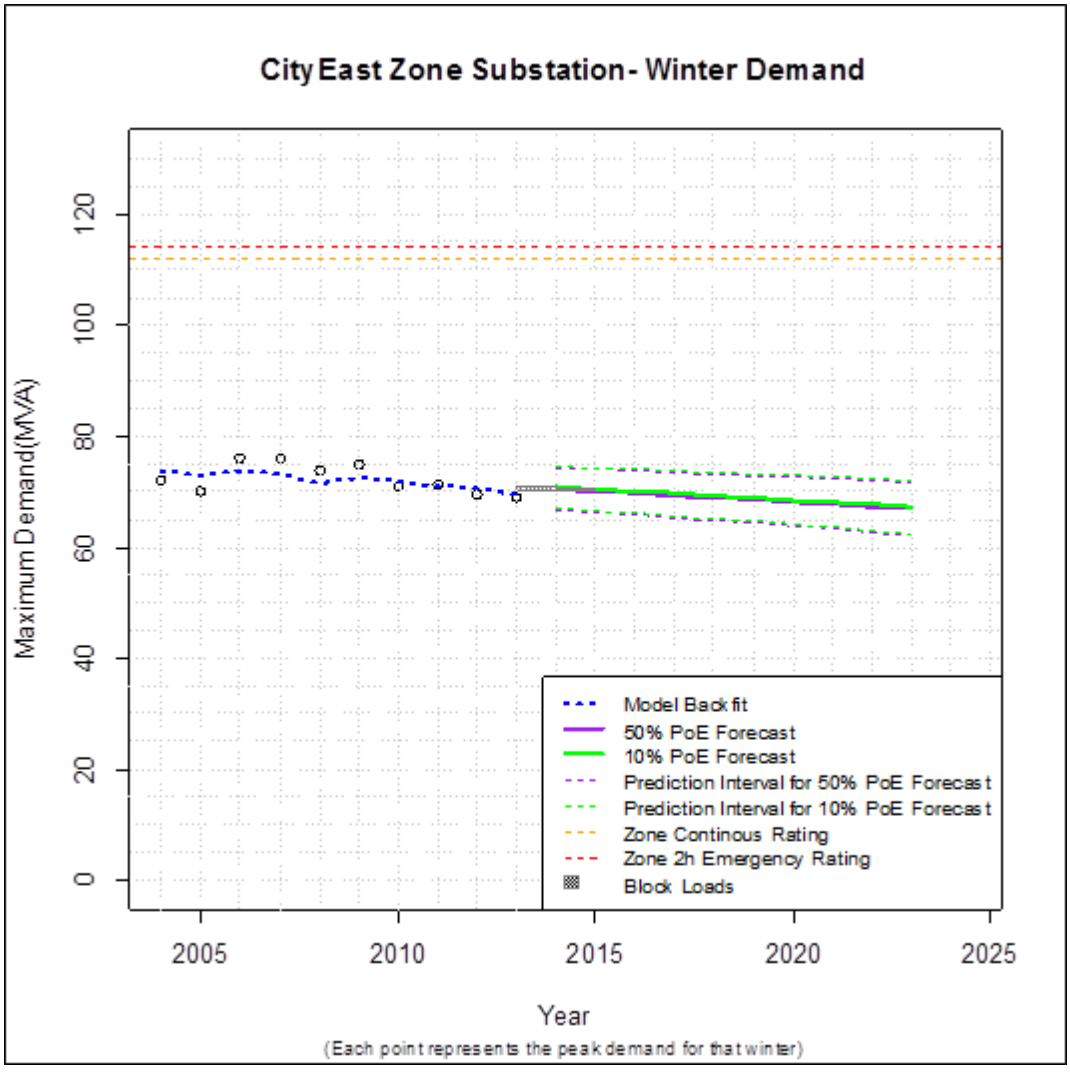
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 70.5 | 70.8 |
| 2015 | 70.1 | 70.5 |
| 2016 | 69.7 | 70.1 |
| 2017 | 69.3 | 69.7 |
| 2018 | 68.9 | 69.3 |
| 2019 | 68.5 | 68.9 |
| 2020 | 68.1 | 68.5 |
| 2021 | 67.7 | 68.1 |
| 2022 | 67.3 | 67.7 |
| 2023 | 66.9 | 67.3 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Residential & Commercial | Wolseley Feeder | CityEast | 0.5 | 12/12/2013 | 90% |
| Community development | Chisholm Feeder | CityEast | 0.125 | 1/02/2014 | 10% |
| Residential Development | Wakefield Feeder | CityEast | 0.07 | 1/01/2015 | 90% |

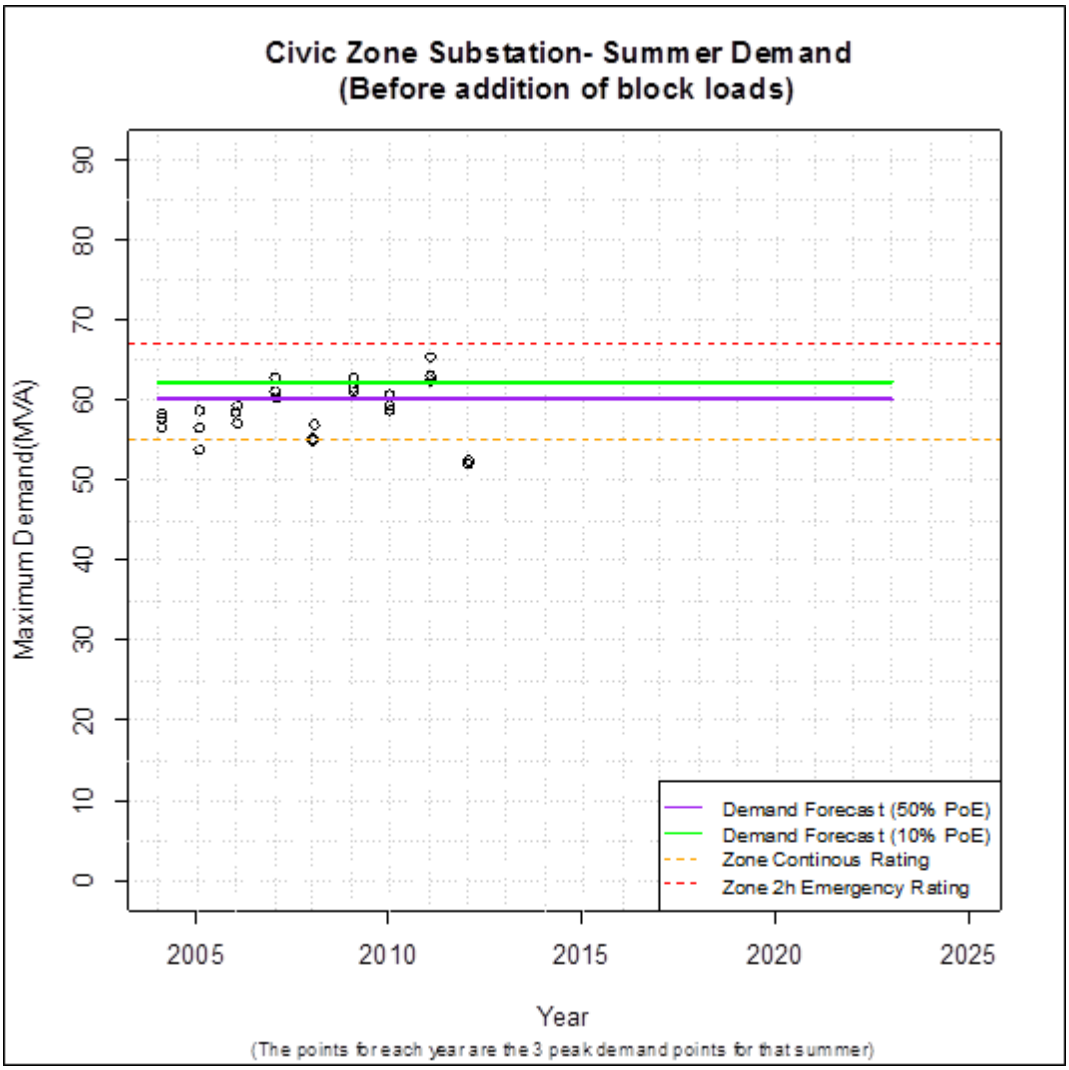
## 5.4 Civic Zone

### 5.4.1 Civic Zone Summer Forecast

**Model Selection**: Model with variable CDD selected based on stepwise procedures and checking against other statistical criteria. Note: Civic Zone is missing 2013 data due to some work on the transformers being completed. The forecast is based on 2004-2012.

**Model/Forecast (before adding block loads):**

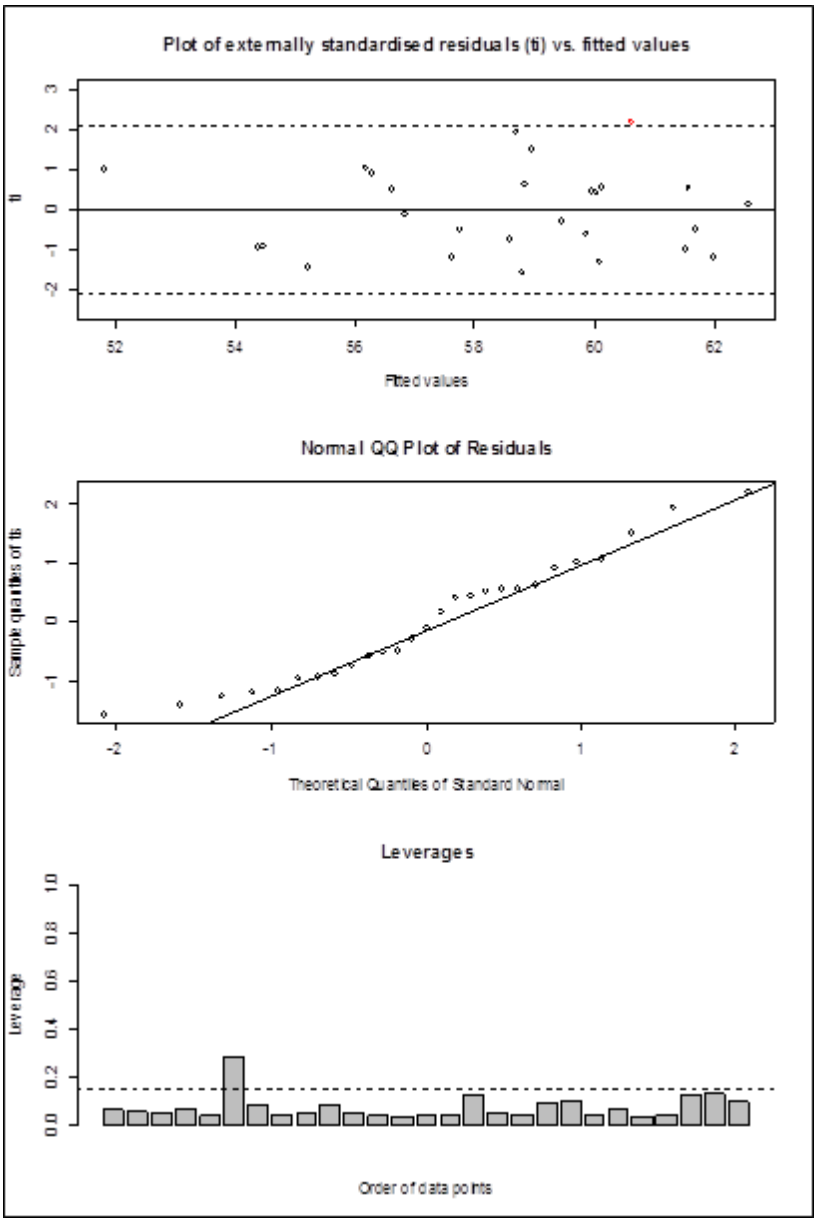
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



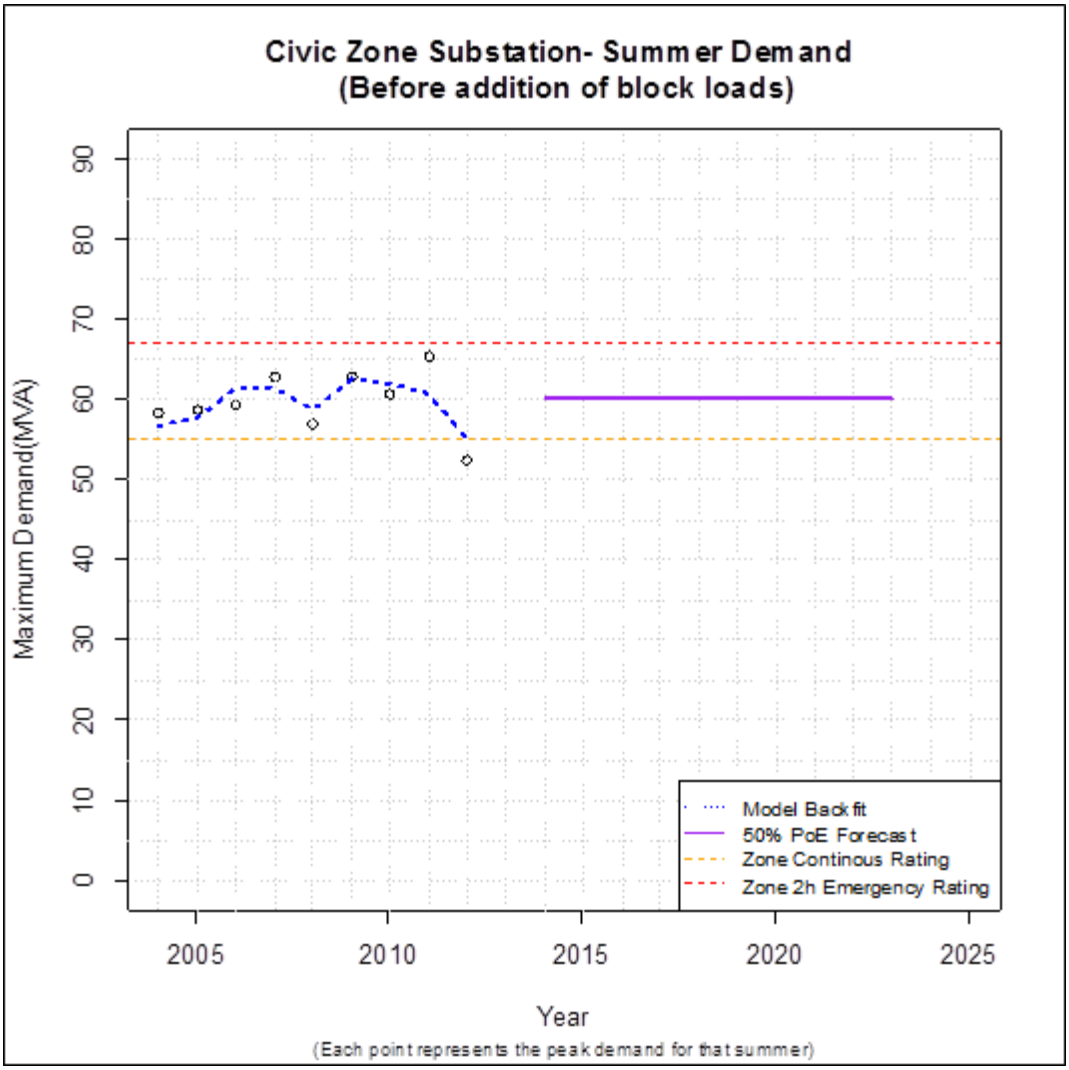

Model Details: Demand = 49.58 + 1.06 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 49.5842 | 1.6493 | 30.064 | < 2e-16 |
| CDD | 1.0637 | 0.1885 | 5.643 | 0.00000713 |
| Residual standard error: 2.381 on 25 degrees of freedom | | | | |
| Multiple R-squared: 0.5602, Adjusted R-squared: 0.5426 | | | | |
| F-statistic: 31.85 on 1 and 25 DF, p-value: 7.13e-06 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



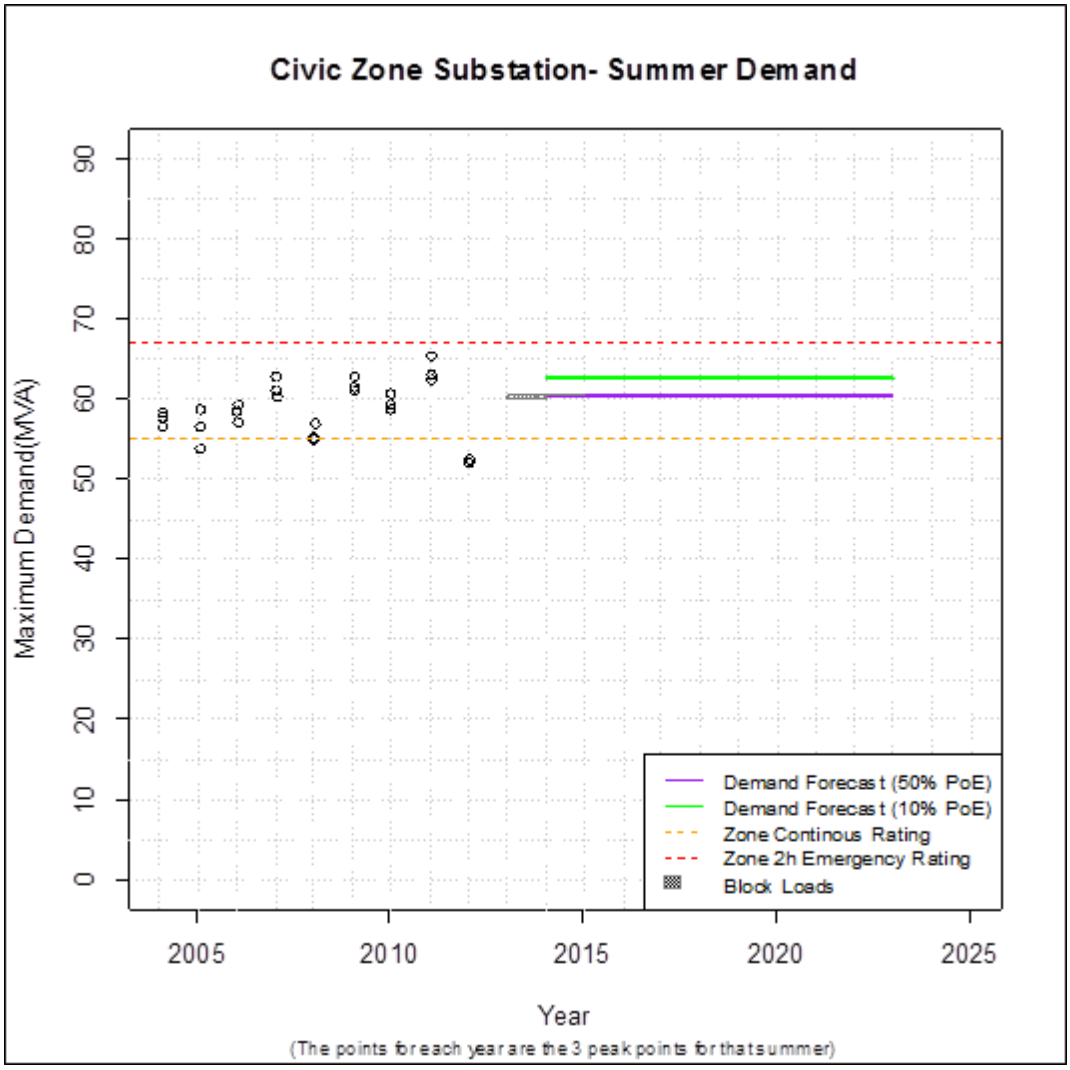
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Civic Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 58.42 | 56.82 | -3% | 3% |
| 2005 | 58.62 | 57.72 | -2% | 2% |
| 2006 | 59.33 | 61.50 | 4% | 4% |
| 2007 | 62.85 | 61.55 | -2% | 2% |
| 2008 | 56.88 | 58.79 | 3% | 3% |
| 2009 | 62.93 | 62.56 | -1% | 1% |
| 2010 | 60.59 | 61.98 | 2% | 2% |
| 2011 | 65.33 | 60.59 | -7% | 7% |
| 2012 | 52.52 | 55.22 | 5% | 5% |
| 2013 | NA | NA | NA | NA |
| | | Average | 0% | 3% |

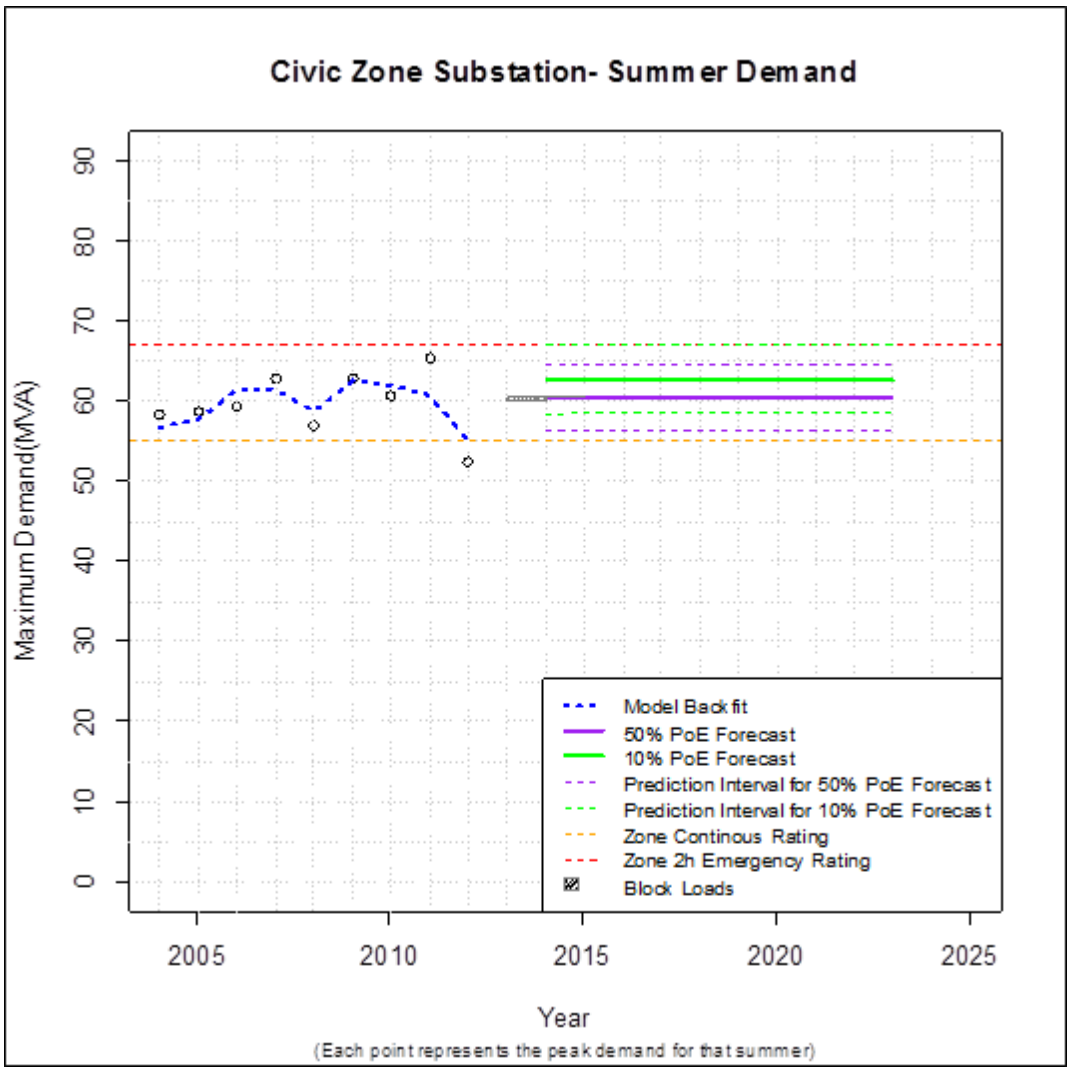
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 60.4 | 62.7 |
| 2015 | 60.5 | 62.7 |
| 2016 | 60.5 | 62.7 |
| 2017 | 60.5 | 62.7 |
| 2018 | 60.5 | 62.7 |
| 2019 | 60.5 | 62.7 |
| 2020 | 60.5 | 62.7 |
| 2021 | 60.5 | 62.7 |
| 2022 | 60.5 | 62.7 |
| 2023 | 60.5 | 62.7 |

4) Graph used in reports/for presentation (incorporating potential future block loads)




**Supporting Document: Block Load Data**

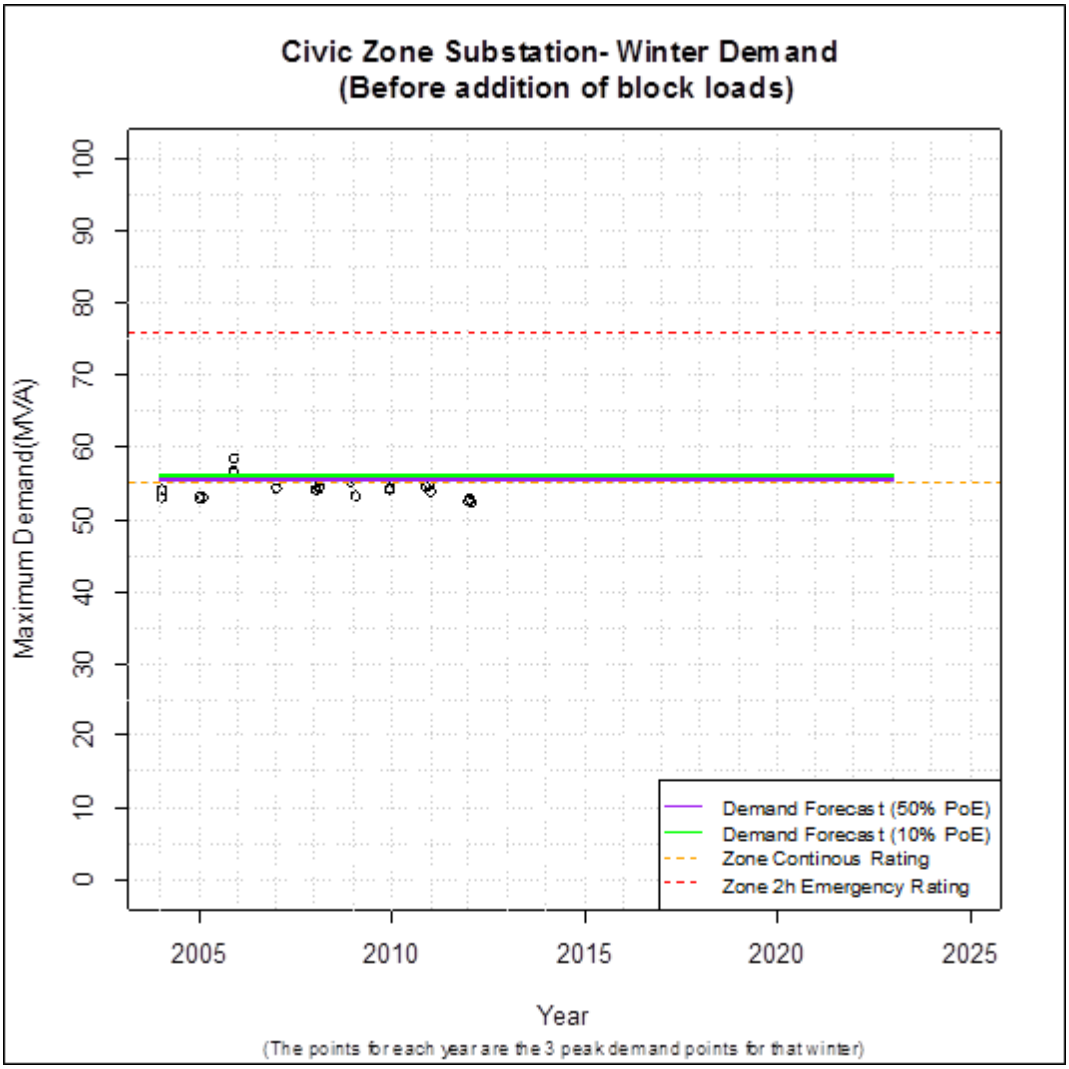
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial | Dryandra Feeder | Civic | 0.18 | 14/08/2013 | 100% |
| Residential & Commercial | Wattle Feeder | Civic | 0.246 | 16/09/2013 | 100% |
| Residential Development | Wattle Feeder | Civic | 0.07 | 1/01/2015 | 90% |

### 5.4.2 Civic Zone Winter Forecast

**Model Selection**: Model with variables MinTemp and 3DayHDD, selected based on stepwise procedures and checking against other statistical criteria. Note: Civic Zone is missing 2013 data due to some work on the transformers being completed. The forecast is based on 2004-2012.

**Model/Forecast (before adding block loads):**

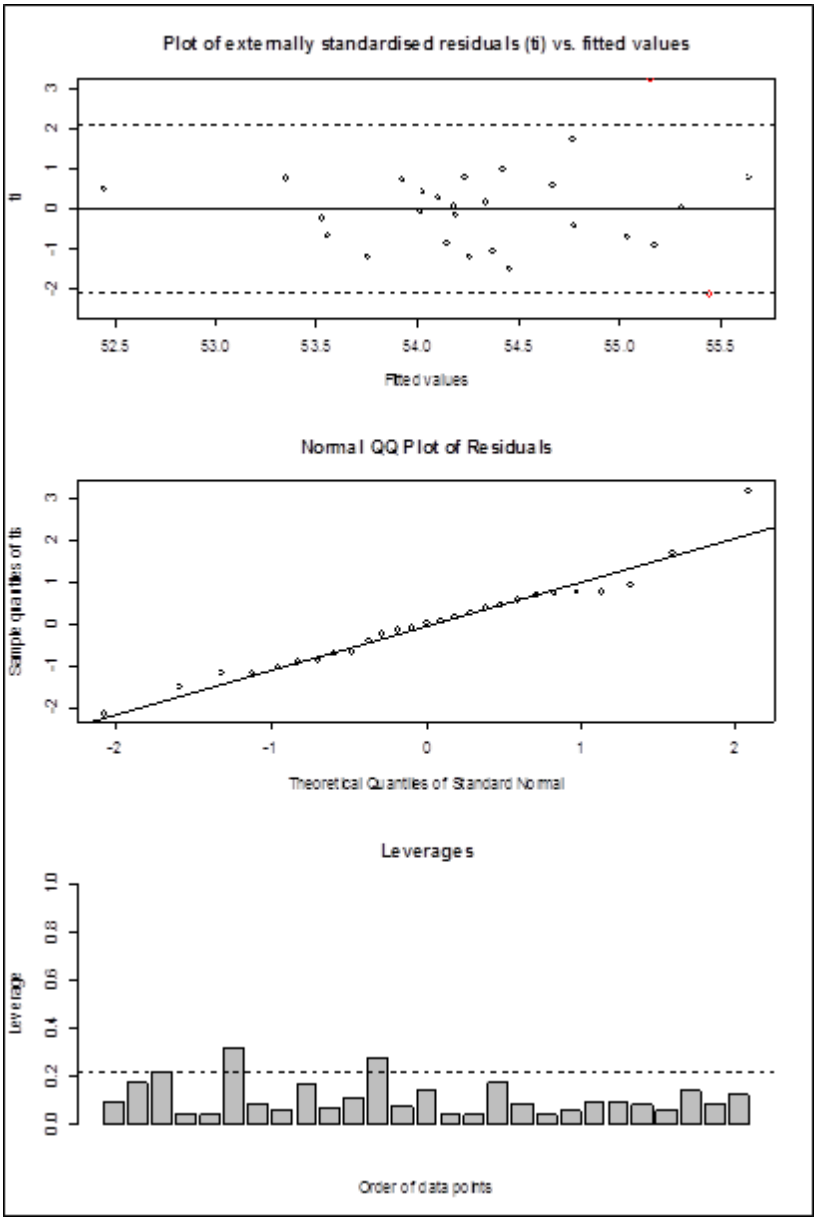
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



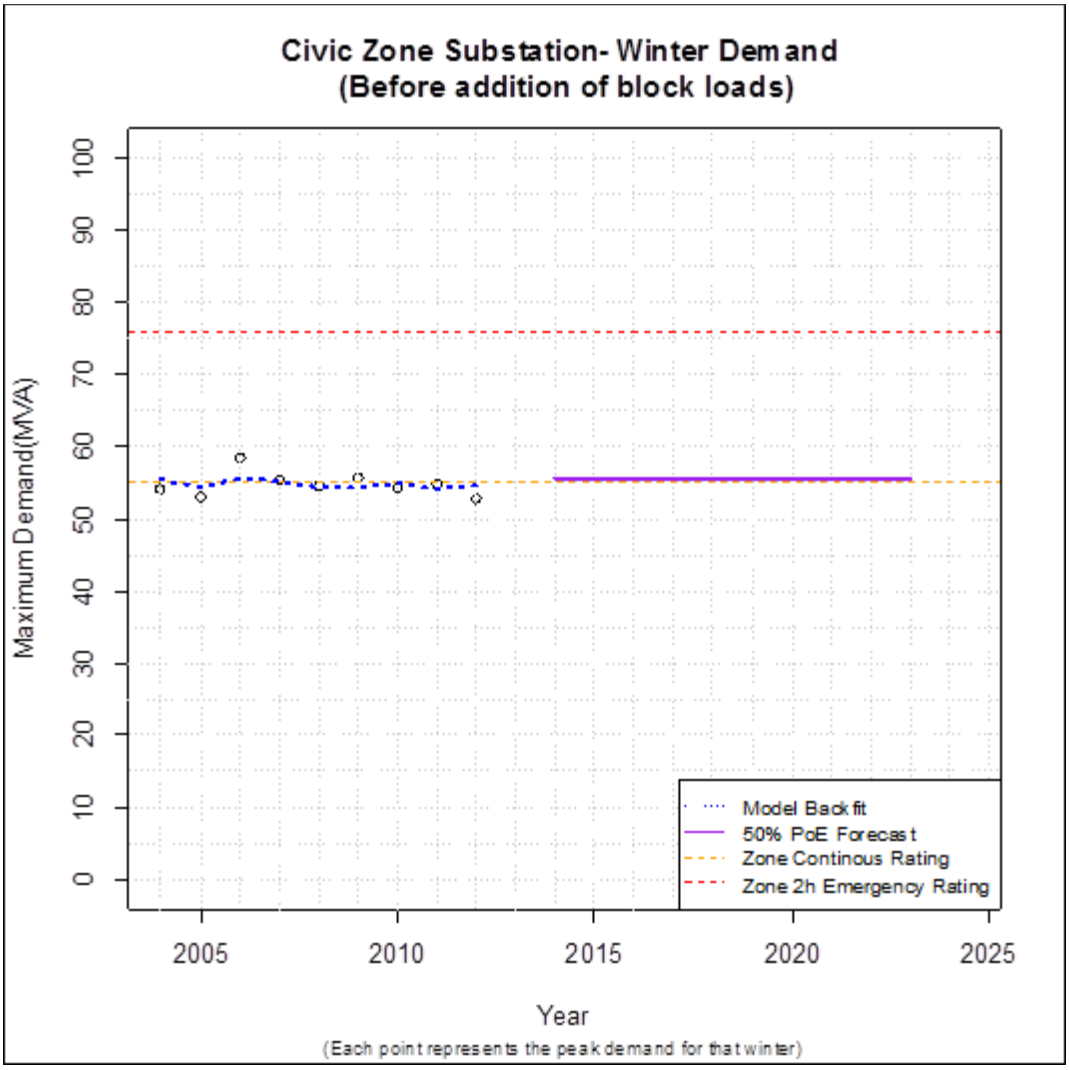

Model Details: Demand = 50.18 – 0.21 * MinTemp + 0.11 * 3DayHDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 50.17919 | 1.58715 | 31.616 | <2e-16 |
| MinTemp | -0.21439 | 0.1158 | -1.851 | 0.0765 |
| 3DayHDD | 0.11473 | 0.04895 | 2.344 | 0.0277 |
| Residual standard error: 1.287 on 24 degrees of freedom | | | | |
| Multiple R-squared: 0.2458, Adjusted R-squared: 0.1829 | | | | |
| F-statistic: 3.911 on 2 and 24 DF, p-value: 0.03387 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



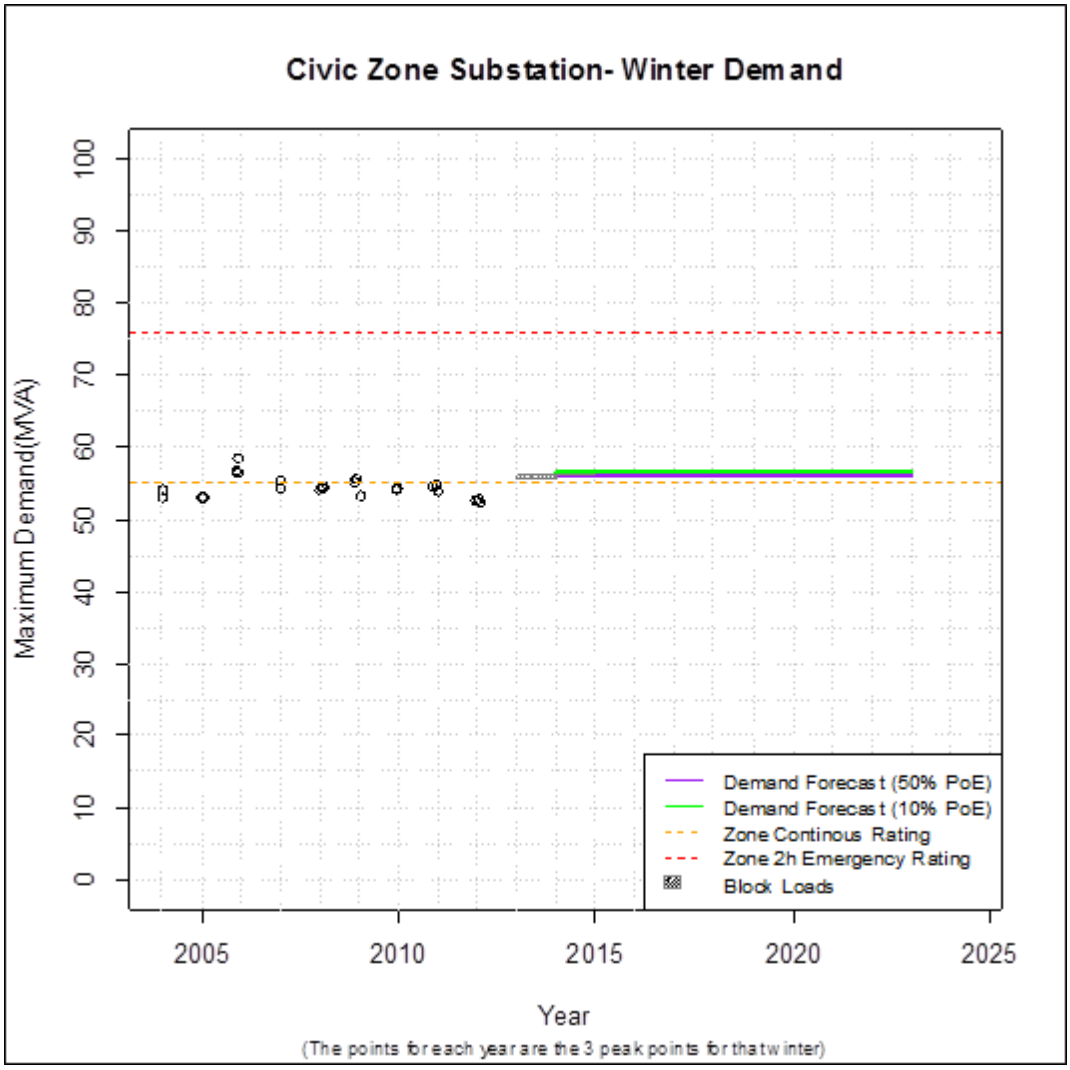
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Civic Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 54.08 | 55.44 | 3% | 3% |
| 2005 | 53.08 | 54.37 | 2% | 2% |
| 2006 | 58.51 | 55.64 | -5% | 5% |
| 2007 | 55.42 | 55.31 | 0% | 0% |
| 2008 | 54.57 | 54.34 | 0% | 0% |
| 2009 | 55.65 | 54.42 | -2% | 2% |
| 2010 | 54.27 | 55.04 | 1% | 1% |
| 2011 | 54.84 | 54.02 | -1% | 1% |
| 2012 | 52.78 | 54.45 | 3% | 3% |
| 2013 | NA | NA | NA | NA |
| | | Average | 0% | 2% |

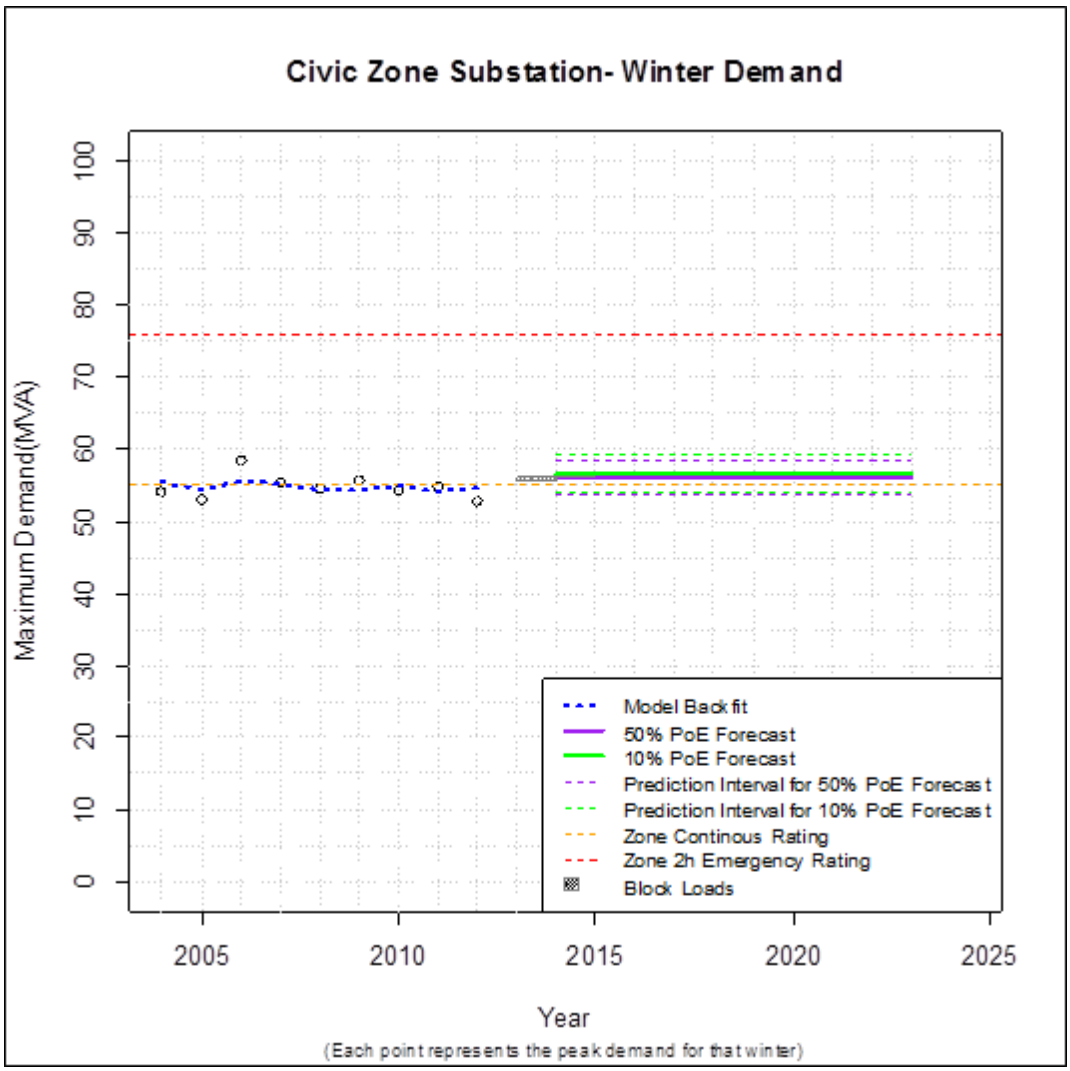
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 56.0 | 56.5 |
| 2015 | 56.1 | 56.6 |
| 2016 | 56.1 | 56.6 |
| 2017 | 56.1 | 56.6 |
| 2018 | 56.1 | 56.6 |
| 2019 | 56.1 | 56.6 |
| 2020 | 56.1 | 56.6 |
| 2021 | 56.1 | 56.6 |
| 2022 | 56.1 | 56.6 |
| 2023 | 56.1 | 56.6 |

4) Graph used in reports/for presentation (incorporating potential future block loads)




**Supporting Document: Block Load Data**

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial | Dryandra Feeder | Civic | 0.18 | 14/08/2013 | 100% |
| Residential & Commercial | Wattle Feeder | Civic | 0.246 | 16/09/2013 | 100% |
| Residential Development | Wattle Feeder | Civic | 0.07 | 1/01/2015 | 90% |

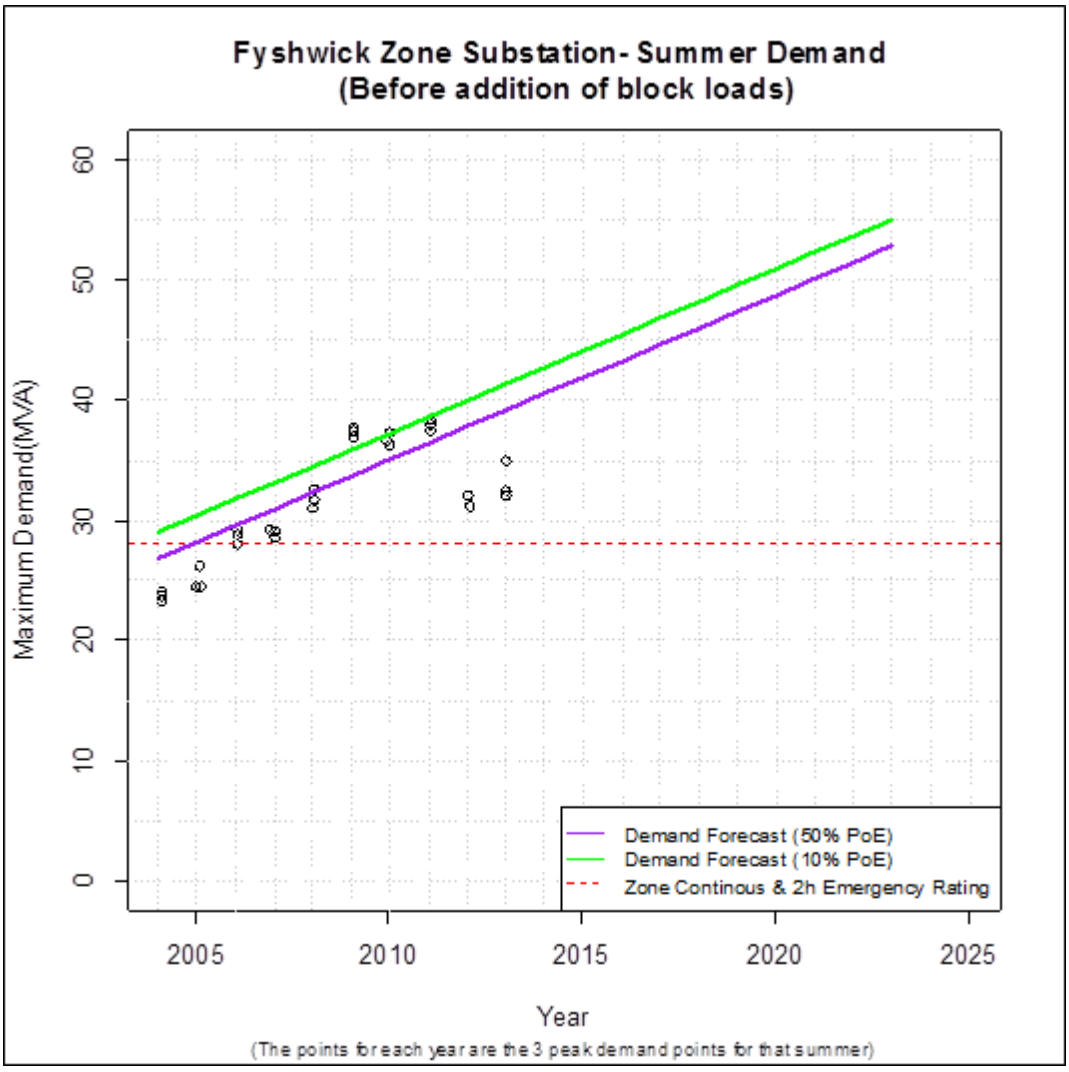
## 5.5 Fyshwick Zone

### 5.5.1 Fyshwick Zone Summer Forecast

**Model Selection**: Model with variables Year and CDD selected based on stepwise procedures and checking against other statistical criteria. Note: permanent switching configurations have been accounted for in this Fyshwick forecast.

