Coliban WATER

Water to live, grow & enjoy

Calculation of water network design demands using statistical analysis of monitoring data

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The problem

Calculate water network design demands to model current and future asset performance.

Key drivers:

- Coliban Water covers a large geographical area, with a big variation in climate.
- Almost all of our water networks have customers which experience water pressures below 20m.
- Previous method tended to overestimate demands.
- Optimise capital spend $$$

Hot & dry in north

- Dust
- +35 ºC for weeks on end in summer
- 425 mm annual rainfall

Wet & cool in south

- 700 m AHD
- Snow
- Frost
- 1050 mm annual rainfall

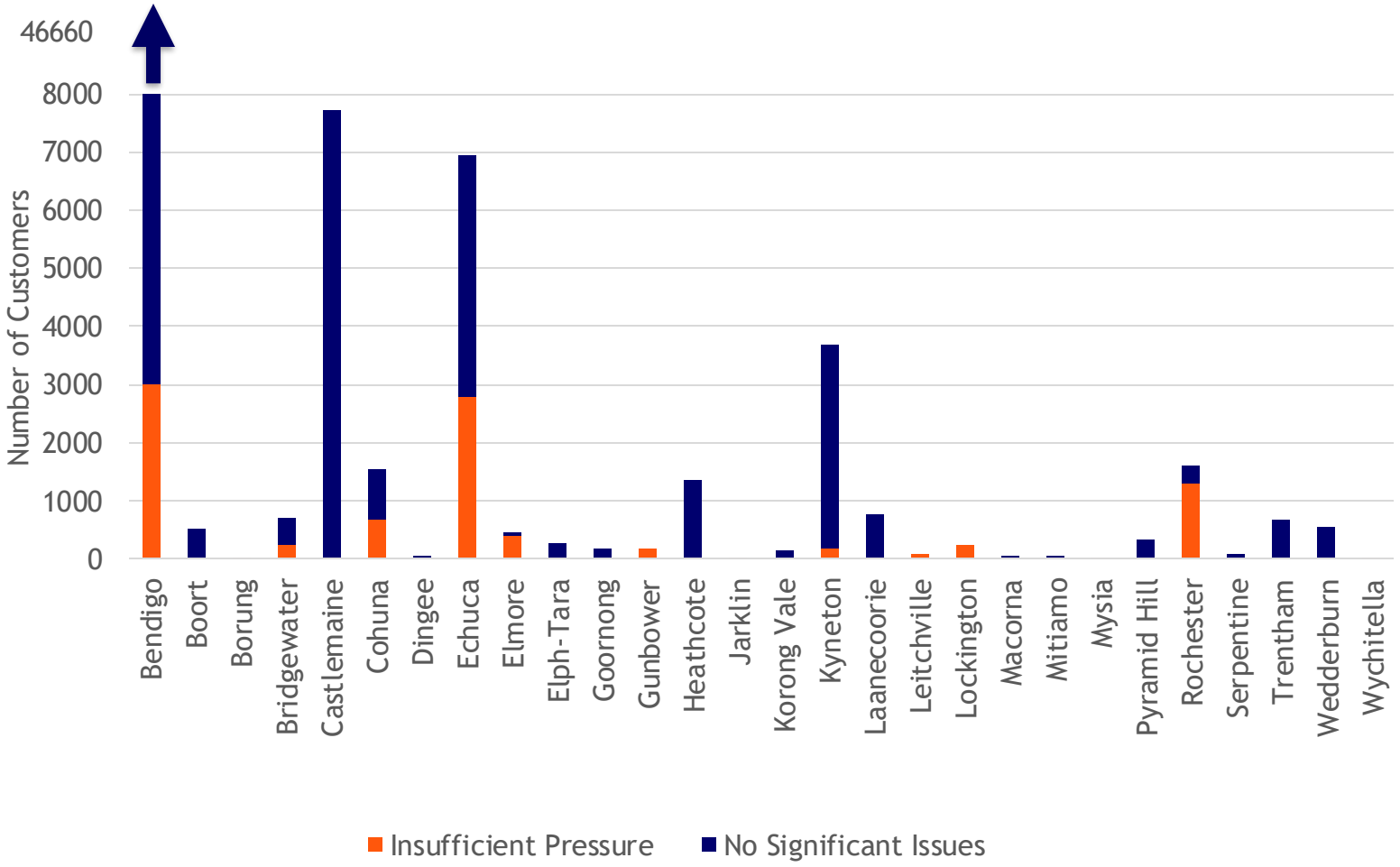
Customer experience

Minimum water pressure of 20m

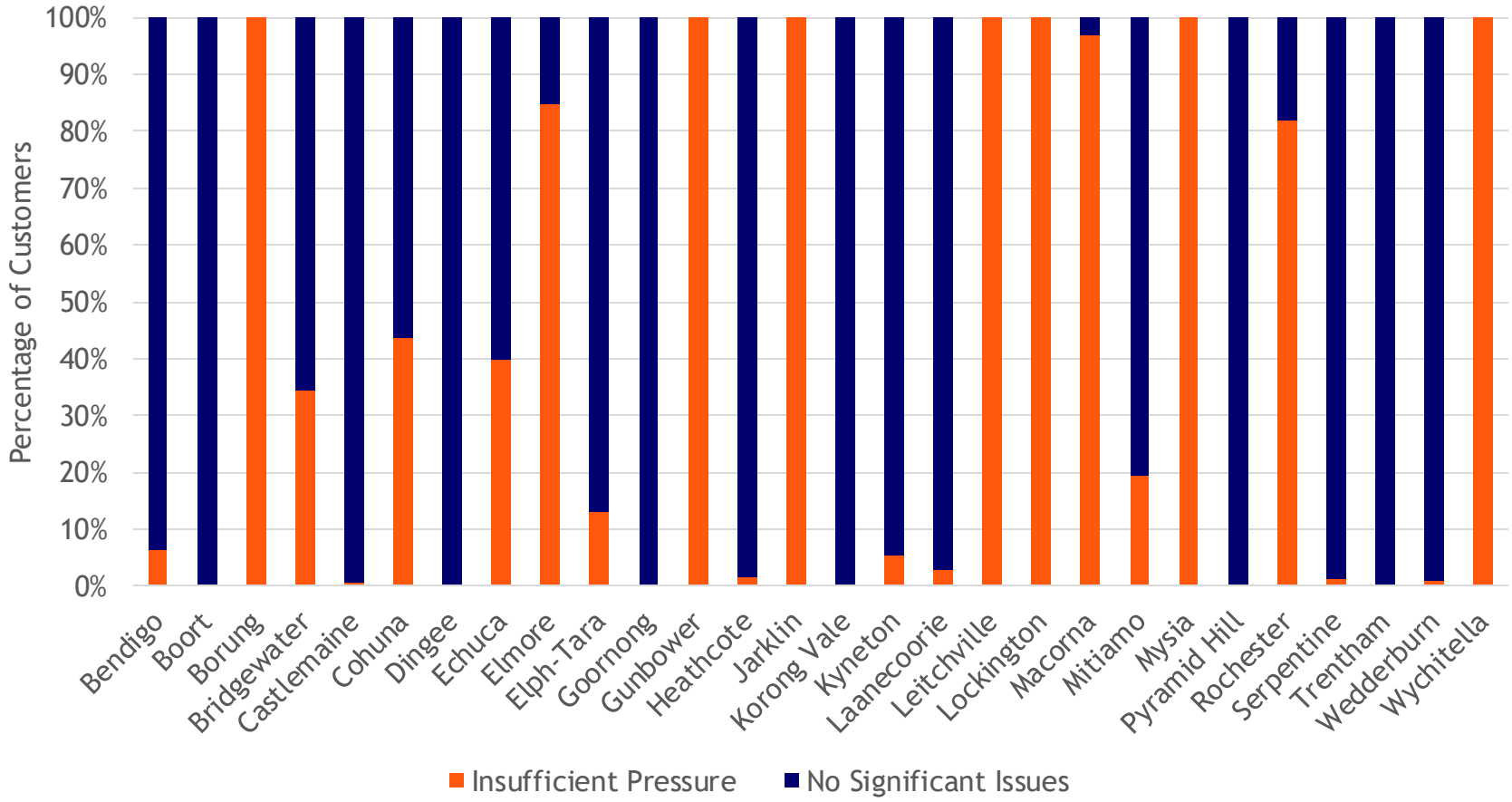
This ensures:

- Operation of hot water service,
- Operation of evaporative air conditioners,
- Operation of backflow prevention devices,
- Fire flow availability,
- Good pressure in the shower, fill the kettle, or water your lawn on a hot day.

