ELECTRICITY INDUSTRY PARTICIPATION CODE
DISTRIBUTED UNMETERED LOAD AUDIT REPORT

For

PALMERSTON NORTH CITY COUNCIL AND MERIDIAN ENERGY LIMITED

Prepared by: Tara Gannon

Date audit commenced: 2 September 2019

Date audit report completed: 18 September 2019

Audit report due date: 20 September 2019

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EXECUTIVE SUMMARY

This audit of the **Palmerston North City Council (PNCC)** DUML database and processes was conducted at the request of **Meridian Energy Limited (Meridian)** in accordance with clause 15.37B. The purpose of this audit is to verify that the volume information is being calculated accurately, and that profiles have been correctly applied.

The audit was conducted in accordance with the audit guidelines for DUML audits version 1.1. The scope of the audit encompasses the collection, security and accuracy of the data, including the preparation of submission information.

A RAMM database is managed by **Alf Downs Streetlighting Limited (Alf Downs)** on behalf of PNCC. The database is remotely hosted by RAMM Software Ltd.

The field work, asset data capture and database population is conducted by Alf Downs. Alf Downs staff update the database from the field using Pocket RAMM.

PNCC's initial LED rollout is complete. The database still records adjusted wattages for LED lights on residential streets where dimming profiles are applied. Because the load is still reconciled using Meridian's DST profiles, the full wattage should be recorded.

Database accuracy is described as follows:

Result	Percentage	Comments
The point estimate of R	105.9	Wattage from survey is higher than the database wattage by 5.9%
R_L	92.9	With a 95% level of confidence it can be concluded that the error could be between -7.1% and 10.4%
R_H	110.4	

The variability of the sample results across the strata means that the true wattage (installed in the field) could be between 7.1% lower and 10.4% higher than the wattage recorded in the DUML database. Non-compliance is recorded because the potential error is greater than ±5.0%.

In absolute terms the installed capacity is estimated to be 36 kW higher than the database indicates.

There is a 95% level of confidence that the installed capacity is between 44 kW lower to 65 kW higher than the database.

In absolute terms, total annual consumption is estimated to be 155,500 kWh higher than the DUML database indicates.

There is a 95% level of confidence that the annual consumption is between 187,900 kWh p.a. lower to 276,900 kWh p.a. higher than the database indicates.

Meridian reconciles this DUML load using the DST profile. Wattages are derived from a RAMM extract provided by Alf Downs each month. On and off times are derived from a data logger read by EMS and are used to create a shape file. Meridian supplies EMS with the capacity information from Alf Downs, and EMS calculates the kWh figures for ICP 0000031152CPB70 and 1000581347PCFF5 and includes them in the relevant AV080 file. This process was audited during Meridian's reconciliation participant audit and EMS' agent audit.

On 18 June 2019, the Electricity Authority issued a memo clarifying the memo of 2012 that stated that a monthly snapshot was sufficient to calculate submission from, and confirmed the code requirement to calculate the correct monthly load must:

- take into account when each item of load was physically installed or removed; and

- wash up volumes must take into account where historical corrections have been made to the DUML load and volumes.

The current monthly report is provided as a snapshot and is non-compliant, and Meridian completes revision submissions where corrections are required. Meridian has not yet updated their processes to be consistent with the Authority's memo.

The future risk rating of 27 indicates that the next audit be completed in three months. This may not be sufficient time to resolve the matters raised and I recommend the Authority considers an audit period of at least six months.

The matters raised are detailed below:

AUDIT SUMMARY

NON-COMPLIANCES

Subject	Section	Clause	Non-Compliance	Controls	Audit Risk Rating	Breach Risk Rating	Remedial Action
Deriving submission information	2.1	11(1) of Schedule 15.3	The database is not confirmed as accurate with a 95% level of confidence as recorded in **section 3.1**. Potential under submission of 61,056 kWh p.a. due to wattages adjusted for dimming. Potential over submission of 4,382 kWh p.a. for metered load. The monthly database extract provided does not track changes at a daily basis and is provided as a snapshot. Livening dates are not recorded for new connections.	Weak	High	9	Investigating
Database accuracy	3.1	15.2 and 15.37B(b)	The database is not confirmed as accurate with a 95% level of confidence. 4,552 LED light wattages have been adjusted to account for dimming. The impact of the adjustment is 14,295.5 W estimated under submission. Meridian reports the load for ICP 0000031152CPB70 against profile DST, and the profiles used by PNCC to adjust wattages have not been approved by the Electricity Authority. The monthly database extract provided does not track changes at a daily basis and is provided as a snapshot. Livening dates are not recorded for new connections. Six lights with incorrect road name or GPS information. Some lights are likely to have incorrect ICPs recorded.	Weak	High	9	Investigating
Volume information accuracy	3.2	15.2 and 15.37B(c)	The database is not confirmed as accurate with a 95% level of confidence as recorded in **section 3.1**.	Weak	High	9	Investigating

Subject	Section	Clause	Non-Compliance	Controls	Audit Risk Rating	Breach Risk Rating	Remedial Action
			Potential under submission of 61,056 kWh p.a. due to wattages adjusted for dimming. Potential over submission of 4,382 kWh p.a. for metered load. The monthly database extract provided does not track changes at a daily basis and is provided as a snapshot. Livening dates are not recorded for new connections.				
Future Risk Rating						27	

Future risk rating	0	1-4	5-8	9-15	16-18	19+
Indicative audit frequency	36 months	24 months	18 months	12 months	6 months	3 months

RECOMMENDATIONS

Subject	Section	Recommendation
ICP identifier and items of load	2.2	Confirm that ICPs are recorded correctly for roads with lights connected to more than one ICP.
Database accuracy	3.1	Where possible confirm the wattages are correct for the 63 light models where the wattages did not match the expected values or there was insufficient information to confirm the correct wattages.

ISSUES

Subject	Section	Description	Issue
		Nil	

1. ADMINISTRATIVE

1.1. Exemptions from Obligations to Comply with Code

Code reference

Section 11 of Electricity Industry Act 2010.

Code related audit information

Section 11 of the Electricity Industry Act provides for the Electricity Authority to exempt any participant from compliance with all or any of the clauses.