**Model/Forecast (before adding block loads):**

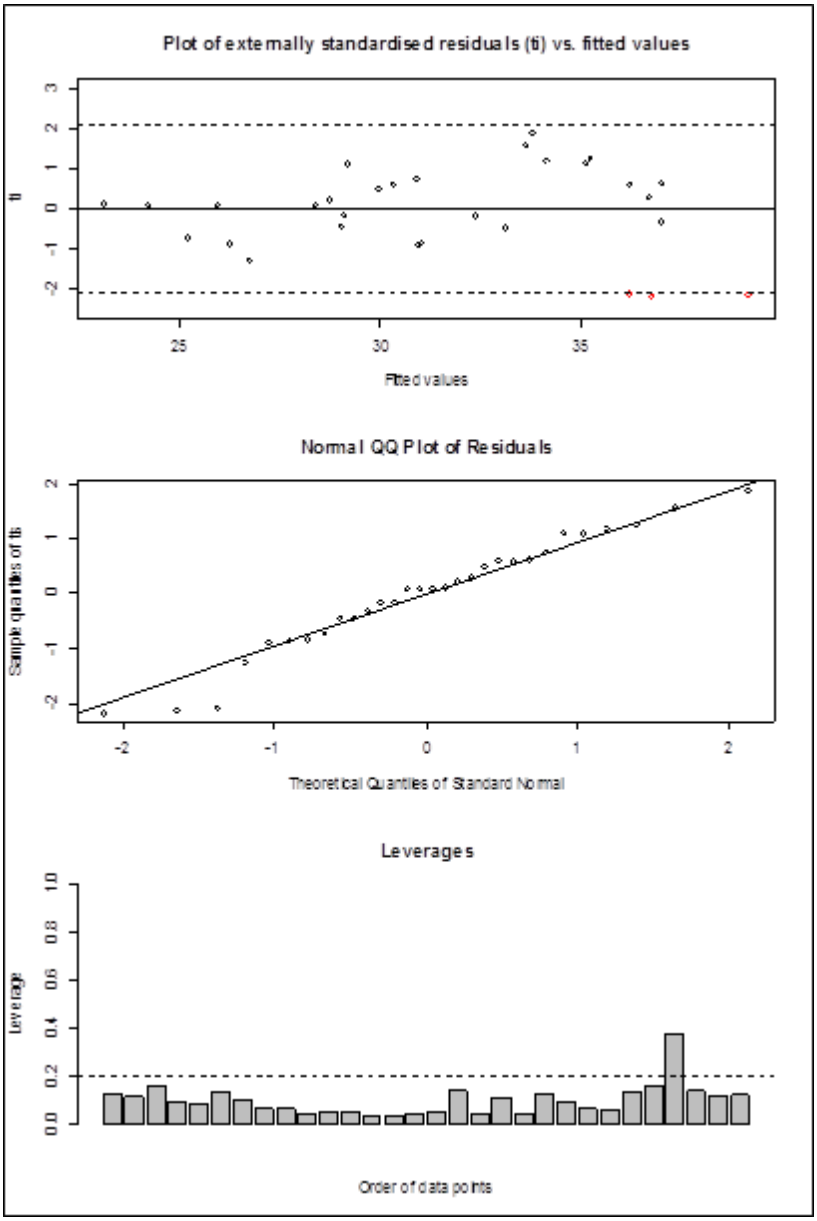
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



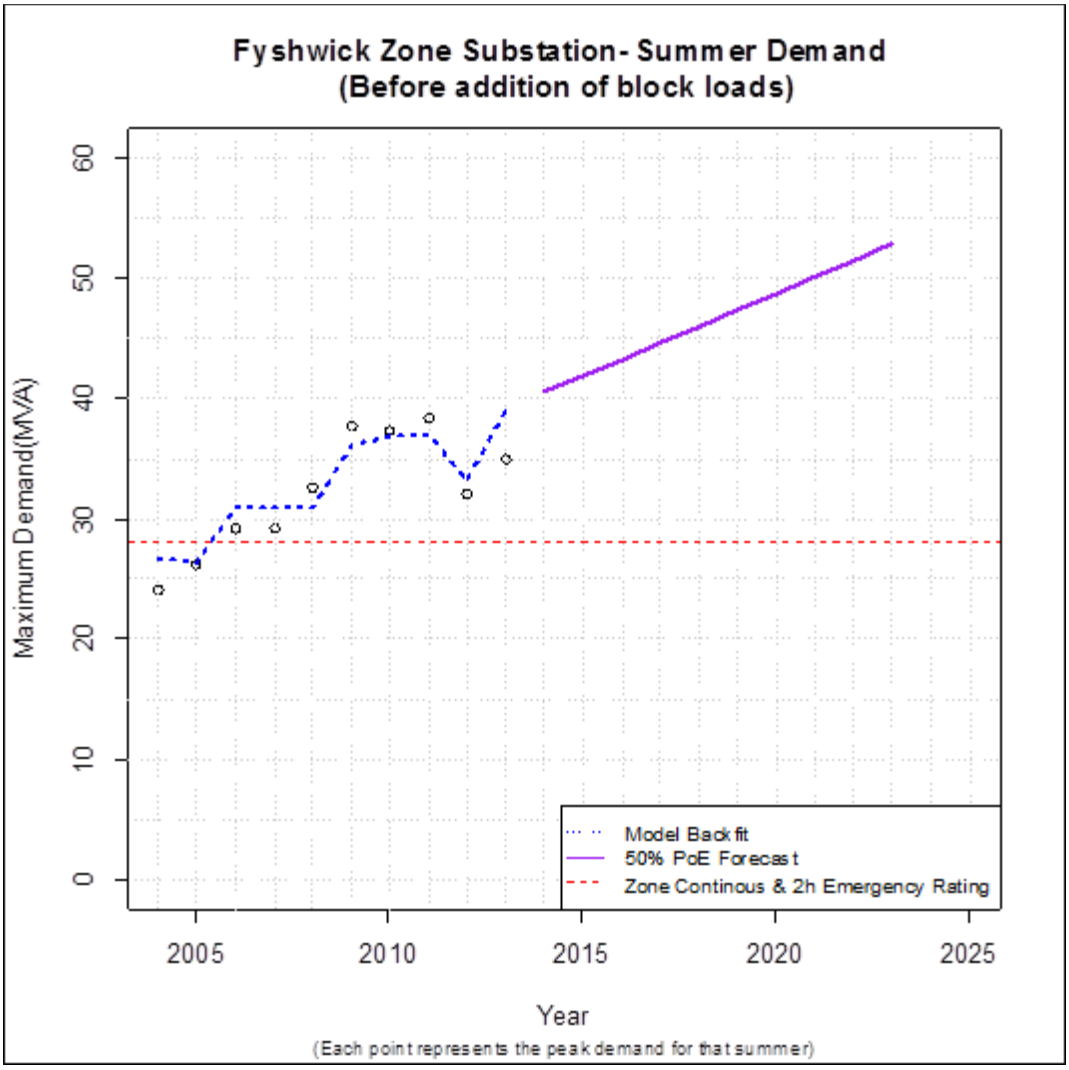

Model Details: Demand = -2726.73 + 1.37 * Year + 1.04 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -2726.7272 | 287.5877 | -9.481 | 4.4E-10 |
| Year | 1.3689 | 0.1431 | 9.568 | 3.63E-10 |
| CDD | 1.0427 | 0.1871 | 5.572 | 6.58E-06 |
| Residual standard error: 2.229 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.8027, Adjusted R-squared: 0.788 | | | | |
| F-statistic: 54.91 on 2 and 27 DF, p-value: 3.059e-10 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



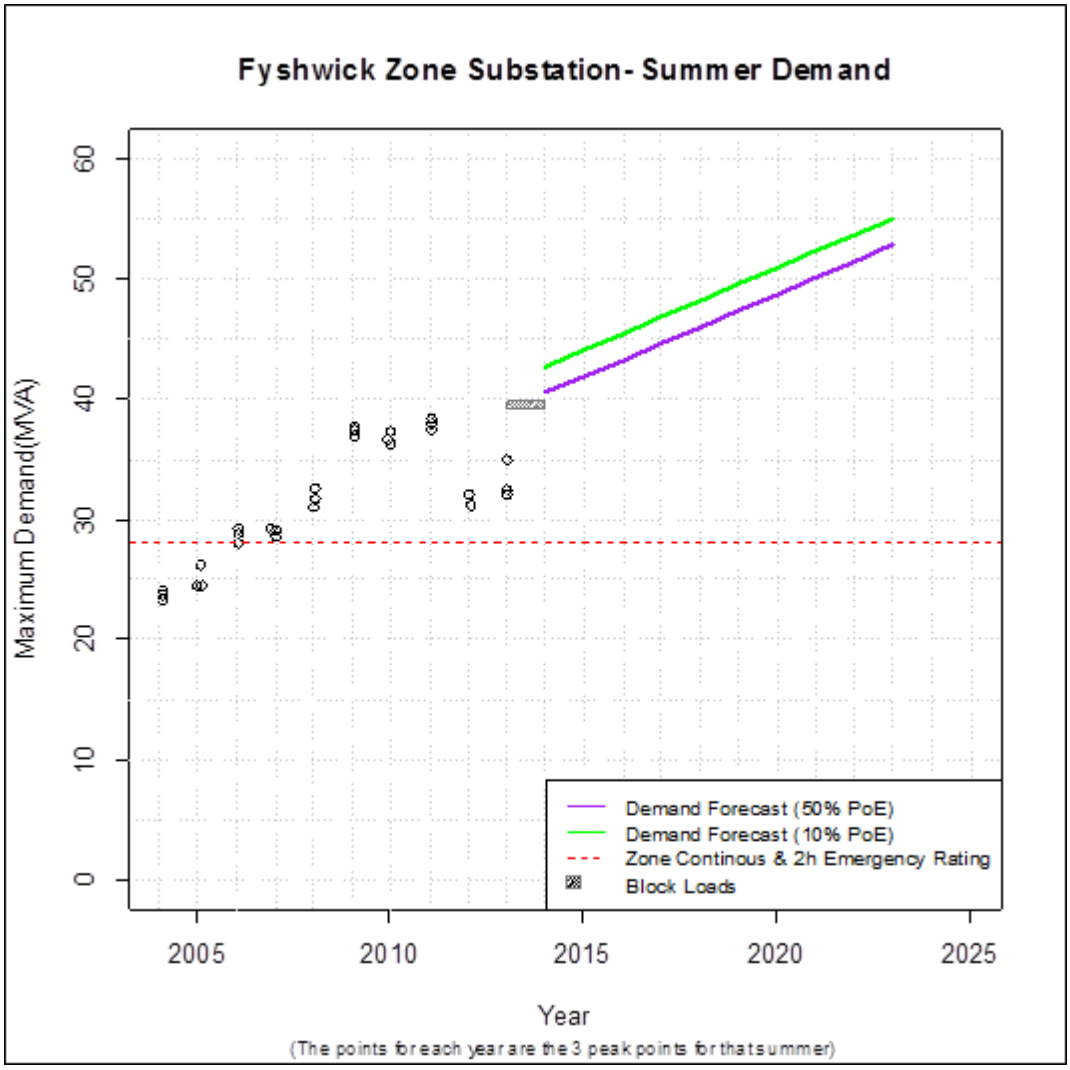
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Fyshwick Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 24.12 | 26.73 | 11% | 11% |
| 2005 | 26.17 | 26.27 | 0% | 0% |
| 2006 | 29.24 | 31.03 | 6% | 6% |
| 2007 | 29.23 | 30.94 | 6% | 6% |
| 2008 | 32.55 | 30.90 | -5% | 5% |
| 2009 | 37.69 | 36.18 | -4% | 4% |
| 2010 | 37.29 | 36.97 | -1% | 1% |
| 2011 | 38.35 | 36.99 | -4% | 4% |
| 2012 | 32.13 | 33.09 | 3% | 3% |
| 2013 | 34.99 | 39.15 | 12% | 12% |
| | | Average | 2% | 5% |

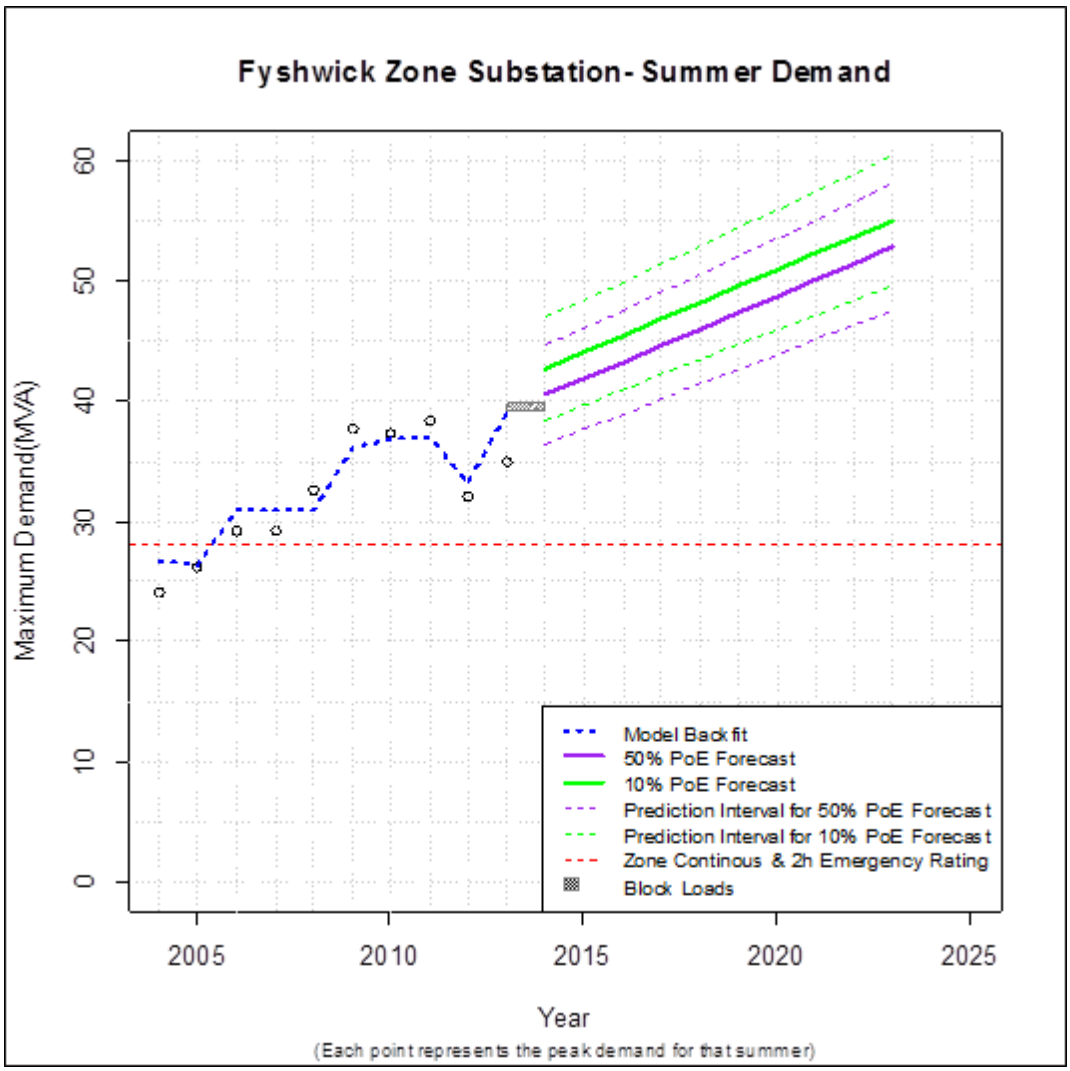
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 40.5 | 42.7 |
| 2015 | 41.9 | 44.1 |
| 2016 | 43.3 | 45.4 |
| 2017 | 44.6 | 46.8 |
| 2018 | 46.0 | 48.2 |
| 2019 | 47.4 | 49.6 |
| 2020 | 48.7 | 50.9 |
| 2021 | 50.1 | 52.3 |
| 2022 | 51.5 | 53.7 |
| 2023 | 52.8 | 55.0 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

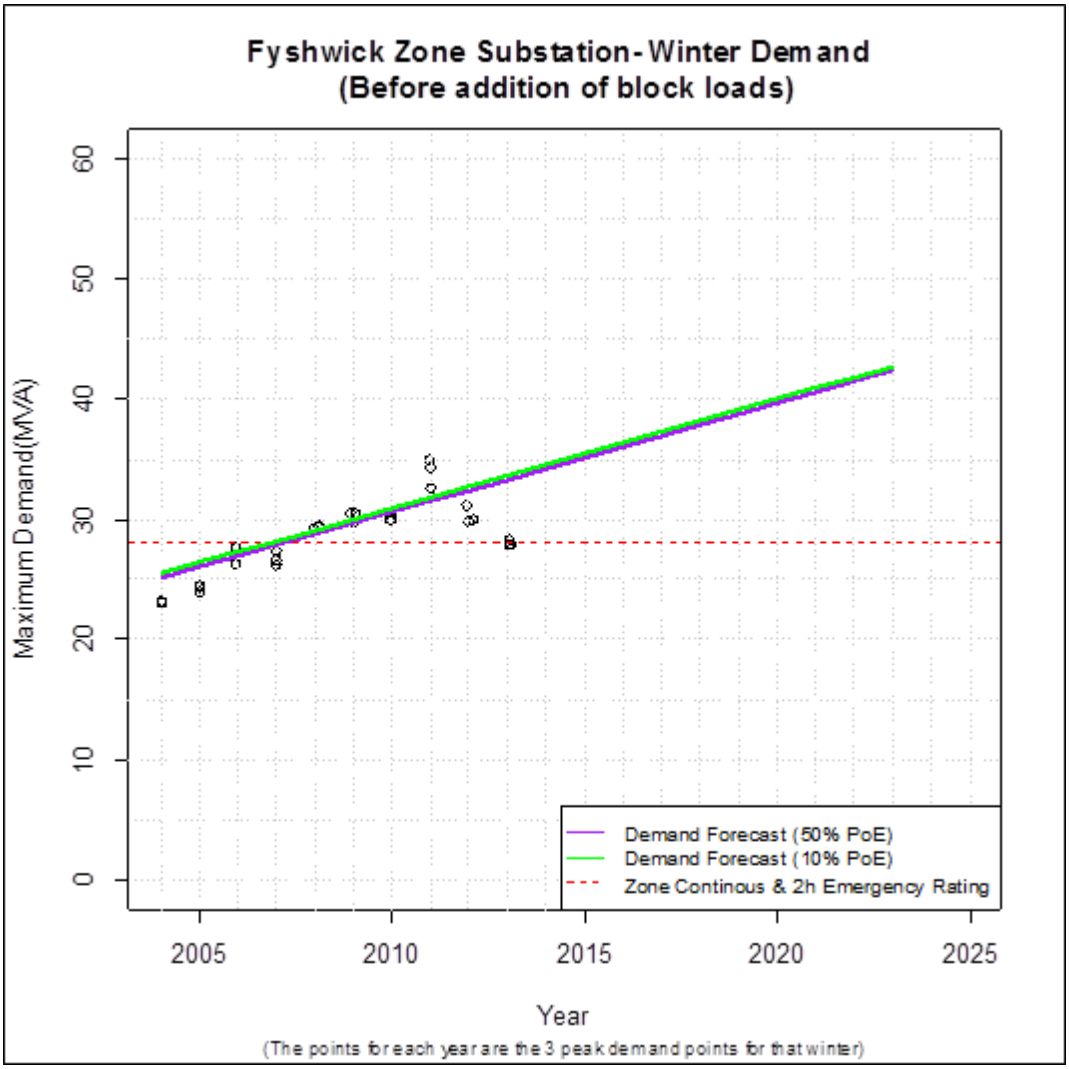
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial & industrial | Collie Feeder | Fyshwick | 0.05 | 20/02/2013 | 100% |
| Commercial | Abattoir Feeder | Fyshwick | 0.086 | 20/03/2013 | 100% |
| Residential Development | Newcastle Feeder | Fyshwick | 0.2 | 5/04/2013 | 100% |
| Commercial | Domayne Feeder | Fyshwick | 0.075 | 6/05/2013 | 100% |
| Commercial Development | Abattoir Feeder | Fyshwick | 0.225 | 16/08/2013 | 100% |
| Commercial | Barrier Feeder | Fyshwick | 0.063 | 12/12/2013 | 90% |

### 5.5.2 Fyshwick Zone Winter Forecast

**Model Selection**: Model with variables Year and HDD, selected based on stepwise procedures and checking against other statistical criteria. Note: permanent switching configurations have been accounted for in this Fyshwick forecast.

**Model/Forecast (before adding block loads):**

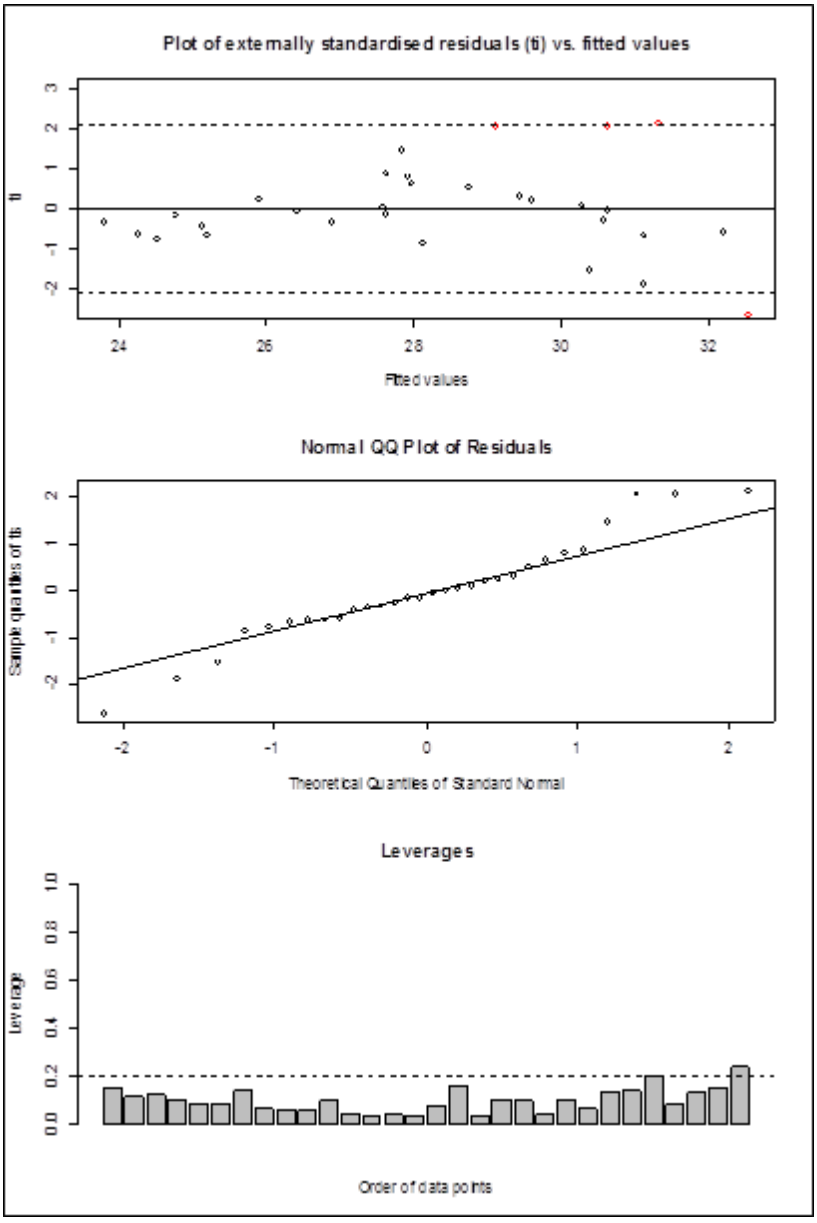
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



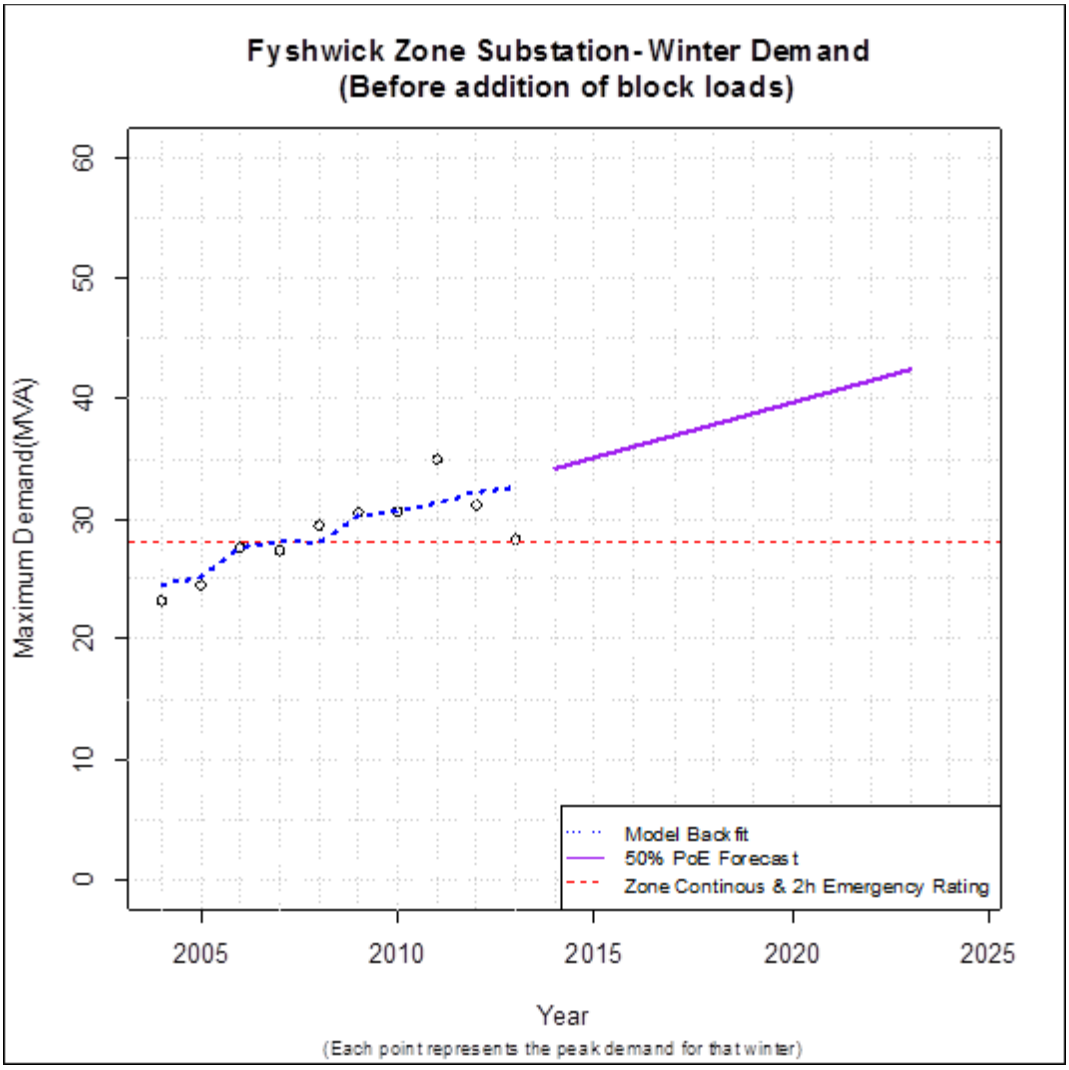

Model Details: Demand = -1798.27 + 0.91 * Year + 0.44 * HDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -1798.2733 | 260.7193 | -6.897 | 0.000000207 |
| Year | 0.907 | 0.1295 | 7.005 | 0.000000157 |
| HDD | 0.4353 | 0.1869 | 2.33 | 0.0276 |
| Residual standard error: 1.93 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.6451, Adjusted R-squared: 0.6188 | | | | |
| F-statistic: 24.54 on 2 and 27 DF, p-value: 8.432e-07 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



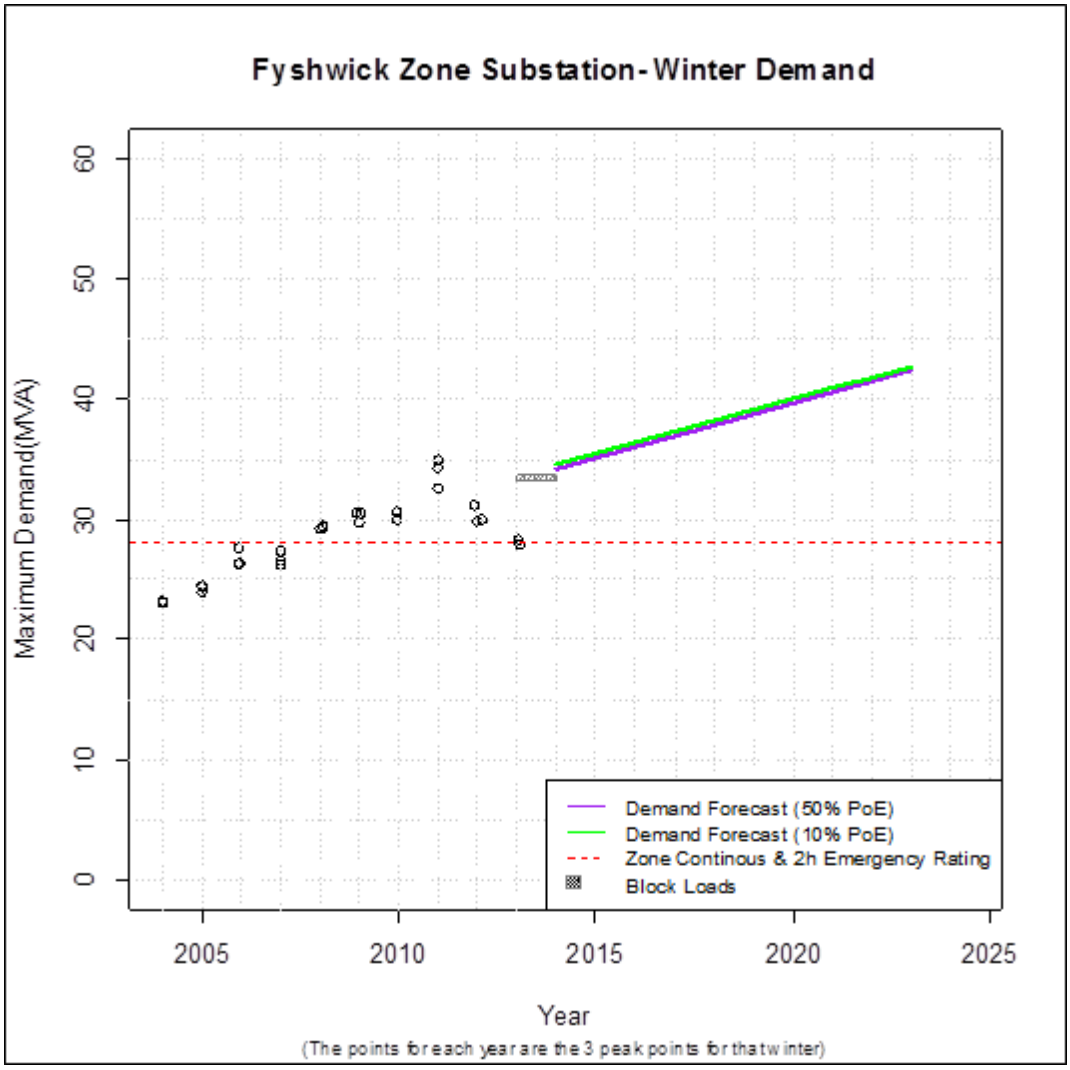
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Fyshwick Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 23.2 | 24.51 | 6% | 6% |
| 2005 | 24.48 | 25.20 | 3% | 3% |
| 2006 | 27.68 | 27.57 | 0% | 0% |
| 2007 | 27.37 | 28.13 | 3% | 3% |
| 2008 | 29.46 | 27.97 | -5% | 5% |
| 2009 | 30.49 | 30.29 | -1% | 1% |
| 2010 | 30.62 | 30.63 | 0% | 0% |
| 2011 | 34.98 | 31.32 | -10% | 10% |
| 2012 | 31.14 | 32.21 | 3% | 3% |
| 2013 | 28.29 | 32.55 | 15% | 15% |
| | | Average | 1% | 5% |

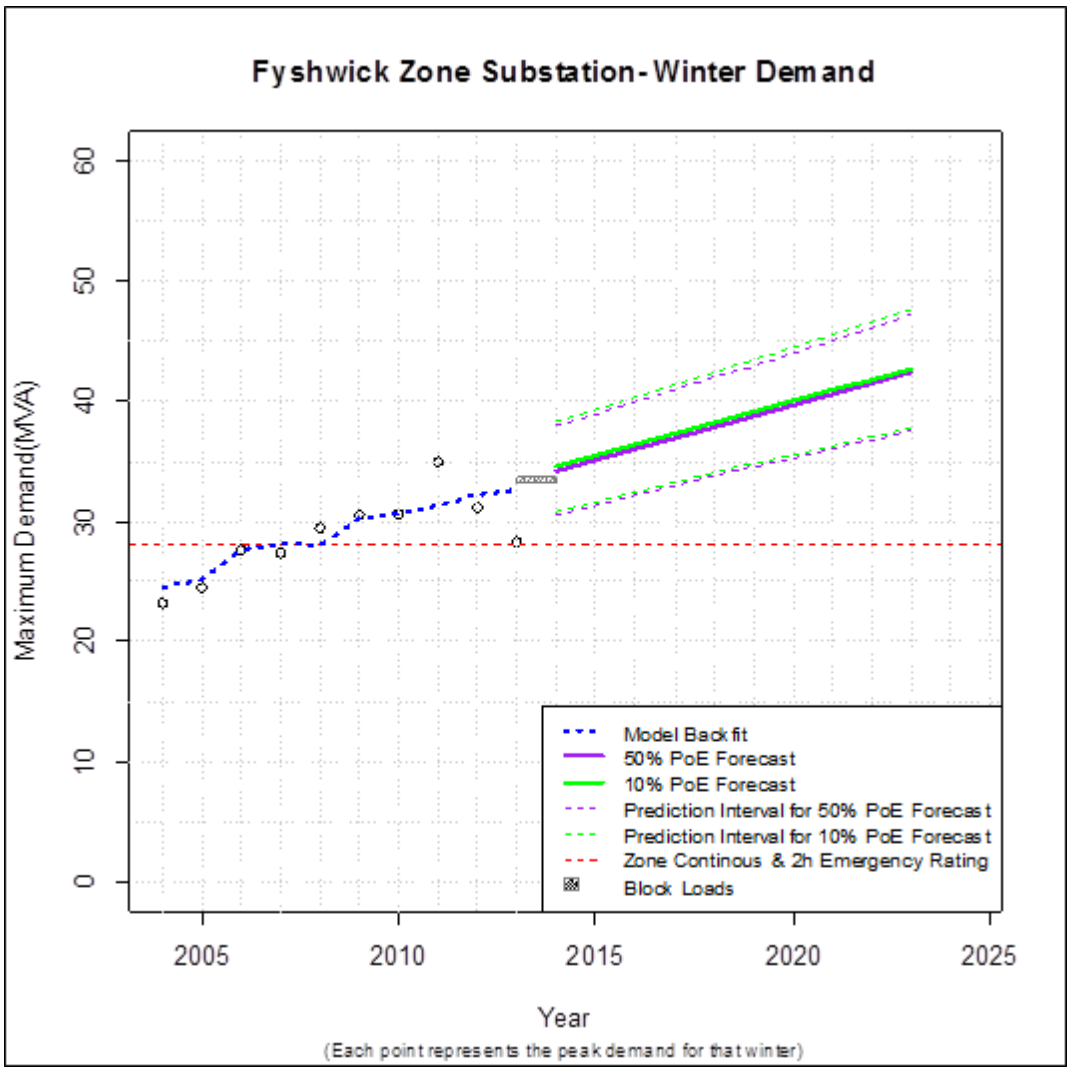
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 34.2 | 34.6 |
| 2015 | 35.1 | 35.5 |
| 2016 | 36.0 | 36.4 |
| 2017 | 36.9 | 37.3 |
| 2018 | 37.8 | 38.2 |
| 2019 | 38.8 | 39.1 |
| 2020 | 39.7 | 40.0 |
| 2021 | 40.6 | 40.9 |
| 2022 | 41.5 | 41.8 |
| 2023 | 42.4 | 42.7 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial Development | Abattoir Feeder | Fyshwick | 0.225 | 16/08/2013 | 100% |
| Commercial | Barrier Feeder | Fyshwick | 0.063 | 12/12/2013 | 90% |

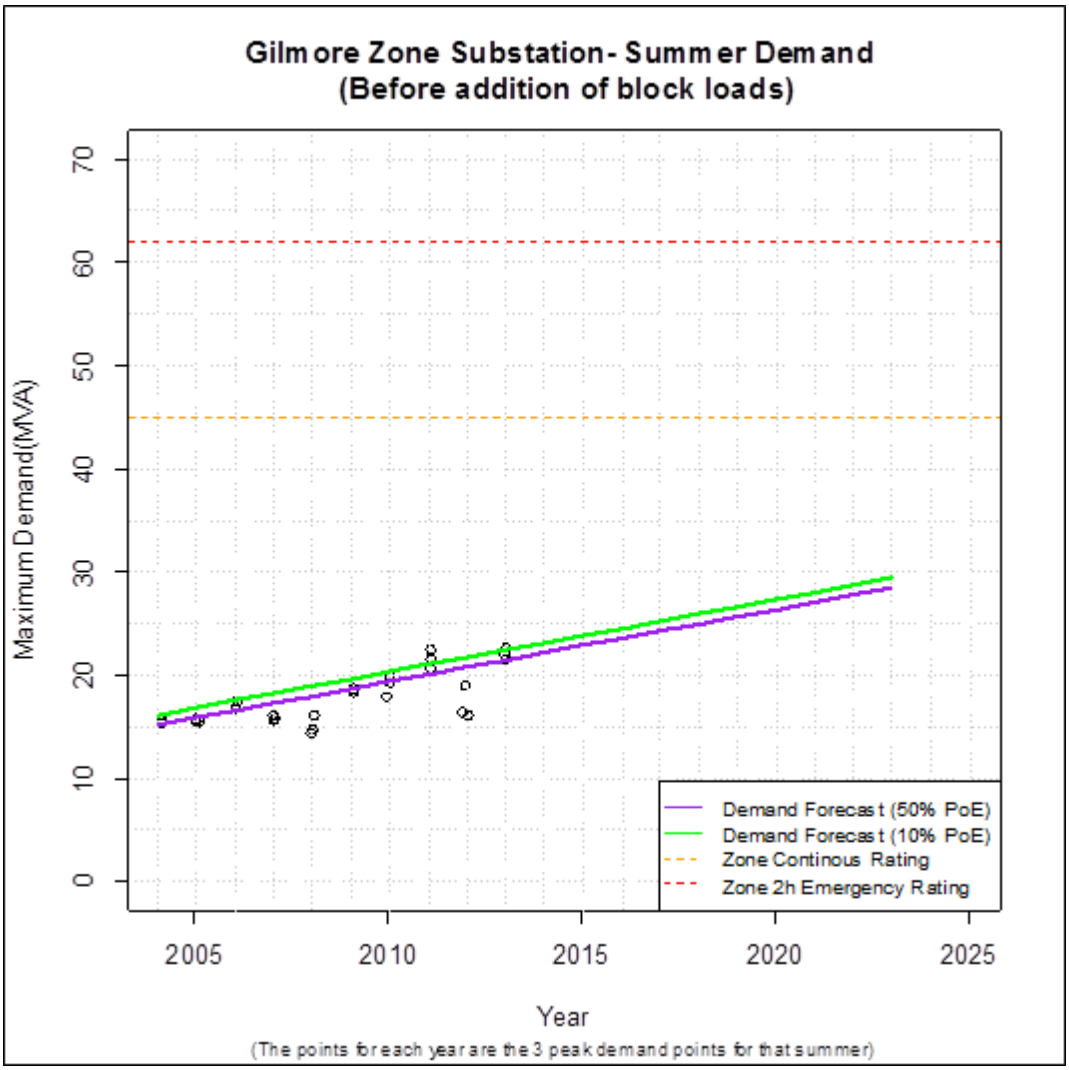
## 5.6 Gilmore Zone

### 5.6.1 Gilmore Zone Summer Forecast

**Model Selection**: Model with variables Year and CDD selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

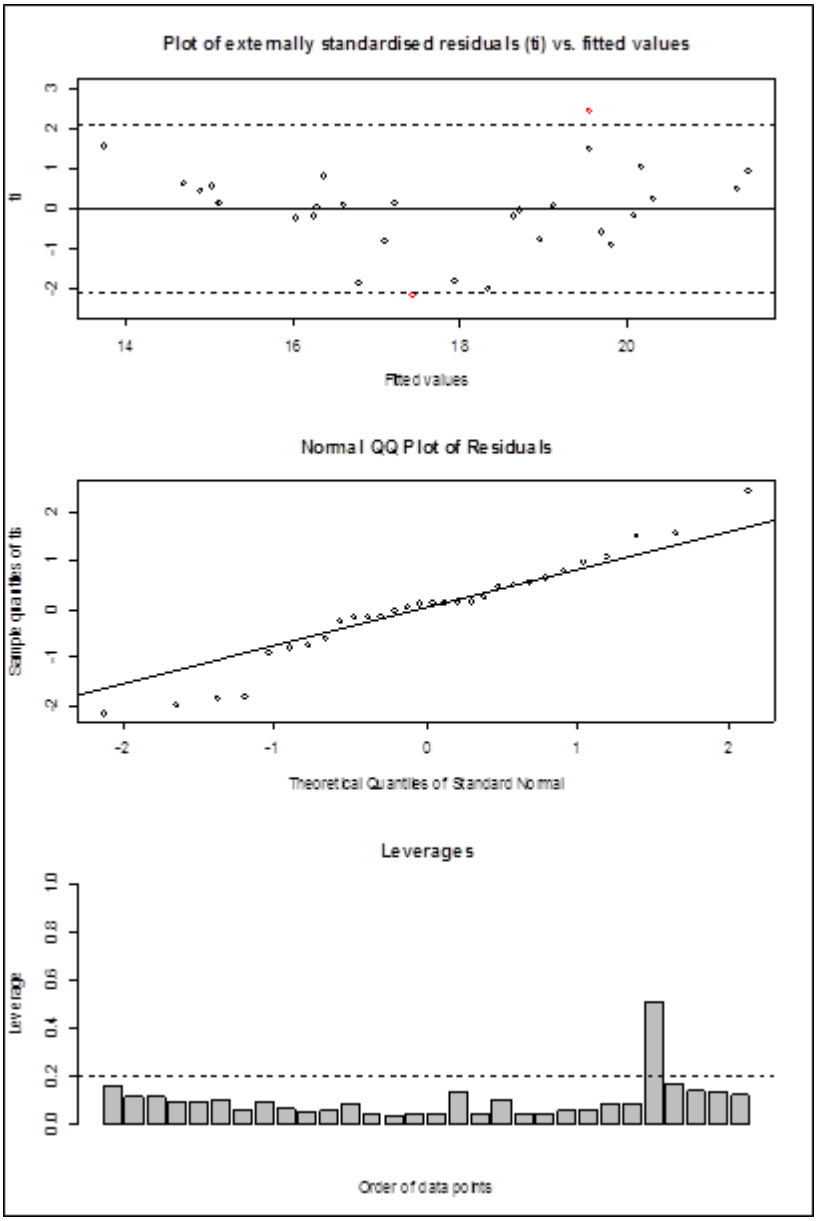
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



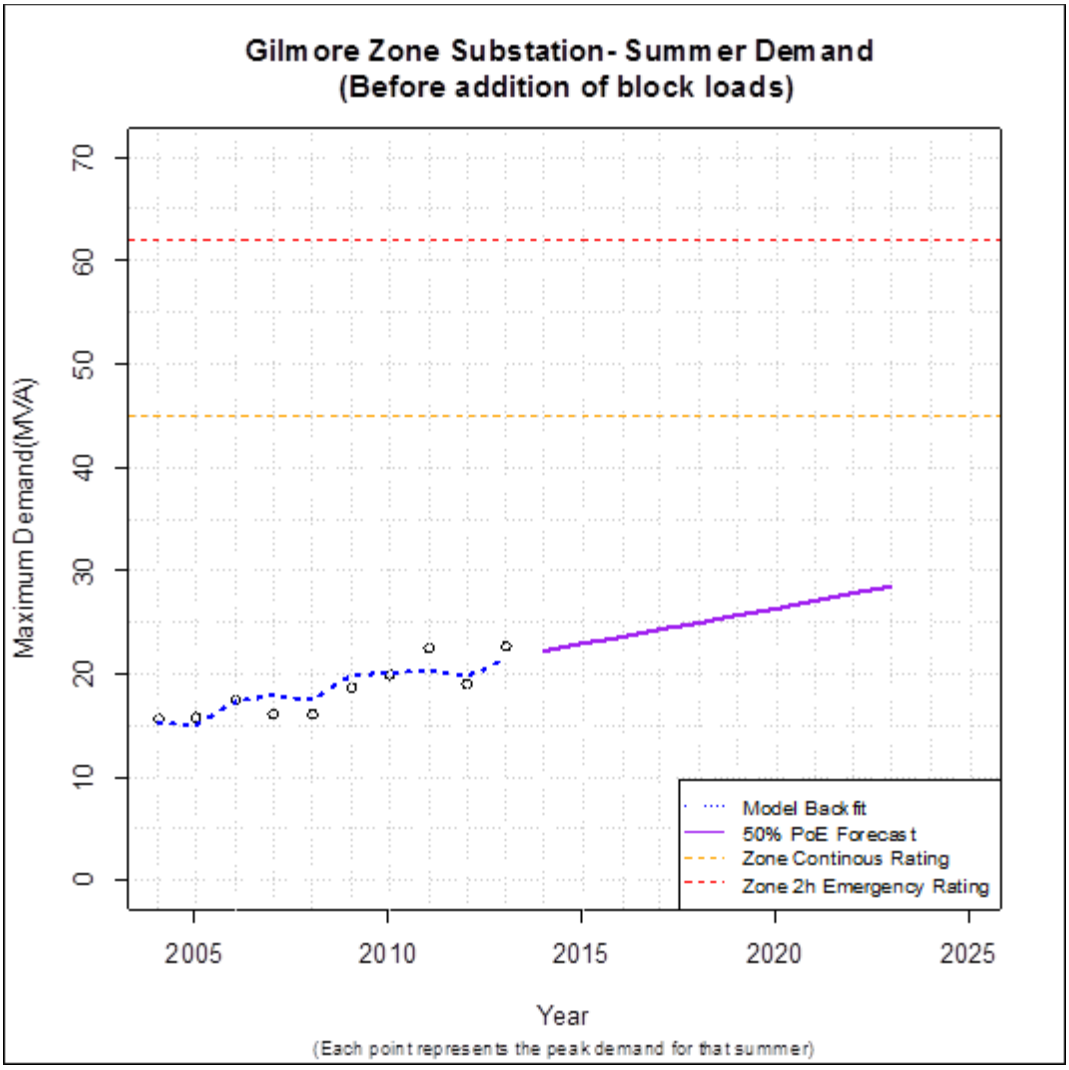

Model Details: Demand = -1391 + 0.70 * Year + 0.46 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -1391 | 178.6 | -7.789 | 2.24E-08 |
| Year | 0.6997 | 0.08886 | 7.874 | 1.82E-08 |
| CDD | 0.4576 | 0.112 | 4.087 | 3.51E-04 |
| Residual standard error: 1.377 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.7205, Adjusted R-squared: 0.6998 | | | | |
| F-statistic: 34.8 on 2 and 27 DF, p-value: 3.356e-08 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