Number of customers with insufficient pressure

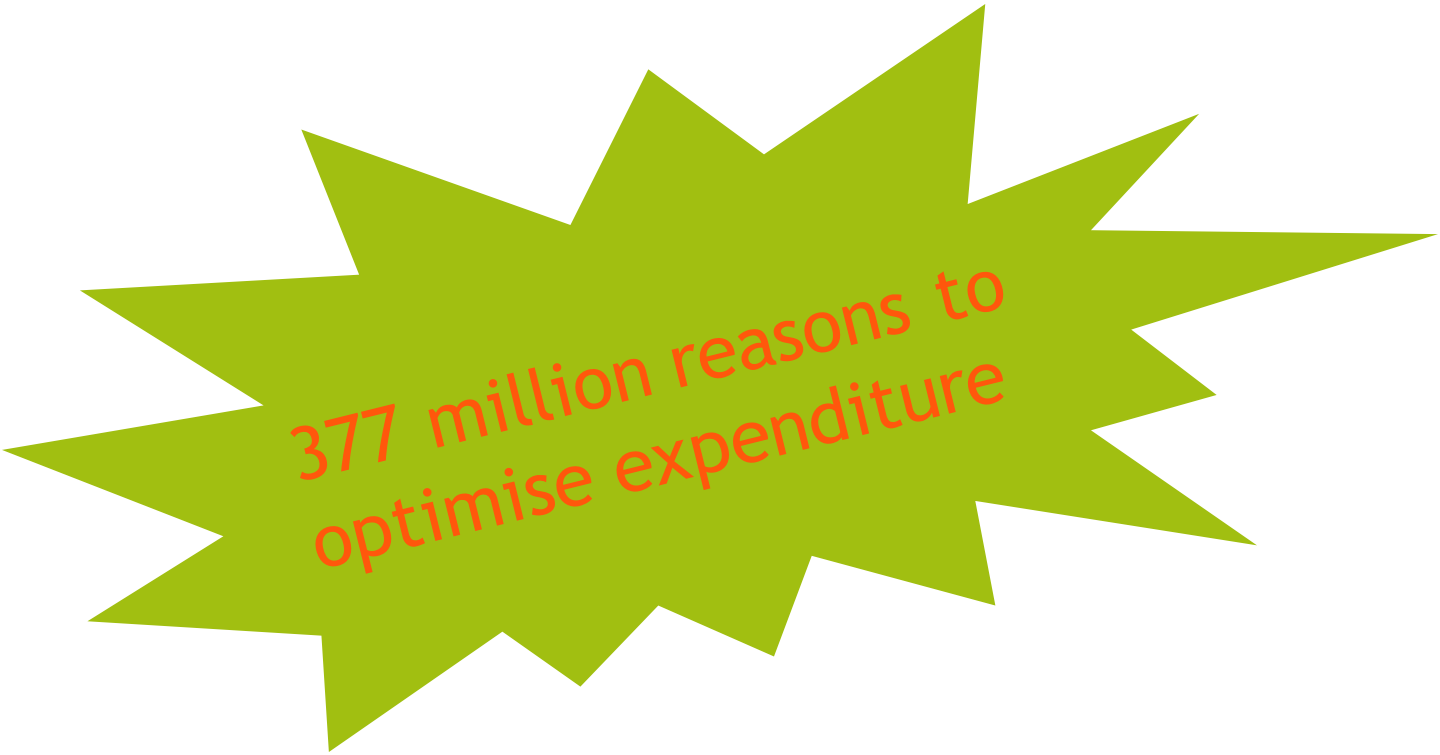


Percentage of customers with insufficient pressure



$$$

- Coliban Water has a limited capital expense budget



Previous design demand method – too conservative

- Used flow data from pre-Millenium Drought
- Scaling factors to account for weekly meter reads
- Assumed greatest demand from large customers coincided with highest observed day
- 10% safety factor
- Demand profile from calibration day