Audit observation

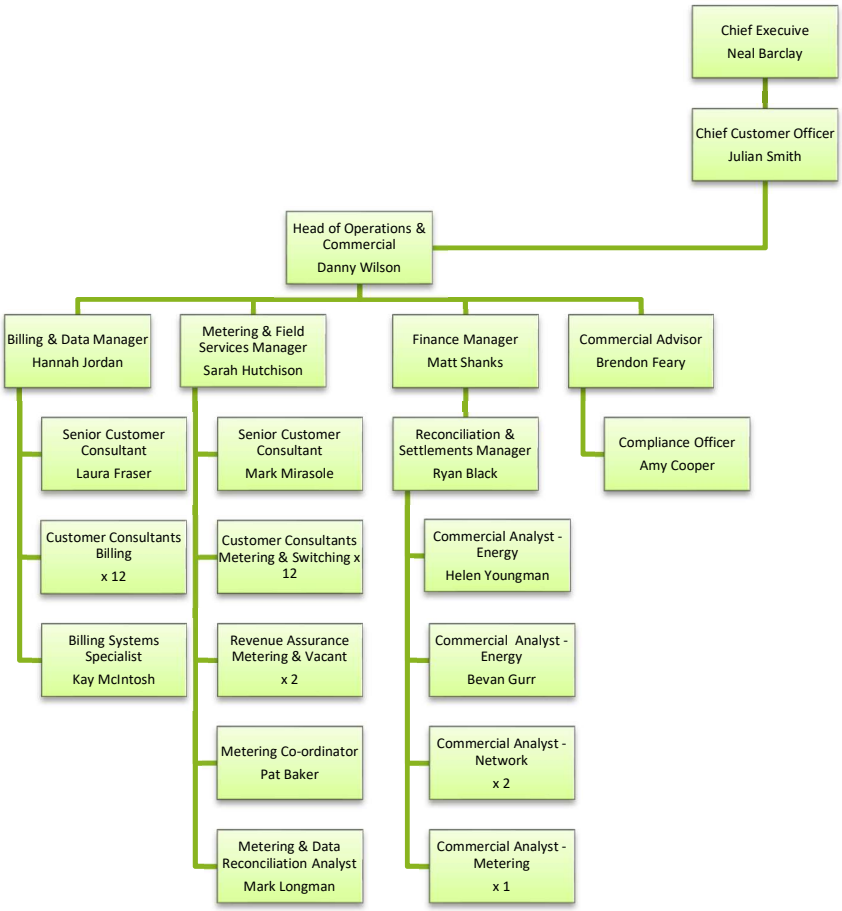
The Electricity Authority's website was reviewed to identify any exemptions relevant to the scope of this audit.

Audit commentary

There are no exemptions in place relevant to the scope of this audit.

1.2. Structure of Organisation

Meridian provided a copy of their organisational structure.



1.3. Persons involved in this audit

Auditor:

Tara Gannon

Veritek Limited

Electricity Authority Approved Auditor

Other personnel assisting in this audit were:

Name	Title	Company
Rob Cuff	Senior Contracts Engineer	Palmerston North City Council
Phil Harris	Street Lighting Contract Administration	Alf Downs Streetlighting Limited
Helen Youngman	Energy Data Analyst	Meridian Energy

1.4. Hardware and Software

The SQL database used for the management of DUML is remotely hosted by RAMM Software Ltd. The database is commonly known as "RAMM" which stands for "Roading Asset and Maintenance Management". The specific module used for DUML is called RAMM Contractor.

RAMM Software Limited backs up the database and assists with disaster recovery as part of their hosting service. Nightly backups are performed. As a minimum daily backups are retained for the previous five working days, weekly backups are retained for the previous four weeks, and monthly backups are retained for the previous six months.

Access to the database is secure by way of password protection.

1.5. Breaches or Breach Allegations

There are no breach allegations relevant to the scope of this audit.

1.6. ICP Data

ICP Number	Description	NSP	Profile	Number of items of load	Database wattage (watts)
0000031152CPB70	Streetlights, 32 The Square, Palmerston North	DST	LTN0331	3,838	245,287.2
1000581347PCFF5	PNCC Streetlights, 28A Redmayne St, Bunnythorpe	DST	BPE0331	5,541	376,013
Total				**9,379**	**621,300.2**

NZTA lights are recorded in the database. NZTA urban lights are the responsibility of PNCC and are recorded in the database against ICP 0000031152CPB70 or 1000581347PCFF5. NZTA rural lights are not PNCC's responsibility and do not have an ICP number recorded. They are excluded in database extracts to Meridian, and NZTA is developing a database for these lights, which will require a separate audit.

Private lights are recorded in the database but excluded from the extracts provided to Meridian for submission. As discussed in Powerco's audit, Powerco is investigating these lights, and intends to arrange for standard or shared unmetered load to be created.

There are a small number of items in the database that are connected to metered ICPs, these have been excluded from the audit.

1.7. Authorisation Received

All information was provided directly by Meridian, PNCC, or Alf Downs.