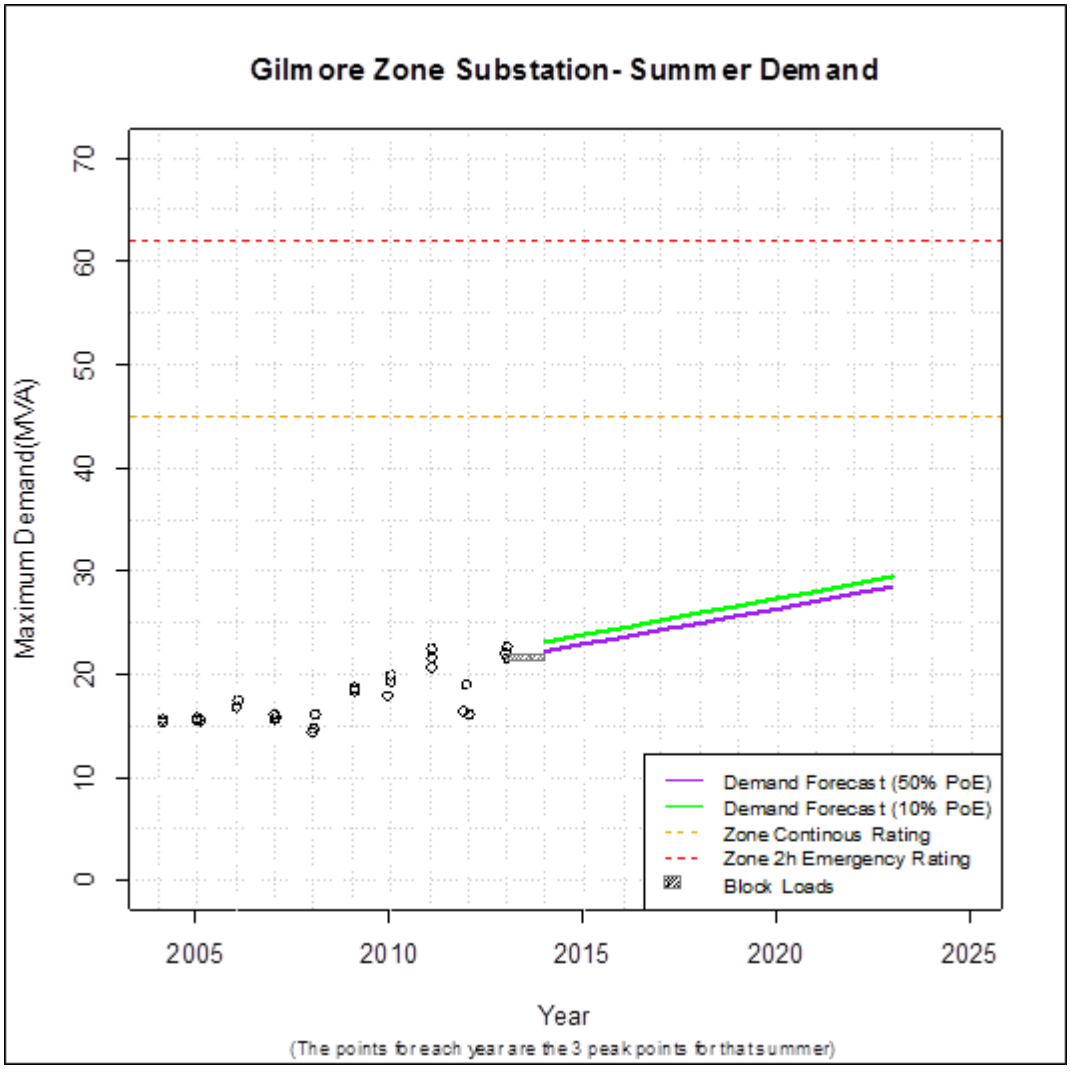
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Gilmore Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 15.66 | 15.12 | -3% | 3% |
| 2005 | 15.77 | 15.02 | -5% | 5% |
| 2006 | 17.43 | 17.21 | -1% | 1% |
| 2007 | 16.03 | 17.93 | 12% | 12% |
| 2008 | 16.03 | 17.44 | 9% | 9% |
| 2009 | 18.66 | 19.81 | 6% | 6% |
| 2010 | 19.87 | 20.07 | 1% | 1% |
| 2011 | 22.52 | 20.32 | -10% | 10% |
| 2012 | 18.91 | 19.69 | 4% | 4% |
| 2013 | 22.69 | 21.46 | -5% | 5% |
| | | Average | 1% | 6% |

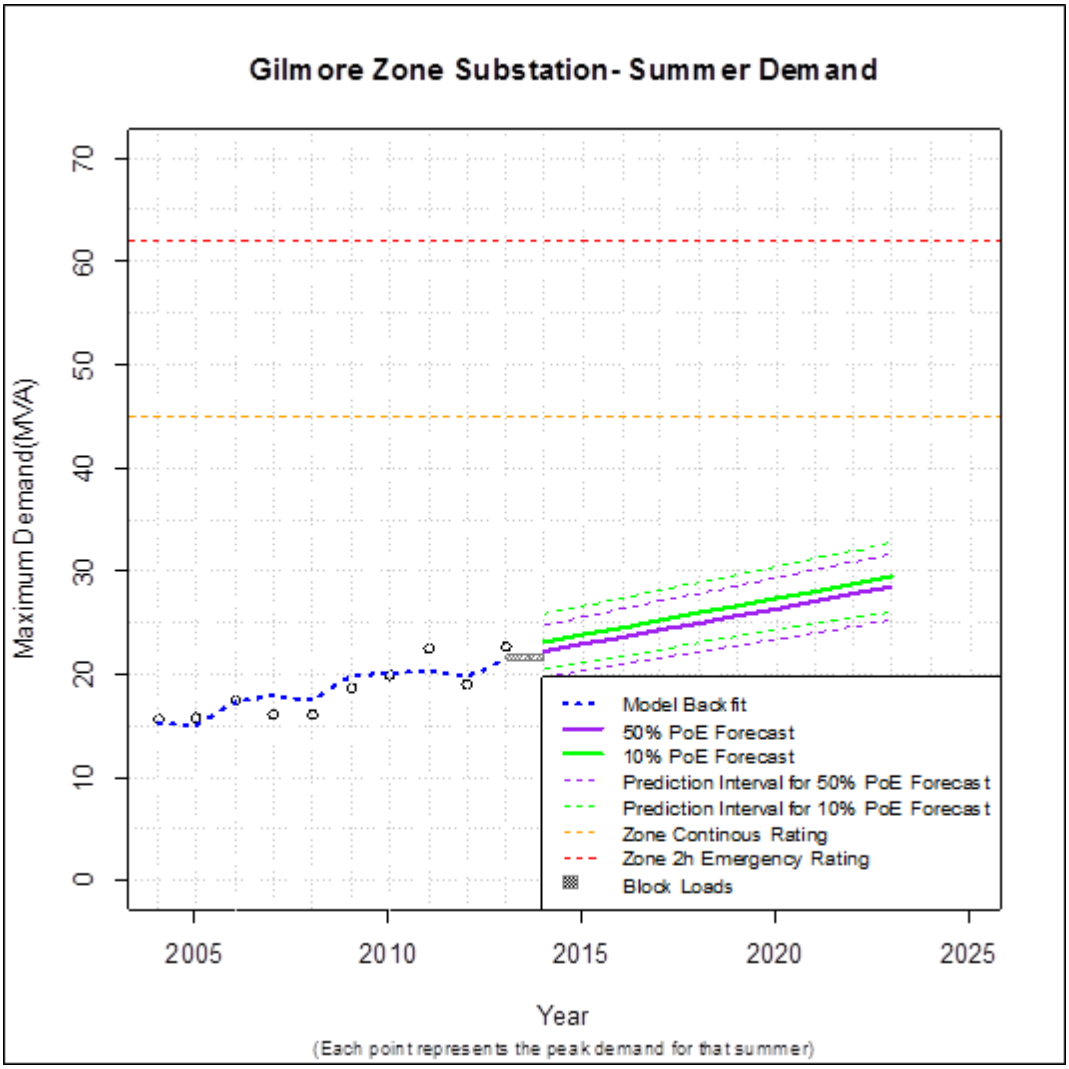
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 22.2 | 23.1 |
| 2015 | 22.9 | 23.8 |
| 2016 | 23.6 | 24.5 |
| 2017 | 24.3 | 25.2 |
| 2018 | 25.0 | 25.9 |
| 2019 | 25.7 | 26.6 |
| 2020 | 26.4 | 27.3 |
| 2021 | 27.1 | 28.0 |
| 2022 | 27.8 | 28.7 |
| 2023 | 28.5 | 29.4 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

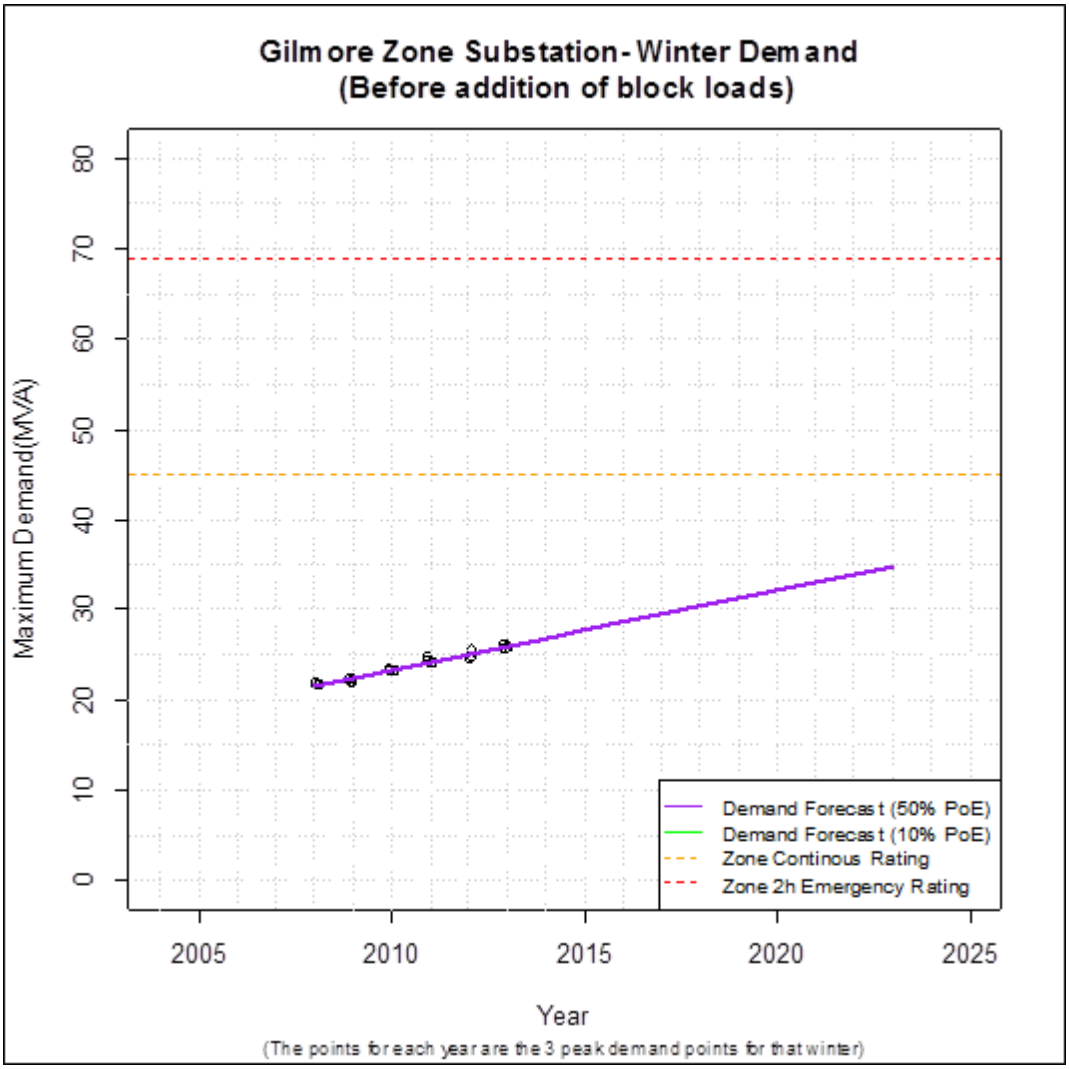
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial & industrial | Monaro Feeder 2 | Gilmore | 0.066 | 5/02/2013 | 100% |
| Commercial & industrial | Monaro Feeder | Gilmore | 0.32 | 20/03/2013 | 100% |

### 5.6.2 Gilmore Zone Winter Forecast

**Model Selection**: There is an obvious increasing trend in winter demand at Gilmore Zone over the most recent 6 years. Hence, the previous years are disregarded when modelling. Only the variable Year was found to be significant in the model, leading to the 50% and 10% PoE forecasts being the same (since there are no weather variables).

**Model/Forecast (before adding block loads):**

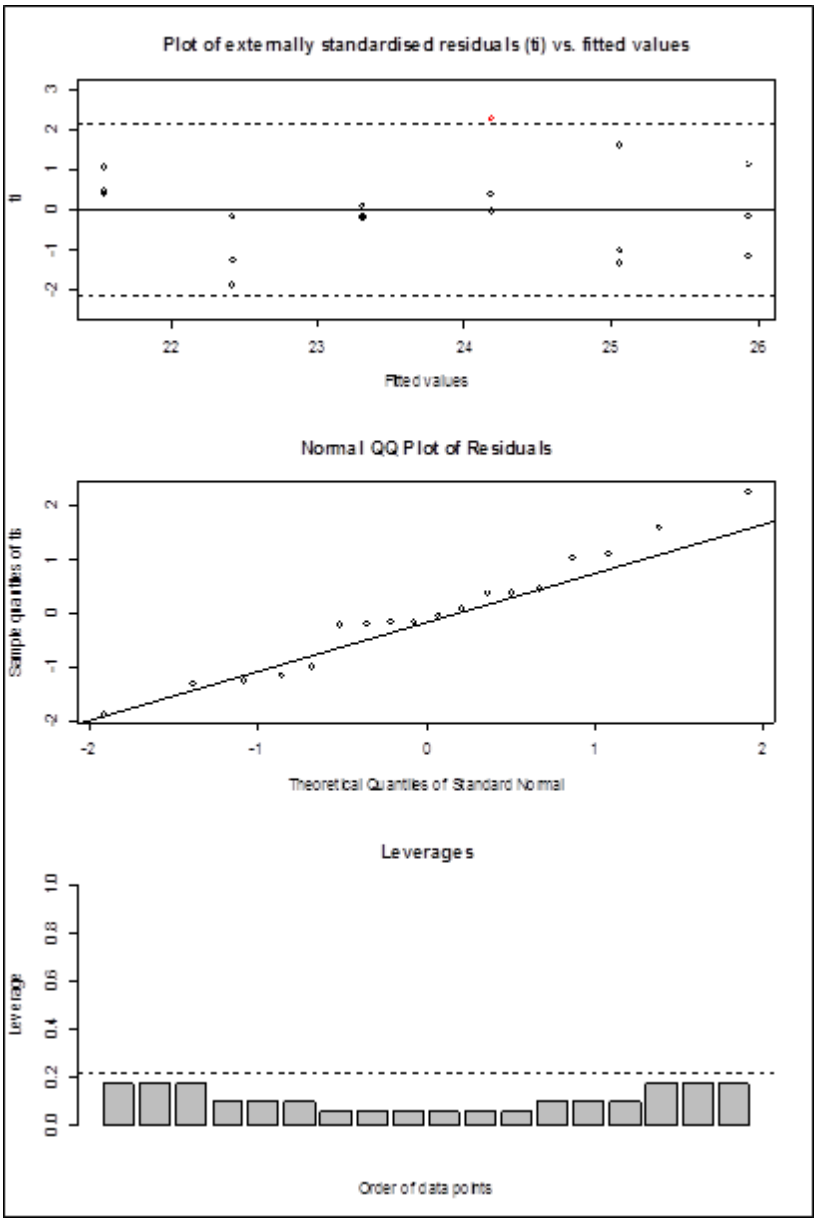
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



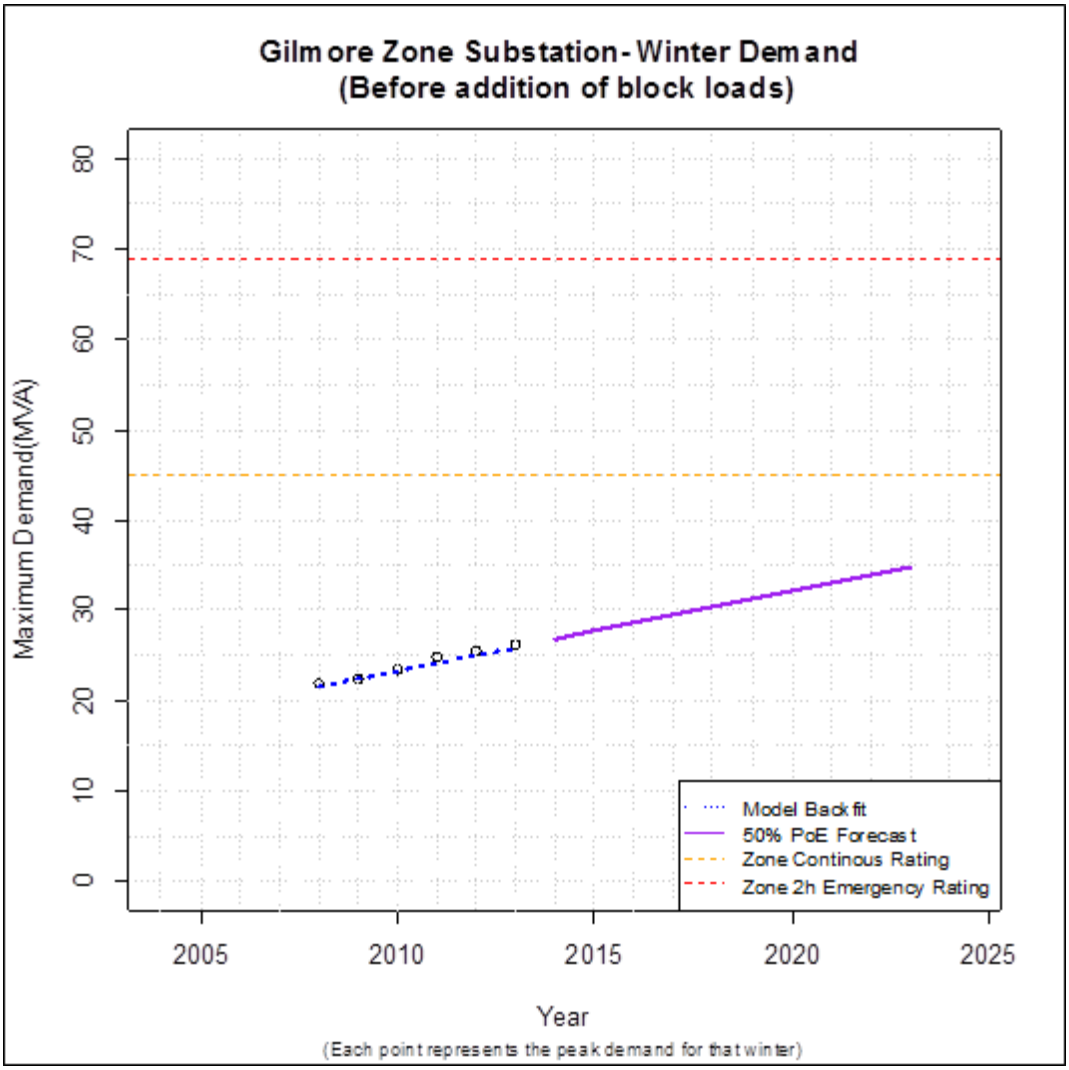

Model Details: Demand = -1741 + 0.88 * Year

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -1741 | 81.1 | -21.46 | 3.21E-13 |
| Year | 0.8776 | 0.04034 | 21.76 | 2.6E-13 |
| Residual standard error: 0.2923 on 16 degrees of freedom | | | | |
| Multiple R-squared: 0.9673, Adjusted R-squared: 0.9653 | | | | |
| F-statistic: 473.4 on 1 and 16 DF, p-value: 2.601e-13 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



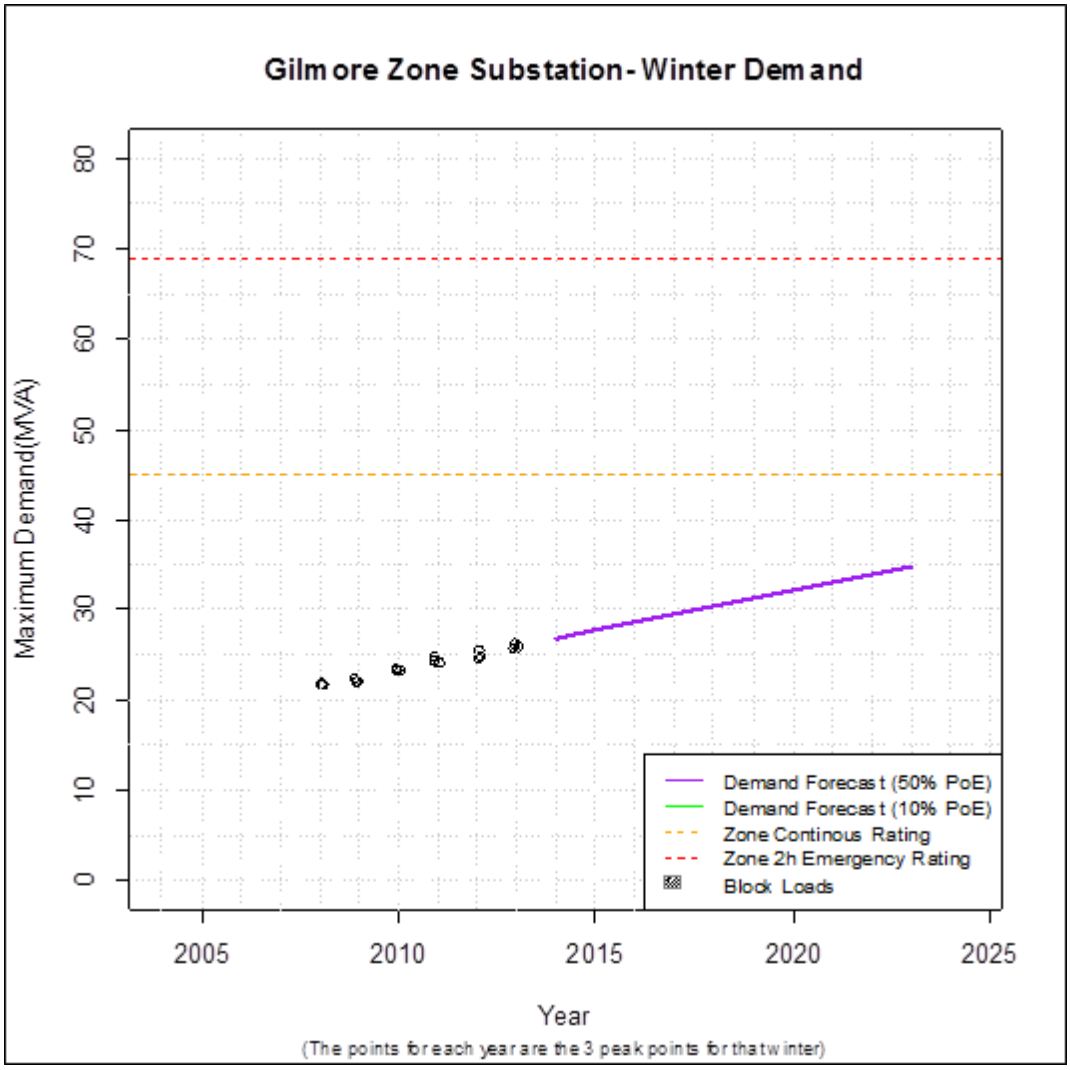
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Gilmore Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | | | | |
| 2005 | | | | |
| 2006 | | | | |
| 2007 | | | | |
| 2008 | 21.82 | 21.54 | -1% | 1% |
| 2009 | 22.37 | 22.42 | 0% | 0% |
| 2010 | 23.33 | 23.30 | 0% | 0% |
| 2011 | 24.75 | 24.18 | -2% | 2% |
| 2012 | 25.48 | 25.05 | -2% | 2% |
| 2013 | 26.23 | 25.93 | -1% | 1% |
| | | Average | -1% | 1% |

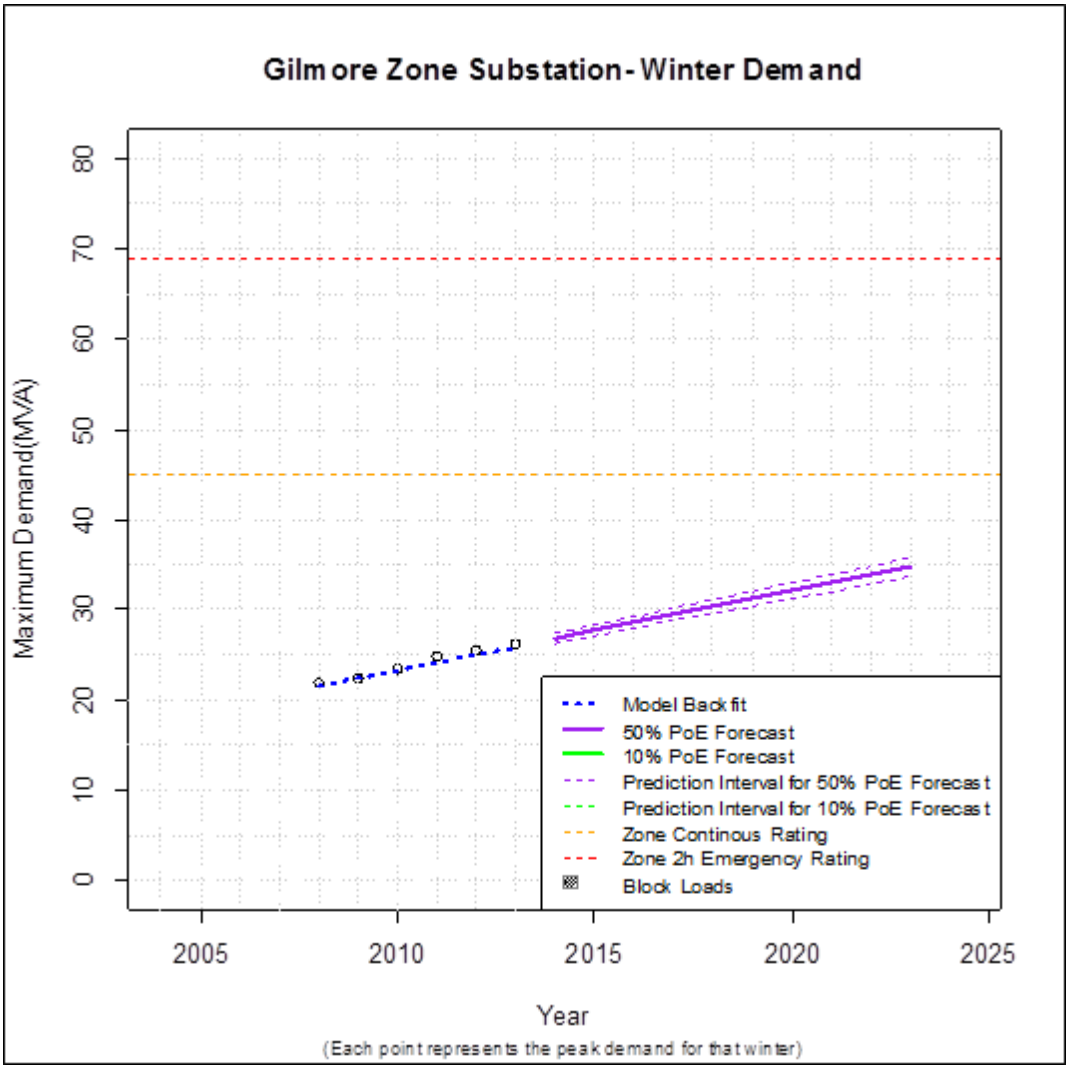
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 26.8 | 26.8 |
| 2015 | 27.7 | 27.7 |
| 2016 | 28.6 | 28.6 |
| 2017 | 29.4 | 29.4 |
| 2018 | 30.3 | 30.3 |
| 2019 | 31.2 | 31.2 |
| 2020 | 32.1 | 32.1 |
| 2021 | 33.0 | 33.0 |
| 2022 | 33.8 | 33.8 |
| 2023 | 34.7 | 34.7 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| None on record | | | | | |

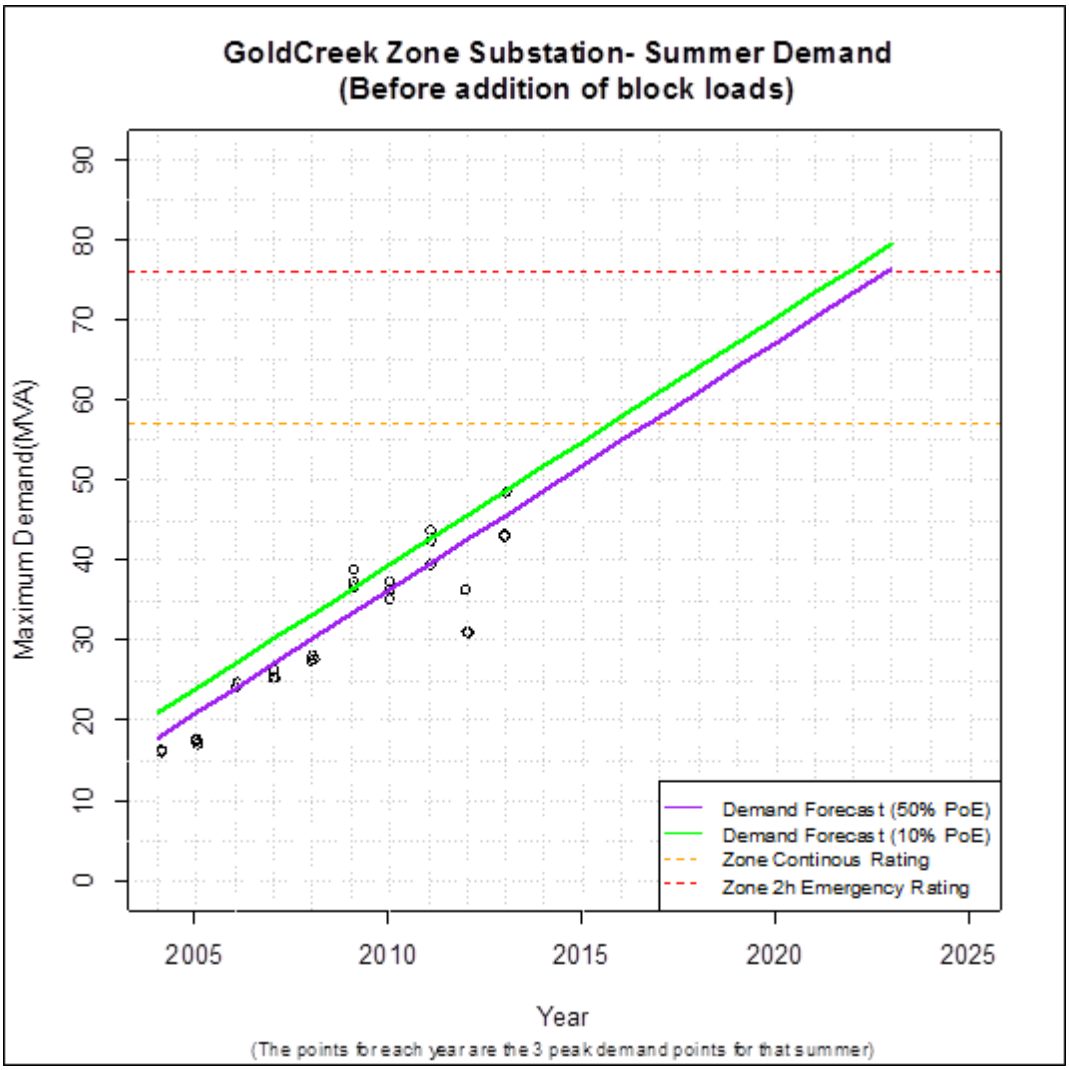
## 5.7 Gold Creek Zone

### 5.7.1 Gold Creek Zone Summer Forecast

**Model Selection**: Model with variables Year and CDD selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

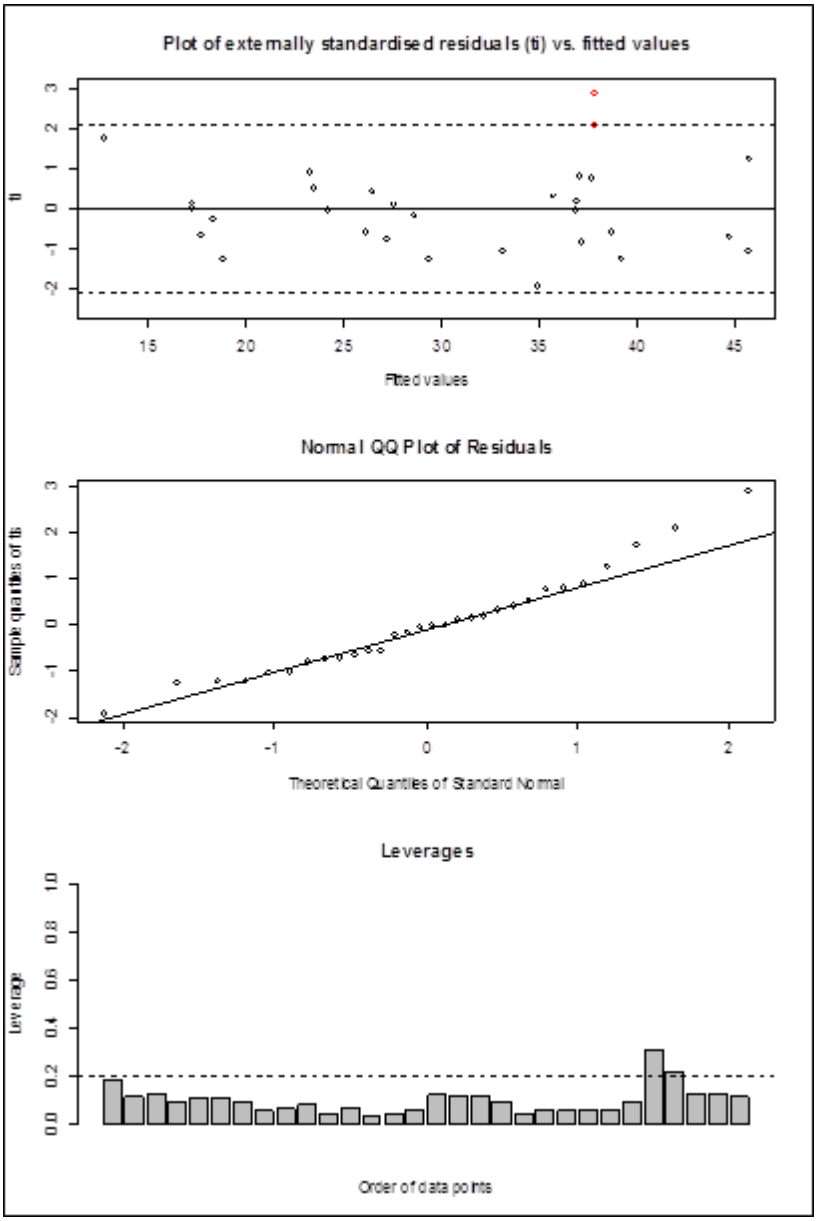
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



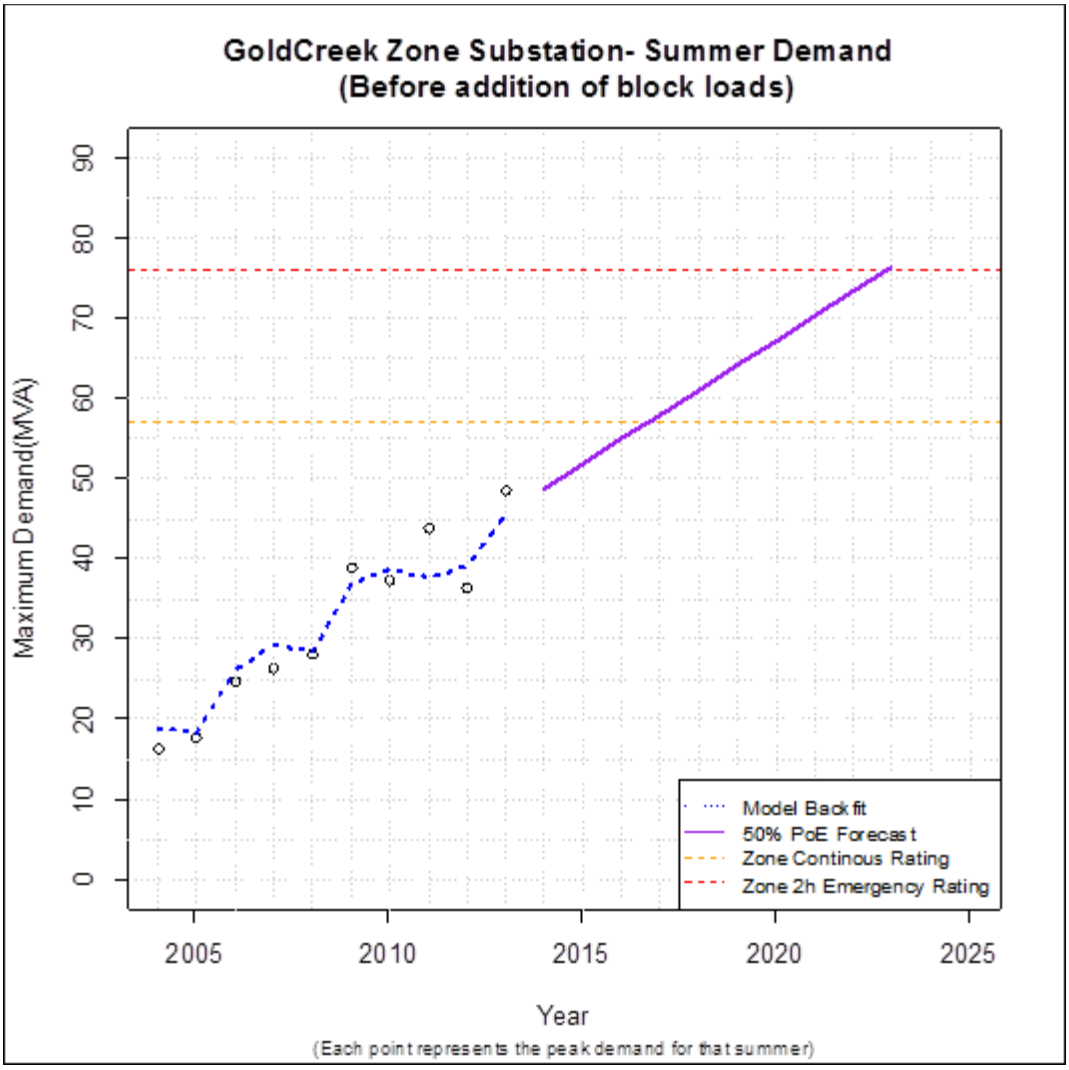

Model Details: Demand = -6172 + 3.08 * Year + 1.46 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -6172.045 | 310.8528 | -19.855 | < 2e-16 |
| Year | 3.0817 | 0.1547 | 19.922 | < 2e-16 |
| CDD | 1.456 | 0.2116 | 6.879 | 2.16E-07 |
| Residual standard error: 2.425 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.9402, Adjusted R-squared: 0.9358 | | | | |
| F-statistic: 212.3 on 2 and 27 DF, p-value: < 2.2e-16 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



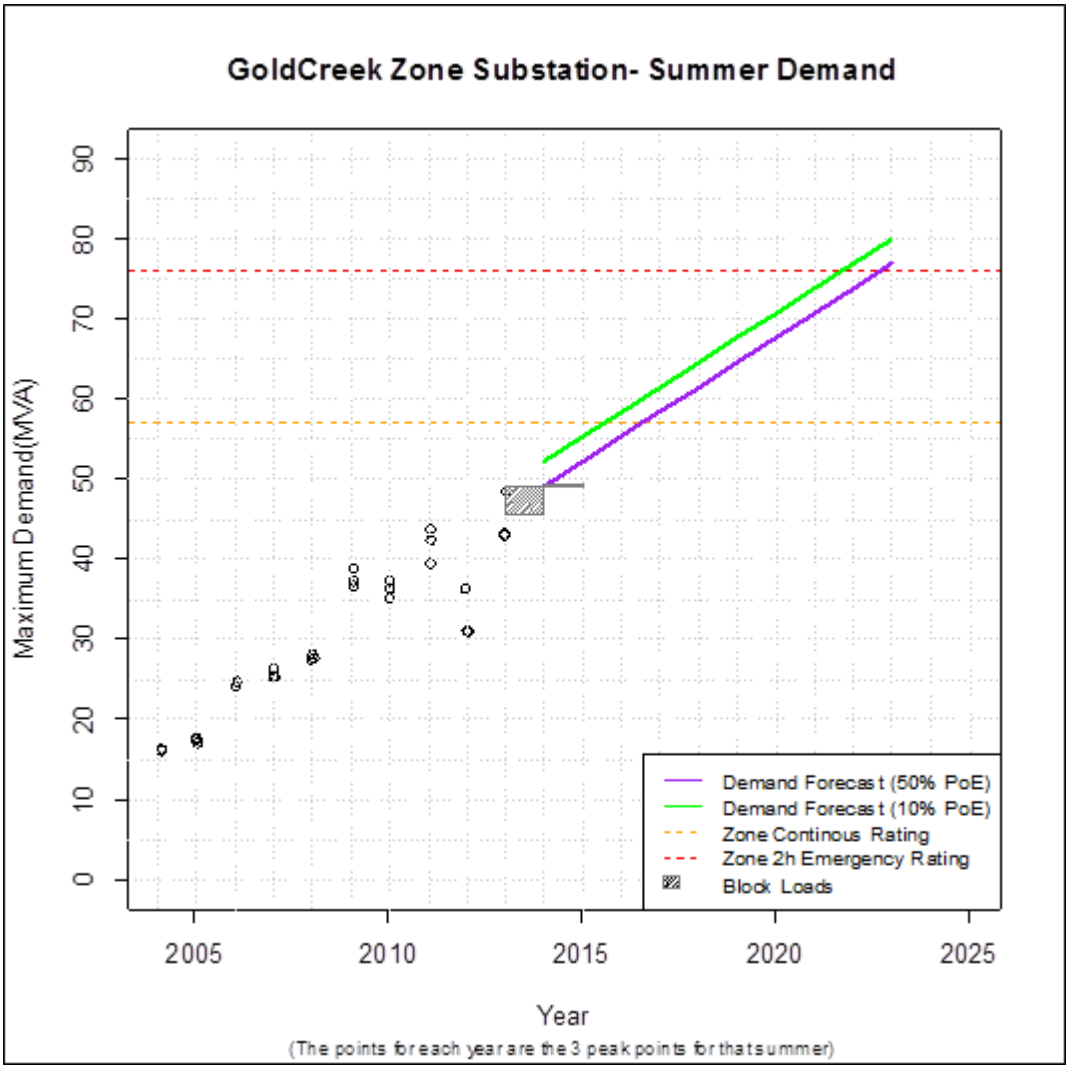
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Gold Creek Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 16.41 | 18.79 | 14% | 14% |
| 2005 | 17.76 | 18.30 | 3% | 3% |
| 2006 | 24.8 | 26.12 | 5% | 5% |
| 2007 | 26.42 | 29.27 | 11% | 11% |
| 2008 | 28.16 | 28.57 | 1% | 1% |
| 2009 | 38.84 | 36.96 | -5% | 5% |
| 2010 | 37.34 | 38.66 | 4% | 4% |
| 2011 | 43.86 | 37.81 | -14% | 14% |
| 2012 | 36.34 | 39.15 | 8% | 8% |
| 2013 | 48.48 | 45.65 | -6% | 6% |
| | | Average | 2% | 7% |

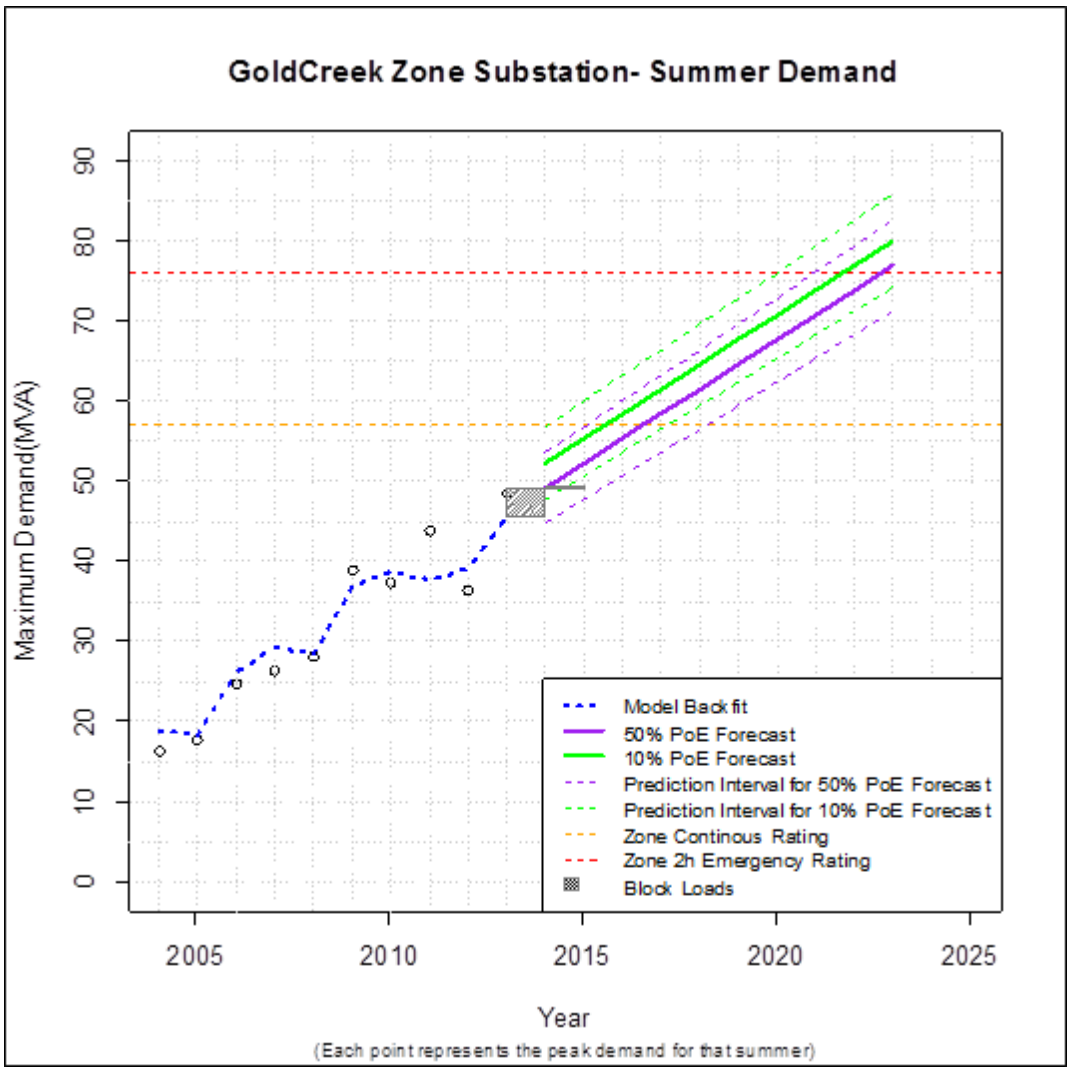
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 49.2 | 52.2 |
| 2015 | 52.3 | 55.3 |
| 2016 | 55.4 | 58.4 |
| 2017 | 58.4 | 61.5 |
| 2018 | 61.5 | 64.6 |
| 2019 | 64.6 | 67.7 |
| 2020 | 67.7 | 70.7 |
| 2021 | 70.8 | 73.8 |
| 2022 | 73.8 | 76.9 |
| 2023 | 76.9 | 80.0 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

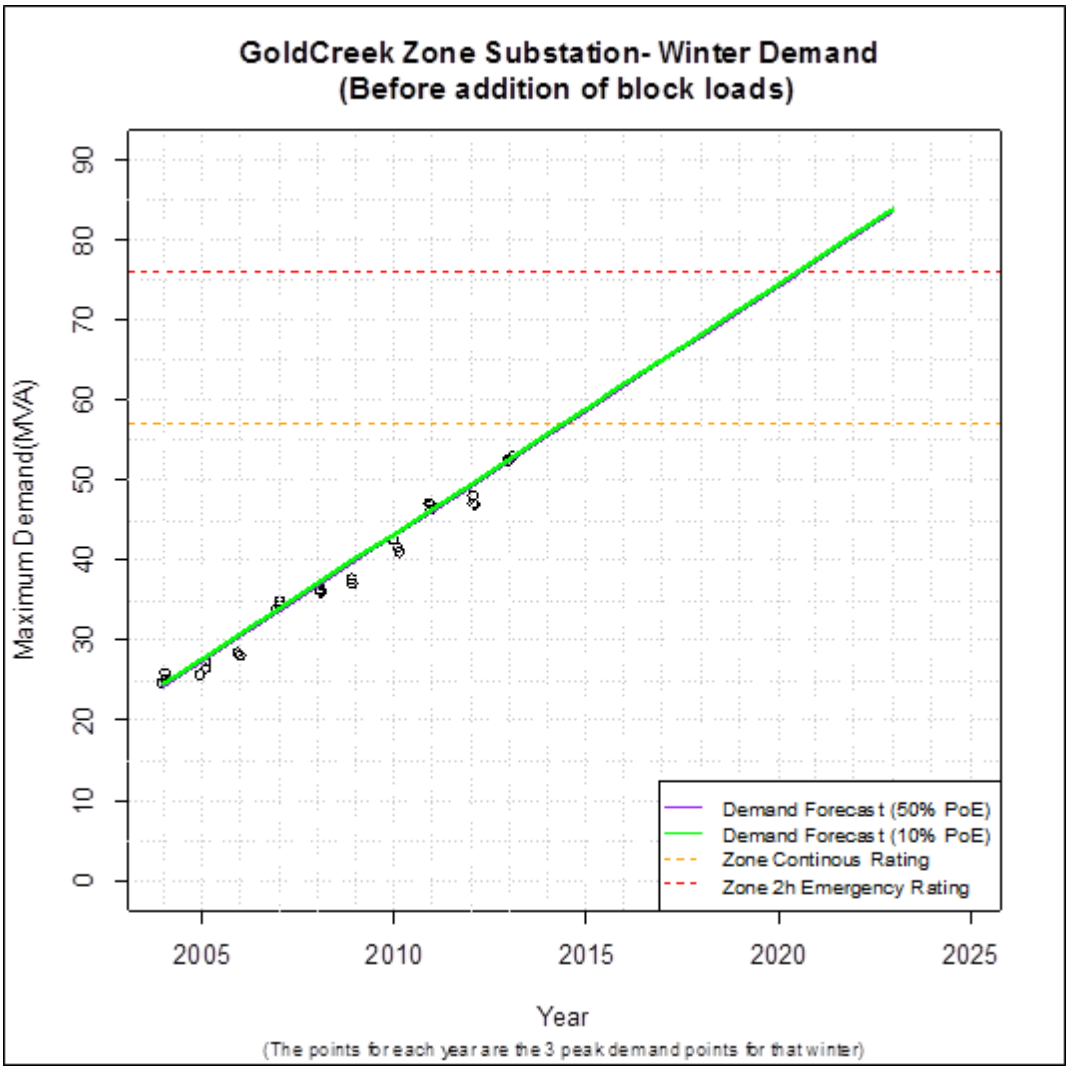
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Residential Development | Nona 2 | GoldCreek | 0.05 | 23/03/2013 | 100% |
| Commercial Development | West Feeder | GoldCreek | 0.055 | 15/05/2013 | 100% |
| | Anthony Rolfe | GoldCreek | 0.22 | 21/06/2013 | 100% |
| Community Development | Gribble feeder | GoldCreek | 0.14 | 8/07/2013 | 100% |
| Commercial Development | Riley Feeder | GoldCreek | 0.171 | 26/07/2013 | 100% |
| Commercial Development | Gungahlin Feeder | GoldCreek | 0.15 | 16/08/2013 | 90% |
| Residential Development | Magenta Feeder | GoldCreek | 0.06 | 16/08/2013 | 100% |
| Commercial & Industrial | Gungahlin | GoldCreek | 0.115 | 1/10/2013 | 10% |
| Residential & Commercial | Anthony Rolfe | GoldCreek | 0.35 | 2/10/2013 | 100% |
| Commercial & Industrial | Gurrang | GoldCreek | 0.25 | 3/10/2013 | 100% |
| Commercial | Gungahlin Feeder | GoldCreek | 0.15 | 30/10/2013 | 40% |
| Commercial Development | Gribble feeder | GoldCreek | 0.18 | 31/10/2013 | 100% |
| Residential Development | Anthony Rolfe Feeder | GoldCreek | 0.065 | 13/11/2013 | 100% |
| Commercial & Industrial | Gungahlin / Gribble | GoldCreek | 0.7 | 28/11/2013 | 100% |
| Commercial Development | Gribble feeder | GoldCreek | 0.9 | 3/01/2014 | 90% |
| Residential & Commercial Development | Gurrang Feeder | GoldCreek | 0.315 | 2/02/2014 | 90% |
| Commercial Development | Saunders Feeder | GoldCreek | 0.144 | 1/01/2015 | 10% |
| Residential Development | Nona Feeder | GoldCreek | 0.475 | 1/01/2015 | 10% |

### 5.7.2 Gold Creek Zone Winter Forecast

**Model Selection**: Model with variables Year and 3DayHDD, selected based on stepwise procedures and checking against other statistical criteria. 3DayHDD is marginally significant.

**Model/Forecast (before adding block loads):**

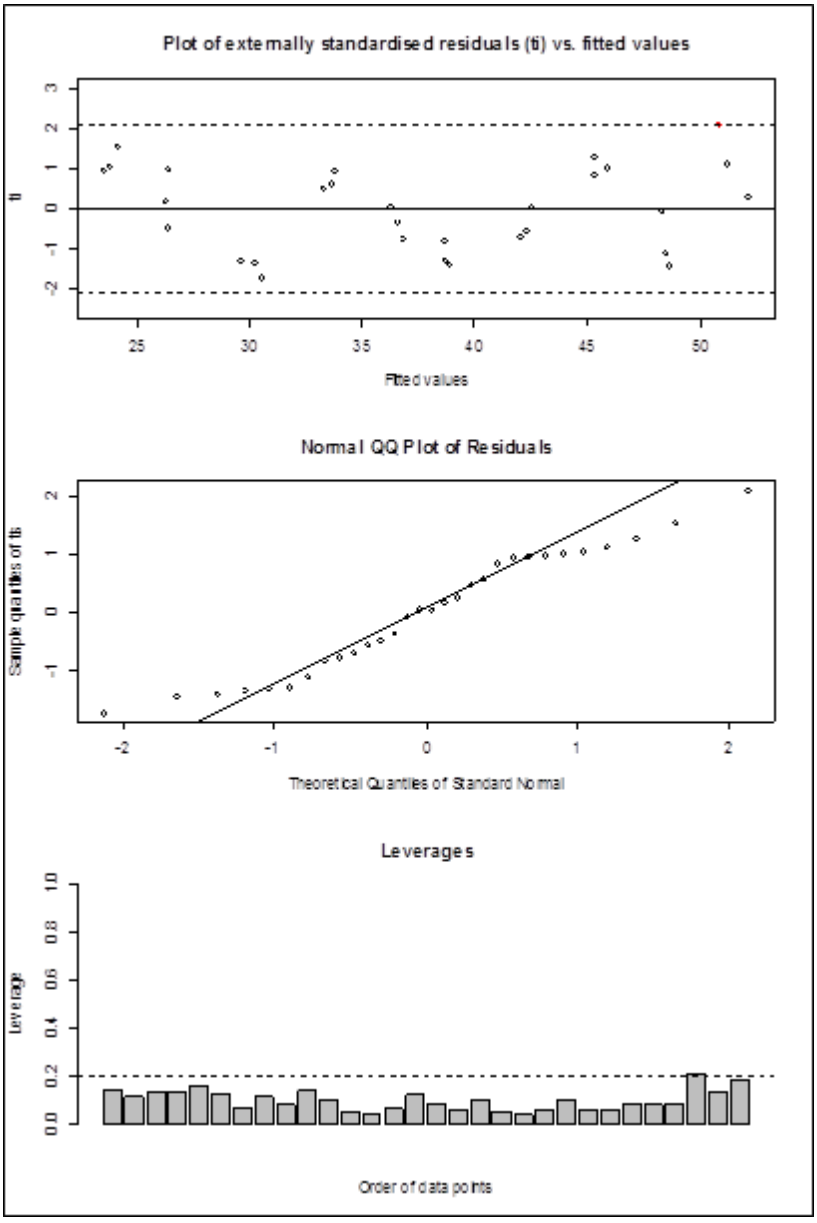
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



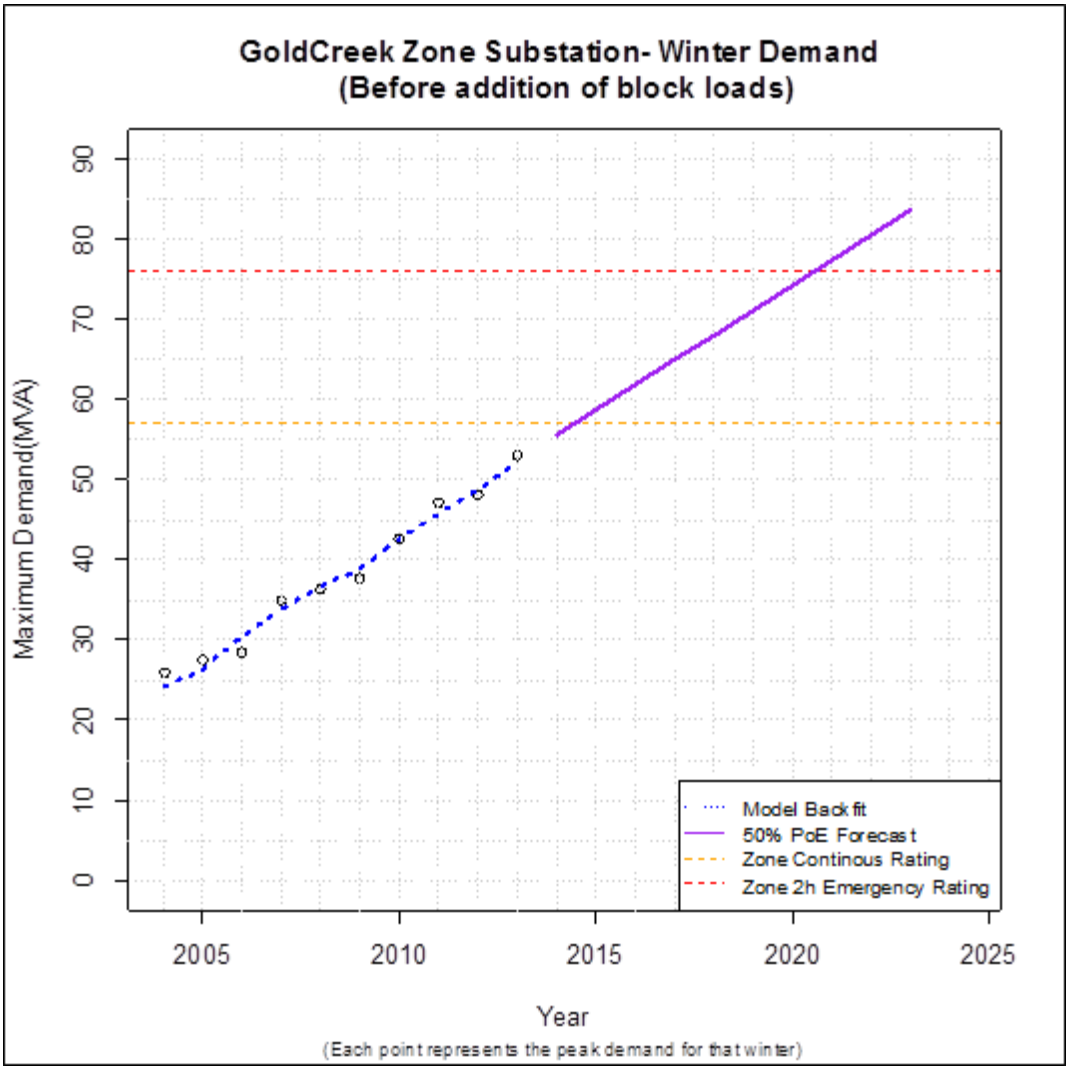

Model Details: Demand = -6215 + 3.11 * Year + 0.08 * 3DayHDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -6215 | 170.9 | -36.364 | <2e-16 |
| Year | 3.112 | 0.08495 | 36.634 | <2e-16 |
| 3DayHDD | 0.08481 | 0.04769 | 1.778 | 0.0866 |
| Residual standard error: 1.302 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.9809, Adjusted R-squared: 0.9795 | | | | |
| F-statistic: 693.2 on 2 and 27 DF, p-value: < 2.2e-16 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



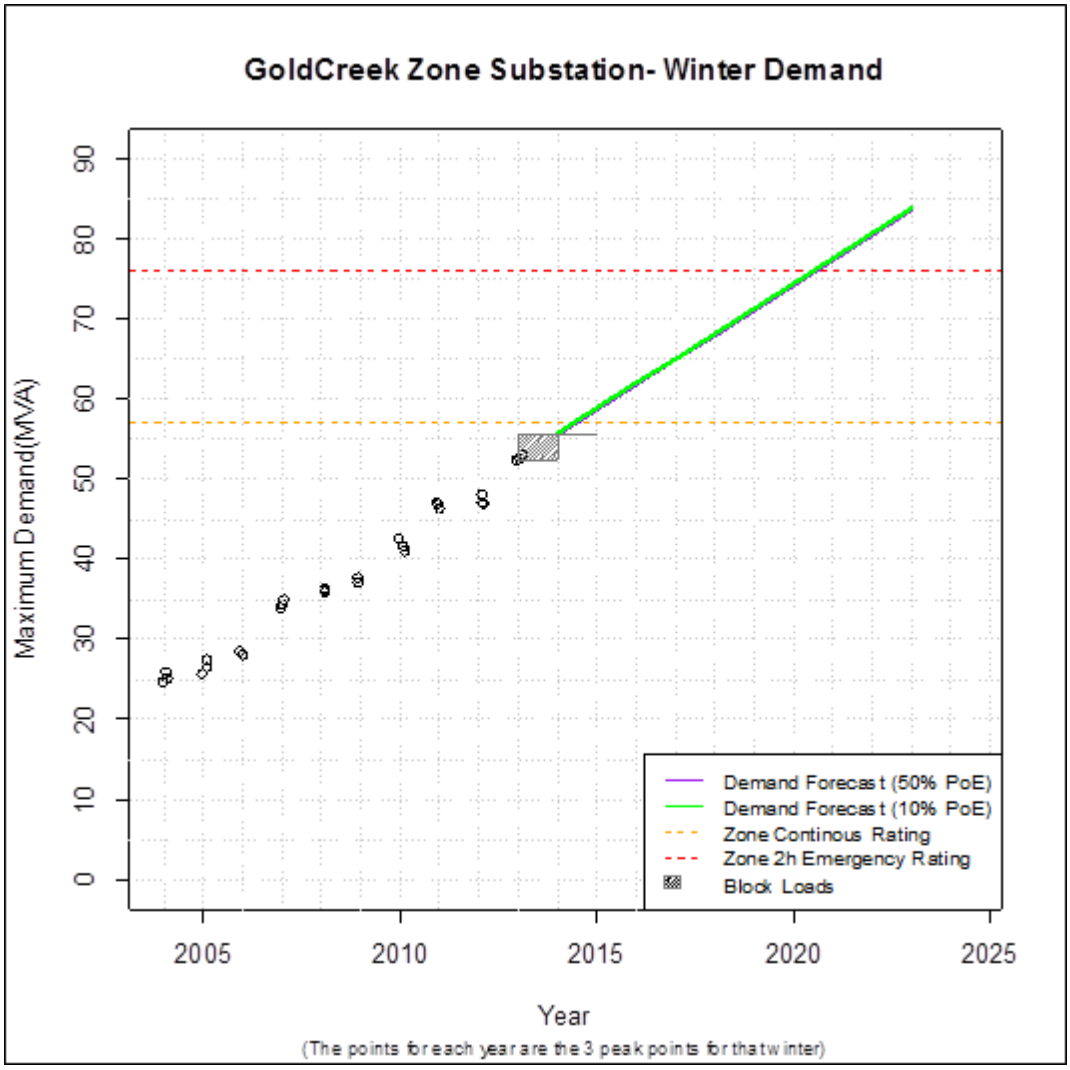
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Gold Creek Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 26 | 24.19 | -7% | 7% |
| 2005 | 27.6 | 26.41 | -4% | 4% |
| 2006 | 28.56 | 30.53 | 7% | 7% |
| 2007 | 34.93 | 33.78 | -3% | 3% |
| 2008 | 36.35 | 36.83 | 1% | 1% |
| 2009 | 37.69 | 38.88 | 3% | 3% |
| 2010 | 42.61 | 42.54 | 0% | 0% |
| 2011 | 47.11 | 45.85 | -3% | 3% |
| 2012 | 48.19 | 48.62 | 1% | 1% |
| 2013 | 53.11 | 52.16 | -2% | 2% |
| | | Average | -1% | 3% |

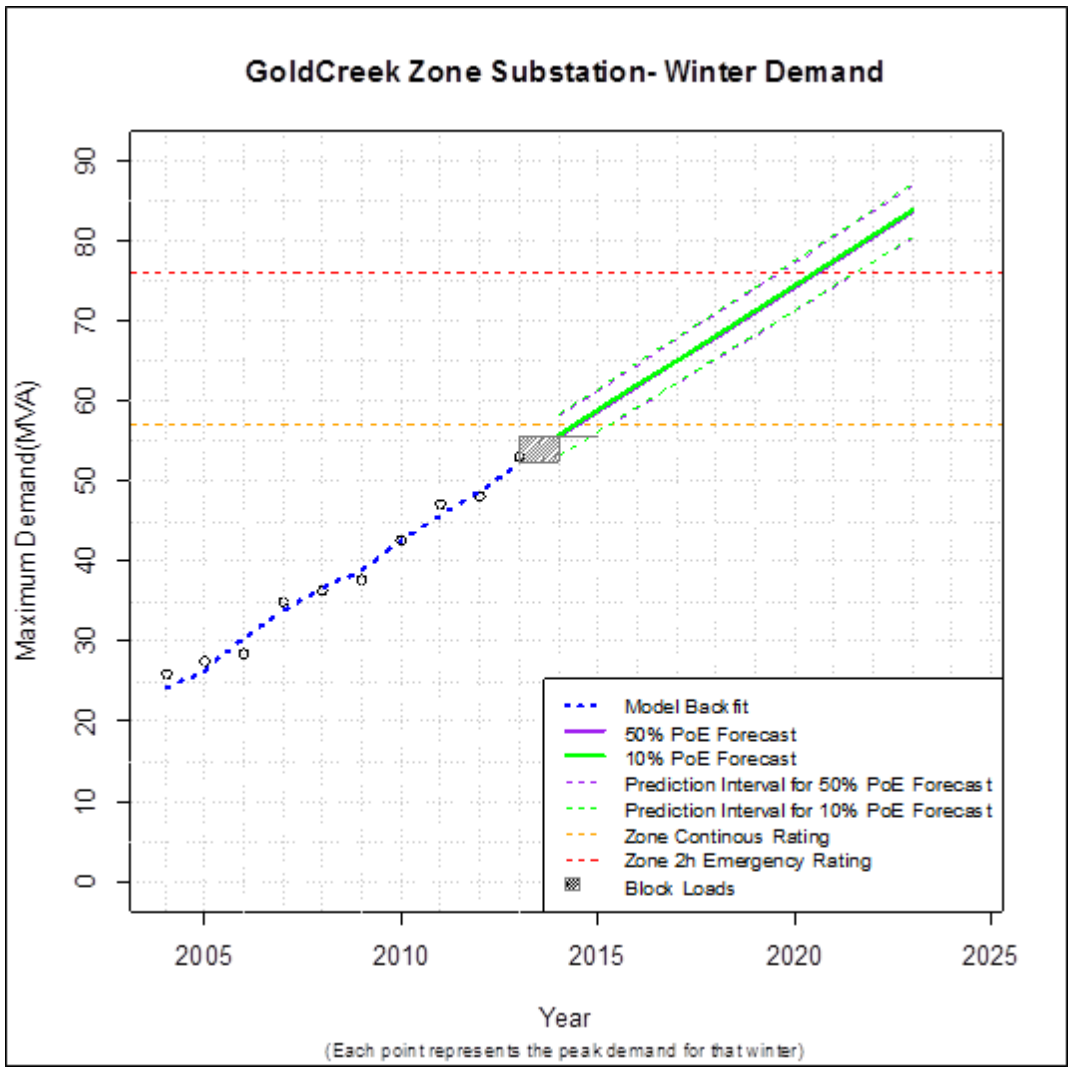
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 55.6 | 55.7 |
| 2015 | 58.7 | 58.9 |
| 2016 | 61.8 | 62.0 |
| 2017 | 64.9 | 65.1 |
| 2018 | 68.0 | 68.2 |
| 2019 | 71.1 | 71.3 |
| 2020 | 74.2 | 74.4 |
| 2021 | 77.4 | 77.5 |
| 2022 | 80.5 | 80.6 |
| 2023 | 83.6 | 83.7 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial Development | Riley Feeder | GoldCreek | 0.171 | 26/07/2013 | 100% |
| Commercial Development | Gungahlin Feeder | GoldCreek | 0.15 | 16/08/2013 | 90% |
| Residential Development | Magenta Feeder | GoldCreek | 0.06 | 16/08/2013 | 100% |
| Commercial & Industrial | Gungahlin | GoldCreek | 0.115 | 1/10/2013 | 10% |
| Residential & Commercial | Anthony Rolfe | GoldCreek | 0.35 | 2/10/2013 | 100% |
| Commercial & Industrial | Gurrang | GoldCreek | 0.25 | 3/10/2013 | 100% |
| Commercial | Gungahlin Feeder | GoldCreek | 0.15 | 30/10/2013 | 40% |
| Commercial Development | Gribble feeder | GoldCreek | 0.18 | 31/10/2013 | 100% |
| Residential Development | Anthony Rolfe Feeder | GoldCreek | 0.065 | 13/11/2013 | 100% |
| Commercial & Industrial | Gungahlin / Gribble | GoldCreek | 0.7 | 28/11/2013 | 100% |
| Commercial Development | Gribble feeder | GoldCreek | 0.9 | 3/01/2014 | 90% |
| Residential & Commercial Development | Gurrang Feeder | GoldCreek | 0.315 | 2/02/2014 | 90% |
| Commercial Development | Saunders Feeder | GoldCreek | 0.144 | 1/01/2015 | 10% |
| Residential Development | Nona Feeder | GoldCreek | 0.475 | 1/01/2015 | 10% |

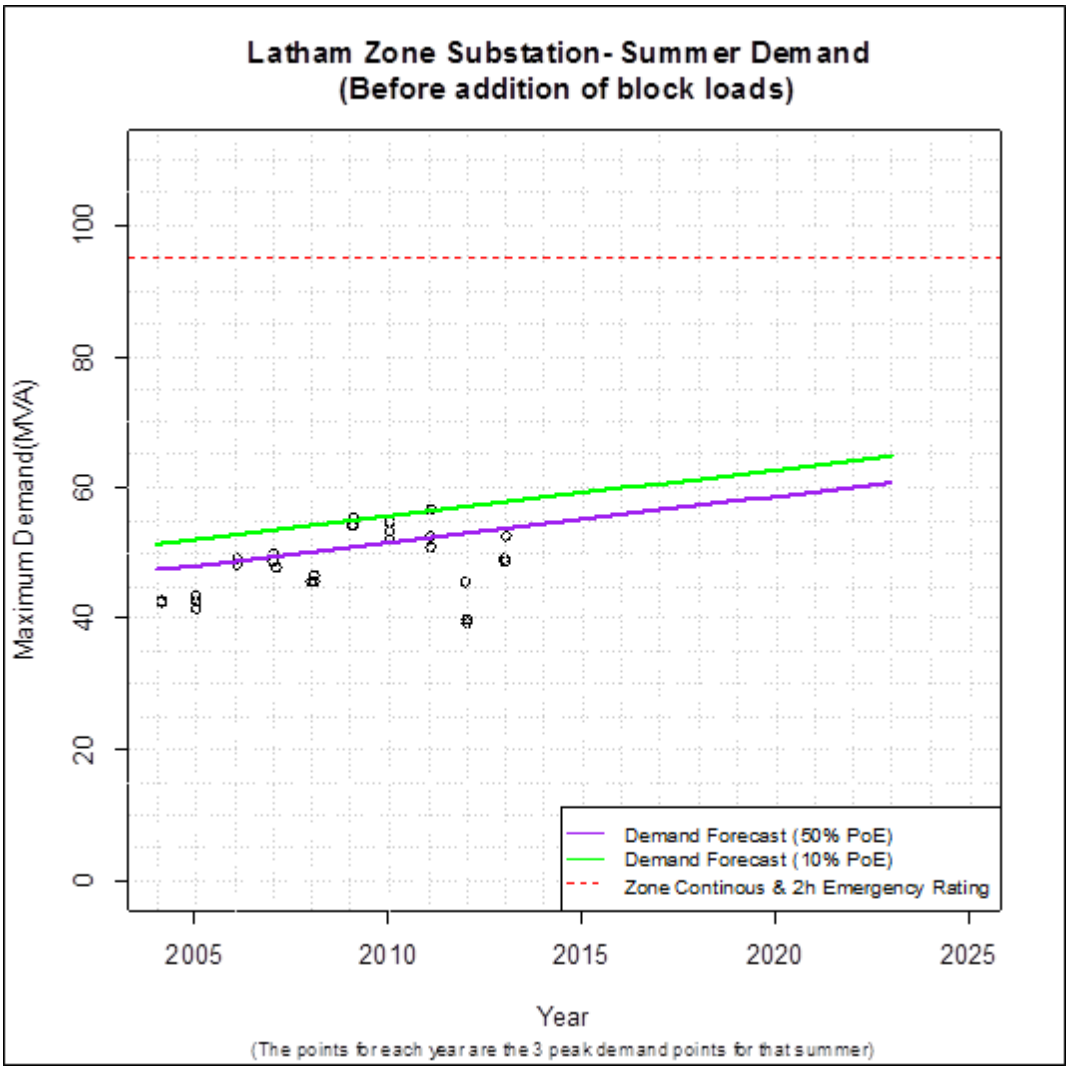
## 5.8 Latham Zone

### 5.8.1 Latham Zone Summer Forecast

**Model Selection**: Model with variables Year and CDD, selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

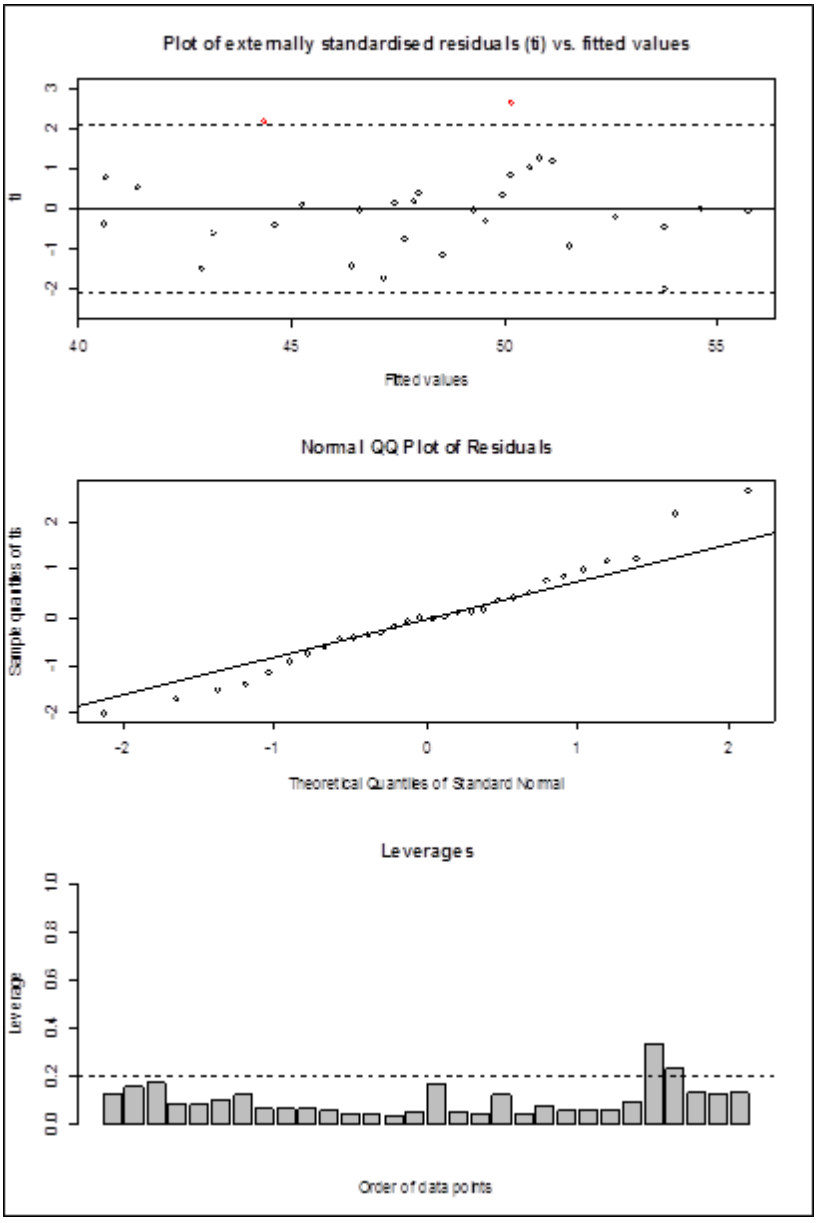
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



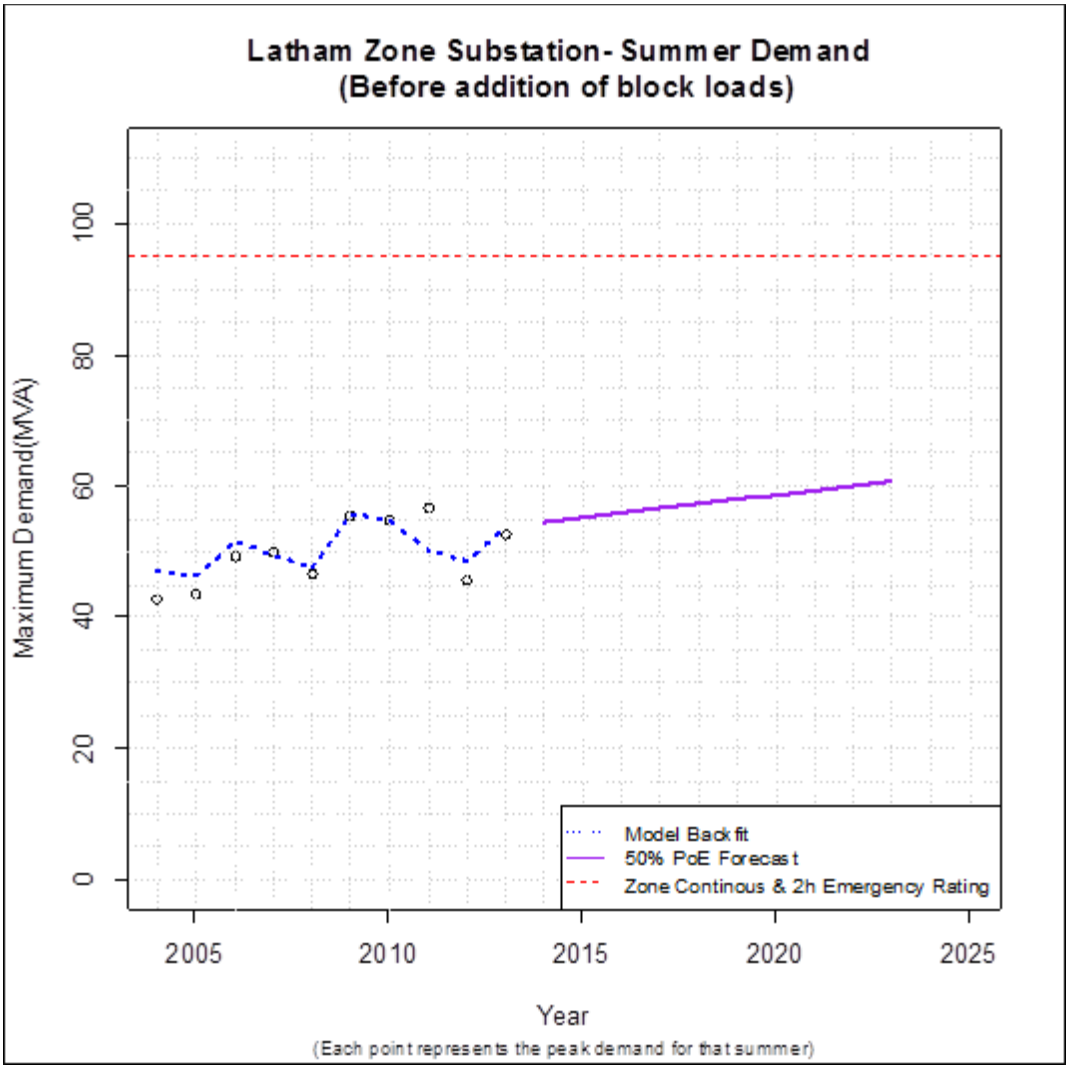

Model Details: Demand = -1380.87 + 0.70 * Year + 1.92 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -1380.8673 | 359.6953 | -3.839 | 0.000677 |
| Year | 0.7033 | 0.179 | 3.929 | 0.000534 |
| CDD | 1.9181 | 0.2751 | 6.973 | 1.70E-07 |
| Residual standard error: 2.813 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.6945, Adjusted R-squared: 0.6718 | | | | |
| F-statistic: 30.69 on 2 and 27 DF, p-value: 1.118e-07 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



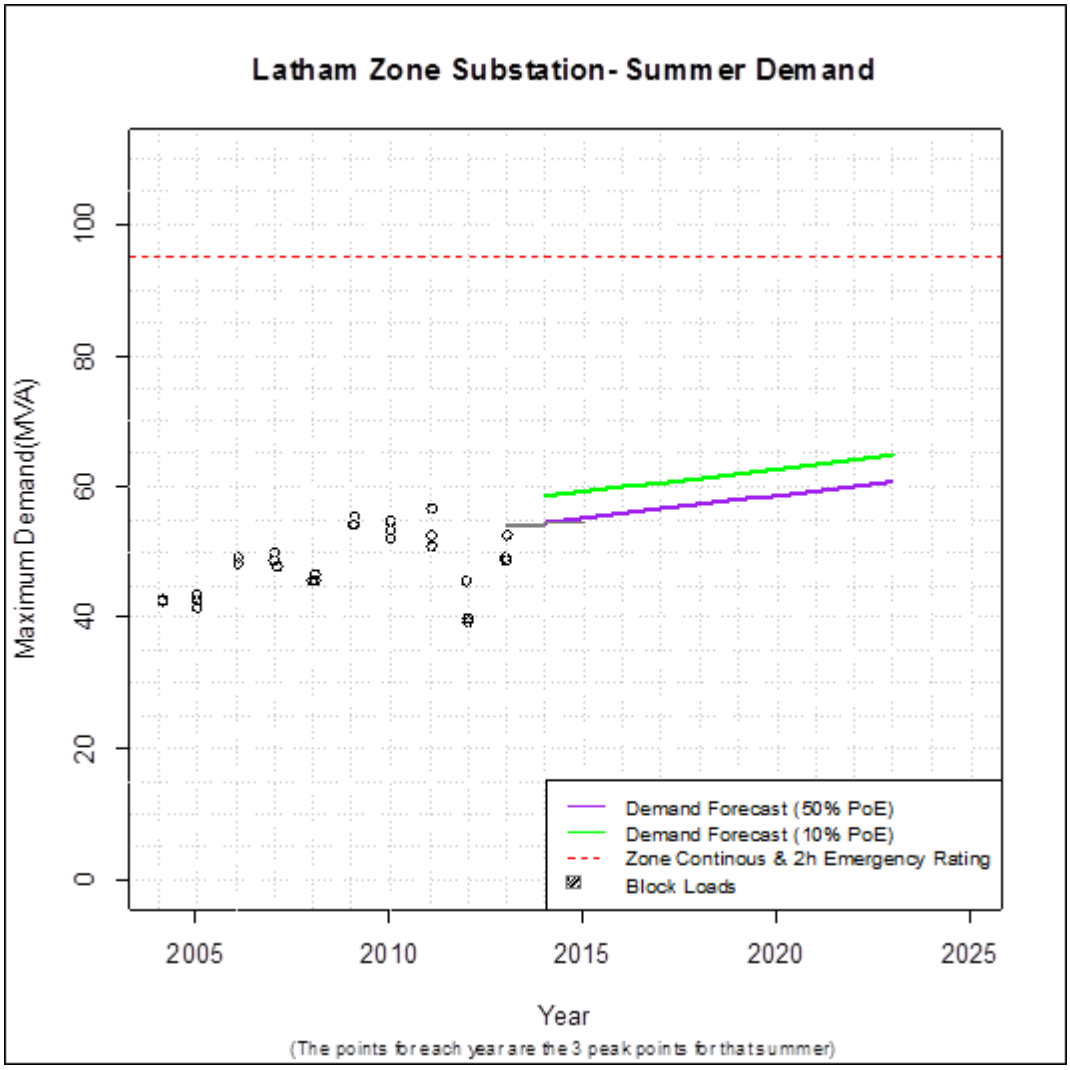
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Latham Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 42.81 | 47.14 | 10% | 10% |
| 2005 | 43.47 | 46.41 | 7% | 7% |
| 2006 | 49.12 | 51.52 | 5% | 5% |
| 2007 | 49.9 | 49.54 | -1% | 1% |
| 2008 | 46.57 | 47.65 | 2% | 2% |
| 2009 | 55.56 | 55.74 | 0% | 0% |
| 2010 | 54.69 | 54.62 | 0% | 0% |
| 2011 | 56.69 | 50.15 | -12% | 12% |
| 2012 | 45.51 | 48.55 | 7% | 7% |
| 2013 | 52.58 | 53.76 | 2% | 2% |
| | | Average | 2% | 5% |

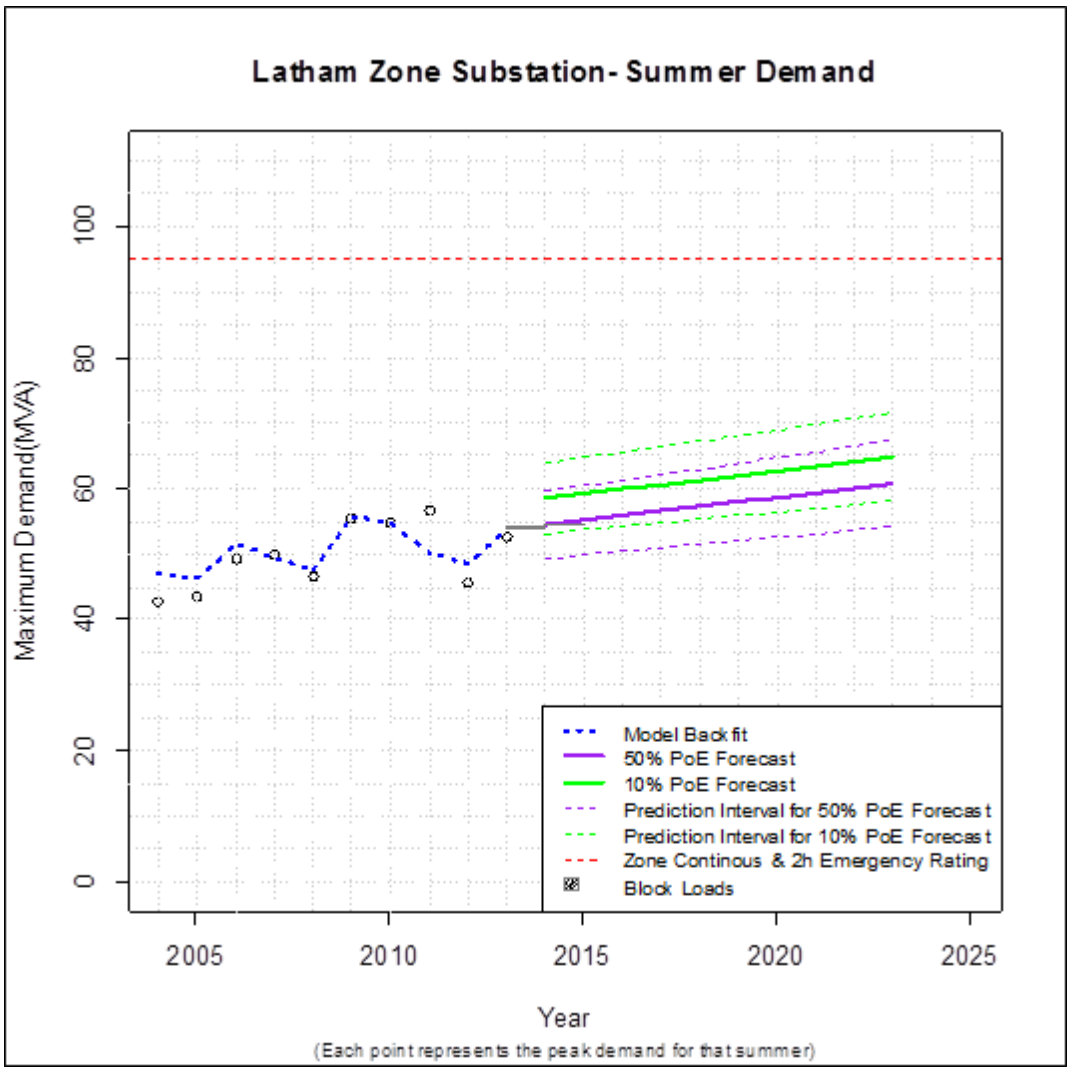
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 54.5 | 58.5 |
| 2015 | 55.2 | 59.2 |
| 2016 | 55.9 | 59.9 |
| 2017 | 56.6 | 60.6 |
| 2018 | 57.3 | 61.3 |
| 2019 | 58.0 | 62.0 |
| 2020 | 58.7 | 62.7 |
| 2021 | 59.4 | 63.4 |
| 2022 | 60.1 | 64.1 |
| 2023 | 60.8 | 64.8 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

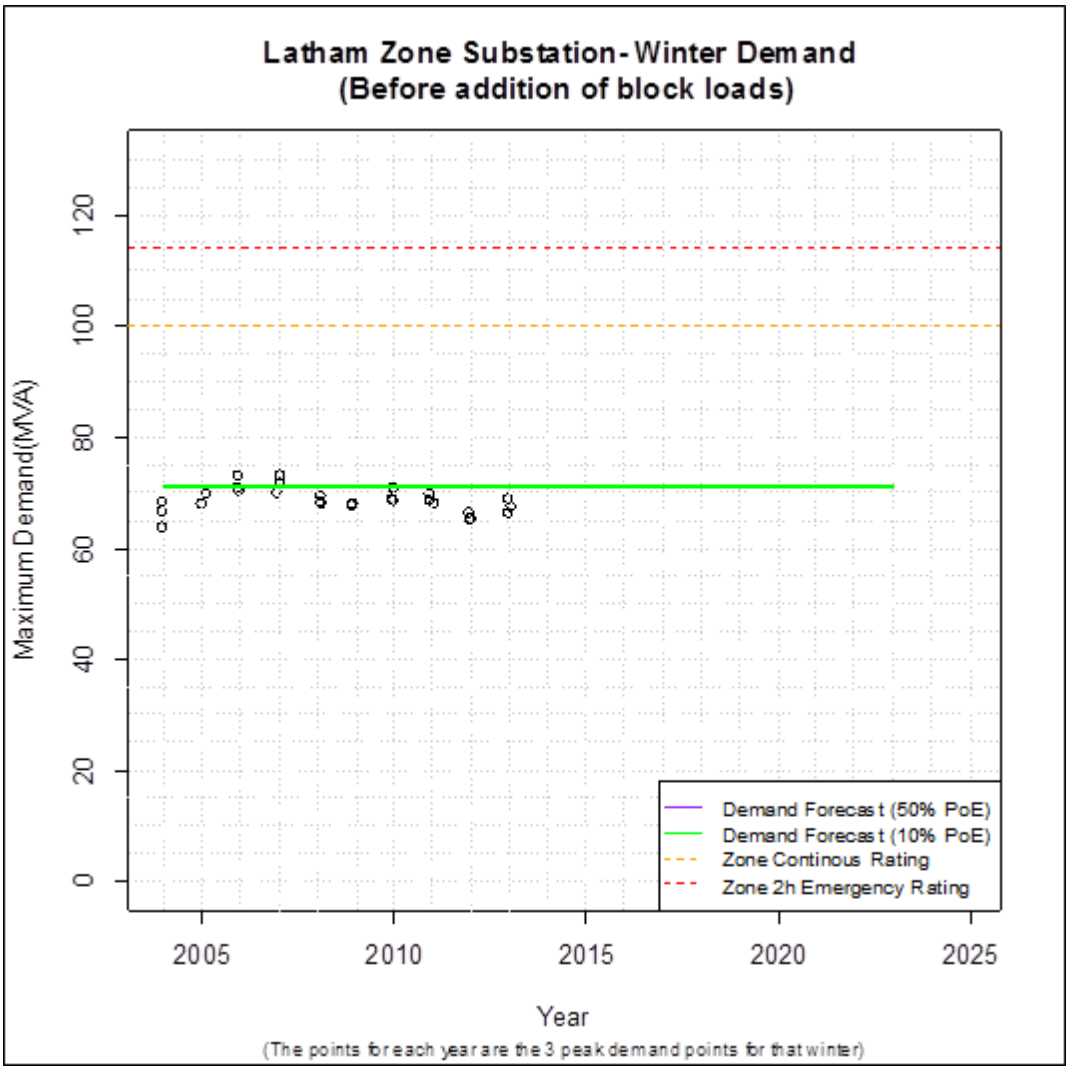
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial & industrial | Bowley Feeder | Latham | 0.13 | 20/02/2013 | 100% |
| Commercial & industrial | Tillyard Feeder | Latham | 0.225 | 17/04/2013 | 100% |
| Residential Development | Verbrugghen Feeder | Latham | 0.02 | 21/05/2013 | 100% |
| Residential & Commercial Development | Patrick Feeder | Latham | 0.077 | 27/06/2013 | 100% |
| Commercial Development | Bowley Feeder | Latham | 0.13 | 1/01/2015 | 10% |
| Commercial Development | Fielder Feeder | Latham | 0.08 | 1/01/2015 | 10% |
| Commercial Development | Patrick Feeder 2 | Latham | 0.13 | 1/01/2015 | 90% |

### 5.8.2 Latham Zone Winter Forecast

**Model Selection**: Model with variable 3DayHDD, selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

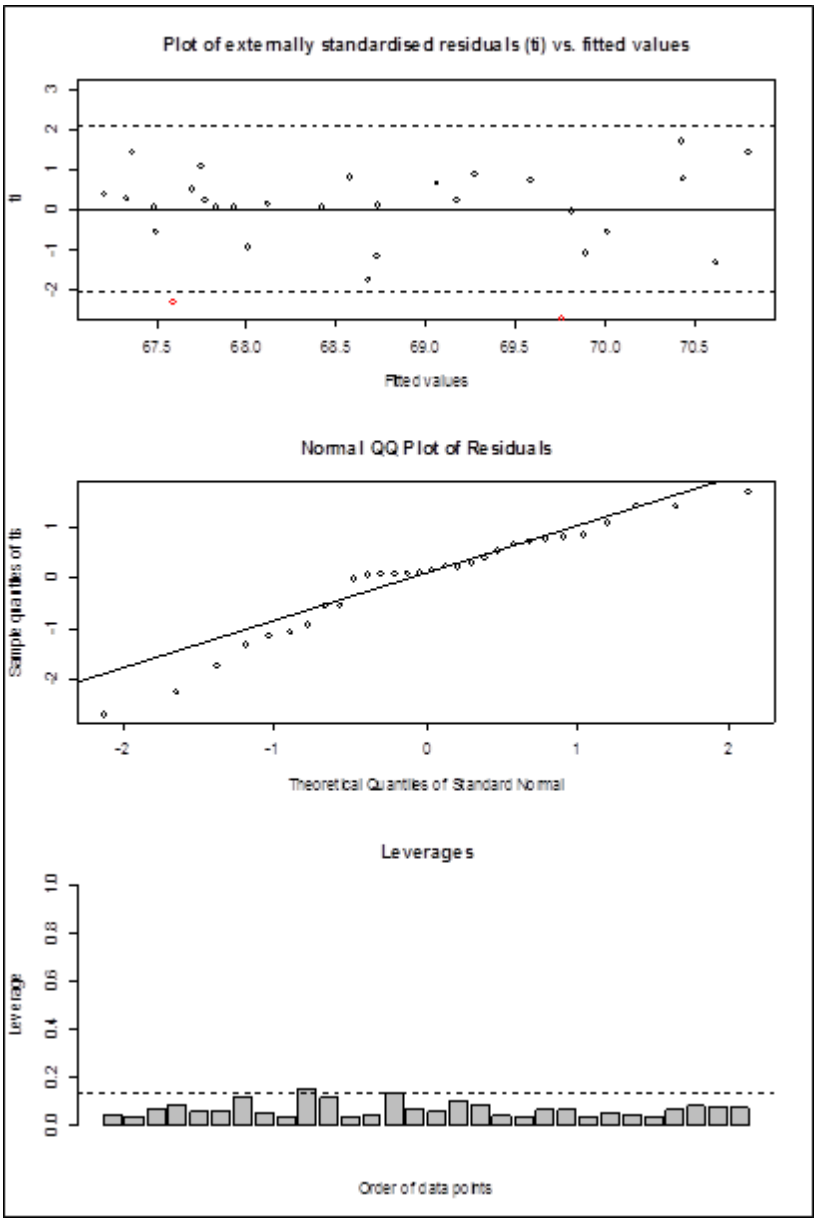
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