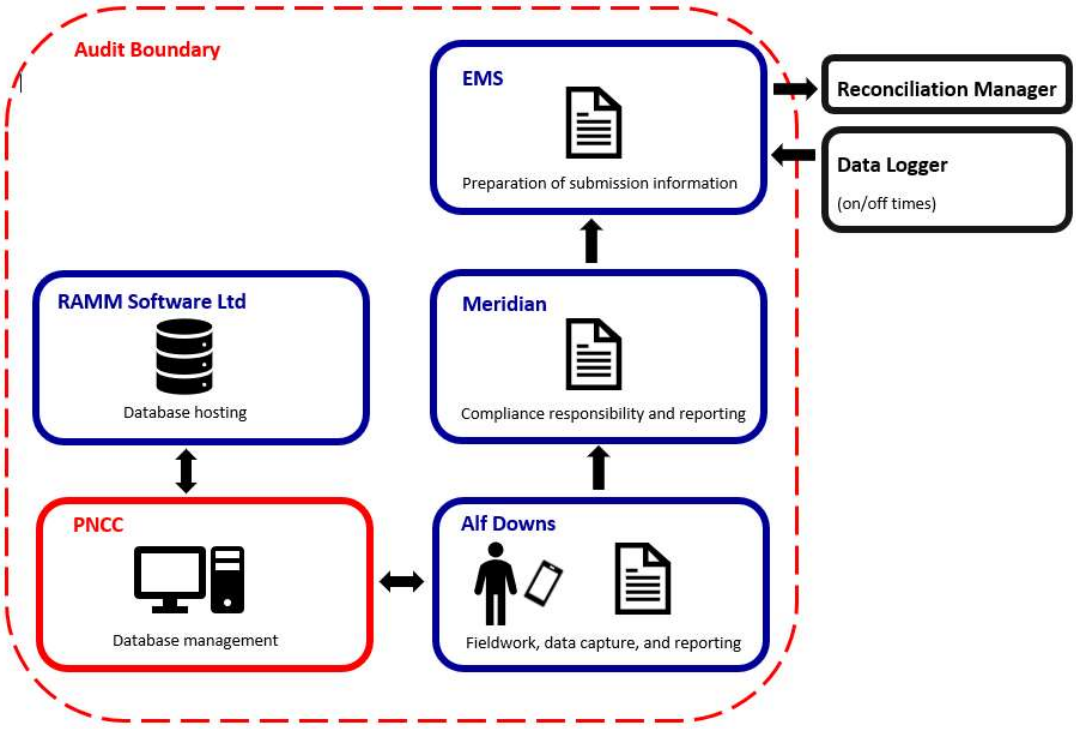
1.8. Scope of Audit

This audit of the PNCC DUML database and processes was conducted at the request of Meridian in accordance with clause 15.37B. The purpose of this audit is to verify that the volume information is being calculated accurately, and that profiles have been correctly applied.

The audit was conducted in accordance with the audit guidelines for DUML audits version 1.1.

A RAMM database is managed by Alf Downs on behalf of PNCC and they provide the monthly reporting to Meridian. The database is remotely hosted by RAMM Software Ltd. The field work, asset data capture and database population is conducted by Alf Downs.

The scope of the audit encompasses the collection, security and accuracy of the data, including the preparation of submission information based on the database reporting. The diagram below shows the audit boundary for clarity.



The field audit was undertaken of a statistical sample of 343 items of load on 2 September 2019.

1.9. Summary of previous audit

The previous audit of this database was undertaken by Rebecca Elliot of Veritek Limited in November 2018. The summary table below shows the statuses of the non-compliances raised in the previous audit. Further comment is made in the relevant sections of this report.

Subject	Section	Clause	Non-compliance	Status
Deriving submission information	2.1	11(1) of Schedule 15.3	PNCC applies unapproved profiles to adjust specified light wattages to account for different drive rates and dimming. 3,564 recorded light wattages differ from expected values resulting in a potential under submission of 81,000 kWh per annum. The database wattage and ballast inaccuracies are estimated to be in excess of the 623 kWh per annum.	Still existing Still existing
All load recorded in database	2.5	11(2A) of Schedule 15.3	One 20W light not included in the database extract used for submission.	Still existing, there are still 11 lights recorded on Monowai Pl
Database accuracy	3.1	15.2 and 15.37B(b)	One item recorded as RGB Sign with a 100W wattage, does not provide sufficient information to be able to confirm the values are correct. PNCC applies unapproved profiles to adjust specified light wattages to account for different drive rates and dimming. 3,564 recorded light wattages differ from expected values resulting in a potential under submission of 81,000 kWh per annum. The database wattage and ballast inaccuracies are estimated to be in excess of the 623 kWh per annum.	Cleared, values are correct Still existing Still existing
Volume information accuracy	3.2	15.2 and 15.37B(c)	PNCC applies unapproved profiles to adjust specified light wattages to account for different drive rates and dimming. 3,564 recorded light wattages differ from expected	Still existing

Subject	Section	Clause	Non-compliance	Status
			values resulting in a potential under submission of 81,000 kWh per annum. The database wattage and ballast inaccuracies are estimated to be in excess of the 623 kWh per annum.	Still existing

1.10. Distributed unmetered load audits (Clause 16A.26 and 17.295F)

Code reference

Clause 16A.26 and 17.295F

Code related audit information

Retailers must ensure that DUML database audits are completed:

1. *by 1 June 2018 (for DUML that existed prior to 1 June 2017)*
2. *within three months of submission to the reconciliation manager (for new DUML)*
3. *within the timeframe specified by the Authority for DUML that has been audited since 1 June 2017.*

Audit observation

Meridian have requested Veritek to undertake this streetlight audit.

Audit commentary

This audit report confirms that the requirement to conduct an audit has been met for this database within the required timeframe.

Audit outcome

Compliant

2. DUML DATABASE REQUIREMENTS

2.1. Deriving submission information (Clause 11(1) of Schedule 15.3)

Code reference

Clause 11(1) of Schedule 15.3

Code related audit information

The retailer must ensure the:

- *DUML database is up to date*
- *methodology for deriving submission information complies with Schedule 15.5.*

Audit observation

The process for calculation of consumption was examined and the application of profiles was checked. The database was checked for accuracy.

Audit commentary

Meridian reconciles this DUML load using the DST profile. Wattages are derived from a RAMM extract provided by Alf Downs each month. On and off times are derived from a data logger read by EMS and are used to create a shape file.

Meridian supplies EMS with the capacity information from Alf Downs, and EMS calculates the kWh figures for ICP 0000031152CPB70 and 1000581347PCFF5 and includes them in the relevant AV080 file. This process was audited during Meridian's reconciliation participant audit and EMS' agent audit.

I compared the RAMM extract provided by Alf Downs to the capacities provided to EMS for June and July 2019 and found that they matched exactly. The RAMM extract included 1026 W of metered load (51W recorded on 1000581347PCFF5, and 975 W recorded on 0000031152CPB70), which was expected to be excluded from submissions. Alf Downs intends to ensure that this metered load is excluded from extracts from September 2019 onwards.

Sources of inaccuracy are as follows:

Issue	Estimated volume information impact (annual kWh)
4,552 LED light wattages have been adjusted to account for dimming.	Estimated 61,056 kWh of under submission.
1026W of metered load is included in the database extracts	4,382 kWh of over submission.

The database is not confirmed as accurate with a 95% level of confidence as recorded in **section 3.1**.

On 18 June 2019, the Electricity Authority issued a memo confirming that the code requirement to calculate the correct monthly load must:

- take into account when each item of load was physically installed or removed; and
- wash up volumes must take into account where historical corrections have been made to the DUML load and volumes.

The current monthly report is provided as a snapshot and this practice is non-compliant. When a wattage is changed in the database due to a physical change or a correction, only the record present at the time the report is run is recorded, not the historical information showing dates of changes. Meridian has not yet updated their processes to be consistent with the Authority's memo.