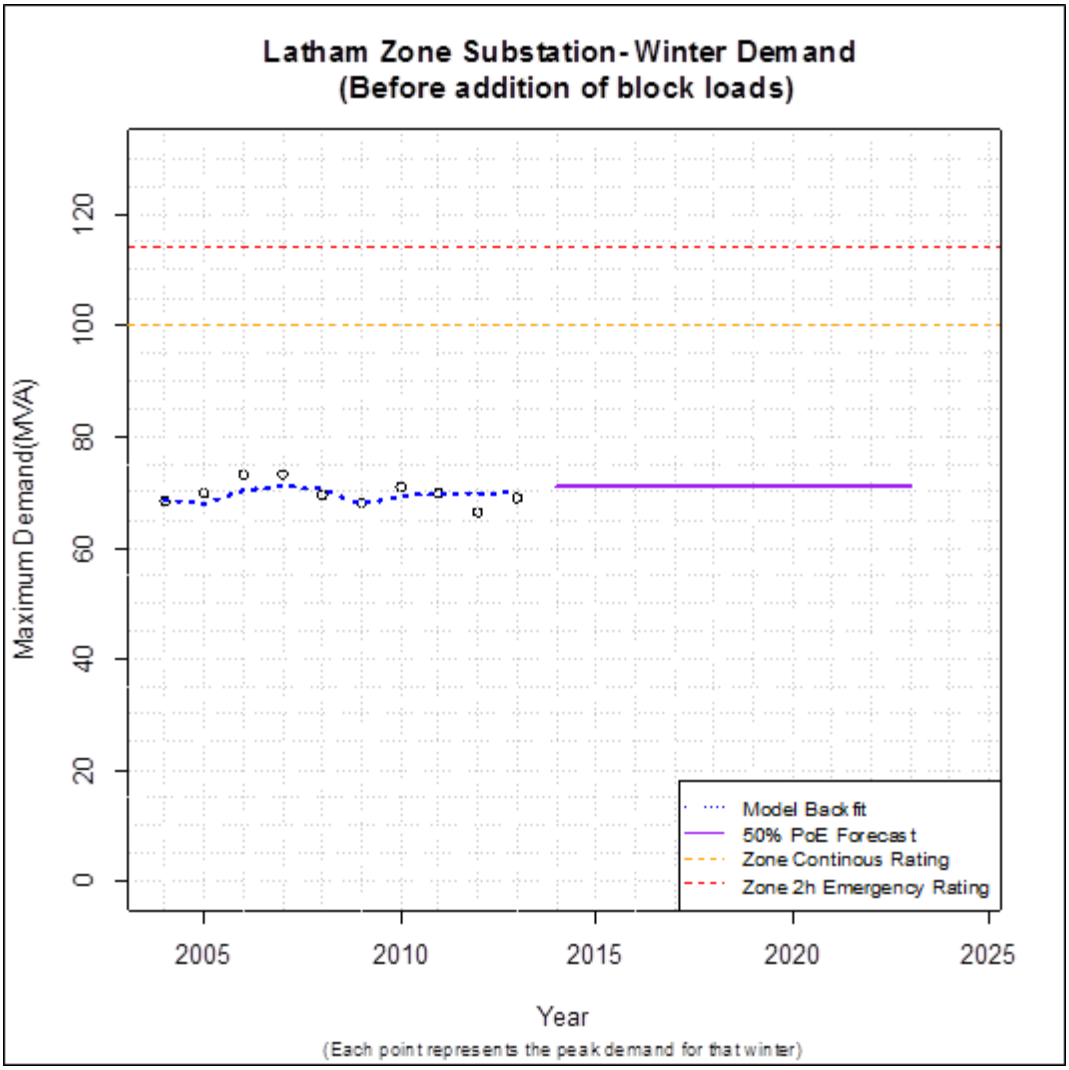

Model Details: Demand = 62.79 + 0.22 * 3DayHDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 62.7877 | 1.88123 | 33.376 | < 2e-16 |
| 3DayHDD | 0.22321 | 0.06963 | 3.206 | 0.00336 |
| Residual standard error: 1.873 on 28 degrees of freedom | | | | |
| Multiple R-squared: 0.2685, Adjusted R-squared: 0.2424 | | | | |
| F-statistic: 10.28 on 1 and 28 DF, p-value: 0.003356 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



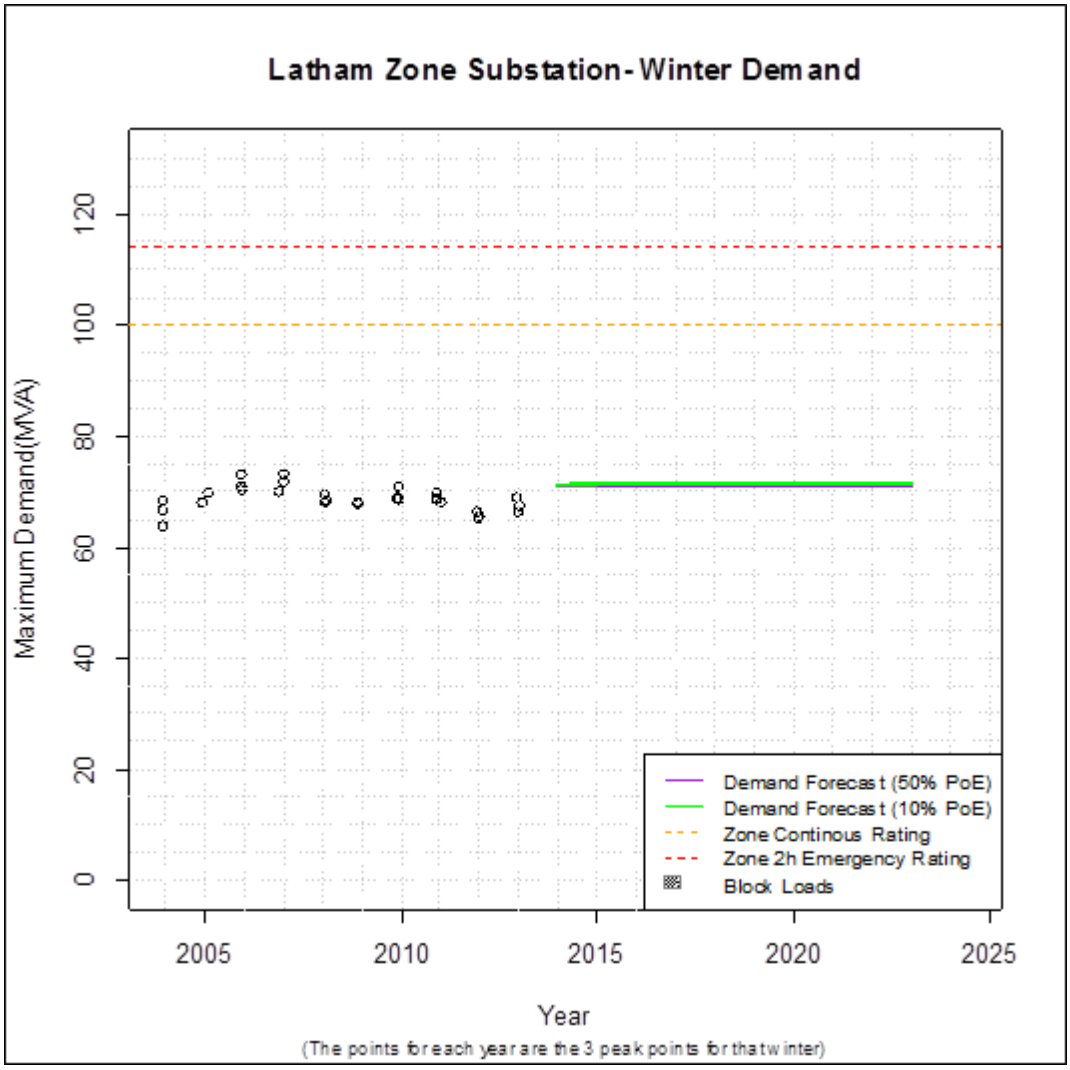
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Latham Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 68.43 | 68.73 | 0% | 0% |
| 2005 | 69.88 | 67.77 | -3% | 3% |
| 2006 | 73.33 | 70.42 | -4% | 4% |
| 2007 | 73.21 | 70.80 | -3% | 3% |
| 2008 | 69.62 | 70.62 | 1% | 1% |
| 2009 | 68 | 67.83 | 0% | 0% |
| 2010 | 70.87 | 69.27 | -2% | 2% |
| 2011 | 69.76 | 69.81 | 0% | 0% |
| 2012 | 66.33 | 69.75 | 5% | 5% |
| 2013 | 69.04 | 70.01 | 1% | 1% |
| | | Average | 0% | 2% |

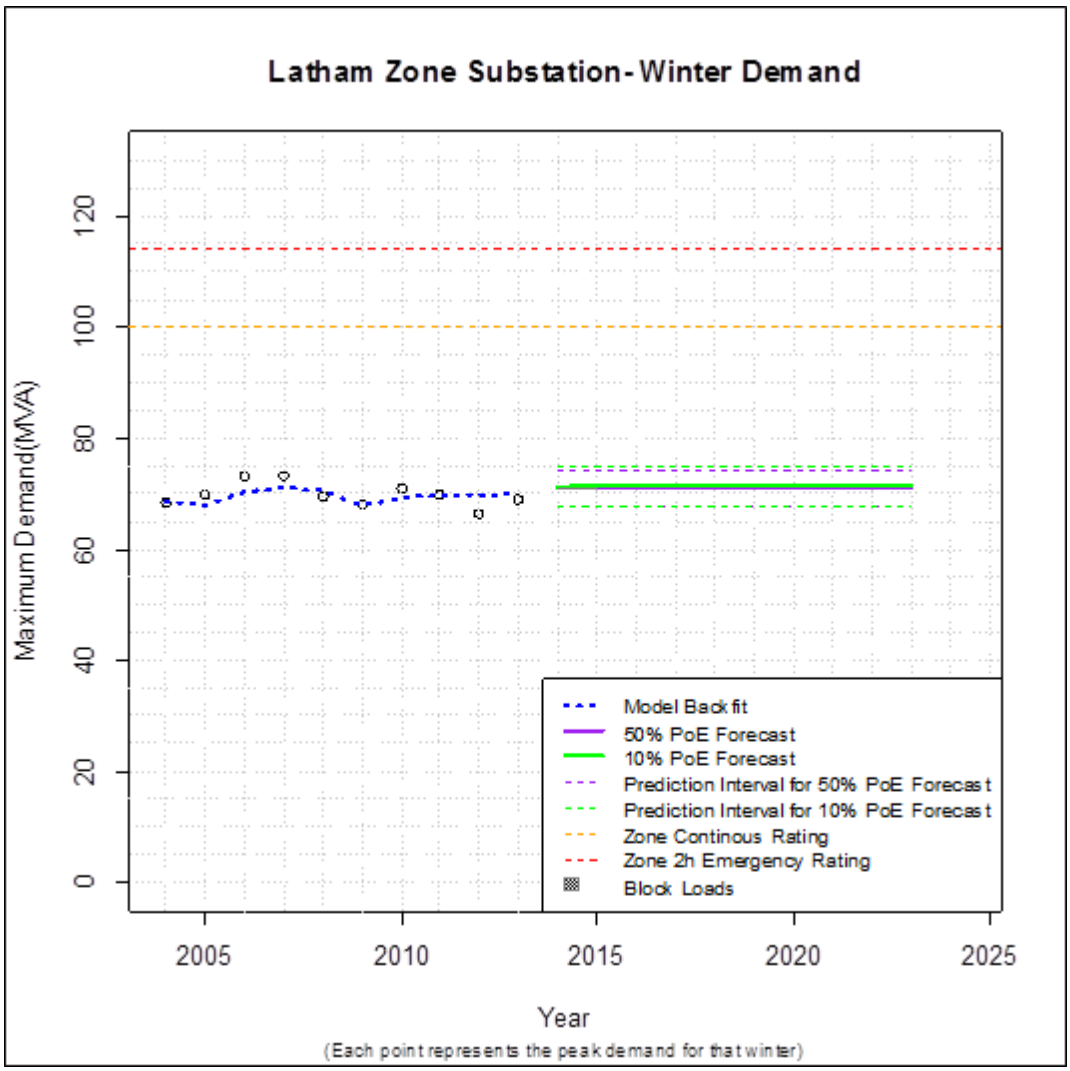
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter ending Aug | 50% PoE (in MVA) | 50% PoE (in MVA) |
| 2014 | 70.8 | 71.2 |
| 2015 | 71.0 | 71.4 |
| 2016 | 71.0 | 71.4 |
| 2017 | 71.0 | 71.4 |
| 2018 | 71.0 | 71.4 |
| 2019 | 71.0 | 71.4 |
| 2020 | 71.0 | 71.4 |
| 2021 | 71.0 | 71.4 |
| 2022 | 71.0 | 71.4 |
| 2023 | 71.0 | 71.4 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial Development | Bowley Feeder | Latham | 0.13 | 1/01/2015 | 10% |
| Commercial Development | Fielder Feeder | Latham | 0.08 | 1/01/2015 | 10% |
| Commercial Development | Patrick Feeder 2 | Latham | 0.13 | 1/01/2015 | 90% |

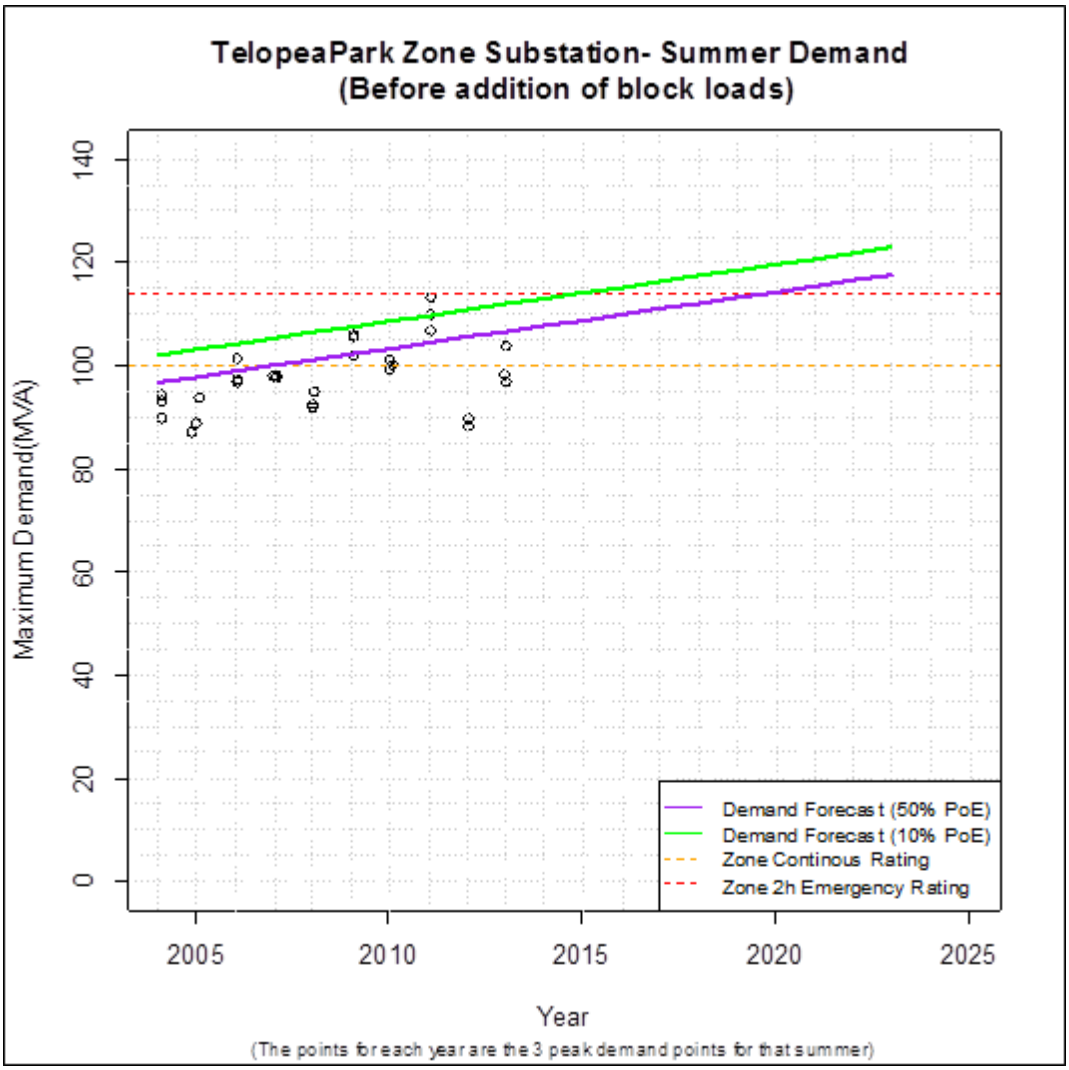
## 5.9 Telopea Park Zone

### 5.9.1 Telopea Park Zone Summer Forecast

**Model Selection**: Model with variables Year, CDD and 3DayCDD selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

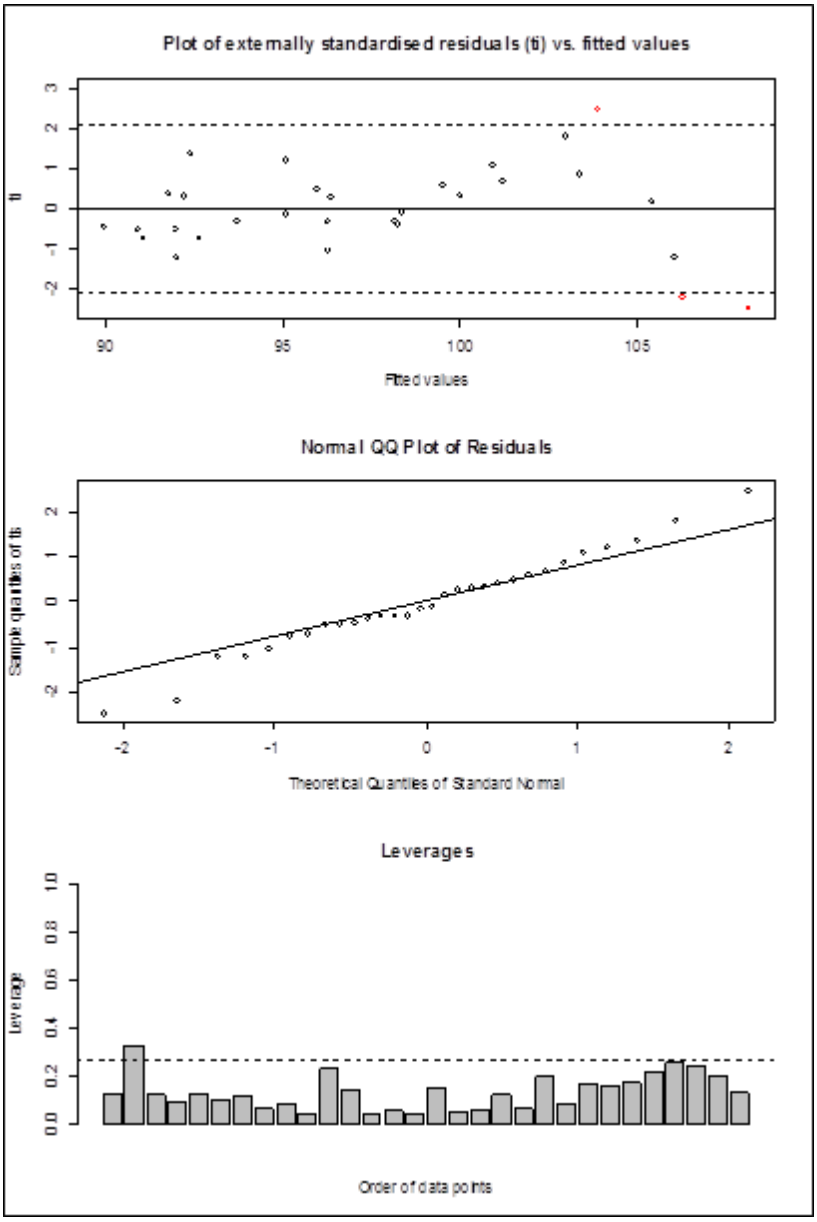
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



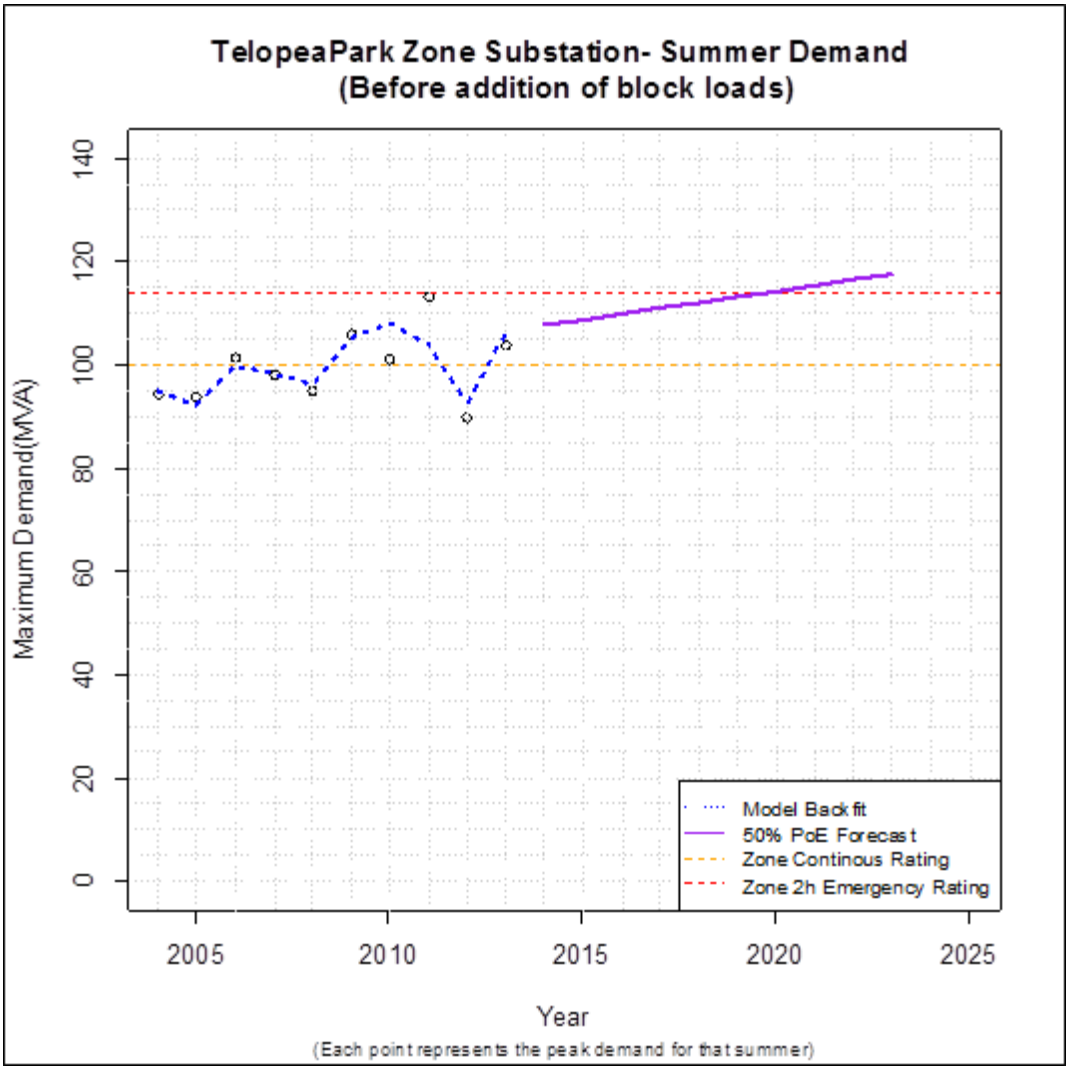

Model Details: Demand = -2128.04 + 1.10 * Year + 1.66 * CDD + 0.35 * 3DayCDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -2128.0409 | 585.0098 | -3.638 | 0.001194 |
| Year | 1.0975 | 0.291 | 3.772 | 0.000845 |
| CDD | 1.6552 | 0.4722 | 3.505 | 1.67E-03 |
| 3DayCDD | 0.3514 | 0.1613 | 2.178 | 3.87E-02 |
| Residual standard error: 4.411 on 26 degrees of freedom | | | | |
| Multiple R-squared: 0.616, Adjusted R-squared: 0.5716 | | | | |
| F-statistic: 13.9 on 3 and 26 DF, p-value: 1.327e-05 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



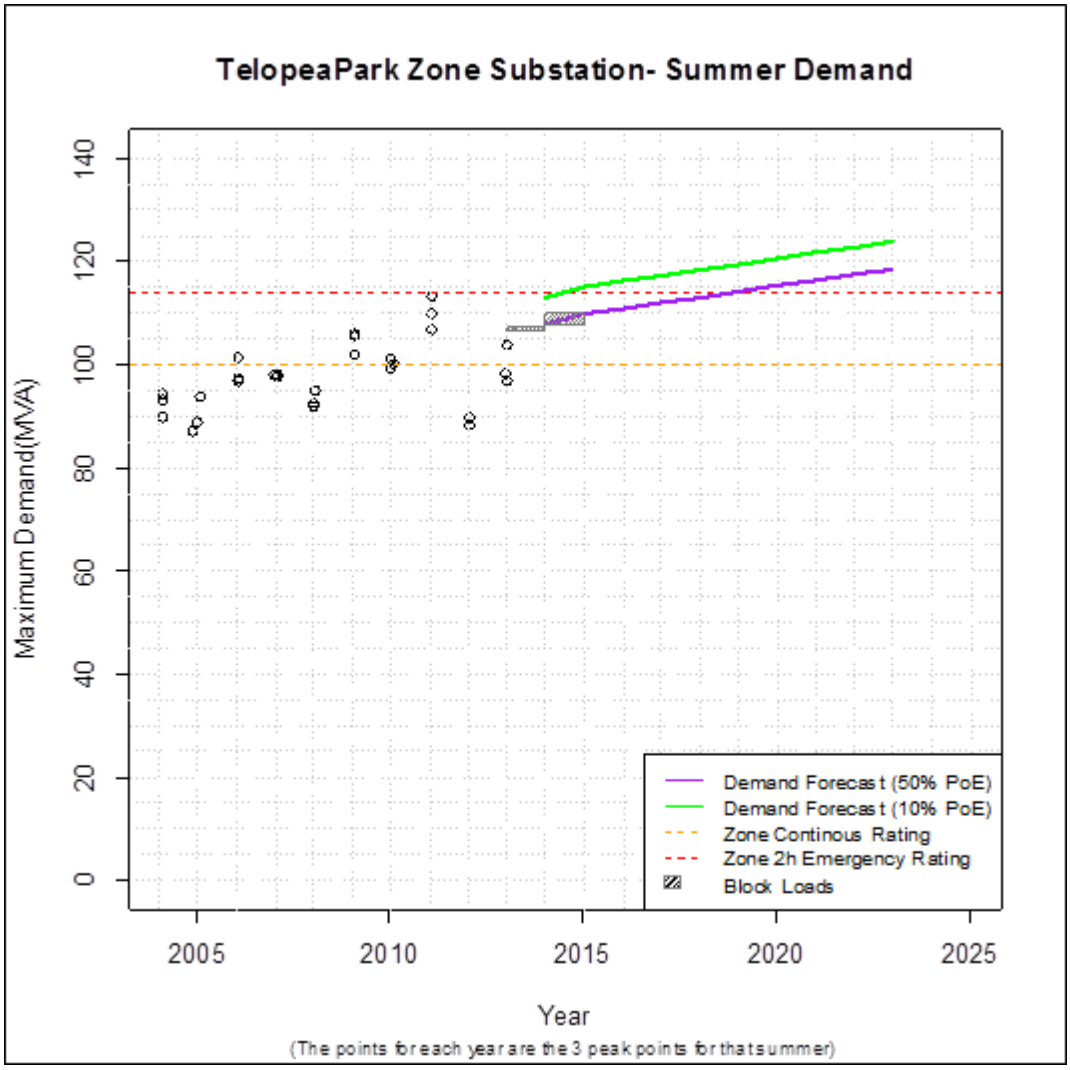
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Telopea Park Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 94.47 | 95.07 | 1% | 1% |
| 2005 | 93.67 | 92.21 | -2% | 2% |
| 2006 | 101.38 | 100.01 | -1% | 1% |
| 2007 | 98.19 | 98.36 | 0% | 0% |
| 2008 | 94.95 | 96.28 | 1% | 1% |
| 2009 | 106.12 | 105.42 | -1% | 1% |
| 2010 | 101.11 | 108.13 | 7% | 7% |
| 2011 | 113.35 | 103.85 | -8% | 8% |
| 2012 | 89.7 | 92.65 | 3% | 3% |
| 2013 | 103.91 | 106.27 | 2% | 2% |
| | | Average | 0% | 3% |

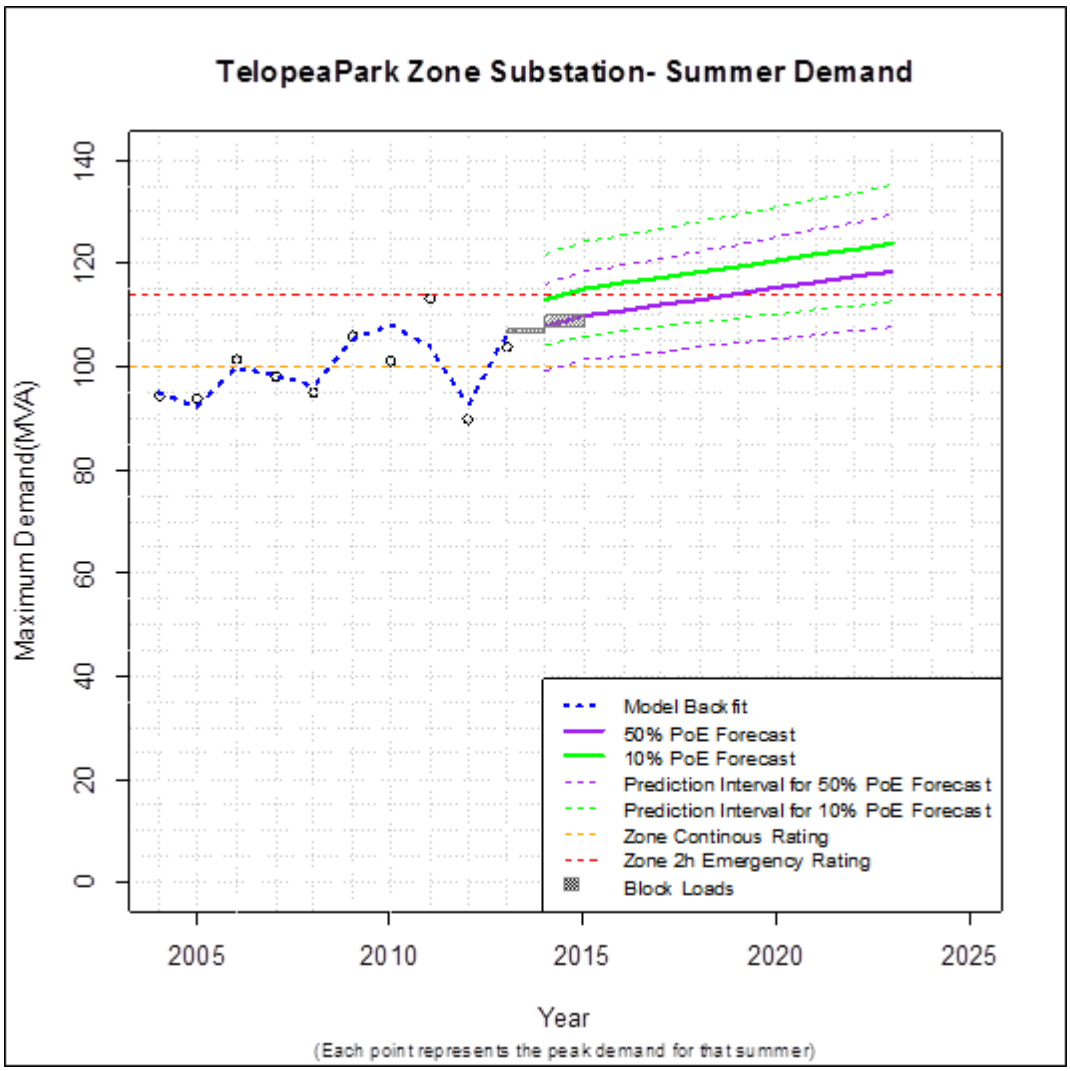
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 107.8 | 113.1 |
| 2015 | 109.8 | 115.2 |
| 2016 | 110.9 | 116.2 |
| 2017 | 112.0 | 117.3 |
| 2018 | 113.1 | 118.4 |
| 2019 | 114.2 | 119.5 |
| 2020 | 115.3 | 120.6 |
| 2021 | 116.4 | 121.7 |
| 2022 | 117.5 | 122.8 |
| 2023 | 118.6 | 123.9 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

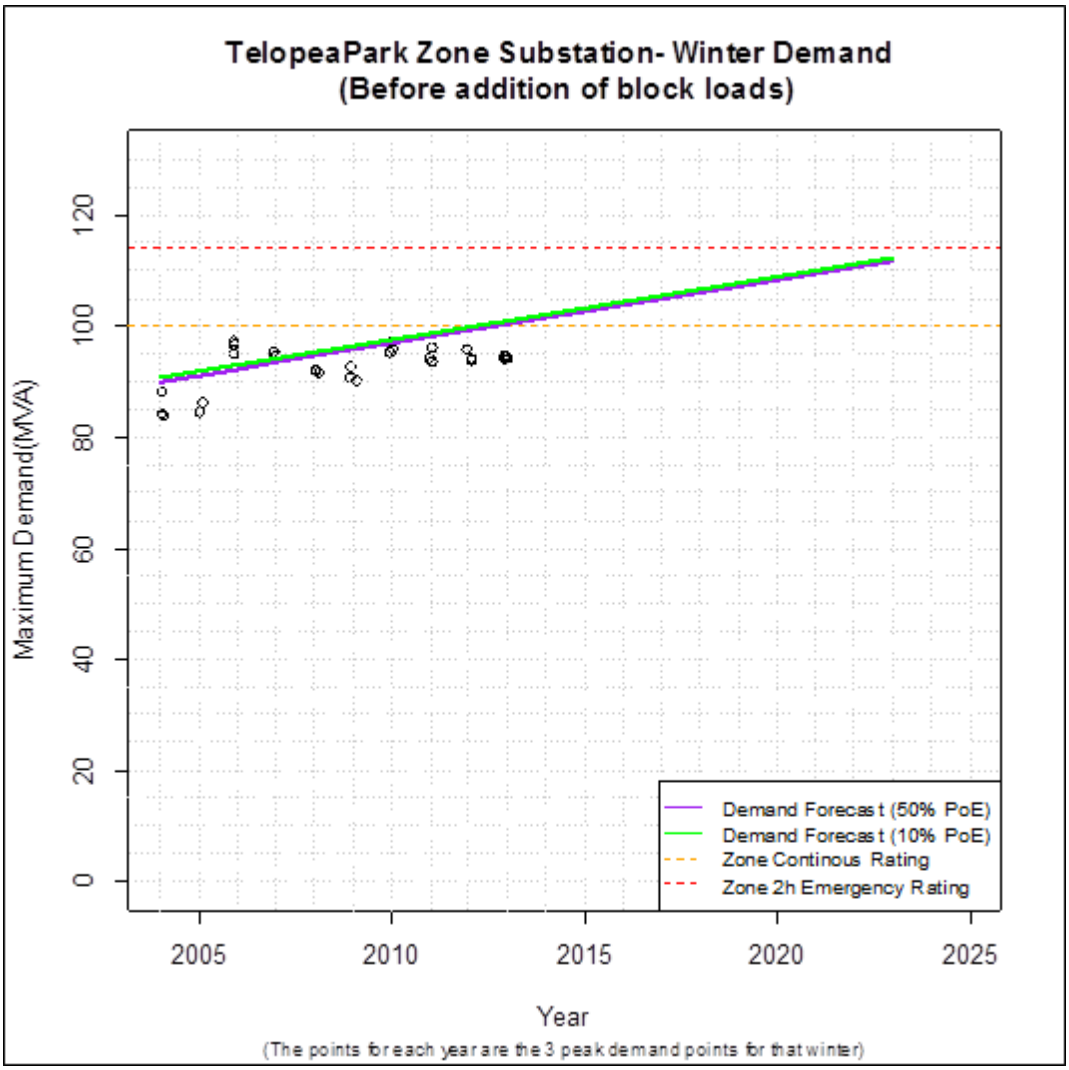
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Residential Development | Strzelecki Feeder | Telopea | 0.065 | 15/04/2013 | 100% |
| Residential Development | Monash Feeder | Telopea | 0.24 | 16/04/2013 | 100% |
| Residential Development | Monash Feeder | Telopea | 0.24 | 22/04/2013 | 100% |
| Commercial | Sandalwood Feeder | Telopea | 0.06 | 13/05/2013 | 100% |
| Commercial | Forester Feeder | Telopea | 0.06 | 14/08/2013 | 100% |
| Residential Development | Monash Feeder | Telopea | 0.5 | 20/05/2014 | 95% |
| Commercial | Mundaring Feeder | Telopea | 1.4 | 15/07/2014 | 90% |
| Commercial | Young feeder | Telopea | 0.31 | 1/08/2014 | 90% |
| Commercial Development | Giles St Feeder | Telopea | 0.55 | 1/01/2015 | 10% |
| Residential Development | Jardine Feeder | Telopea | 0.06 | 1/01/2015 | 10% |

### 5.9.2 Telopea Park Zone Winter Forecast

**Model Selection**: Model with variables Year and 3DayHDD, selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

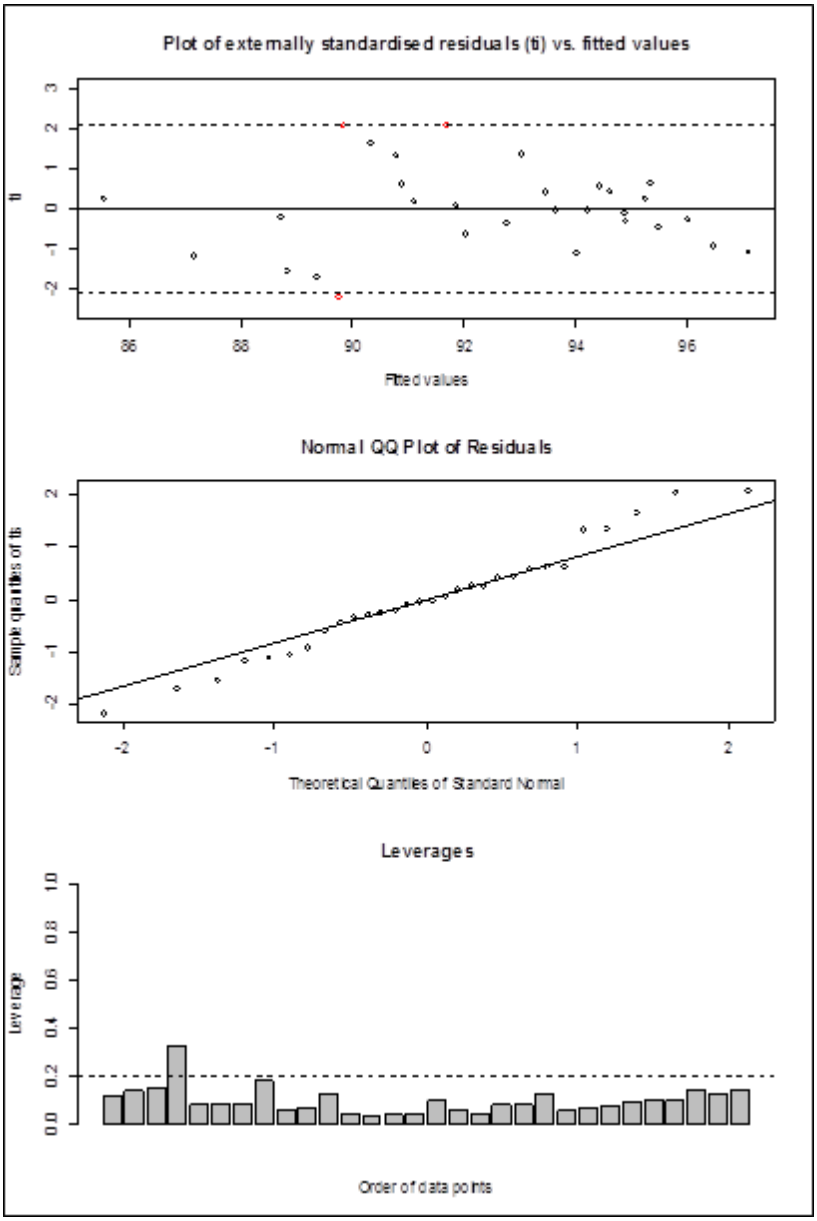
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



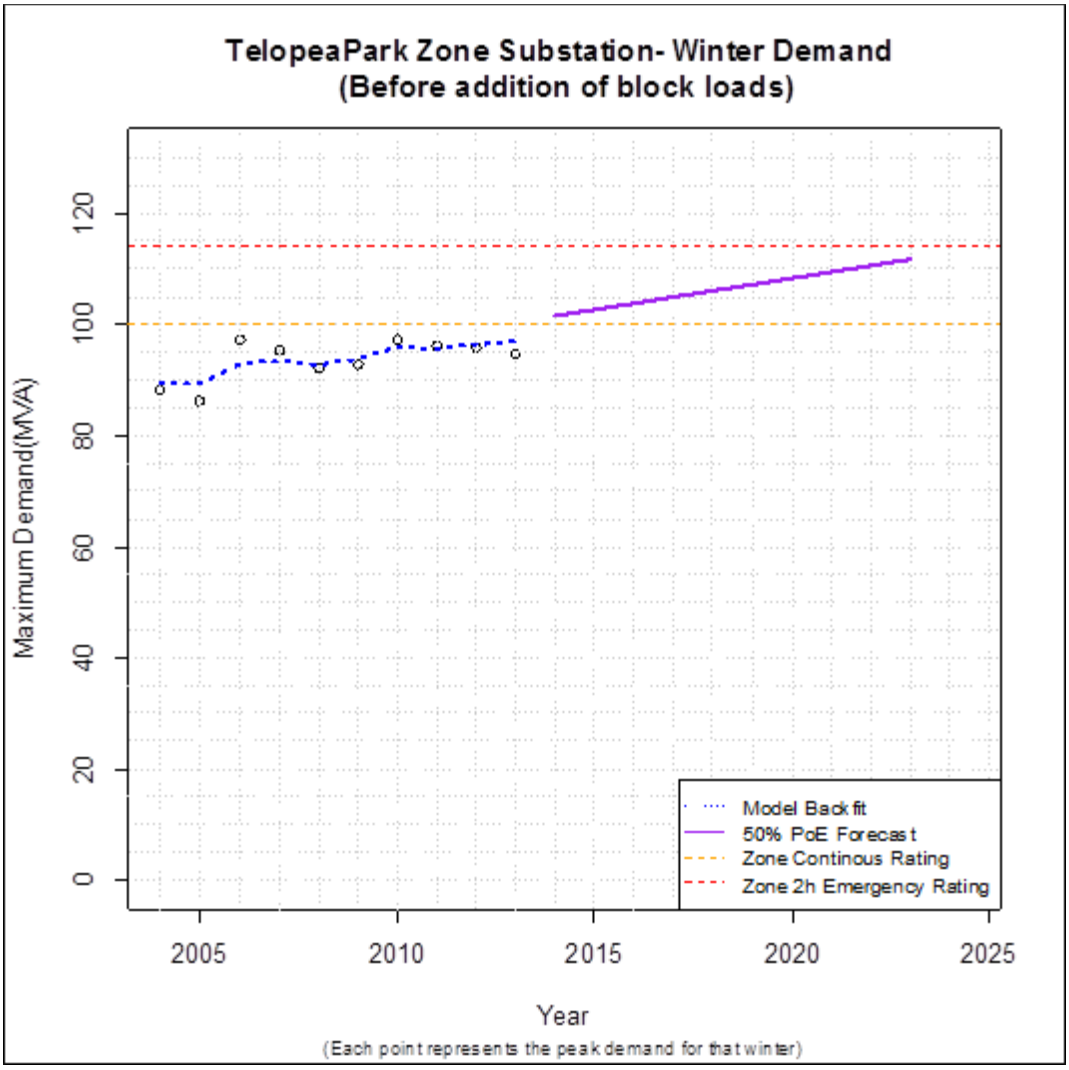

Model Details: Demand = -2209.16 + 1.14 * Year + 0.36 * 3DayHDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -2209.1585 | 440.1519 | -5.019 | 0.0000289 |
| Year | 1.1408 | 0.2182 | 5.229 | 0.0000165 |
| 3DayHDD | 0.3646 | 0.1375 | 2.651 | 0.0133 |
| Residual standard error: 2.982 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.5032, Adjusted R-squared: 0.4664 | | | | |
| F-statistic: 13.67 on 2 and 27 DF, p-value: 7.922e-05 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



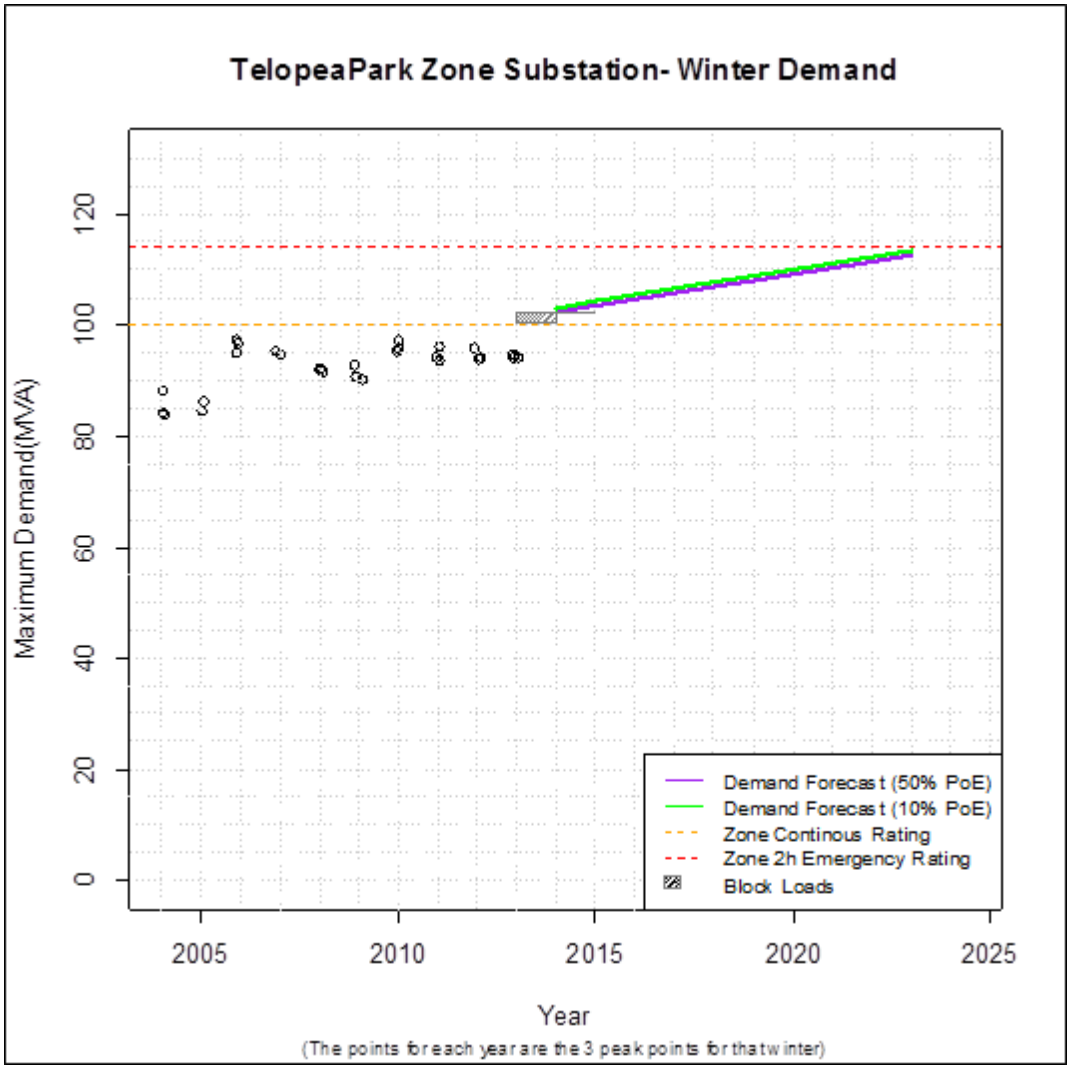
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Telopea Park Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 88.13 | 89.75 | 2% | 2% |
| 2005 | 86.18 | 89.34 | 4% | 4% |
| 2006 | 97.26 | 93.03 | -4% | 4% |
| 2007 | 95.39 | 93.44 | -2% | 2% |
| 2008 | 92.05 | 92.74 | 1% | 1% |
| 2009 | 92.64 | 93.99 | 1% | 1% |
| 2010 | 97.15 | 95.99 | -1% | 1% |
| 2011 | 96.11 | 95.47 | -1% | 1% |
| 2012 | 95.8 | 96.45 | 1% | 1% |
| 2013 | 94.6 | 97.08 | 3% | 3% |
| | | Average | 0% | 2% |