The database contains a “light install date” and a “lamp install date” but there is not a field for “livening date” for newly connected lights. Lights may be recorded in the database prior to vesting, and the new connections process may need to be revised to ensure that any livened period where the developer is responsible is correctly handled.

Alf Downs records the date that the data is loaded for all new connections and changes. This means that where Alf Downs has completed the new connection or change, the date is likely to be accurate. Where another party has completed the work, the date will only be accurate if Alf Downs has recorded the data on the day the change was made.

Audit outcome

Non-compliant

Non-compliance	Description
Audit Ref: 2.1 With: Clause 11(1) of Schedule 15.3 From: 01-Sep-18 To: 02-Sep-19	The database is not confirmed as accurate with a 95% level of confidence as recorded in **section 3.1**. Potential under submission of 61,056 kWh p.a. due to wattages adjusted for dimming. Potential over submission of 4,382 kWh p.a. for metered load. The monthly database extract provided does not track changes at a daily basis and is provided as a snapshot. Livening dates are not recorded for new connections. Potential impact: High Actual impact: High Audit history: Twice Controls: Weak Breach risk rating: 9
Audit risk rating	**Rationale for audit risk rating**
High	The controls over the database are rated as weak, due to the large number of discrepancies identified during the field count and analysis of the RAMM database extract. If profiles are agreed with the Authority it is expected that controls will improve to moderate. The audit risk rating is high based on kWh variances discussed in **section 3.1**.

Actions taken to resolve the issue	Completion date	Remedial action status
Despite our requests to them, PNCC have not updated the wattages in their database. Meridian had intended to implement a process so that wattages were corrected prior to submission being calculated however this did not occur.		Investigating
Meridian is in the process of developing this process and will retrospectively apply corrected wattages and revise submissions where possible.	31 Oct 2019	
Investigation has found the metered load identified has been recorded against DUML ICPs since Feb 2019. Submissions will be revised to remove this load where applicable and PNCC asked to correct the ICPs for these lights back to the correct ICPs so they are not included in DUML calculations	31 Oct 2019	
Preventative actions taken to ensure no further issues will occur	**Completion date**	
We will continue trying to engage with PNCC re a profile for dimming LED's or adjustment of database wattages	Ongoing	

2.2. ICP identifier and items of load (Clause 11(2)(a) and (aa) of Schedule 15.3)

Code reference

Clause 11(2)(a) and (aa) of Schedule 15.3

Code related audit information

The DUML database must contain:

- *each ICP identifier for which the retailer is responsible for the DUML*
- *the items of load associated with the ICP identifier.*

Audit observation

The database was checked to confirm the correct ICP was recorded against each item of load.

Audit commentary

Each item of load has an ICP recorded against it.

The previous audit noted that there were two NSPs in the PNCC region, and it was unclear whether loads were recorded against the correct NSP. PNCC has worked with Powerco to confirm the correct NSPs, and the lights have now been split between the Bunnythorpe and Linton NSPs.

NSP	NSP	Count of lights	Percentage of lights
0000031152CPB70	LTN0331	3,838	41%
1000581347PCFF5	BPE0331	5,541	59%

Analysis of the RAMM extract found 43 roads with lights connected to different ICPs. Some roads may genuinely have lights connected to more than one ICP, but it appears that some ICPs are incorrectly assigned. I recommend checking the ICP mapping to ensure that the ICP numbers are correctly assigned. Because both NSPs are within the BA4WESTPOCOG balancing area, there is no impact on reconciliation.

Street	0000031152CPB70 (LTN0331)	1000581347PCFF5 (BPE0331)	Total
ALBERT ST	1	104	105
APOLLO PDE	5	22	27
ARGYLE AVE	10	2	12
BENMORE AVE	15	17	32
BERESFORD ST	4	3	7
BROADWAY AVE	2	208	210
COLEMAN PL	23	20	43
COLLEGE ST	85	34	119
CP_CORONATION	3	1	4
CP_GLOBE PITT ST	3	1	4
FEATHERSTON ST	49	75	124
FERGUSON ST	67	57	124
FITZHERBERT AVE	27	110	137
FLYGERS LINE	1	4	5
FRANCIS WAY	1	6	7
GEMINI AVE	4	8	12
GEORGE ST	39	35	74
GUY AVE	8	3	11
HAVILL ST	10	1	11
HUIA ST	1	1	2
JAMES LINE	9	33	42
JUPITER ST	3	5	8
MAIN WEST	41	19	60
MATTHEWS AVE	14	1	15
MIRO ST	5	3	8
NAPIER RD	5	11	16
PALM DR	2	8	10
PARK RD	52	27	79
PEARL GROVE	1	3	4
PLUTO PL	1	1	2
QUEEN ST	1	10	11
RANGITIKEI ST	41	85	126
ROSALIE TCE	1	24	25
SATURN CRES	1	4	5

Street	0000031152CPB70 (LTN0331)	1000581347PCFF5 (BPE0331)	Total
SETTERS LINE EAST	1	6	7
SQUARE INNER	10	33	43
SQUARE OUTER	63	123	186
TREMAINE AVE	59	87	146
VALOR DR	4	5	9
VENUS WAY	1	1	2
VICTORIA DR	6	6	12
WALDING ST NORTH	17	8	25
WALDING ST SOUTH	2	1	3

Description	Recommendation	Audited party comment	Remedial action
Regarding Clause 11(2)(a) and (aa) of Schedule 15.3 ICP assignment	Confirm that ICPs are recorded correctly for roads with lights connected to more than one ICP.	We will refer these observations to Powerco for validation.	Identified

NZTA lights are recorded in the database. NZTA urban lights are the responsibility of PNCC and are recorded in the database against ICP 0000031152CPB70 or 1000581347PCFF5. NZTA rural lights are not PNCC's responsibility and do not have an ICP number recorded. They are excluded in database extracts to Meridian, and NZTA is developing a database for these lights, which will require a separate audit.

Private lights are recorded in the database but excluded from the extracts provided to Meridian for submission. As discussed in Powerco's audit, Powerco is investigating these lights, and intends to arrange for standard or shared unmetered load to be created.

Audit outcome

Compliant

2.3. Location of each item of load (Clause 11(2)(b) of Schedule 15.3)

Code reference

Clause 11(2)(b) of Schedule 15.3

Code related audit information

The DUML database must contain the location of each DUML item.

Audit observation

The database was checked to confirm the location is recorded for all items of load.

Audit commentary

The database contains fields for carriageway area, road name, displacement, GPS coordinates, and pole numbers.

All items of load are locatable. 9,378 (99.98%) items of load have GPS coordinates, and the other two items have sufficient road name and displacement information to allow them to be readily located.

The accuracy of locations is discussed in **section 3.1**.

Audit outcome

Compliant

2.4. Description and capacity of load (Clause 11(2)(c) and (d) of Schedule 15.3)

Code reference

Clause 11(2)(c) and (d) of Schedule 15.3

Code related audit information

The DUML database must contain:

- *a description of load type for each item of load and any assumptions regarding the capacity*
- *the capacity of each item in watts.*

Audit observation

The database was checked to confirm that:

- it contained a field for light type and wattage capacity;
- wattage capacities include any ballast or gear wattage; and
- each item of load has a light type, light wattage, and gear wattage recorded.

Audit commentary

A description of each light is recorded in the lamp model field, and wattages are recorded in the lamp wattage and gear wattage fields.

All items of load have a lamp model, lamp wattage, and gear wattage populated. No lamp or gear wattages were invalidly recorded as zero.

The accuracy of the recorded wattages is discussed in **section 3.1**.

Audit outcome

Compliant

2.5. All load recorded in database (Clause 11(2A) of Schedule 15.3)

Code reference

Clause 11(2A) of Schedule 15.3

Code related audit information

The retailer must ensure that each item of DUML for which it is responsible is recorded in this database.

Audit observation

The field audit was undertaken of a statistical sample of 343 items of load on 2 September 2019. The sample was selected from six strata, as follows:

1. Non roading
2. Roading ICP 0000031152CPB70 (street names A-Main)
3. Roading ICP 0000031152CPB70 (street names Mair to Z)
4. Roading ICP 1000581347PCFF5 (street names A - Fitc)
5. Roading ICP 1000581347PCFF5 (street names Fitz-Park)
6. Roading ICP 1000581347PCFF5 (street names Parkl-Z).

Audit commentary

The field audit discrepancies are detailed in the table below:

Street	Database count	Field count	Light count difference	Wattage recorded incorrectly	Comments
ABRAHAM PL	2	2	-	2	2 x 20W (L20) LED lights were recorded with 14W profiled wattage.
BALCAIRN PL	2	2	-	2	2 x 20W (L20) LED lights were recorded with 14W profiled wattage.
BALRICKARD WAY	18	18	-	13	13 x 20W (L20) LED lights were recorded with 14W profiled wattage. Two lights were recorded with different street names as discussed in **section 3.1**.
BOUNTY PL	3	3	-	3	3 x 18W (L18) LED lights were recorded with 15W profiled wattage.
CATLINS CRES	6	6	-	6	6 x 20W (L20) LED lights were recorded with 14W profiled wattage.
CHIPPENDALE CRES	13	13	-	13	13 x 20W (L20) LED lights were recorded with 14W profiled wattage.
COLYTON RD_A	2	2	-	-	Two lights were recorded with different street names as discussed in **section 3.1**.
DITTMER DR	22	22	-	21	20 x 20W (L20) LED lights were recorded with 14W profiled wattage. 1 x 64W (L64) light was recorded with 66W.
DORSET CRES	6	6	-	6	6 x 20W (L20) LED lights were recorded with 14W profiled wattage.
DUTTON STREET_B	4	4	-	-	Two lights on separate poles were recorded with the same GPS coordinates as discussed in **section 3.1**.
EDGEWARE RD	6	6	-	6	6 x 18W (L18) LED lights were recorded with 15W profiled wattage.
EPSOM RD	10	10	-	10	10 x 18W (L18) LED lights were recorded with 15W profiled wattage.
GILLESPIES LINE	21	21	-	1	1 x 20W (L20) LED light was recorded with 14W profiled wattage.

Street	Database count	Field count	Light count difference	Wattage recorded incorrectly	Comments
GILLESPIES SIDE RD NO 84-106	2	2	-	2	2 x 20W (L20) LED lights were recorded with 14W profiled wattage.
HENARE ST	7	7	-	7	7 x 20W (L20) LED lights were recorded with 14W profiled wattage.
MERIDIAN GR	19	18	-1	18	1 x 70W sodium light was recorded in the database but not present on the street. 1 x 18W (L18) LED light was recorded as a 70W sodium light in the database. 17 x 18W (L18) LED lights were recorded with 15W profiled wattage.
PURIRI TCE	10	10	-	7	7 x 20W (L20) LED lights were recorded with 14W profiled wattage.
ROSALIE TCE	25	25	-	25	1 x 20W (L20) LED light was recorded as a 70W sodium light in the database. 1 x 20W (L20) LED light was recorded as a 15W LED light in the database. 1 x 38W (L38) LED light was recorded as a 88W LED light in the database. 22 x 20W (L20) LED lights were recorded with 14W profiled wattage.
SAVAGE CRES	31	31	-	29	29 x 20W (L20) LED lights were recorded with 14W profiled wattage.
STILLWATER PL	13	13	-	13	13 x 20W (L20) LED lights were recorded with 14W profiled wattage.
SWANSEA ST	8	8	-	7	7 x 18W (L18) LED lights were recorded with 15W profiled wattage.
TRENT AVE	5	5	-	5	7 x 20W (L20) LED lights were recorded with 14W profiled wattage.
UNION ST	8	8	-	8	8 x 20W (L20) LED lights were recorded with 14W profiled wattage.
WINSTON AVE	11	11	-	9	9 x 20W (L20) LED lights were recorded with 14W profiled wattage.
WOOD ST	18	18	-	16	3 x 118W (L118) LED lights were recorded with 112W.

Street	Database count	Field count	Light count difference	Wattage recorded incorrectly	Comments
					13 x 137W (L137) LED lights were recorded with 131W.
WOODSTOCK PL	2	2	-	2	17 x 18W (L18) LED lights were recorded with 15W profiled wattage.
Grand Total	**274**	**273**	**-1**	**231**	

This clause relates to lights in the field that are not recorded in the database. The audit did not find any additional lights in the field.

The count differences where lights were present in the database but not recorded in the field, and wattage differences are discussed in **section 3.1**.

Audit outcome

Compliant

2.6. Tracking of load changes (Clause 11(3) of Schedule 15.3)

Code reference

Clause 11(3) of Schedule 15.3

Code related audit information

The DUML database must track additions and removals in a manner that allows the total load (in kW) to be retrospectively derived for any given day.