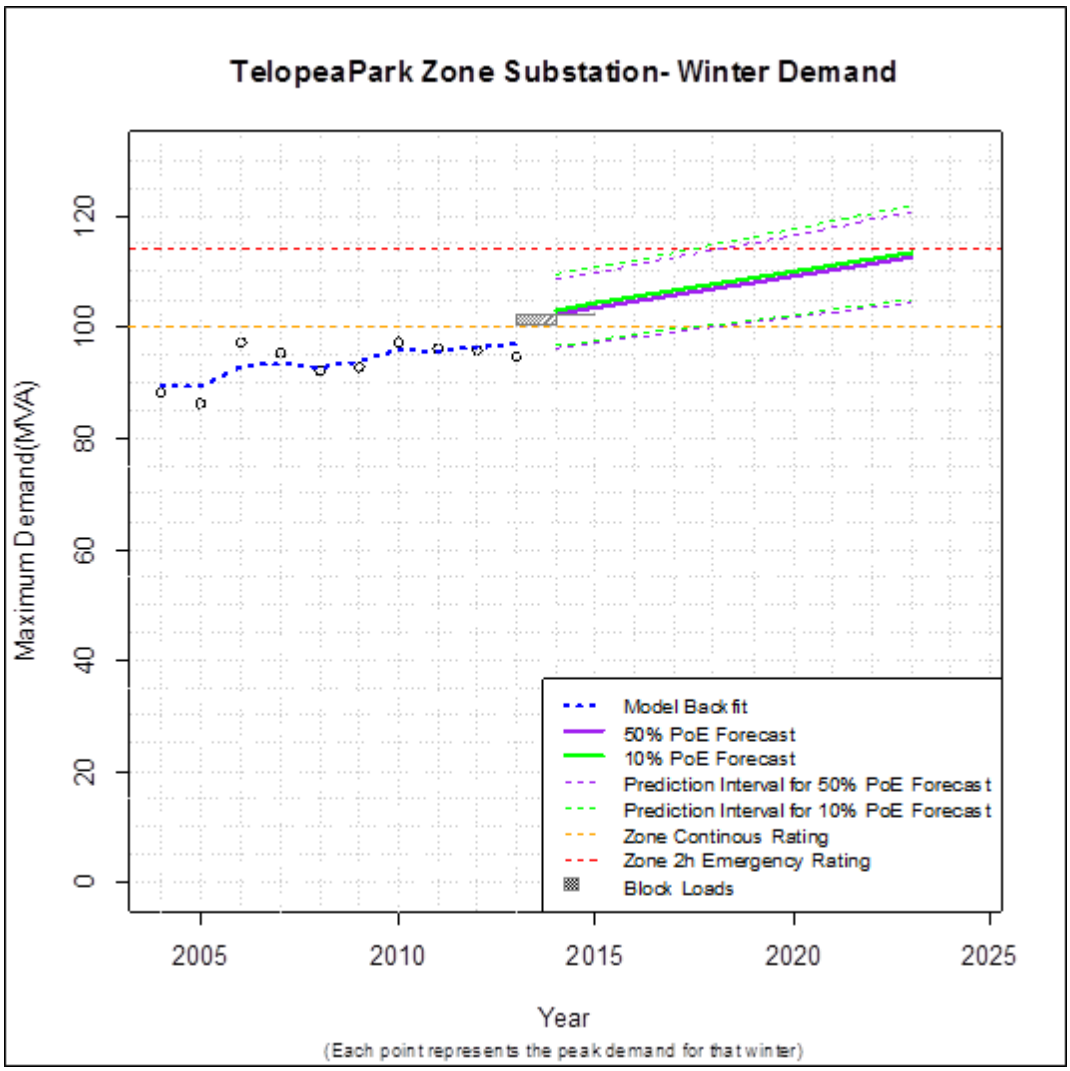
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 102.4 | 103.1 |
| 2015 | 103.5 | 104.2 |
| 2016 | 104.7 | 105.4 |
| 2017 | 105.8 | 106.5 |
| 2018 | 106.9 | 107.7 |
| 2019 | 108.1 | 108.8 |
| 2020 | 109.2 | 109.9 |
| 2021 | 110.4 | 111.1 |
| 2022 | 111.5 | 112.2 |
| 2023 | 112.6 | 113.4 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial | Forester Feeder | Telopea | 0.06 | 14/08/2013 | 100% |
| Residential Development | Monash Feeder | Telopea | 0.5 | 20/05/2014 | 95% |
| Commercial | Mundaring Feeder | Telopea | 1.4 | 15/07/2014 | 90% |
| Commercial | Young feeder | Telopea | 0.31 | 1/08/2014 | 90% |
| Commercial Development | Giles St Feeder | Telopea | 0.55 | 1/01/2015 | 10% |
| Residential Development | Jardine Feeder | Telopea | 0.06 | 1/01/2015 | 10% |

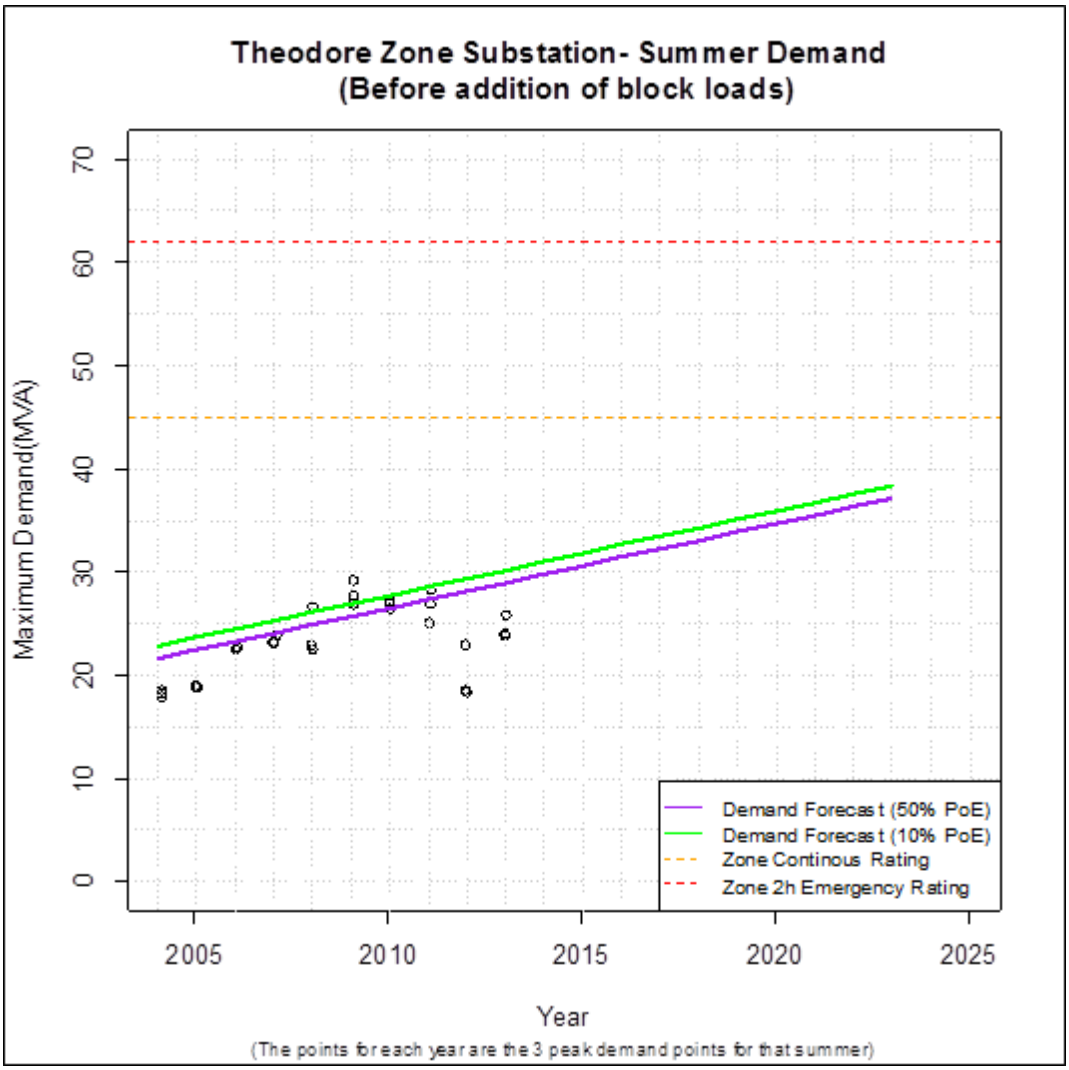
## 5.10 Theodore Zone

### 5.10.1 Theodore Zone Summer Forecast

**Model Selection**: Model with variables Year and 3DayCDD selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

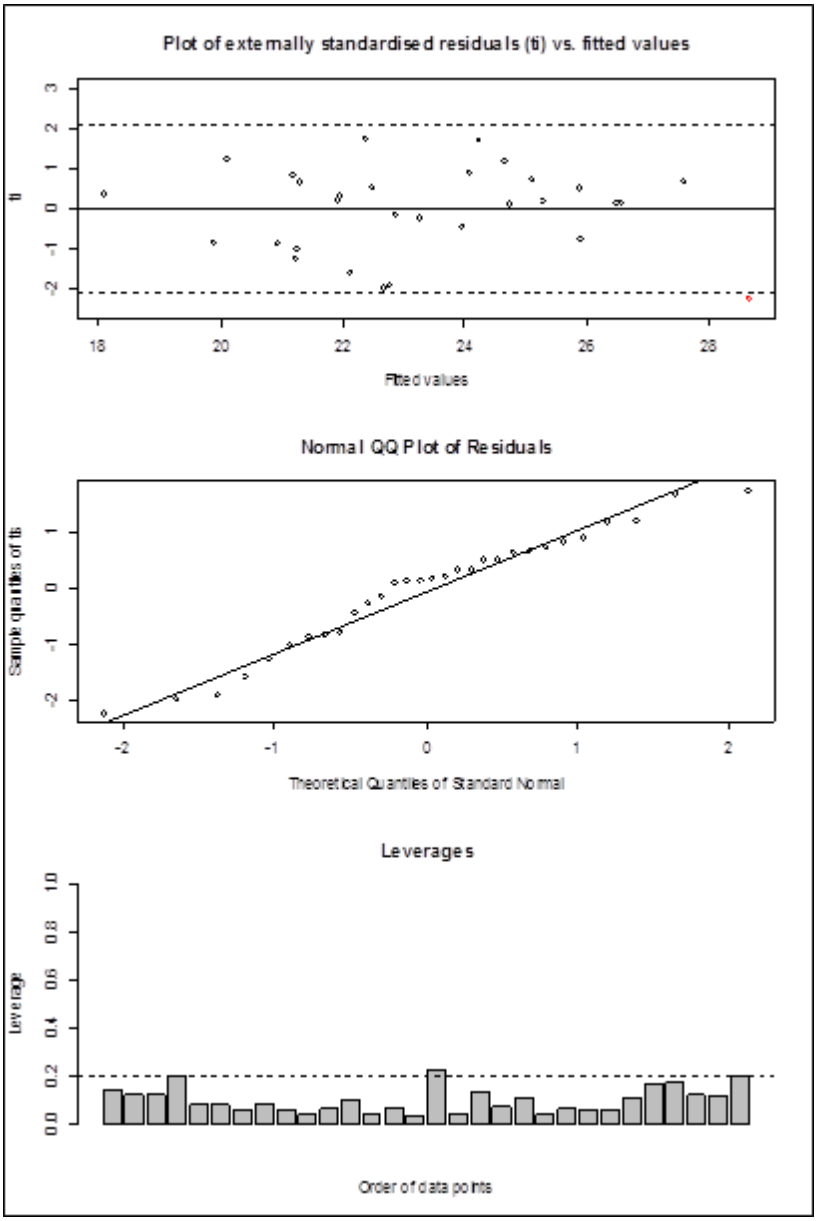
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



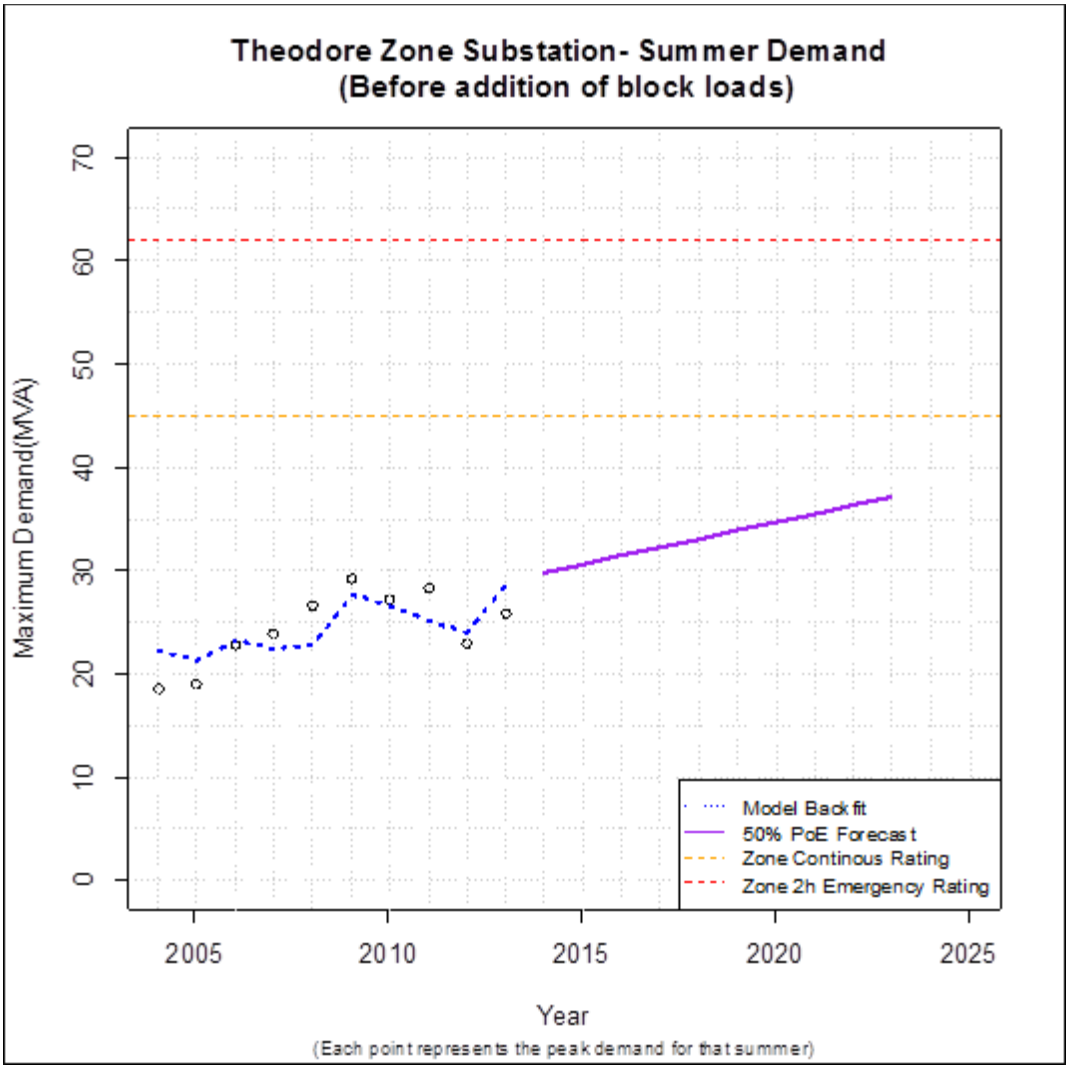

Model Details: Demand = -1624.33 + 0.82 * Year + 0.24 * 3DayCDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -1624.3275 | 350.0494 | -4.64 | 0.0000801 |
| Year | 0.8183 | 0.1741 | 4.7 | 0.0000681 |
| 3DayCDD | 0.2353 | 0.0661 | 3.56 | 1.40E-03 |
| Residual standard error: 2.569 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.4937, Adjusted R-squared: 0.4562 | | | | |
| F-statistic: 13.16 on 2 and 27 DF, p-value: 0.0001023 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



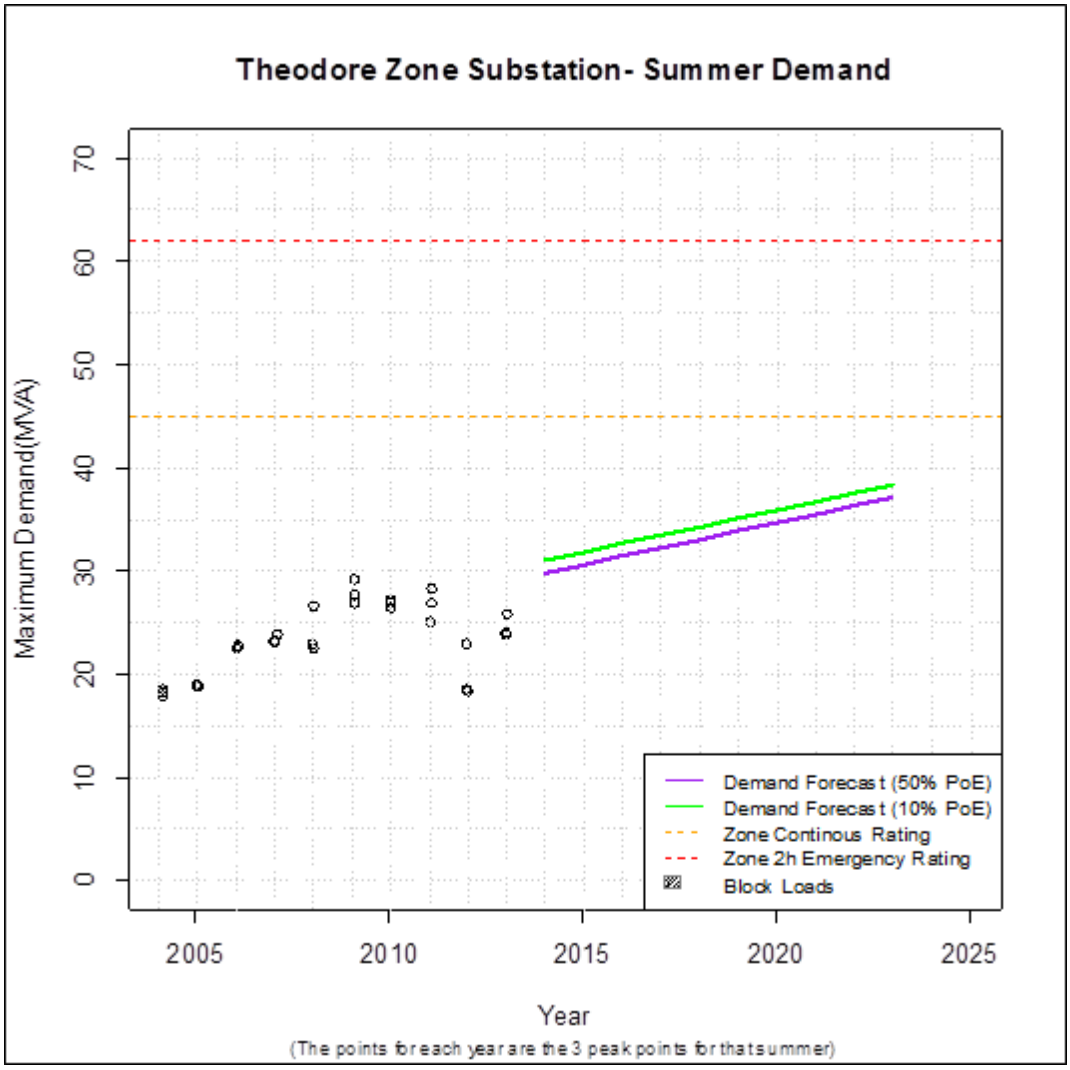
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Theodore Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 18.48 | 22.11 | 20% | 20% |
| 2005 | 18.9 | 21.23 | 12% | 12% |
| 2006 | 22.81 | 23.25 | 2% | 2% |
| 2007 | 23.83 | 22.48 | -6% | 6% |
| 2008 | 26.63 | 22.84 | -14% | 14% |
| 2009 | 29.16 | 27.59 | -5% | 5% |
| 2010 | 27.19 | 26.55 | -2% | 2% |
| 2011 | 28.3 | 25.10 | -11% | 11% |
| 2012 | 22.88 | 23.95 | 5% | 5% |
| 2013 | 25.76 | 28.65 | 11% | 11% |
| | | Average | 1% | 9% |

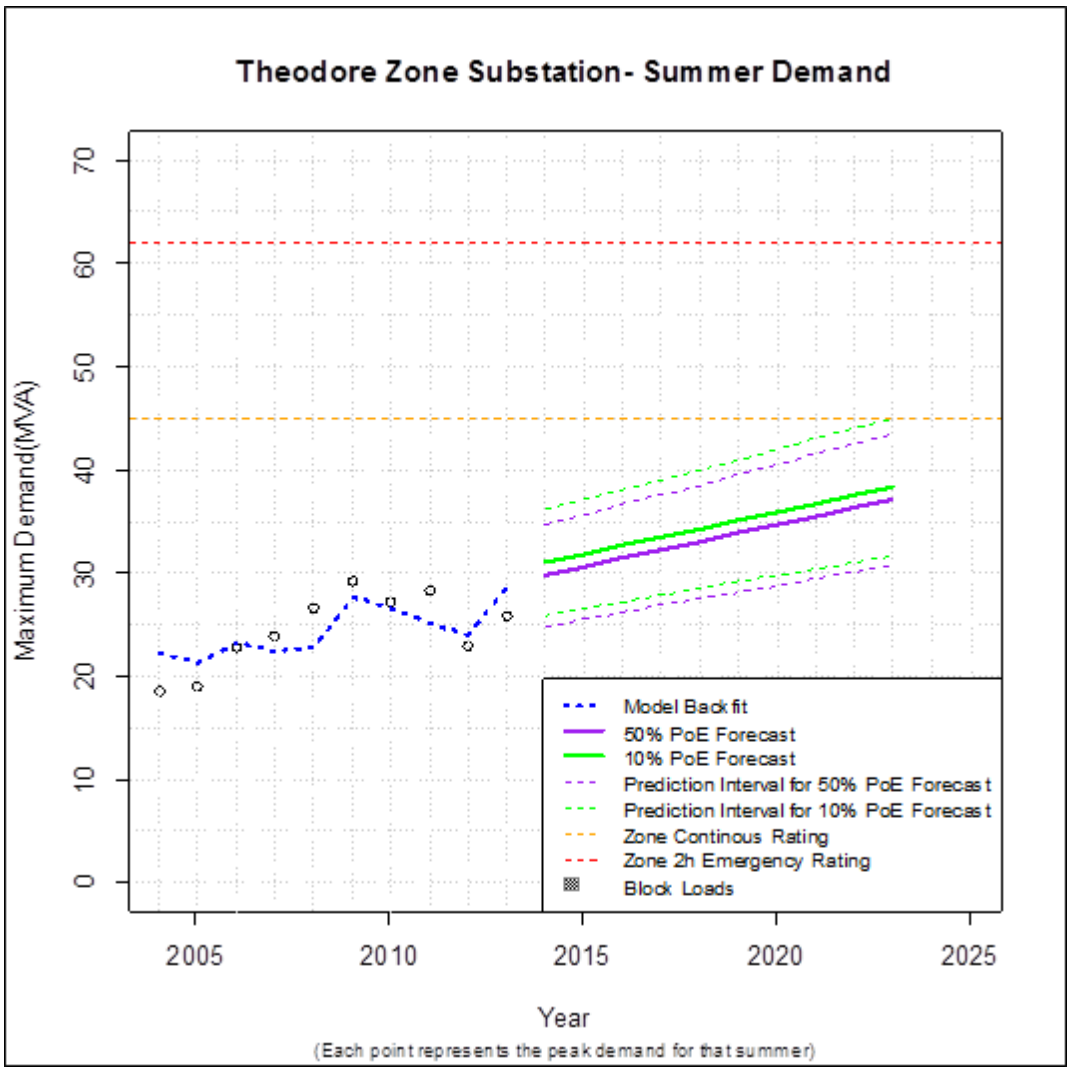
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 29.8 | 31.0 |
| 2015 | 30.6 | 31.8 |
| 2016 | 31.4 | 32.6 |
| 2017 | 32.2 | 33.4 |
| 2018 | 33.0 | 34.3 |
| 2019 | 33.9 | 35.1 |
| 2020 | 34.7 | 35.9 |
| 2021 | 35.5 | 36.7 |
| 2022 | 36.3 | 37.5 |
| 2023 | 37.1 | 38.4 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

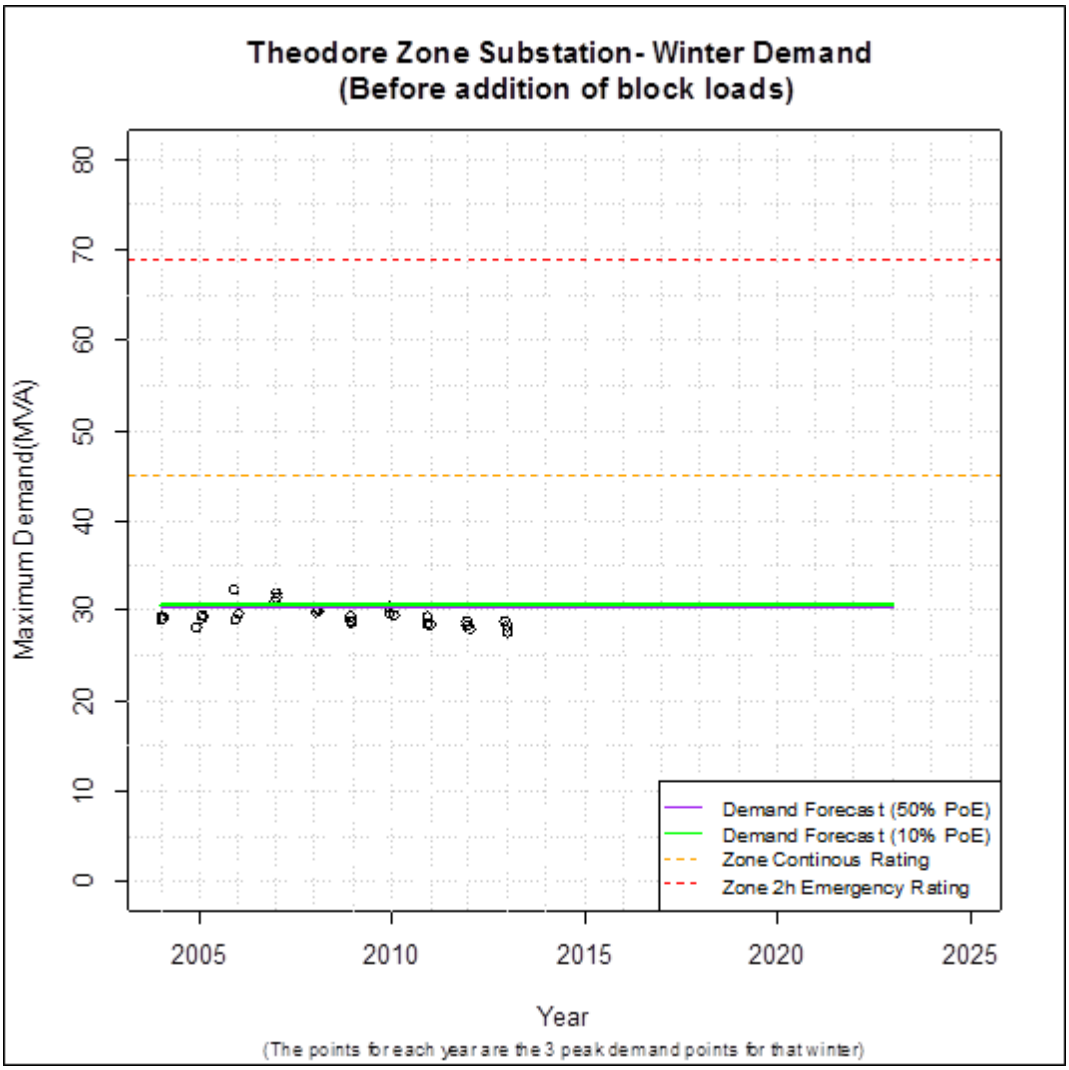
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| None on record | | | | | |

### 5.10.2 Theodore Zone Winter Forecast

**Model Selection**: Model with variables Year and 3DayHDD, selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

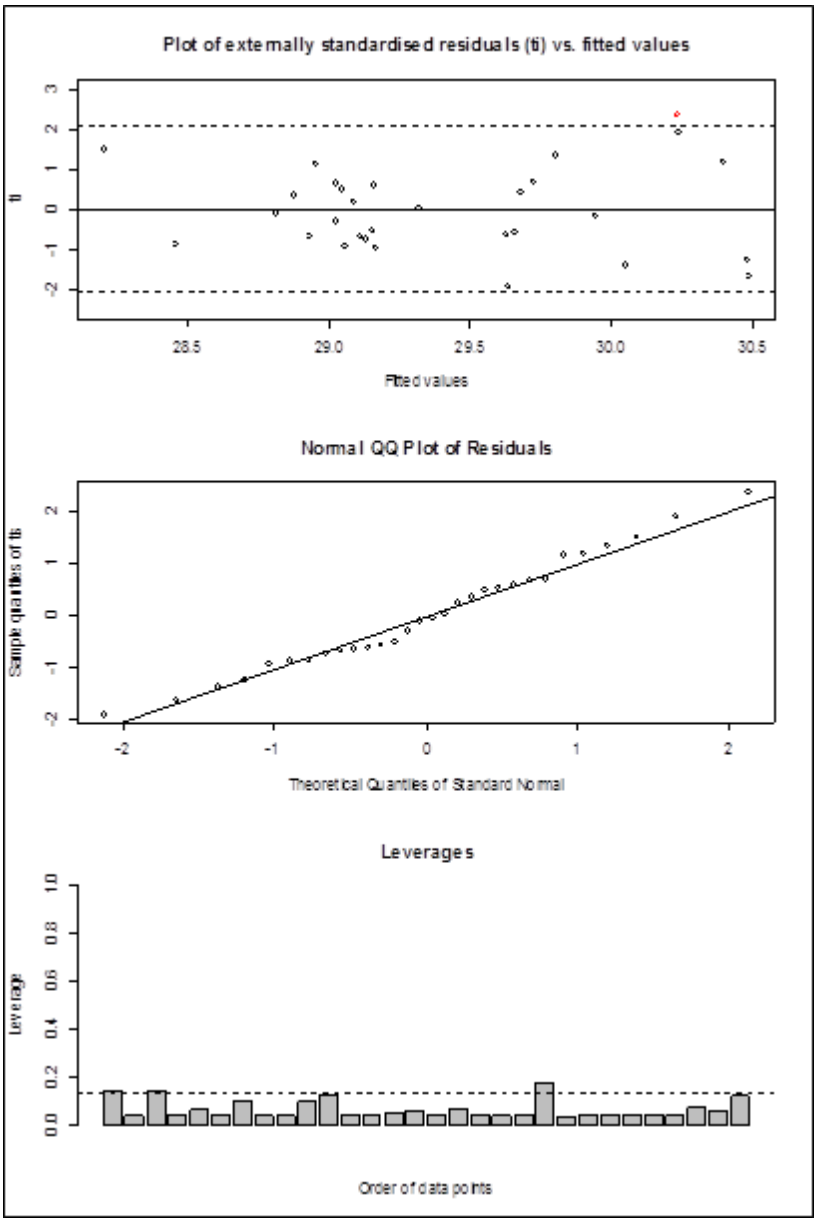
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



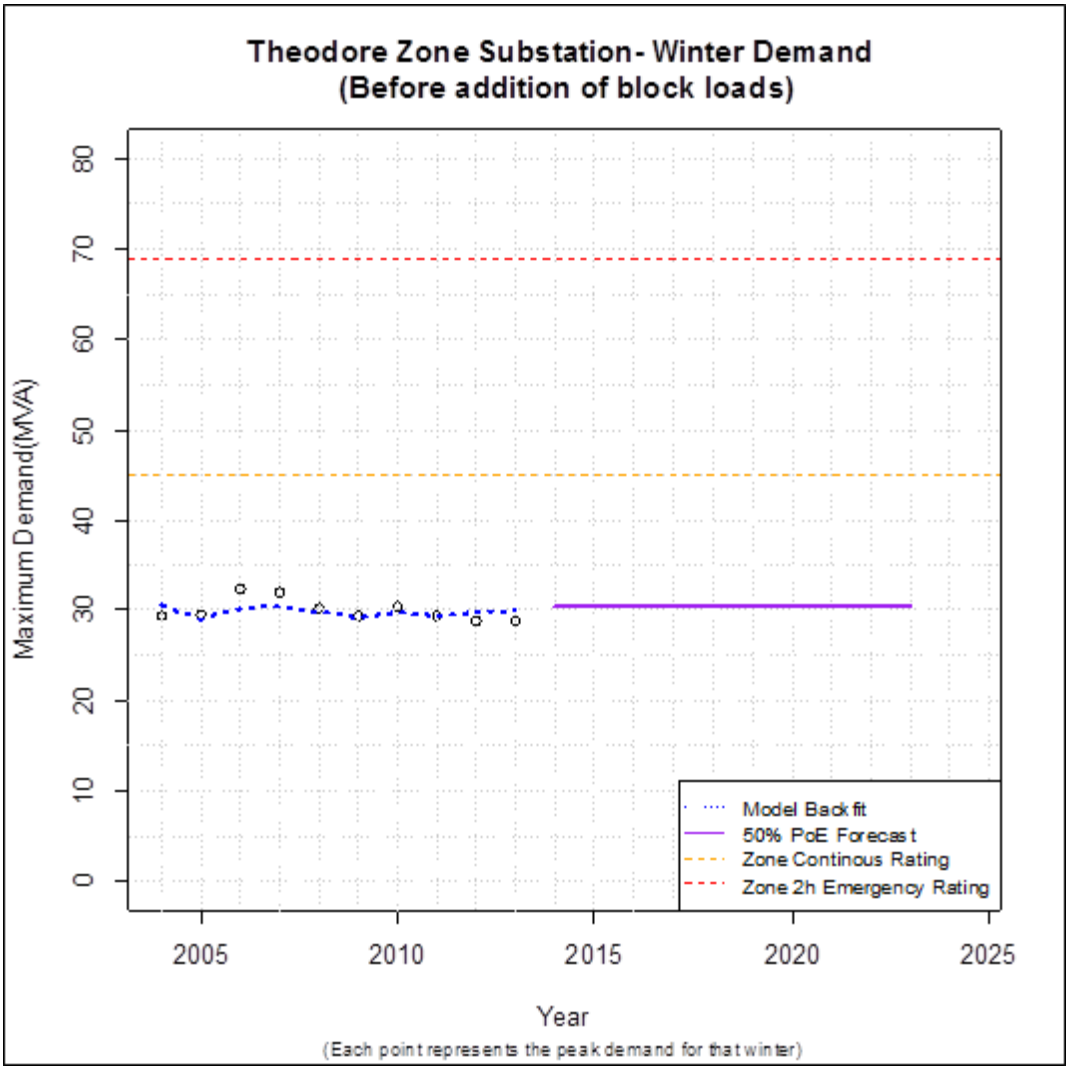

Model Details: Demand = 26.86 + 0.10 * 3DayHDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 26.85809 | 0.81145 | 33.099 | < 2e-16 |
| 3DayHDD | 0.09857 | 0.0305 | 3.232 | 0.00314 |
| Residual standard error: 0.991 on 28 degrees of freedom | | | | |
| Multiple R-squared: 0.2717, Adjusted R-squared: 0.2457 | | | | |
| F-statistic: 10.45 on 1 and 28 DF, p-value: 0.00314 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



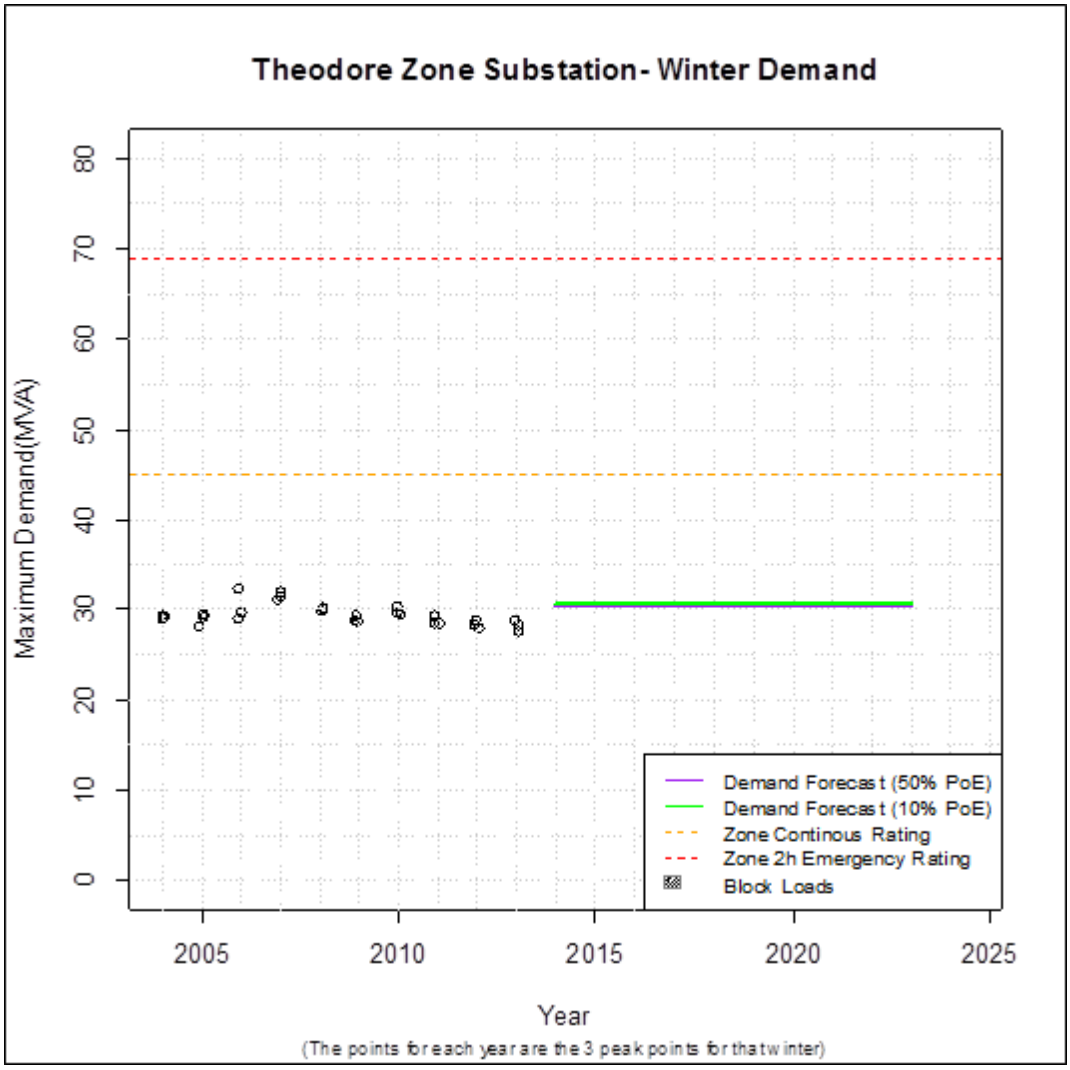
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Theodore Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 29.37 | 30.49 | 4% | 4% |
| 2005 | 29.58 | 29.06 | -2% | 2% |
| 2006 | 32.3 | 30.23 | -6% | 6% |
| 2007 | 31.95 | 30.40 | -5% | 5% |
| 2008 | 30.15 | 29.94 | -1% | 1% |
| 2009 | 29.32 | 29.15 | -1% | 1% |
| 2010 | 30.41 | 29.72 | -2% | 2% |
| 2011 | 29.36 | 29.32 | 0% | 0% |
| 2012 | 28.75 | 29.63 | 3% | 3% |
| 2013 | 28.76 | 30.05 | 4% | 4% |
| | | Average | -1% | 3% |

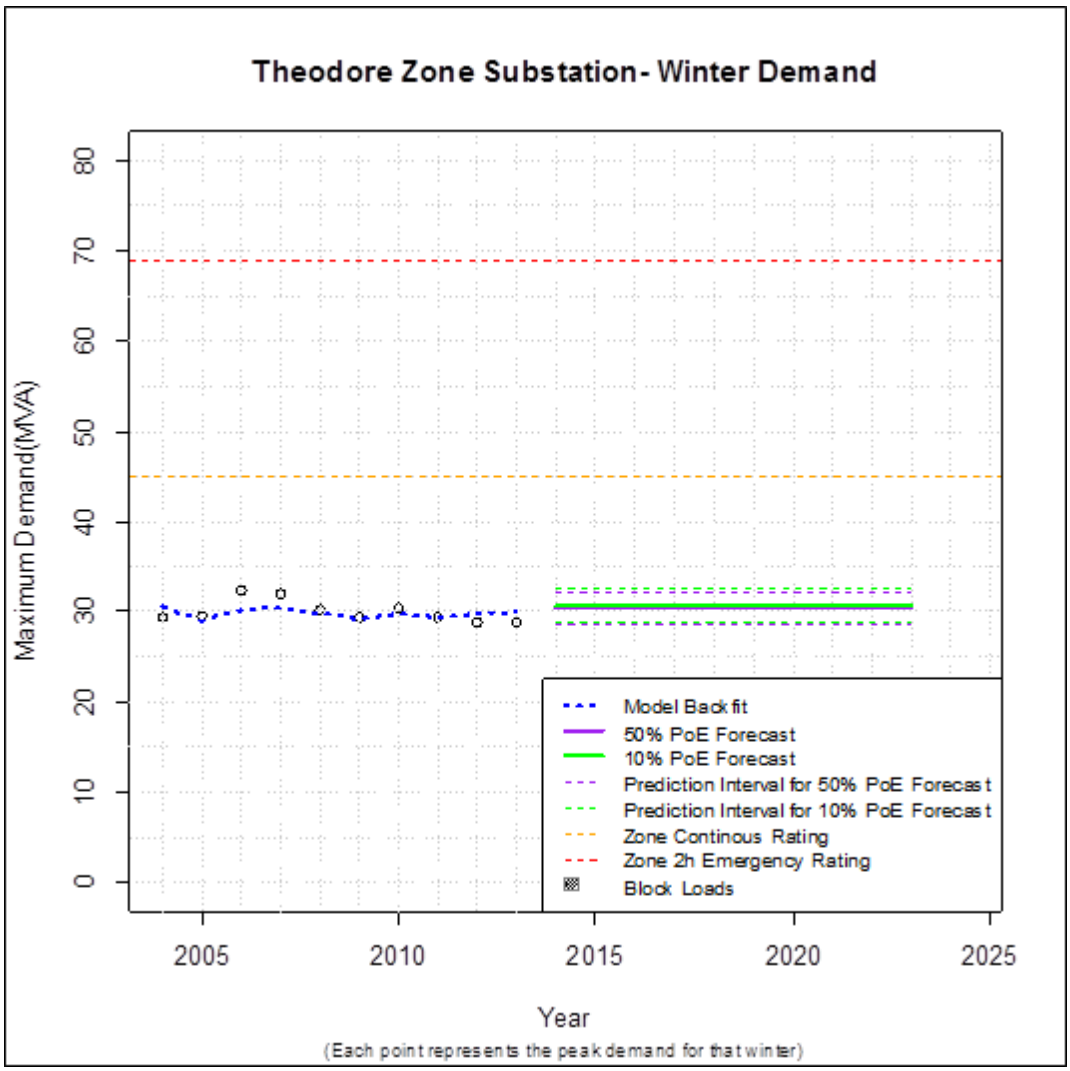
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 30.4 | 30.6 |
| 2015 | 30.4 | 30.6 |
| 2016 | 30.4 | 30.6 |
| 2017 | 30.4 | 30.6 |
| 2018 | 30.4 | 30.6 |
| 2019 | 30.4 | 30.6 |
| 2020 | 30.4 | 30.6 |
| 2021 | 30.4 | 30.6 |
| 2022 | 30.4 | 30.6 |
| 2023 | 30.4 | 30.6 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| None on record | | | | | |

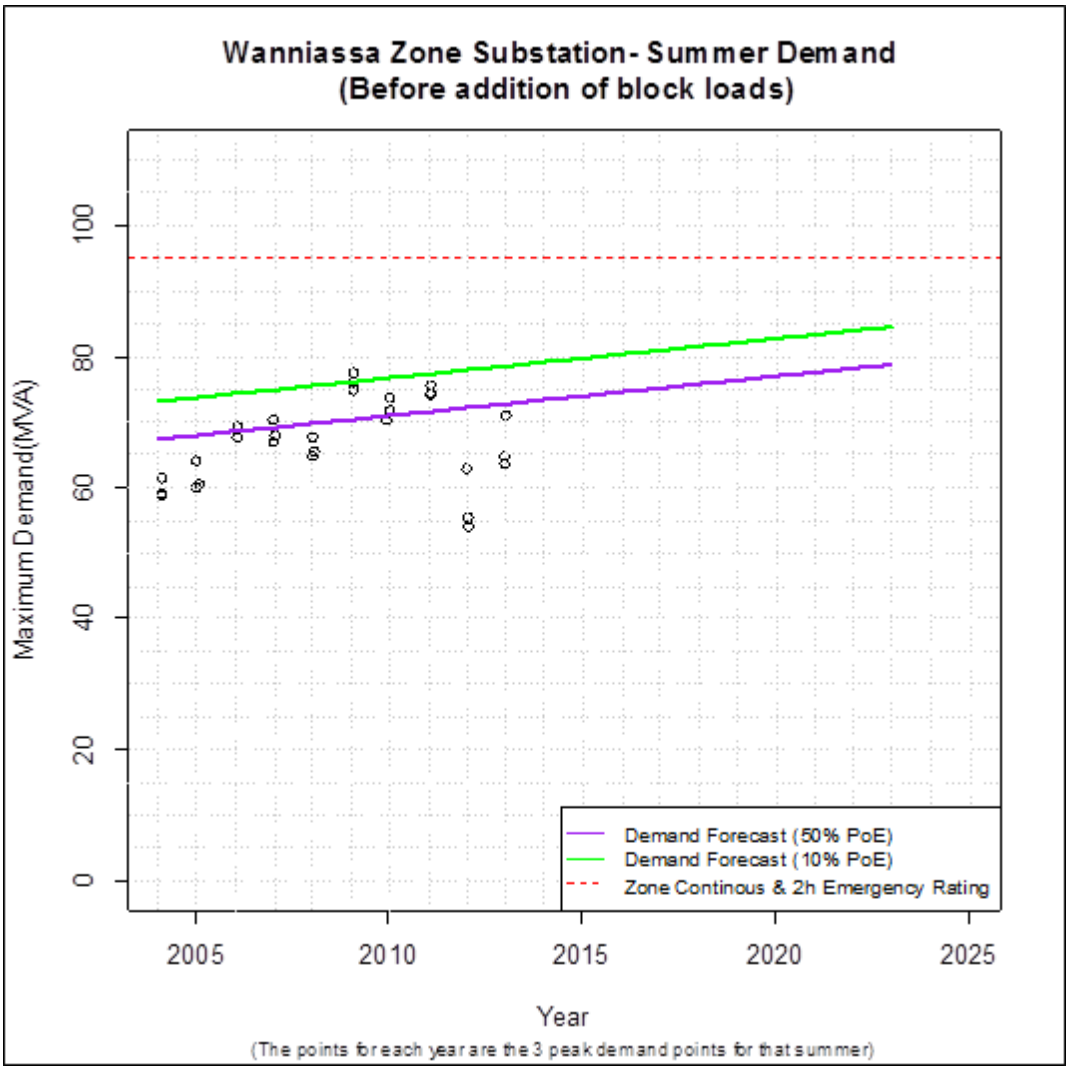
## 5.11 Wanniassa Zone

### 5.11.1 Wanniassa Zone Summer Forecast

**Model Selection**: Model with variables Year and CDD selected based on stepwise procedures and checking against other statistical criteria.