Audit observation

The process for tracking of changes in the database was examined.

Audit commentary

The RAMM database functionality achieves compliance with the code.

The change management process and the compliance of the database reporting provided to Meridian is detailed in **sections 3.1** and **3.2**.

Audit outcome

Compliant

2.7. Audit trail (Clause 11(4) of Schedule 15.3)

Code reference

Clause 11(4) of Schedule 15.3

Code related audit information

The DUML database must incorporate an audit trail of all additions and changes that identify:

- *the before and after values for changes*
- *the date and time of the change or addition*
- *the person who made the addition or change to the database.*

Audit observation

The database was checked for audit trails.

Audit commentary

The database has a complete audit trail.

Audit outcome

Compliant

3. ACCURACY OF DUML DATABASE

3.1. Database accuracy (Clause 15.2 and 15.37B(b))

Code reference

Clause 15.2 and 15.37B(b)

Code related audit information

Audit must verify that the information recorded in the retailer's DUML database is complete and accurate.

Audit observation

Meridian's submissions are based on a monthly extract from the RAMM database. A RAMM database extract was provided in August 2019 and I assessed the accuracy of this by using the DUML Statistical Sampling Guideline. The table below shows the survey plan.

Plan Item	Comments
Area of interest	Palmerston North City Council Street Lights
Strata	The database contains the PNCC items of load for both DUML ICPs in the Palmerston North Region. The processes for the management of all PNCC items of load are the same, but I decided to place the items of load into six strata: 1. Non roading 2. Roading ICP 0000031152CPB70 (street names A-Main) 3. Roading ICP 0000031152CPB70 (street names Mair to Z) 4. Roading ICP 1000581347PCFF5 (street names A - Fitc) 5. Roading ICP 1000581347PCFF5 (street names Fitz-Park) 6. Roading ICP 1000581347PCFF5 (street names Parkl-Z)
Area units	I created a pivot table of the roads and I used a random number generator in a spreadsheet to select a total of 35 sub-units.
Total items of load	343 items of load were checked.

Wattages were checked for alignment with the published standardised wattage table produced by the Electricity Authority against the RAMM database.

The change management process and timeliness of database updates was evaluated.

Audit commentary

Field audit findings

A field audit was conducted of a statistical sample of 343 items of load. The "database auditing tool" was used to analyse the results, which are shown in the table below.

Result	Percentage	Comments
The point estimate of R	105.9	Wattage from survey is higher than the database wattage by 5.9%
R_L	92.9	With a 95% level of confidence it can be concluded that the error could be between -7.1% and 10.4%
R_H	110.4	

These results were categorised in accordance with the "Distributed Unmetered Load Statistical Sampling Audit Guideline", effective from 01/02/19 and the table below shows that Scenario B (detailed below) is the best fit. However, because R_L is less than 0.95 and R_H is greater than 1.05 the sample is not precise enough to confirm that the inaccuracy is statistically significant at the 95% level.

The conclusion from Scenario B is that the variability of the sample results across the strata means that the true wattage (installed in the field) could be between 7.1% lower and 10.4% higher than the wattage recorded in the DUML database. Non-compliance is recorded because the potential error is greater than ±5.0%.

In absolute terms the installed capacity is estimated to be 36 kW higher than the database indicates.

There is a 95% level of confidence that the installed capacity is between 44 kW lower to 65 kW higher than the database.

In absolute terms, total annual consumption is estimated to be 155,500 kWh higher than the DUML database indicates.

There is a 95% level of confidence that the annual consumption is between 187,900 kWh p.a. lower to 276,900 kWh p.a. higher than the database indicates.

Scenario	Description
A - **Good accuracy, good precision**	This scenario applies if: (a) R_H is less than 1.05; and (b) R_L is greater than 0.95 The conclusion from this scenario is that: (a) the best available estimate indicates that the database is accurate within +/- 5 %; and (b) this is the best outcome.
B - **Poor accuracy, demonstrated with statistical significance**	This scenario applies if: (a) the point estimate of R is less than 0.95 or greater than 1.05 (b) as a result, either R_L is less than 0.95 or R_H is greater than 1.05. There is evidence to support this finding. In statistical terms, the inaccuracy is statistically significant at the 95% level
C - **Poor precision**	This scenario applies if: (a) the point estimate of R is between 0.95 and 1.05

Scenario	Description
	(b) R_L is less than 0.95 and/or R_H is greater than 1.05 The conclusion from this scenario is that the best available estimate is not precise enough to conclude that the database is accurate within +/- 5 %

Light description and capacity accuracy

As discussed in **section 2.4**, all lights have a lamp and gear wattage recorded. Lamp and gear wattages were compared to the expected values and found:

1. 4,552 LED light wattages have been adjusted to account for dimming. The impact of the adjustment is 14,295.5 W estimated under submission. Meridian reports the load for ICPs 0000031152CPB70 and 1000581347PCFF5 against profile DST, and the profiles used by PNCC to adjust wattages have not been approved by the Electricity Authority.

2. I identified five lights with gear wattages which differed from the expected values:

Light model	Count	Gear wattage	Comment
160watt Mercury Vapour ML	1	0	Compliant, Alf Downs confirmed this light does not have separate ballast.
36watt TLD Fluorescent	1	17	To be checked by Alf Downs, and updated as necessary. 10W ballast is expected.
TLD 20watt	1	5	To be checked by Alf Downs, and updated as necessary. 10W ballast is expected.
TLD 20watts/33x 2 tubes	2	5	To be checked by Alf Downs, and updated as necessary. 10W ballast is expected.

   I rechecked the gear wattage discrepancies identified in the previous audit and found all were resolved apart from the exceptions above, which require further investigation.

3. 63 lamp models (1,767 lights) had recorded wattages that did not match the specifications I found, or there was insufficient detail in the model information to confirm the correct wattage. The lights were checked with Alf Downs and PNCC who confirmed that some of their suppliers changed their lamp wattages as technology improved. Wattages for affected lamps varied between delivery batches; sometimes old stock was received after newer stock. Wherever possible, Alf Downs ensures that there is a sticker on each light denoting its wattage and I saw evidence of this during the field audit. I could not confirm that the wattages were correct, and recommend they are checked.