**Model/Forecast (before adding block loads):**

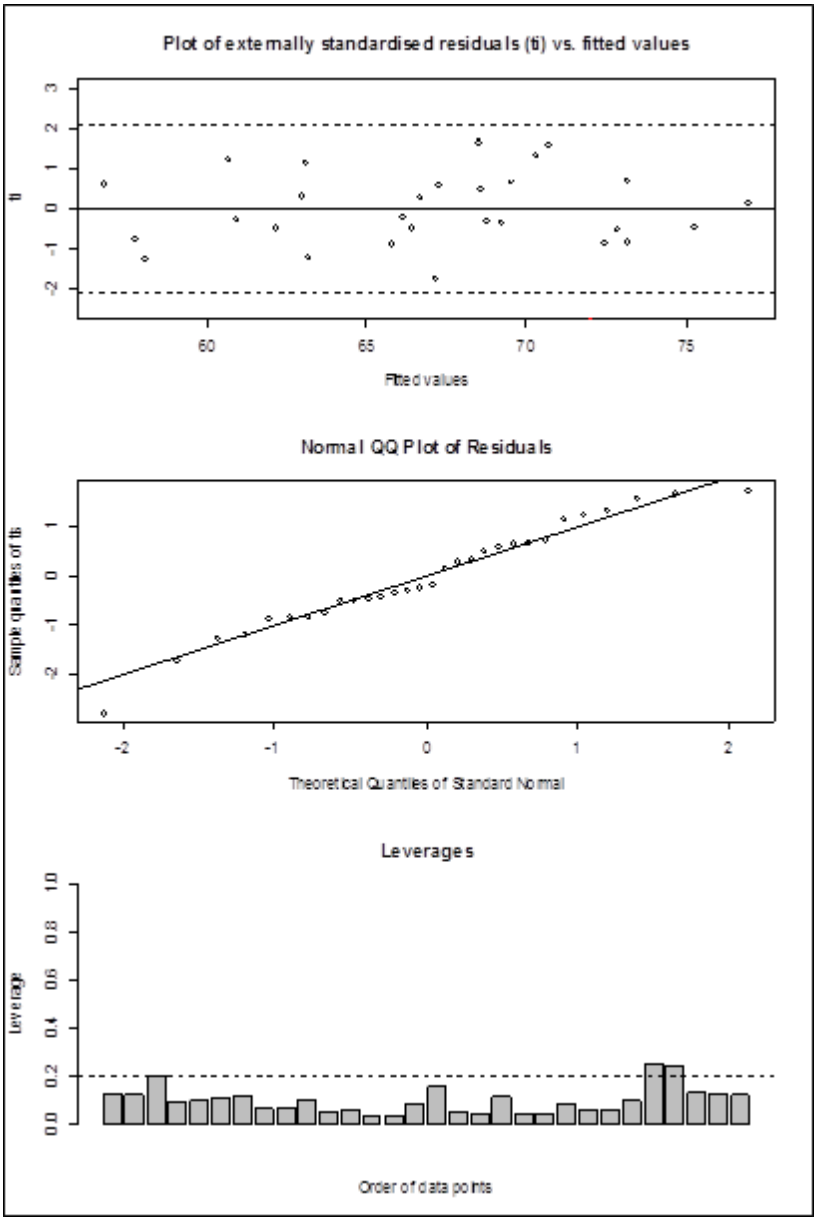
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



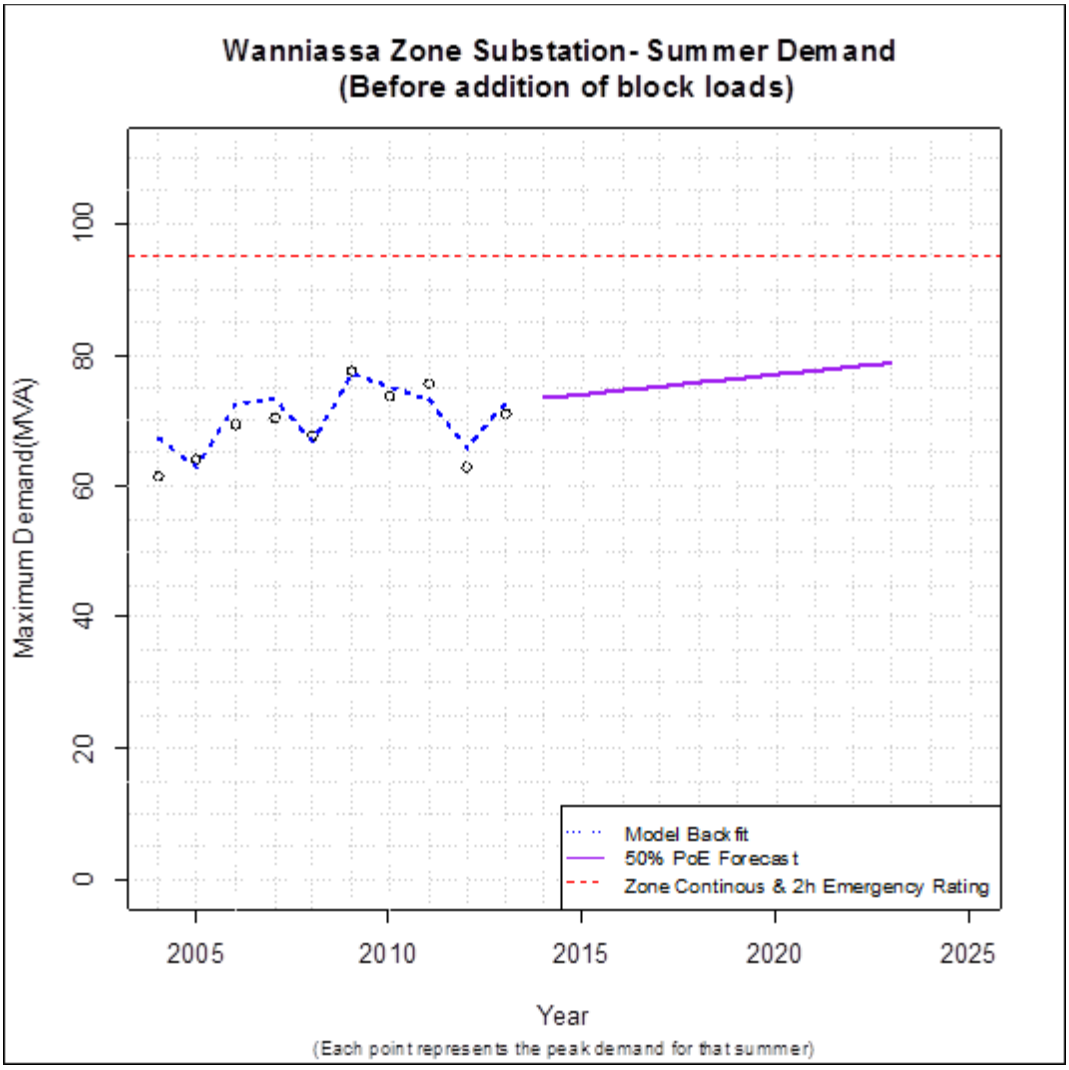

Model Details: Demand = -1163.14 + 0.60 * Year + 2.73 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | -1163.1431 | 465.8738 | -2.497 | 0.0189 |
| Year | 0.6007 | 0.2318 | 2.591 | 0.0152 |
| CDD | 2.7275 | 0.3659 | 7.454 | 5.11E-08 |
| Residual standard error: 3.64 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.6898, Adjusted R-squared: 0.6668 | | | | |
| F-statistic: 30.02 on 2 and 27 DF, p-value: 1.371e-07 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



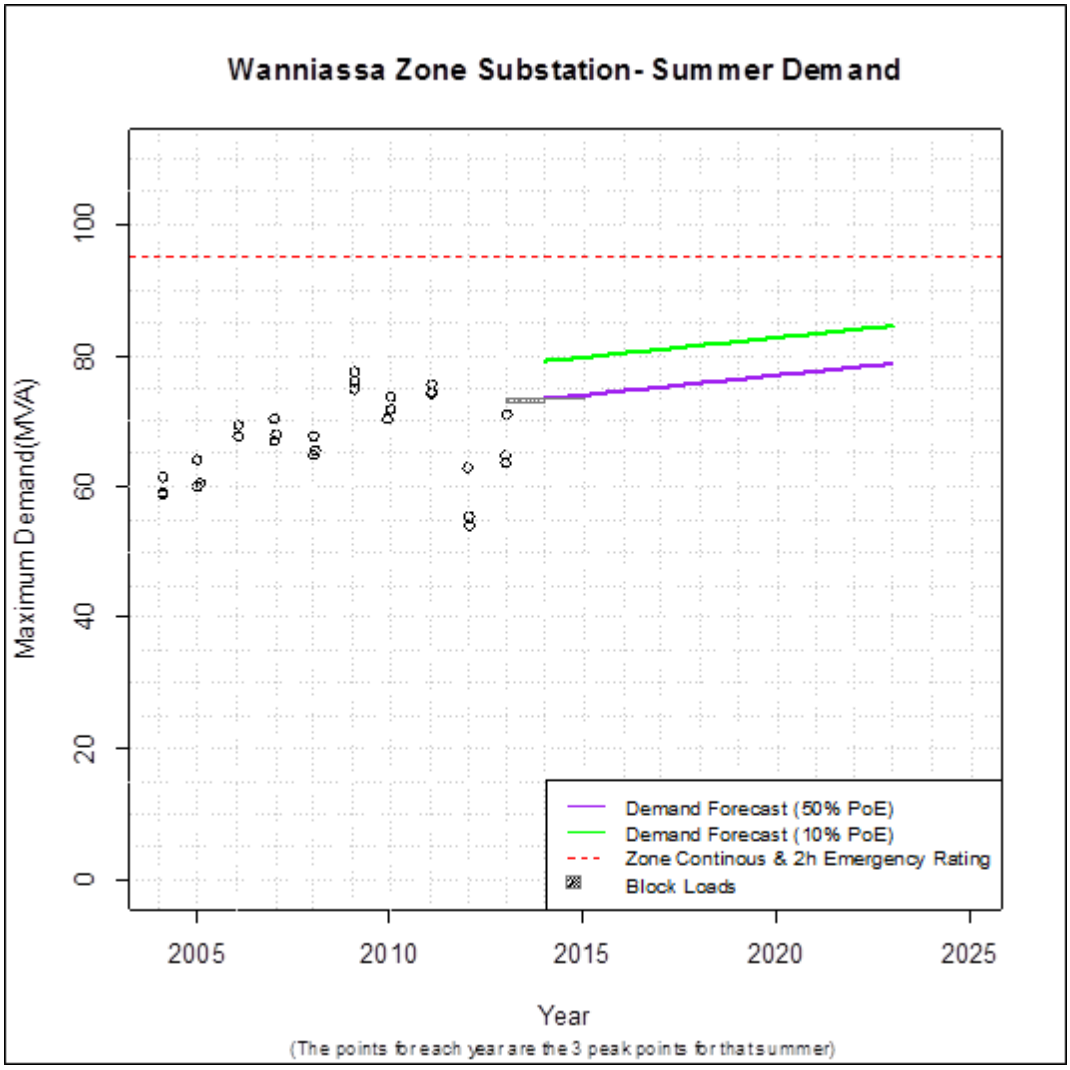
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Wanniassa Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 61.51 | 67.13 | 9% | 9% |
| 2005 | 64.09 | 62.96 | -2% | 2% |
| 2006 | 69.45 | 72.42 | 4% | 4% |
| 2007 | 70.29 | 73.16 | 4% | 4% |
| 2008 | 67.75 | 66.67 | -2% | 2% |
| 2009 | 77.49 | 76.95 | -1% | 1% |
| 2010 | 73.74 | 75.24 | 2% | 2% |
| 2011 | 75.63 | 73.11 | -3% | 3% |
| 2012 | 62.88 | 65.80 | 5% | 5% |
| 2013 | 71.11 | 72.81 | 2% | 2% |
| | | Average | 2% | 3% |

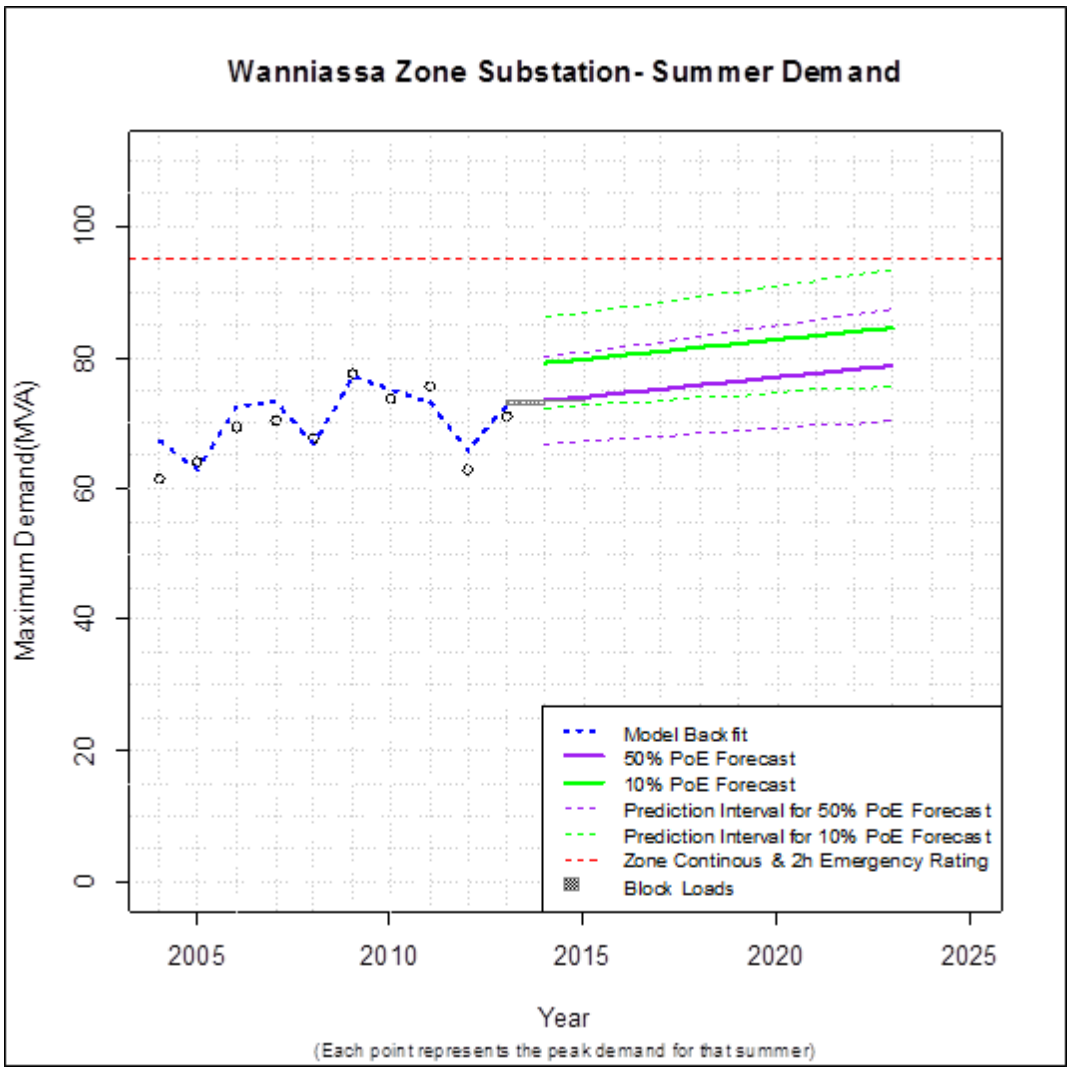
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 73.4 | 79.1 |
| 2015 | 74.0 | 79.7 |
| 2016 | 74.6 | 80.3 |
| 2017 | 75.2 | 80.9 |
| 2018 | 75.8 | 81.5 |
| 2019 | 76.4 | 82.1 |
| 2020 | 77.0 | 82.7 |
| 2021 | 77.6 | 83.3 |
| 2022 | 78.2 | 83.9 |
| 2023 | 78.8 | 84.5 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

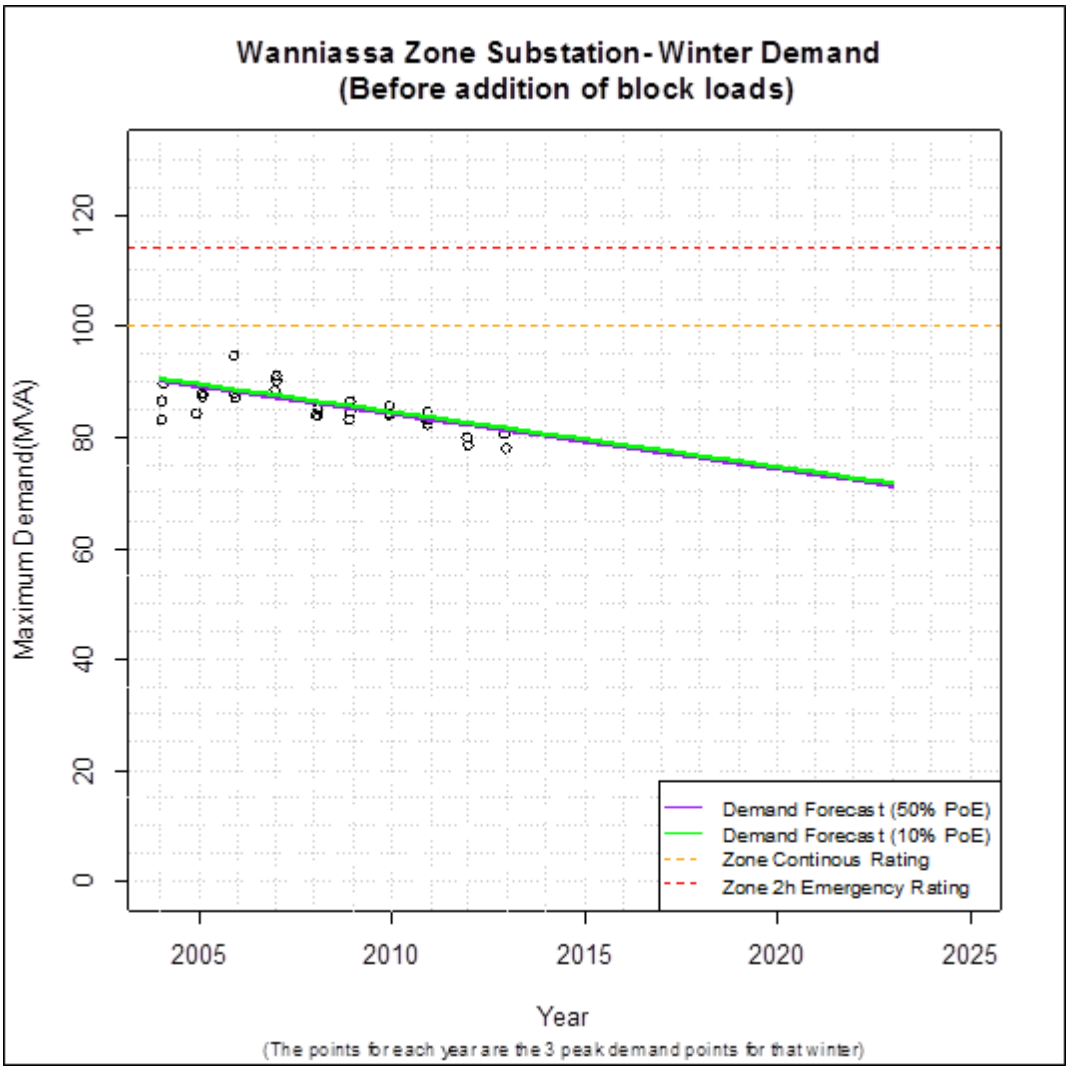
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial & industrial | Fincham | Wanniassa | 0.1 | 19/02/2013 | 100% |
| Commercial | Langmore Feeder 3 | Wanniassa | 0.425 | 7/05/2013 | 100% |
| SCR | Hawkesbury Feeder | Wanniassa | 0.1 | 1/01/2015 | 10% |

### 5.11.2 Wanniassa Zone Winter Forecast

**Model Selection**: Model with variables Year and HDD, selected based on stepwise procedures and checking against other statistical criteria. HDD is marginally significant.

**Model/Forecast (before adding block loads):**

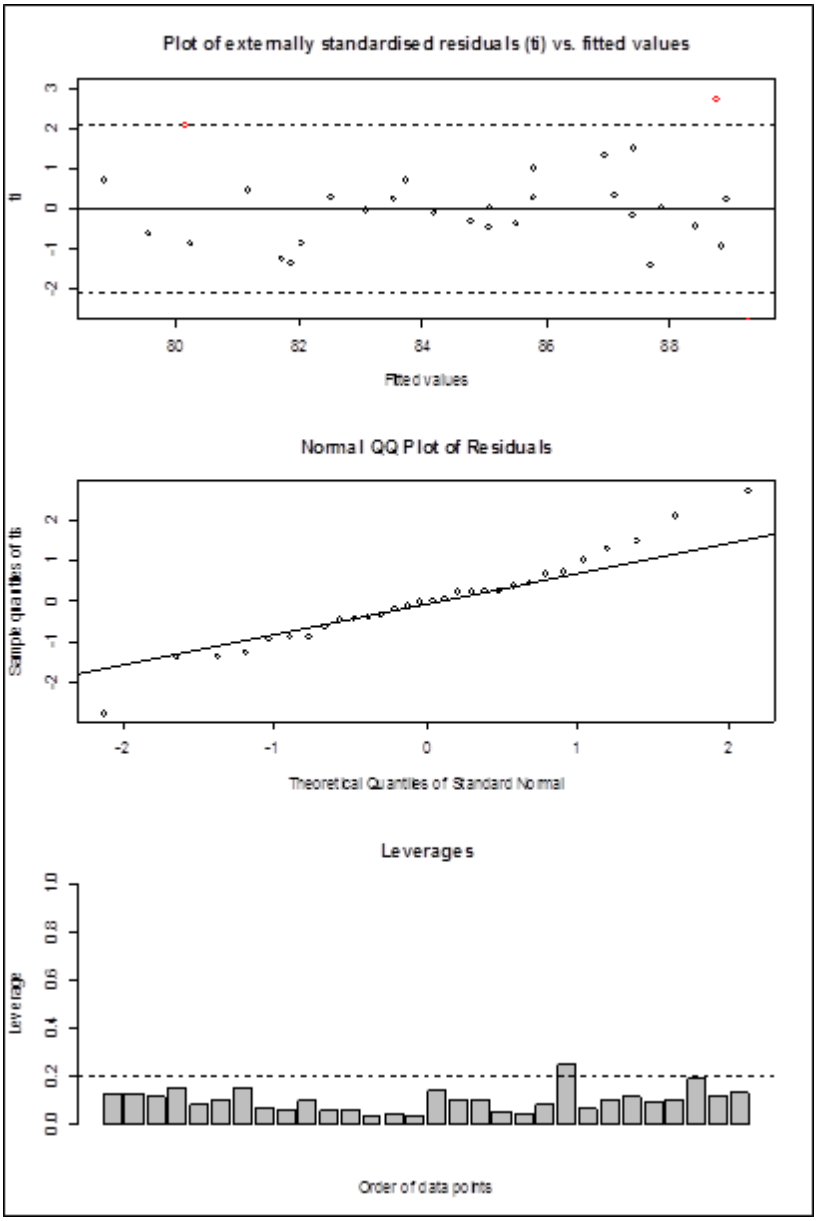
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



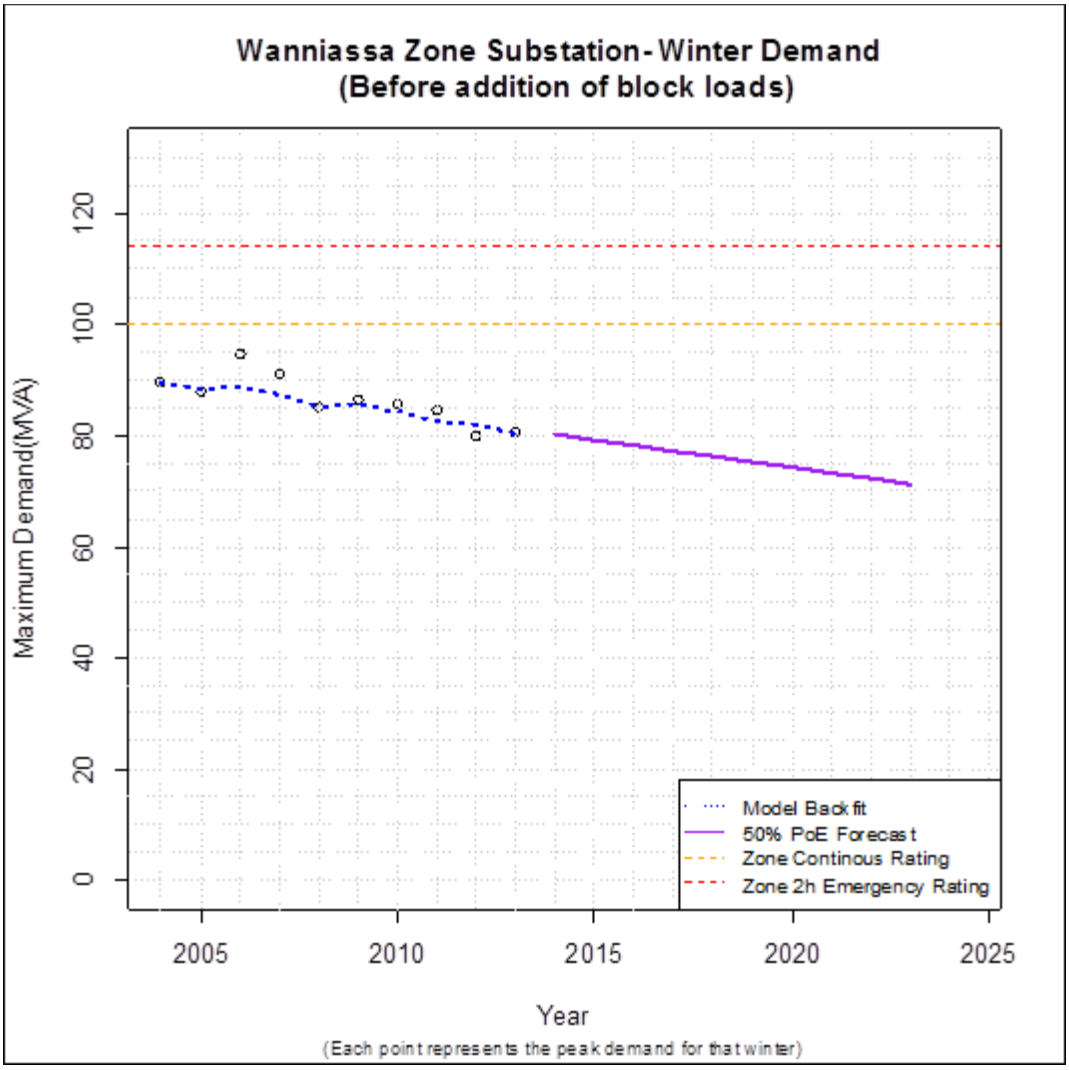

Model Details: Demand = 2068.63 – 0.99 * Year + 0.42 * HDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 2068.6275 | 337.1811 | 6.135 | 0.00000148 |
| Year | -0.99 | 0.1677 | -5.902 | 0.00000274 |
| HDD | 0.4219 | 0.233 | 1.811 | 0.0813 |
| Residual standard error: 2.624 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.6017, Adjusted R-squared: 0.5722 | | | | |
| F-statistic: 20.4 on 2 and 27 DF, p-value: 4.006e-06 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



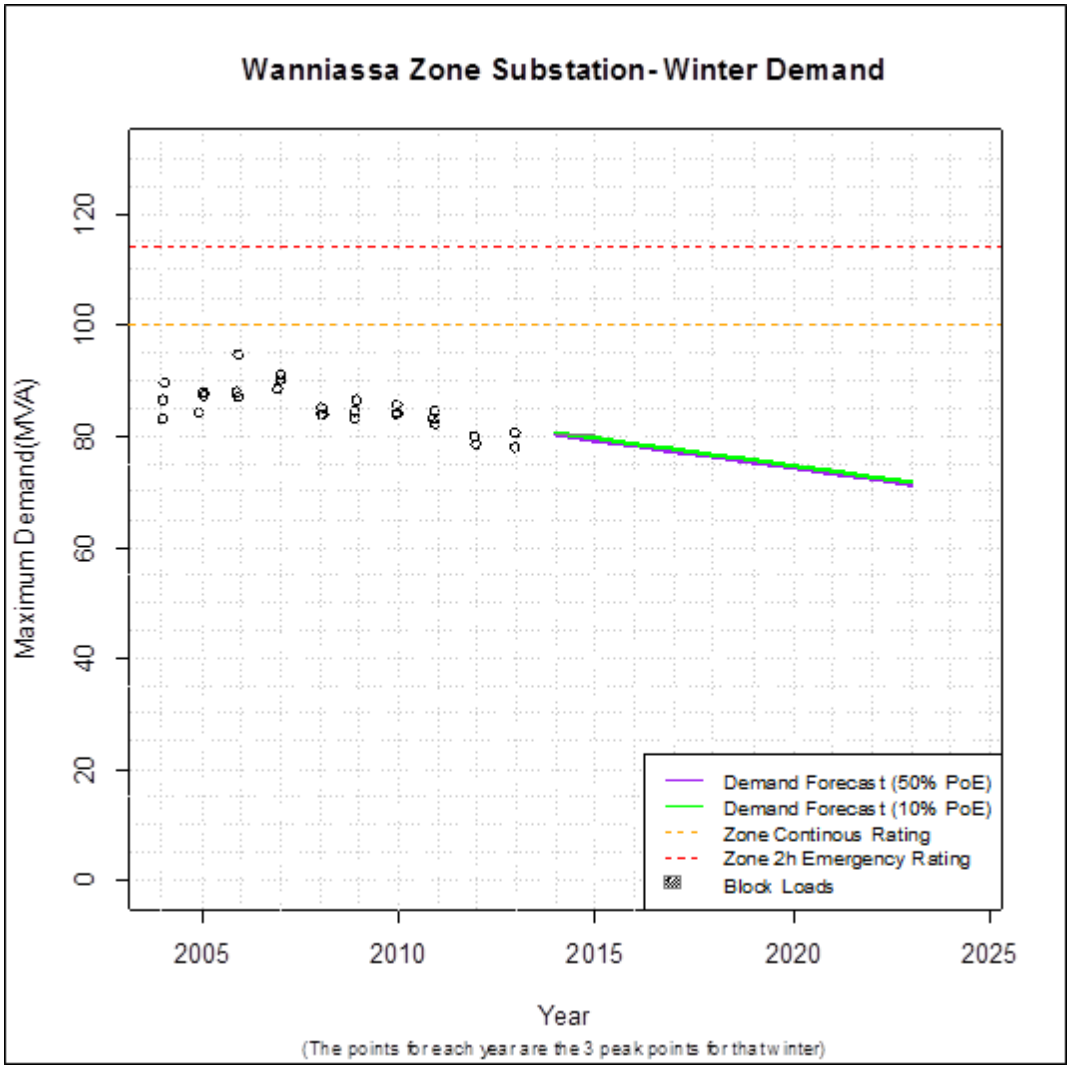
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Wanniassa Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 89.52 | 89.27 | 0% | 0% |
| 2005 | 88 | 88.41 | 0% | 0% |
| 2006 | 94.69 | 88.75 | -6% | 6% |
| 2007 | 91.05 | 87.42 | -4% | 4% |
| 2008 | 85.22 | 85.08 | 0% | 0% |
| 2009 | 86.49 | 85.78 | -1% | 1% |
| 2010 | 85.59 | 84.18 | -2% | 2% |
| 2011 | 84.65 | 82.51 | -3% | 3% |
| 2012 | 79.88 | 82.03 | 3% | 3% |
| 2013 | 80.5 | 80.24 | 0% | 0% |
| | | Average | -1% | 2% |

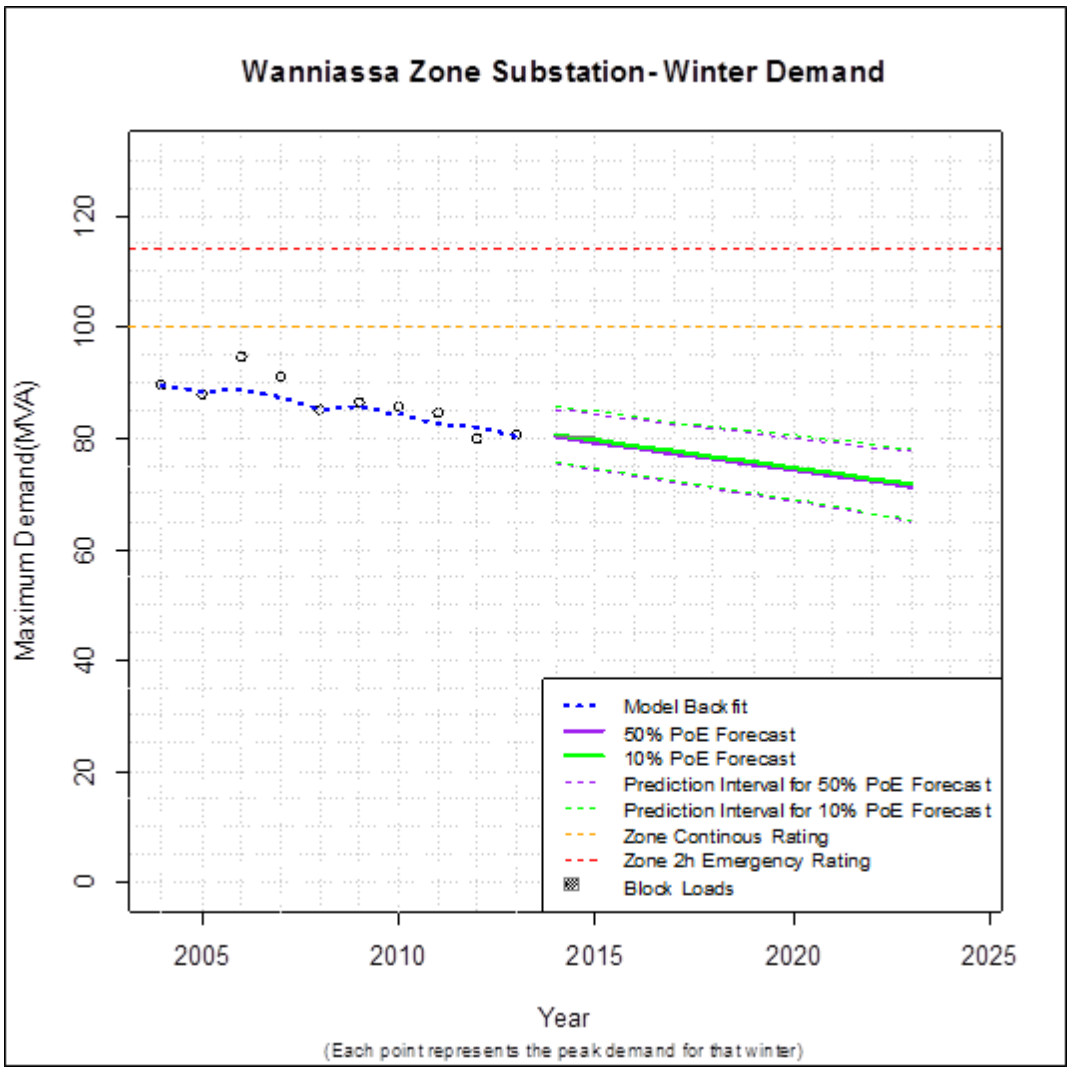
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 80.2 | 80.6 |
| 2015 | 79.3 | 79.6 |
| 2016 | 78.3 | 78.6 |
| 2017 | 77.3 | 77.6 |
| 2018 | 76.3 | 76.6 |
| 2019 | 75.3 | 75.6 |
| 2020 | 74.3 | 74.6 |
| 2021 | 73.3 | 73.7 |
| 2022 | 72.3 | 72.7 |
| 2023 | 71.3 | 71.7 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| SCR | Hawkesbury Feeder | Wanniassa | 0.1 | 1/01/2015 | 10% |

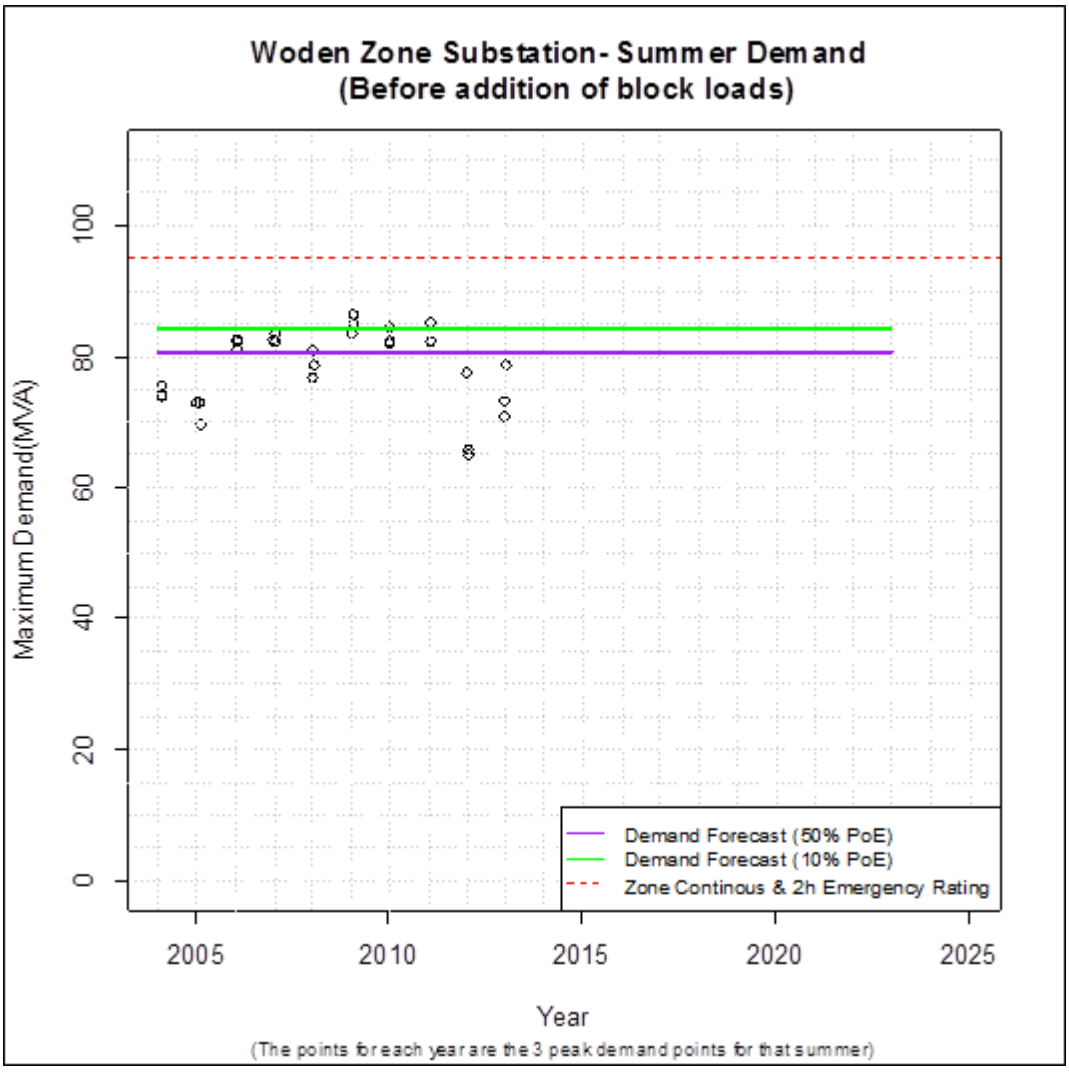
## 5.12 Woden Zone

### 5.12.1 Woden Zone Summer Forecast

**Model Selection**: Model with variable CDD selected based on stepwise procedures and checking against other statistical criteria. Originally chosen model with variables MaxTemp and CDD was rejected because the coefficients were unreasonable.

**Model/Forecast (before adding block loads):**

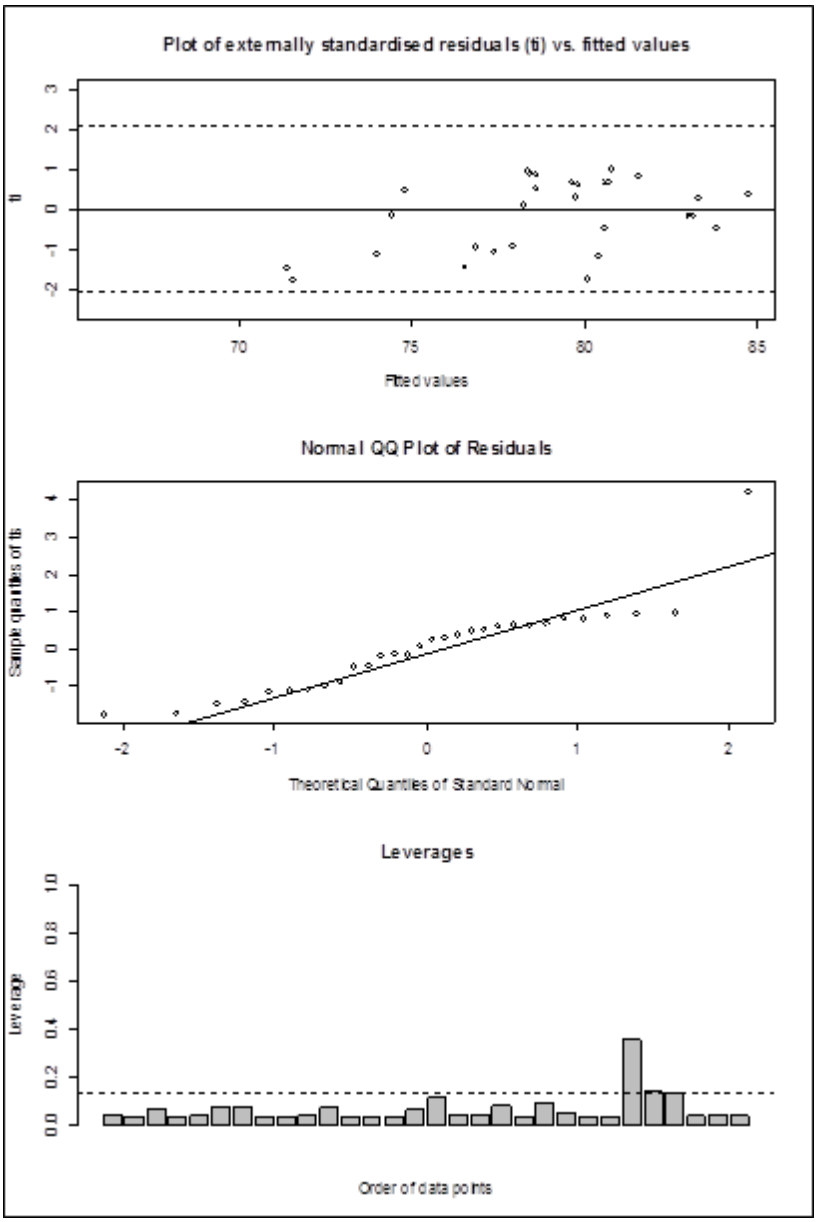
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



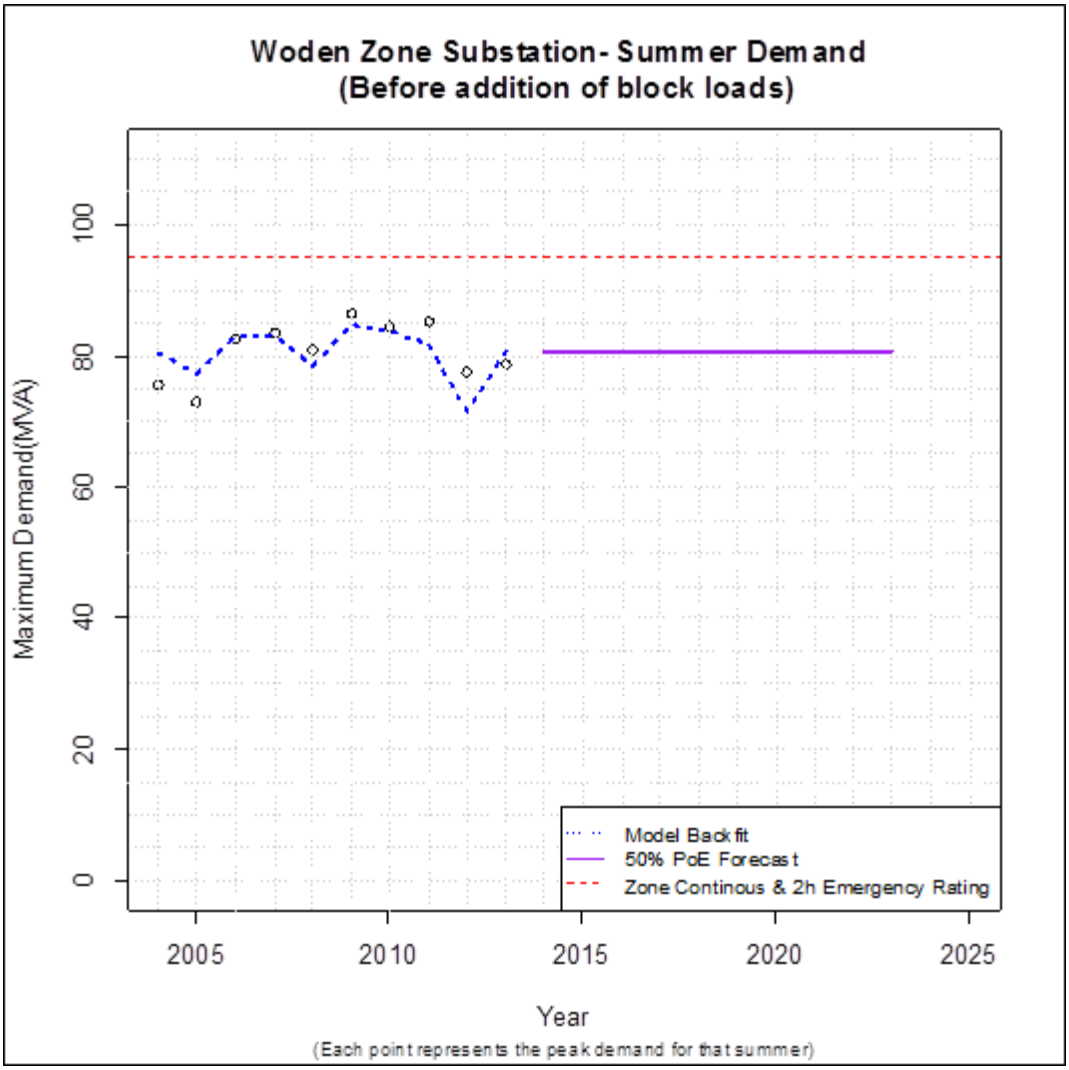

Model Details: Demand = 63.57 + 1.74 * CDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 63.5653 | 2.9778 | 21.346 | < 2e-16 |
| CDD | 1.736 | 0.3347 | 5.187 | 0.0000166 |
| Residual standard error: 4.232 on 28 degrees of freedom | | | | |
| Multiple R-squared: 0.4901, Adjusted R-squared: 0.4719 | | | | |
| F-statistic: 26.91 on 1 and 28 DF, p-value: 1.661e-05 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



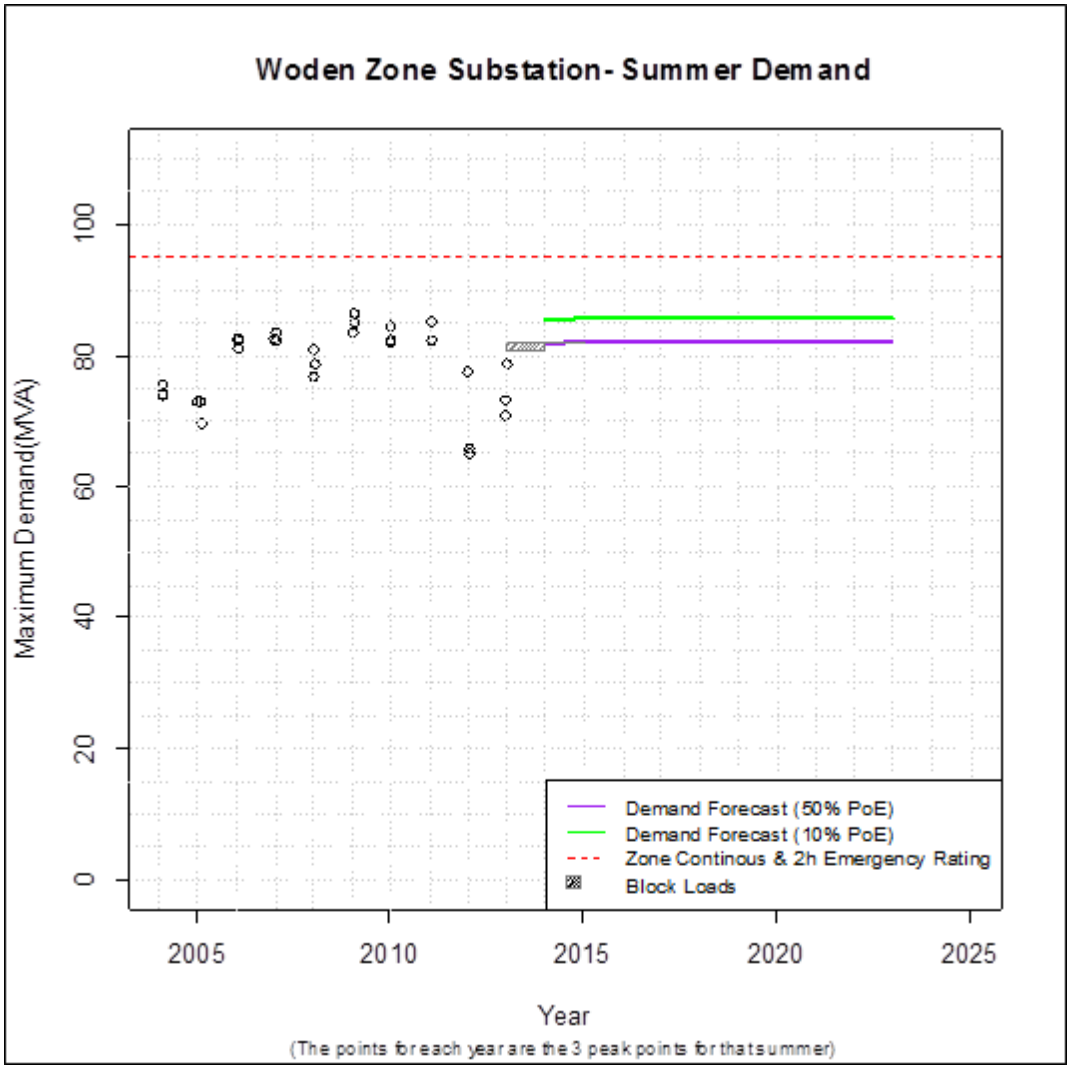
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Woden Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 75.71 | 80.40 | 6% | 6% |
| 2005 | 73.05 | 77.37 | 6% | 6% |
| 2006 | 82.45 | 83.01 | 1% | 1% |
| 2007 | 83.43 | 83.10 | 0% | 0% |
| 2008 | 80.87 | 78.58 | -3% | 3% |
| 2009 | 86.34 | 84.74 | -2% | 2% |
| 2010 | 84.51 | 83.79 | -1% | 1% |
| 2011 | 85.09 | 81.53 | -4% | 4% |
| 2012 | 77.49 | 71.55 | -8% | 8% |
| 2013 | 78.8 | 80.58 | 2% | 2% |
| | | Average | 0% | 3% |