Description	Recommendation	Audited party comment	Remedial action
Regarding Clause 15.2 and 15.37B(b) Lamp wattages	Where possible confirm the wattages are correct for the 63 light models where the wattages did not match the expected values or there was insufficient information to confirm the correct wattages.	We will ask Alf Downs to confirm this information if possible.	Identified

The previous audit recommended that the light and gear wattage for the RGB sign (Slim Pole ID 11945) be confirmed. I viewed "as built" documentation and specifications for this custom made sign during the audit, and confirmed that 100W with no gear wattage is correct.

I have not attempted to calculate the exact impact of these discrepancies, due to difficulty in confirming the correct values. I have recorded the audit risk rating as high due to the large numbers of discrepancies and the impact of the profiling.

Address accuracy

During the field audit I found some lights with inaccurate road name or GPS information:

Database Road Name	Slim Pole ID	Comment
COLYTON RD_A	9284 and 9285	Lights were located at the upper end of Oxford Street, before the road name changes to Colyton Rd.
CORRIB GR	12204	Light is located on Balrickard Way.
LEEDS ST	8851	Light is located on Balrickard Way.
DUTTON STREET_B	10682	Two lights have the same GPS location recorded, but are in separate locations along a walkway.

ICP number and owner accuracy

The previous audit noted that there were two NSPs in the PNCC region, and it was unclear whether loads were recorded against the correct NSP. PNCC has worked with Powerco to confirm the correct NSPs, and the lights have now been split between the Bunnythorpe and Linton NSPs.

Analysis of the RAMM extract found 43 roads with lights connected to different ICPs. Some roads may be genuinely have lights connected to more than one ICP, but it appears that some ICPs are incorrectly assigned. I recommend checking the ICP mapping to ensure that the ICP numbers are correctly assigned. Further detail is recorded in **section 2.2**.

Change management process findings

The RAMM database is managed by Alf Downs on behalf of PNCC. The field work, asset data capture and database population is conducted by Alf Downs. Staff update the database from the field using Pocket RAMM.

I walked through the new connection process. New connections may be completed by the distributor, the developer, or Alf Downs with PNCC's approval.

- For subdivisions, once livening has occurred an "as built" plan is provided to PNCC, who then takes responsibility for the lights. Alf Downs visits the site to record the light details using Pocket RAMM once confirmation that the new connection is ready is received from the developer, or a request

is received from PNCC. Alf Downs also monitors new connections that are expected to be connected and will query with PNCC if they notice lights are on, but have not been recorded in RAMM.

- Other new connections are typically completed by Alf Downs and the details are loaded into Pocket RAMM at the time of installation.

The current monthly report is provided as a snapshot and this practice is non-compliant. When a wattage is changed in the database due to a physical change or a correction, only the record present at the time the report is run is recorded, not the historical information showing dates of changes.

The database contains a "light install date" and a "lamp install date" but there is not a field for "livening date" for newly connected lights. Lights may be recorded in the database prior to vesting, and the new connections process may need to be revised to ensure that any livened period where the developer is responsible is correctly handled.

Alf Downs records the date that the data is loaded for all new connections and changes. This means that where Alf Downs has completed the new connection or change, the date is likely to be accurate. Where another party has completed the work, the date will only be accurate if Alf Downs has recorded the data on the day the change was made.

Each month PNCC reviews Alf Down's invoice and checks that the work requested has been completed, including field checks. Any discrepancies are sent to Alf Downs for investigation and correction.

Monthly outage patrols also identify database discrepancies.

Festive lights

Festive lights are recorded in the database and reported separately with on and off dates when they are connected. I walked through this process and viewed the RAMM reports for the last festive period.

Private lights

Private lights are recorded in the database but excluded from submission. Powerco is investigating these lights, and intends to arrange for standard or shared unmetered load to be created.

Audit outcome

Non-compliant

Non-compliance	Description
Audit Ref: 3.1 With: Clause 15.2 and 15.37B(b) From: 01-Sep-18 To: 02-Sep-19	The database is not confirmed as accurate with a 95% level of confidence. 4,552 LED light wattages have been adjusted to account for dimming. The impact of the adjustment is 14,295.5 W estimated under submission. Meridian reports the load for ICP 0000031152CPB70 against profile DST, and the profiles used by PNCC to adjust wattages have not been approved by the Electricity Authority. The monthly database extract provided does not track changes at a daily basis and is provided as a snapshot. Livening dates are not recorded for new connections. Six lights with incorrect road name or GPS information. Some lights are likely to have incorrect ICPs recorded. Potential impact: High Actual impact: High Audit history: Twice Controls: Weak Breach risk rating: 9
Audit risk rating	**Rationale for audit risk rating**
High	The controls over the database are rated as weak, due to the large number of discrepancies identified during the field count and analysis of the RAMM database extract. If profiles are agreed with the Authority it is expected that controls will improve to moderate. The audit risk rating is high based on kWh variances.

Actions taken to resolve the issue	Completion date	Remedial action status
Despite our requests to them, PNCC have not updated the wattages in their database. Meridian had intended to implement a process so that wattages were corrected prior to submission being calculated however this did not occur.		Investigating
Meridian is in the process of developing this process and will retrospectively apply corrected wattages and revise submissions where possible.	31 Oct 2019	
We will pass on the minor inaccuracies found with location details for correction	31 Oct 2019	
Preventative actions taken to ensure no further issues will occur	**Completion date**	
We will continue trying to engage with PNCC re a profile for dimming LED's or adjustment of database wattages	Ongoing	

3.2. Volume information accuracy (Clause 15.2 and 15.37B(c))

Code reference

Clause 15.2 and 15.37B(c)

Code related audit information

The audit must verify that:

- *volume information for the DUML is being calculated accurately*
- *profiles for DUML have been correctly applied.*

Audit observation

The submission was checked for accuracy for the month the database extract was supplied. This included:

- checking the registry to confirm that the ICP has the correct profile and submission flag; and
- checking the database extract combined with the on hours against the submitted figure to confirm accuracy.

Audit commentary

Meridian reconciles this DUML load using the DST profile, and the correct profiles and submission types are recorded on the registry. Wattages are derived from a RAMM extract provided by Alf Downs each month. On and off times are derived from a data logger read by EMS and are used to create a shape file.

Meridian supplies EMS with the capacity information from Alf Downs, and EMS calculates the kWh figures for ICP 0000031152CPB70 and 1000581347PCFF5 and includes them in the relevant AV080 file. This process was audited during Meridian's reconciliation participant audit and EMS' agent audit.