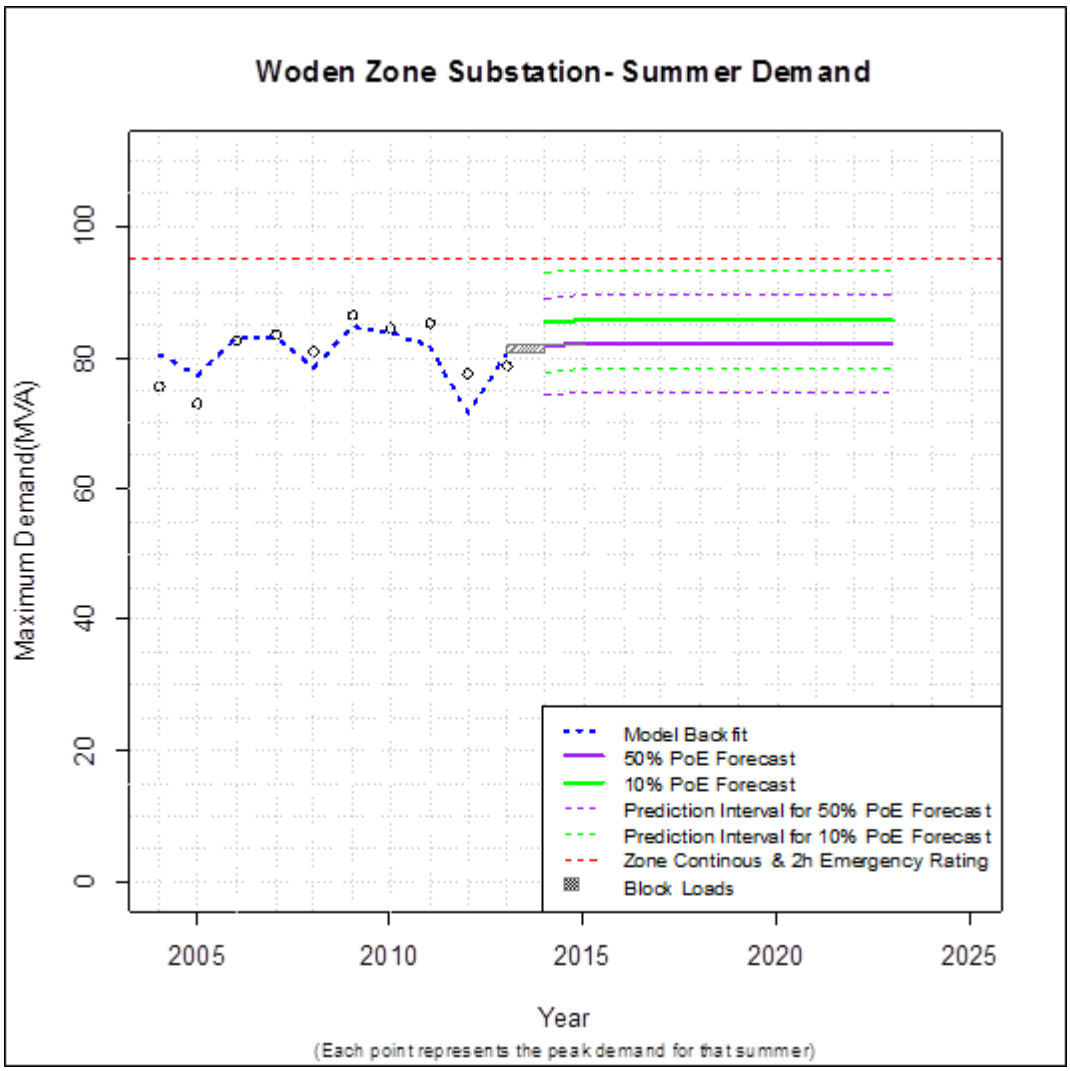
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Summer ending Feb | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 81.7 | 85.4 |
| 2015 | 82.0 | 85.7 |
| 2016 | 82.0 | 85.7 |
| 2017 | 82.0 | 85.7 |
| 2018 | 82.0 | 85.7 |
| 2019 | 82.0 | 85.7 |
| 2020 | 82.0 | 85.7 |
| 2021 | 82.0 | 85.7 |
| 2022 | 82.0 | 85.7 |
| 2023 | 82.0 | 85.7 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

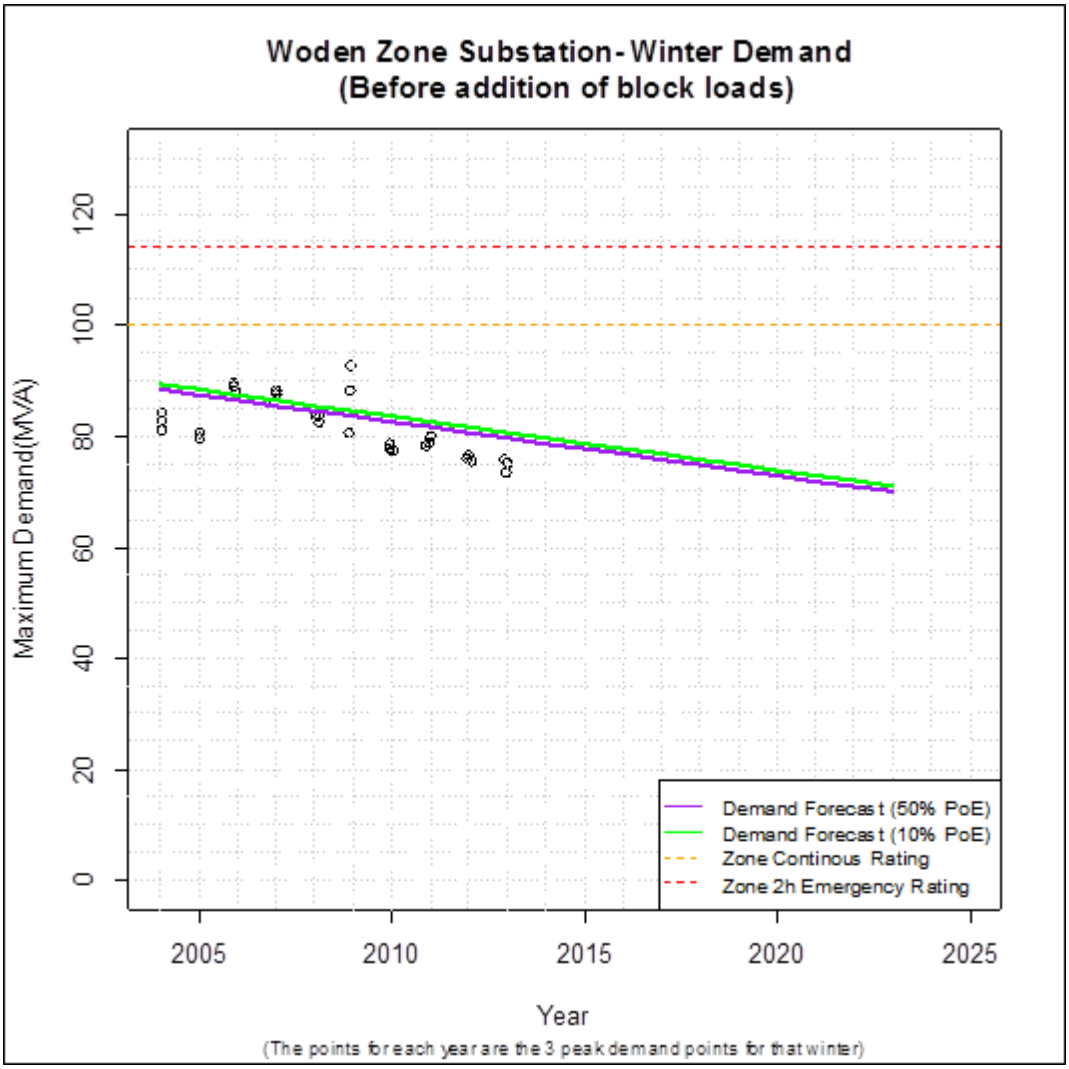
| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Commercial | Yarralumla Feeder | Woden | 0.1 | 11/06/2013 | 10% |
| Residential Development | Deakin No.2 Feeder | Woden | 0.12 | 14/08/2013 | 100% |
| Residential Development | Cotter Feeder | Woden | 0.45 | 29/08/2013 | 100% |
| Residential Development | Easty Feeder | Woden | 0.65 | 19/09/2013 | 90% |
| Commercial Development | Phillip North Feeder | Woden | 2 | 1/01/2015 | 10% |
| Commercial Development | Wilson Feeder 2 | Woden | 0.255 | 1/01/2015 | 10% |
| Commercial Development | Theodore Feeder | Woden | 0.08 | 1/01/2015 | 90% |

### 5.12.2 Woden Zone Winter Forecast

**Model Selection**: Model with variables Year and HDD, selected based on stepwise procedures and checking against other statistical criteria. Originally chosen model with variables Year, MinTemp and HDD was rejected because the coefficients were unreasonable.

**Model/Forecast (before adding block loads):**

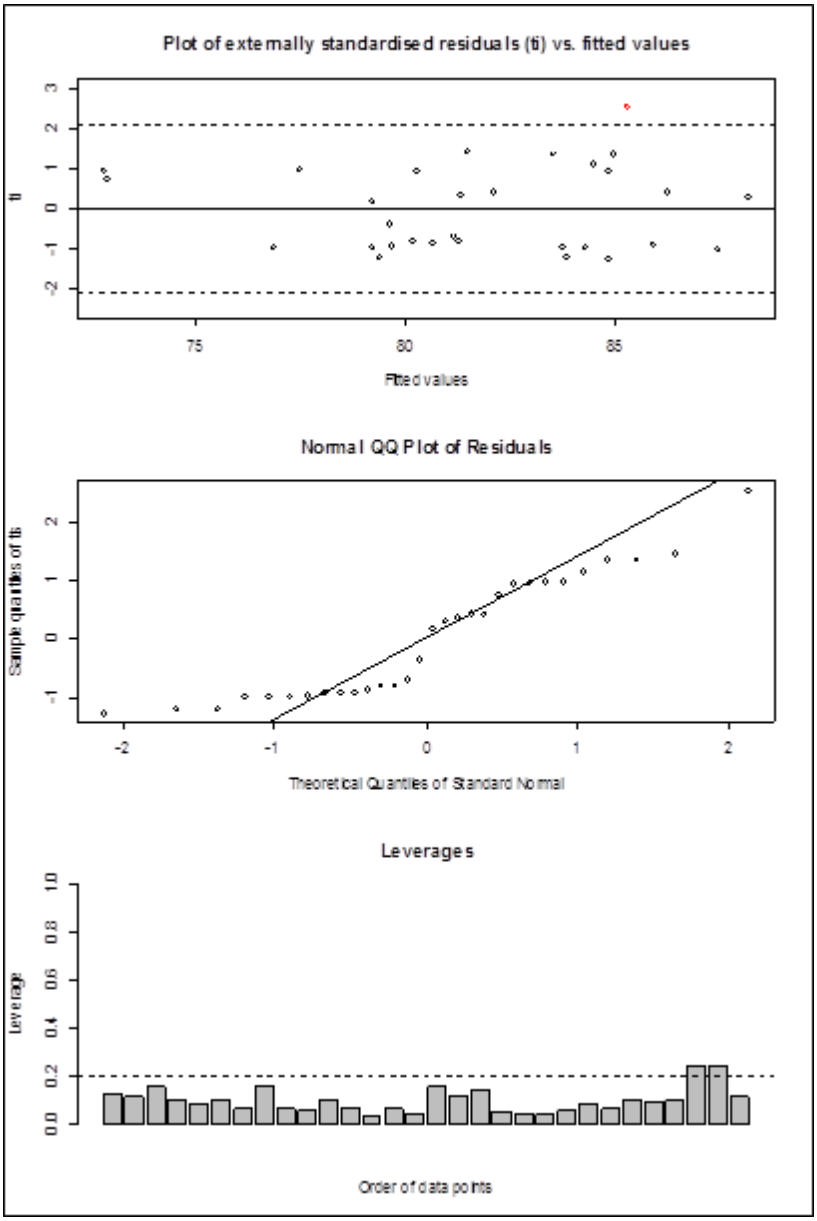
1) Graph showing historical demand, the 10% and 50% PoE 10-year forecasts, and back-fit showing what historical demand the model would forecast given 10% and 50% PoE weather conditions in the past.



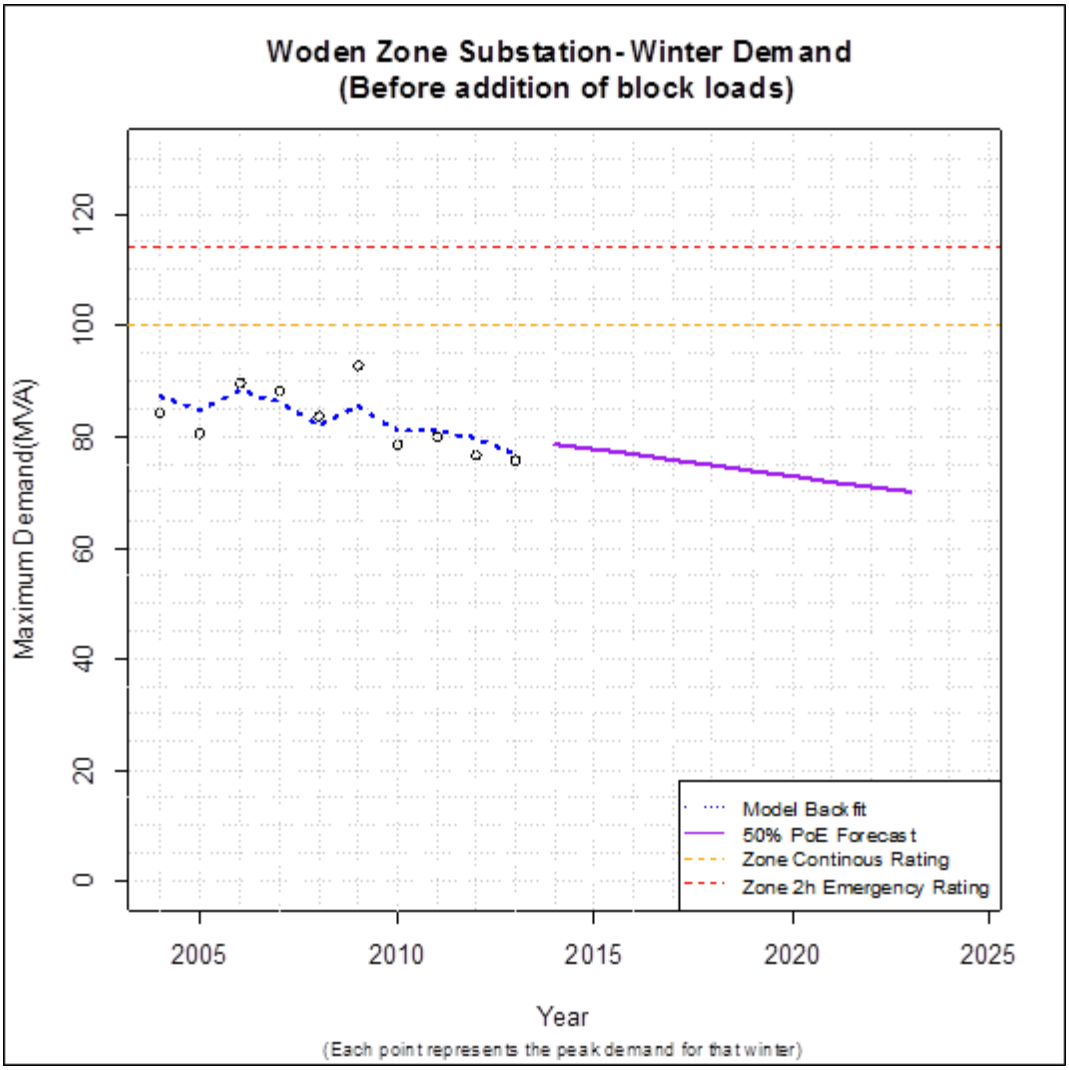

Model Details: Demand = 2017.19 – 0.97 * Year + 1.22 * HDD

| Model Coefficients | | | | |
|---|---|---|---|---|
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
| (Intercept) | 2017.1946 | 462.544 | 4.361 | 0.000169 |
| Year | -0.9704 | 0.23 | -4.219 | 0.000247 |
| HDD | 1.2201 | 0.3779 | 3.229 | 0.003255 |
| Residual standard error: 3.589 on 27 degrees of freedom | | | | |
| Multiple R-squared: 0.5439, Adjusted R-squared: 0.5102 | | | | |
| F-statistic: 16.1 on 2 and 27 DF, p-value: 2.493e-05 | | | | |

The model is scrutinized to ensure that it is suited for the data. For e.g. diagnostic checking of residuals, normal Q-Q plots, leverage plots, VIF, and a number of other methods are used. Attached below are some diagnostic graphs supporting the model.



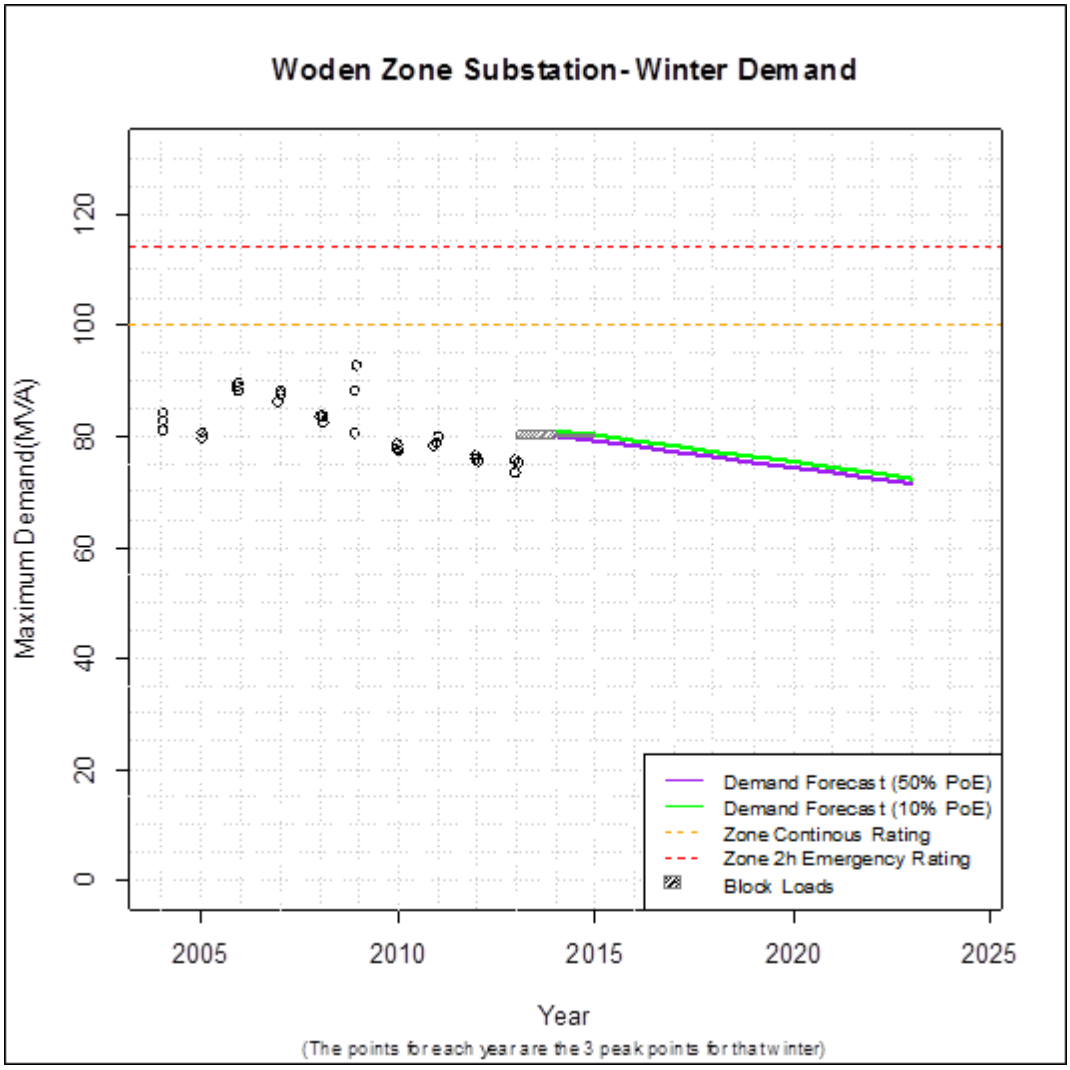
2) Graph and statistics assessing the back-fit accuracy of the model. The back-fit forecast is compared to the single highest peak demand point from each year.



| Year | Woden Peak (MVA) | Back-fit using actual temp (MVA) | Deviation of Backfit from actual | Deviation Magnitude |
|---|---|---|---|---|
| 2004 | 84.12 | 87.43 | 4% | 4% |
| 2005 | 80.6 | 84.82 | 5% | 5% |
| 2006 | 89.57 | 88.18 | -2% | 2% |
| 2007 | 88.18 | 86.23 | -2% | 2% |
| 2008 | 83.63 | 82.09 | -2% | 2% |
| 2009 | 92.87 | 85.27 | -8% | 8% |
| 2010 | 78.46 | 81.25 | 4% | 4% |
| 2011 | 79.86 | 81.13 | 2% | 2% |
| 2012 | 76.55 | 79.67 | 4% | 4% |
| 2013 | 75.79 | 76.81 | 1% | 1% |
| | | Average | 1% | 3% |

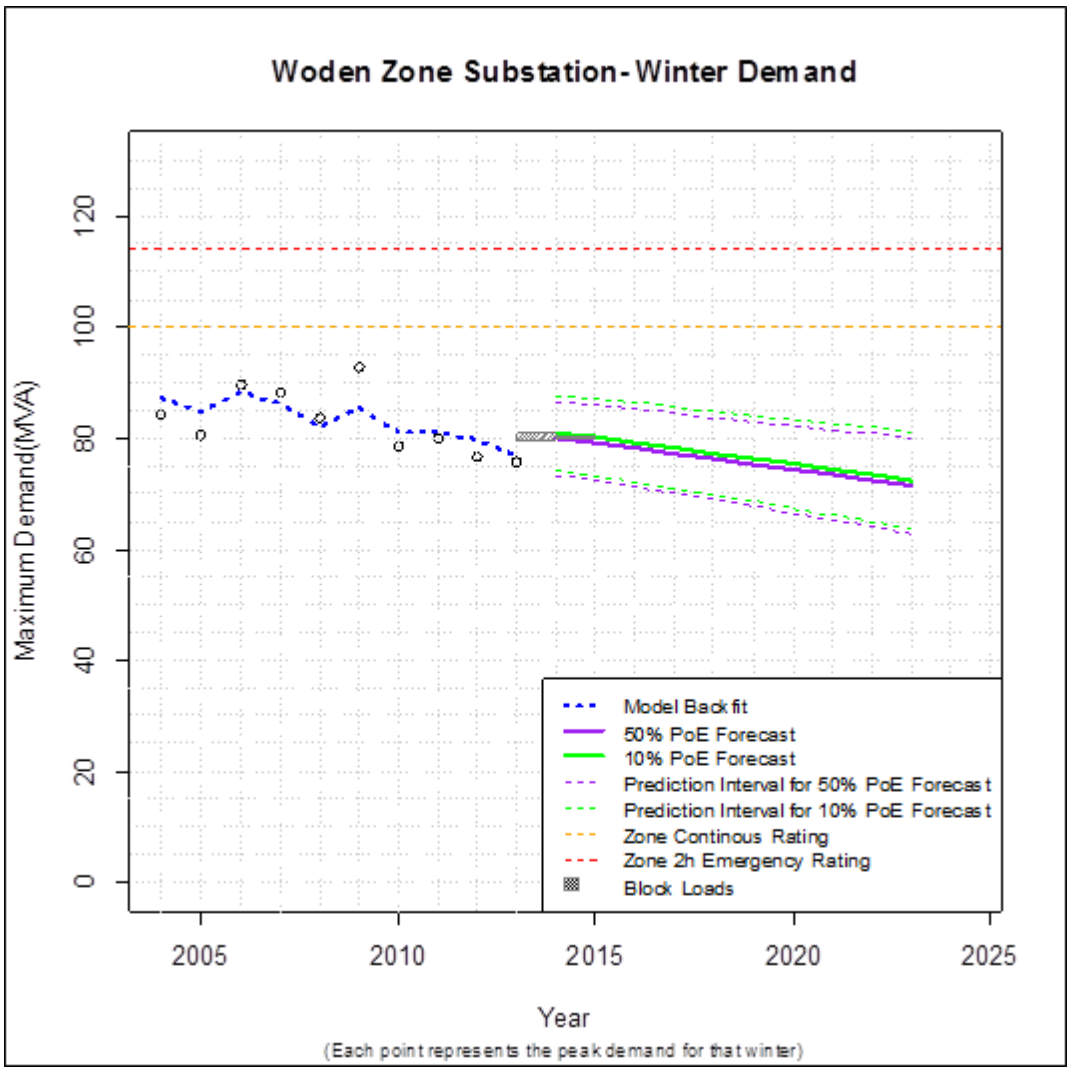
**Final Model/Forecast (including block loads):**

3) Graph and table showing the final forecast (incorporating potential future block loads).



| Final Forecast (Incorporating Block Loads) | | |
|---|---|---|
| Winter Ending Aug | 50% PoE (in MVA) | 10% PoE (in MVA) |
| 2014 | 79.9 | 80.8 |
| 2015 | 79.2 | 80.2 |
| 2016 | 78.2 | 79.2 |
| 2017 | 77.2 | 78.2 |
| 2018 | 76.3 | 77.3 |
| 2019 | 75.3 | 76.3 |
| 2020 | 74.3 | 75.3 |
| 2021 | 73.4 | 74.3 |
| 2022 | 72.4 | 73.4 |
| 2023 | 71.4 | 72.4 |

4) Graph used in reports/for presentation (incorporating potential future block loads)



## Supporting Document: Block Load Data

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply Required Date | Project probability |
|---|---|---|---|---|---|
| Residential Development | Deakin No.2 Feeder | Woden | 0.12 | 14/08/2013 | 100% |
| Residential Development | Cotter Feeder | Woden | 0.45 | 29/08/2013 | 100% |
| Residential Development | Easty Feeder | Woden | 0.65 | 19/09/2013 | 90% |
| Commercial Development | Phillip North Feeder | Woden | 2 | 1/01/2015 | 10% |
| Commercial Development | Wilson Feeder 2 | Woden | 0.255 | 1/01/2015 | 10% |
| Commercial Development | Theodore Feeder | Woden | 0.08 | 1/01/2015 | 90% |

## 5.13 Block Loads Data

The way that block loads are accounted for are explained in the example below:

Summer – all block loads falling between 15 Jan 2014 and 15 Jan 2015 are included in the 2015 forecast.

Winter – all block loads falling between 15 July 2014 and 15 July 2015 are included in the 2015 forecast.

*Block loads that are “completed” before 15 Jan 2013 are not included in the summer forecasts, block loads that are “completed” before 15 July 2013 are not included in the winter forecasts.

All data on block (spot) loads are provided in the table below.

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply required date | Project probability |
|---|---|---|---|---|---|
| Residential & Commercial Development | Eardley Feeder | Belconnen | 0.06 | 17/06/2013 | 100% |
| Residential Development | Meacham Feeder | Belconnen | 0.06 | 17/09/2013 | 100% |
| Commercial Development | Eardley Feeder & Joy Commins Feeder | Belconnen | 3 | 1/01/2015 | 50% |
| Residential & Commercial Development | Cameron North feeder | Belconnen | 2 | 1/02/2015 | 40% |
| Commercial Development | Lonsdale Feeder | CityEast | 0.1 | 13/06/2013 | 100% |
| Residential & Commercial Development | wolsley Feeder | CityEast | 0.5 | 12/12/2013 | 90% |
| Community development | Chisholm Feeder | CityEast | 0.125 | 1/02/2014 | 10% |
| Residential Development | Wakefield Feeder 3 | CityEast | 0.07 | 1/01/2015 | 90% |
| Commercial | Dryandra Feeder | Civic | 0.18 | 14/08/2013 | 100% |
| Residential & Commercial Development | Wattle Feeder | Civic | 0.246 | 16/09/2013 | 100% |
| Residential Development | Wattle Feeder | Civic | 0.07 | 1/01/2015 | 90% |
| Commercial & industrial | Collie Fdr | Fyshwick | 0.05 | 20/02/2013 | 100% |

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply required date | Project probability |
|---|---|---|---|---|---|
| Commercial | Abattoir feeder | Fyshwick | 0.086 | 20/03/2013 | 100% |
| Residential Development | Newcastle feeder 1 | Fyshwick | 0.2 | 5/04/2013 | 100% |
| Commercial | Domayne Feeder 1 | Fyshwick | 0.075 | 6/05/2013 | 100% |
| Commercial Development | Abattoir feeder | Fyshwick | 0.225 | 16/08/2013 | 100% |
| Commercial | Barrier Feeder | Fyshwick | 0.063 | 12/12/2013 | 90% |
| Commercial & industrial | Monaro Feeder 2 | Gilmore | 0.066 | 5/02/2013 | 100% |
| Commercial & industrial | Monaro Feeder | Gilmore | 0.32 | 20/03/2013 | 100% |
| Residential Development | Nona 2 | GoldCreek | 0.05 | 23/03/2013 | 100% |
| Commercial Development | West Feeder | GoldCreek | 0.055 | 15/05/2013 | 100% |
| | Anthony Rolfe | GoldCreek | 0.22 | 21/06/2013 | 100% |
| Community Development | Gribble feeder | GoldCreek | 0.14 | 8/07/2013 | 100% |
| Commercial Development | Riley Feeder | GoldCreek | 0.171 | 26/07/2013 | 100% |
| Commercial Development | Gungahlin Feeder | GoldCreek | 0.15 | 16/08/2013 | 90% |
| Residential Development | Magenta Feeder | GoldCreek | 0.06 | 16/08/2013 | 100% |
| Commercial & industrial | Gungahlin | GoldCreek | 0.115 | 1/10/2013 | 10% |
| Residential & Commercial Development | Anthony Rolfe | GoldCreek | 0.35 | 2/10/2013 | 100% |
| Commercial & industrial | Gurrang | GoldCreek | 0.25 | 3/10/2013 | 100% |
| Commercial | Gungahlin Feeder | GoldCreek | 0.15 | 30/10/2013 | 40% |
| Commercial Development | Gribble feeder | GoldCreek | 0.18 | 31/10/2013 | 100% |
| Residential Development | Anthony Rolfe Feeder | GoldCreek | 0.065 | 13/11/2013 | 100% |
| Commercial & industrial | Gungahlin / Gribble Feeder | GoldCreek | 0.7 | 28/11/2013 | 100% |
| Commercial Development | Gribble feeder | GoldCreek | 0.9 | 3/01/2014 | 90% |
| Residential & Commercial | Gurrang Feeder | GoldCreek | 0.315 | 2/02/2014 | 90% |

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply required date | Project probability |
|---|---|---|---|---|---|
| Development | | | | | |
| Commercial Development | Saunders Feeder | GoldCreek | 0.144 | 1/01/2015 | 10% |
| Residential Development | Nona Feeder | GoldCreek | 0.475 | 1/01/2015 | 10% |
| Commercial & industrial | Bowley Feeder | Latham | 0.13 | 20/02/2013 | 100% |
| Commercial & industrial | Tillyard Feeder | Latham | 0.225 | 17/04/2013 | 100% |
| Residential Development | Verbrugghen Feeder (1) | Latham | 0.02 | 21/05/2013 | 100% |
| Residential & Commercial Development | Patrick Feeder | Latham | 0.077 | 27/06/2013 | 100% |
| Commercial Development | Bowley Feeder | Latham | 0.13 | 1/01/2015 | 10% |
| Commercial Development | Fielder Feeder | Latham | 0.08 | 1/01/2015 | 10% |
| Commercial Development | Patrick Feeder 2 | Latham | 0.13 | 1/01/2015 | 90% |
| Residential Development | Strzelecki Feeder | TelopeaPark | 0.065 | 15/04/2013 | 100% |
| Residential Development | Monash Feeder | TelopeaPark | 0.24 | 16/04/2013 | 100% |
| Residential Development | Monash Feeder | TelopeaPark | 0.24 | 22/04/2013 | 100% |
| Commercial | Sandalwood Feeder | TelopeaPark | 0.06 | 13/05/2013 | 100% |
| Commercial | Forester Feeder | TelopeaPark | 0.06 | 14/08/2013 | 100% |
| Residential Development | Monash Feeder | TelopeaPark | 0.5 | 20/05/2014 | 95% |
| Commercial | Mundaring Feeder | TelopeaPark | 1.4 | 15/07/2014 | 90% |
| Commercial | Young feeder | TelopeaPark | 0.31 | 1/08/2014 | 90% |
| Commercial Development | Giles St Feeder | TelopeaPark | 0.55 | 1/01/2015 | 10% |
| Residential Development | Jardine Feeder | TelopeaPark | 0.06 | 1/01/2015 | 10% |
| Commercial & industrial | Fincham | Wanniassa | 0.1 | 19/02/2013 | 100% |
| Commercial | Langmore Feeder 3 | Wanniassa | 0.425 | 7/05/2013 | 100% |
| SCR | Hawkesbury Feeder | Wanniassa | 0.1 | 1/01/2015 | 10% |

| Development type | Supply source feeder | Supply source zone sub | Expected ADMD Increase (MVA) | Supply required date | Project probability |
|---|---|---|---|---|---|
| Commercial | Yarralumla Feeder | Woden | 0.1 | 11/06/2013 | 10% |
| Residential Development | Deakin No.2 Feeder | Woden | 0.12 | 14/08/2013 | 100% |
| Residential Development | Cotter Feeder | Woden | 0.45 | 29/08/2013 | 100% |
| Residential Development | Easty Feeder | Woden | 0.65 | 19/09/2013 | 90% |
| Commercial Development | Phillip North Feeder | Woden | 2 | 1/01/2015 | 10% |
| Commercial Development | Wilson Feeder 2 | Woden | 0.255 | 1/01/2015 | 10% |
| Commercial Development | Theodore Feeder | Woden | 0.08 | 1/01/2015 | 90% |

# 6. Reconciliation between forecasts

This section shows the comparison of the top-down system forecast, with a bottom-up system forecast. The bottom-up forecast has been derived by summing the individual zone forecast, and taking loss factors and diversity factors into account.

The difference between the summer top-down and bottom-up forecasts is ±3%, while the difference in the winter forecast is 5% in the early years and up to 10% by the end of the forecast period.

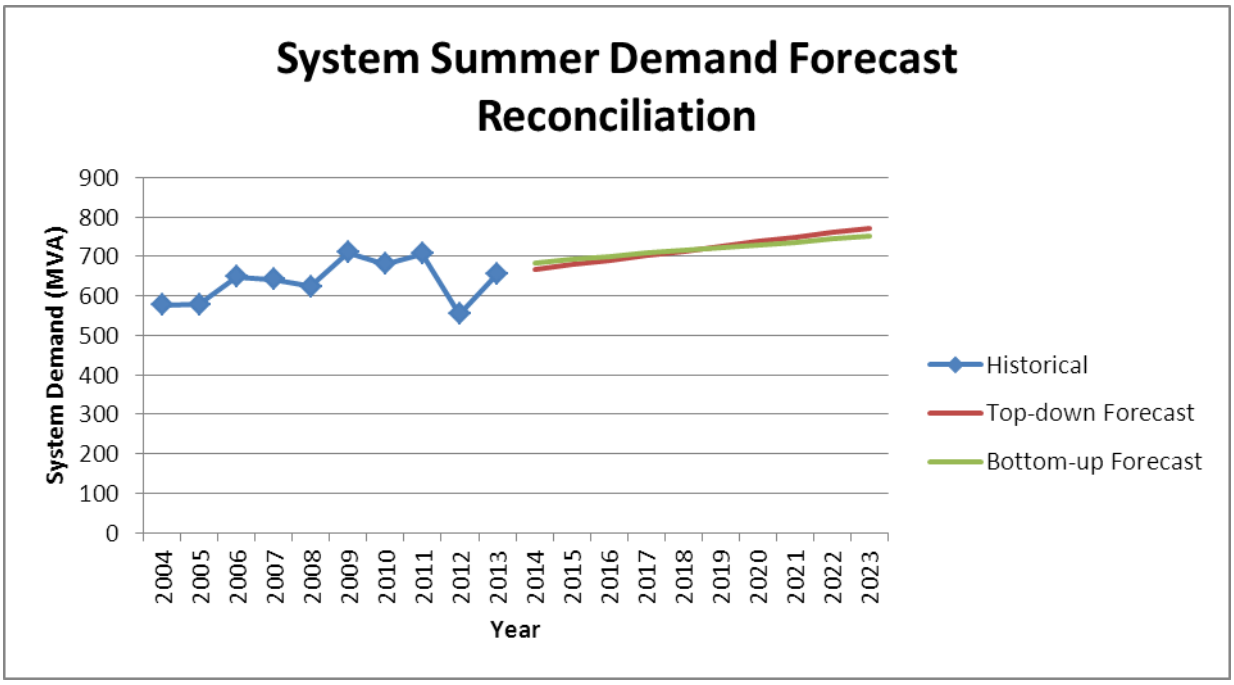
## 6.1 Loss Factors

The summer and winter system peaks were compared to the sum of the demand at each zone substation at the time of the system peaks. While complete data was not available for each year, this analysis showed that the losses on the ActewAGL transmission network **at the time of the system peak** were in the range of **7 to 10 %.** This may be different to the average loss factors calculated for other purposes.

## 6.2 Diversity Factors

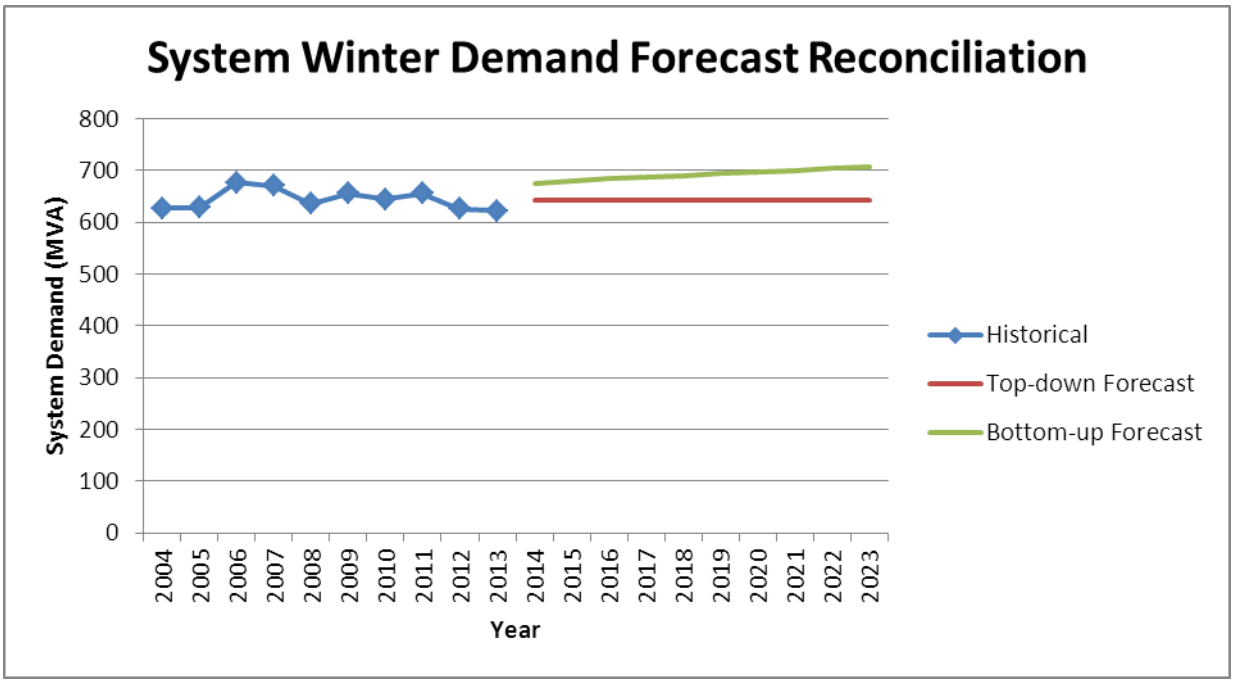
| | **Average Diversity Factor (load on the zone at the time of system peak demand, as a percentage of the zone peak demand)** | |
|---|---|---|
| **Zone** | **Summer** | **Winter** |
| Belconnen | 99% | 100% |
| City East | 99% | 99% |
| Civic | 98% | 77% |
| Fyshwick | 93% | 57% |
| Gilmore | 91% | 95% |
| Gold Creek | 84% | 95% |
| Latham | 83% | 96% |
| Telopea Park | 98% | 94% |
| Theodore | 76% | 95% |
| Wanniassa | 95% | 98% |
| Woden | 97% | 99% |

## 6.3 Summer Demand Forecast



| | System Summer Peak Demand (MVA) | | | Deviation of Top-down forecast from Bottom-up System Forecast |
|---|---|---|---|---|
| Year | Historical | Top-down Forecast | Bottom-up Forecast | |
| 2004 | 577.4 | | | |
| 2005 | 579.2 | | | |
| 2006 | 648.2 | | | |
| 2007 | 642.7 | | | |
| 2008 | 623.5 | | | |
| 2009 | 711.2 | | | |
| 2010 | 681.5 | | | |
| 2011 | 707.1 | | | |
| 2012 | 555 | | | |
| 2013 | 656 | | | |
| 2014 | | 667.1 | 682.3 | 2% |
| 2015 | | 678.9 | 693.6 | 2% |
| 2016 | | 690.9 | 700.9 | 1% |
| 2017 | | 702.6 | 708.1 | 1% |
| 2018 | | 714.3 | 715.4 | 0% |
| 2019 | | 726.1 | 722.6 | 0% |
| 2020 | | 737.8 | 729.9 | -1% |
| 2021 | | 749.5 | 737.1 | -2% |
| 2022 | | 761.1 | 744.4 | -2% |
| 2023 | | 772.7 | 751.6 | -3% |

## 6.4 Winter Demand Forecast



| | System Winter Peak Demand (MVA) | | | Deviation of Top-down forecast from Bottom-up System Forecast |
|---|---|---|---|---|
| Year | Historical | Top-down Forecast | Bottom-up Forecast | |
| 2004 | 627.6 | | | |
| 2005 | 628.5 | | | |
| 2006 | 677 | | | |
| 2007 | 671 | | | |
| 2008 | 636.6 | | | |
| 2009 | 655.6 | | | |
| 2010 | 645 | | | |
| 2011 | 656.3 | | | |
| 2012 | 626.3 | | | |
| 2013 | 622.9 | | | |
| 2014 | | 643.1 | 674.7 | 5% |
| 2015 | | 643.1 | 681.1 | 6% |
| 2016 | | 643.1 | 684.5 | 6% |
| 2017 | | 643.1 | 687.8 | 7% |
| 2018 | | 643.1 | 691.1 | 7% |
| 2019 | | 643.1 | 694.4 | 8% |
| 2020 | | 643.1 | 697.8 | 9% |
| 2021 | | 643.1 | 701.1 | 9% |
| 2022 | | 643.1 | 704.4 | 10% |
| 2023 | | 643.1 | 707.8 | 10% |

# 7. Responses to other items in RIN Schedule 1 section 8

The following table provides responses to items relating to forecasts of maximum demand that have not been covered by the information contained in the preceding sections of this attachment.

| Ref | Schedule 1 requirement | ActewAGL Distribution response |
|---|---|---|
| 8.2(b) | Provide where ActewAGL's approach to weather *correction* has changed, provide historically consistent weather corrected *maximum demand* data, as per the format in *regulatory templates* 5.3 and 5.4 using ActewAGL's current approach. If this data is unavailable, explain why. | The approach to weather correction has not changed. |
| 8.3(f) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain any appliance models, where used, or assumptions relating to average *customer* energy usage (by *customer* type) | No appliance model or assumptions about future average customer energy use were used. Efficiency trends are captured through the regression approach. |
| 8.3(i) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain how the forecasts resulting from these methods and assumptions have been used in determining the following:<br><br>(i) capital expenditure forecasts; and<br>(ii) operating and maintenance expenditure forecasts | Refer to Chapter 6 and Attachment D4: Distribution Annual Planning Report. |
| 8.3(j) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain whether ActewAGL used the forecasting model(s) it used in the joint planning process for the purposes of its | Forecasts were provided to TransGrid for joint planning. |

| Ref | Schedule 1 requirement | ActewAGL Distribution response |
|---|---|---|
| | *regulatory proposal* | |
| 8.3(k) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain whether ActewAGL forecasts both *coincident* and *non-coincident maximum demand* at the feeder, *connection point*, *subtransmission substation* and *zone substation* level, and how these forecasts reconcile with the system level forecasts (including how various assumptions that are allowed for at the system level relate to the *network* level forecasts) | ActewAGL Distribution does not forecast both coincident and non-coincident maximum demand at the feeder, connection point, subtransmission substation and zone substation level. |
| 8.3(l) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain whether ActewAGL records historic *maximum demand* in *MW*, *MVA* or both | ActewAGL Distribution generally records historic maximum demand in MVA, but also MW where power factor is measured. |
| 8.3(m) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain the *probability of exceedance* that ActewAGL uses in *network planning* | ActewAGL Distribution uses a PoE of 10% in network planning. |
| 8.3(n) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain the contingency planning process, in particular the process used to assess high system demand | Refer to Attachment D5: Distribution Network Augmentation Criteria. |
| 8.3(o) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain how risk is managed across the network, particularly in relation to load sharing across network elements and | Refer to Chapter 6. |

| Ref | Schedule 1 requirement | ActewAGL Distribution response |
|---|---|---|
| | non-network solutions to peak demand events | |
| 8.3(p) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain whether and how the *maximum demand* forecasts underlying the *regulatory proposal* reconcile with any demand information or related planning statements published by AEMO, as well as forecasts produced by any transmission network service providers connected to ActewAGL's *network* | ActewAGL Distribution was unable to find any relevant AEMO forecasts for the ACT. |
| 8.3(q) | For each of the methodologies provided and described in response to paragraph 8.1, and, where relevant, data requested under 8.2(b) and 8.2(c), explain how the normal and emergency ratings are used in determining capacity for individual *zone substations* and *sub-transmission lines* | Refer to Attachment D16: Electrical Data Manual |
| 8.3(r) and 8.3(s) | *See Schedule 1 for detailed requirements* | Refer to business cases for individual projects. |
| 8.4(a) | Provide evidence that any independent verifier engaged has examined the reasonableness of the method, processes and assumptions in determining the forecasts and has sufficiently capable expertise in undertaking a verification of forecasts | Refer to Attachment C2: Review of demand forecast methodology. |
| 8.4(b) | Provide all documentation, analysis and models evidencing the results of the independent verification | Refer to Attachment C2: Review of demand forecast methodology. |