I compared the RAMM extract provided by Alf Downs to the capacities provided to EMS for June and July 2019 and found that they matched exactly. The RAMM extract included 1026 W of metered load (51W recorded on 1000581347PCFF5, and 975 W recorded on 0000031152CPB70), which was expected to be excluded from submissions. Alf Downs intends to ensure that this metered load is excluded from extracts from September 2019 onwards.

Sources of inaccuracy are as follows:

Issue	Estimated volume information impact (annual kWh)
4,552 LED light wattages have been adjusted to account for dimming.	Estimated 61,056 kWh of under submission.
1026W of metered load is included in the database extracts	4,382 kWh of over submission.

The database is not confirmed as accurate with a 95% level of confidence as recorded in **section 3.1**.

On 18 June 2019, the Electricity Authority issued a memo confirming that the code requirement to calculate the correct monthly load must:

- take into account when each item of load was physically installed or removed; and
- wash up volumes must take into account where historical corrections have been made to the DUML load and volumes.

The current monthly report is provided as a snapshot and this practice is non-compliant. When a wattage is changed in the database due to a physical change or a correction, only the record present at the time the report is run is recorded, not the historical information showing dates of changes. Meridian has not yet updated their processes to be consistent with the Authority's memo.

The database contains a "light install date" and a "lamp install date" but there is not a field for "livening date" for newly connected lights. Lights may be recorded in the database prior to vesting, and the new connections process may need to be revised to ensure that any livened period where the developer is responsible is correctly handled.

Alf Downs records the date that the data is loaded for all new connections and changes. This means that where Alf Downs has completed the new connection or change, the date is likely to be accurate. Where another party has completed the work, the date will only be accurate if Alf Downs has recorded the data on the day the change was made.

Audit outcome

Non-compliant

Non-compliance	Description
Audit Ref: 3.2 With: Clause 15.2 and 15.37B(c) From: 01-Sep-18 To: 02-Sep-19	The database is not confirmed as accurate with a 95% level of confidence as recorded in **section 3.1**. Potential under submission of 61,056 kWh p.a. due to wattages adjusted for dimming. Potential over submission of 4,382 kWh p.a. for metered load. The monthly database extract provided does not track changes at a daily basis and is provided as a snapshot. Livening dates are not recorded for new connections. Potential impact: High Actual impact: High Audit history: Twice Controls: Weak Breach risk rating: 9
Audit risk rating	**Rationale for audit risk rating**
High	The controls over the database are rated as weak, due to the large number of discrepancies identified during the field count and analysis of the RAMM database extract. If profiles are agreed with the Authority it is expected that controls will improve to moderate. The audit risk rating is high based on kWh variances discussed in **section 3.1**.

Actions taken to resolve the issue	Completion date	Remedial action status
Despite our requests to them, PNCC have not updated the wattages in their database. Meridian had intended to implement a process so that wattages were corrected prior to submission being calculated however this did not occur.		Investigating
Meridian is in the process of developing this process and will retrospectively apply corrected wattages and revise submissions where possible.	31 Oct 2019	
Investigation has found the metered load identified has been recorded against DUML ICPs since Feb 2019. Submissions will be revised to remove this load where applicable and PNCC asked to correct the ICPs for these lights back to the correct ICPs so they are not included in DUML calculations	31 Oct 2019	
Preventative actions taken to ensure no further issues will occur	**Completion date**	
We will continue trying to engage with PNCC re a profile for dimming LED's or adjustment of database wattages	Ongoing	

CONCLUSION

PNCC's initial LED rollout is complete. The database still records adjusted wattages for LED lights on residential streets where dimming profiles are applied. Because the load is still reconciled using Meridian's DST profiles, the full wattage should be recorded.

Database accuracy is described as follows:

Result	Percentage	Comments
The point estimate of R	105.9	Wattage from survey is higher than the database wattage by 5.9%
R_L	92.9	With a 95% level of confidence it can be concluded that the error could be between -7.1% and 10.4%
R_H	110.4	

The variability of the sample results across the strata means that the true wattage (installed in the field) could be between 7.1% lower and 10.4% higher than the wattage recorded in the DUML database. Non-compliance is recorded because the potential error is greater than ±5.0%.

In absolute terms the installed capacity is estimated to be 36 kW higher than the database indicates.

There is a 95% level of confidence that the installed capacity is between 44 kW lower to 65 kW higher than the database.

In absolute terms, total annual consumption is estimated to be 155,500 kWh higher than the DUML database indicates.

There is a 95% level of confidence that the annual consumption is between 187,900 kWh p.a. lower to 276,900 kWh p.a. higher than the database indicates.

Meridian reconciles this DUML load using the DST profile. Wattages are derived from a RAMM extract provided by Alf Downs each month. On and off times are derived from a data logger read by EMS and are used to create a shape file. Meridian supplies EMS with the capacity information from Alf Downs, and EMS calculates the kWh figures for ICP 0000031152CPB70 and 1000581347PCFF5 and includes them in the relevant AV080 file. This process was audited during Meridian's reconciliation participant audit and EMS' agent audit.

On 18 June 2019, the Electricity Authority issued a memo clarifying the memo of 2012 that stated that a monthly snapshot was sufficient to calculate submission from, and confirmed the code requirement to calculate the correct monthly load must:

- take into account when each item of load was physically installed or removed; and
- wash up volumes must take into account where historical corrections have been made to the DUML load and volumes.

The current monthly report is provided as a snapshot and is non-compliant, and Meridian completes revision submissions where corrections are required. Meridian does not intend to update their processes to be consistent with the Authority's memo.

The future risk rating of 27 indicates that the next audit be completed in three months. This may not be sufficient time to resolve the matters raised and I recommend the Authority considers an audit period of at least six months.

PARTICIPANT RESPONSE

Meridian intends to reduce the potential market impact of the reduced LED wattages recorded in the database by adjusting these wattages outside the database before calculating submission information.

Meridian has made a number of attempts to engage with PNCC regarding development of a new profile for these dimming lights or changing the wattages in the database to the approved wattages however have not been able to progress either to date.

Meridian has read the memo issued by the Authority on 18th June 2019 clarifying how changes to the database within a month are expected to be treated when calculating monthly load however is still considering what changes it can make to processes. Any changes to calculate database capacity and consumption effectively at a daily level (where a database records this) are likely to add considerable time to our existing processes and have relatively low impact to accuracy of monthly submissions in our view.