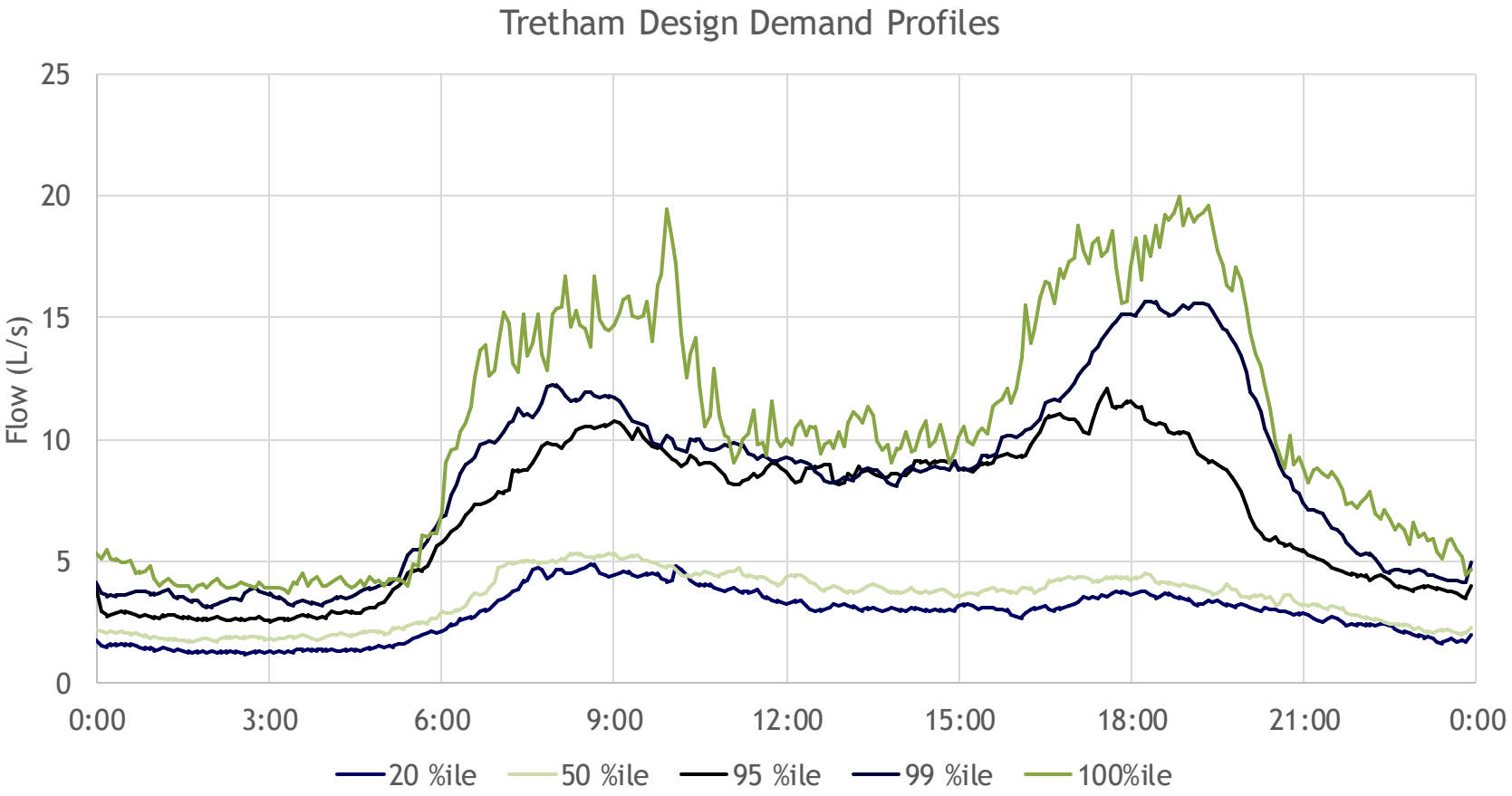
… Most networks had not experienced their design demand any time since 2010, even with growth in the catchment. With constrained capital expenditure, we need to avoid over design and un-necessary works.

The solution

Create design demand profiles based on observed networks flow data.

- 20th percentile (typical winter day)
- 50th percentile (median day)
- 95th percentile (typical summer day)
- 99th percentile (hot summer day)
- 100th percentile (highest demand day)

Design demand profiles



Calculating design demand percentiles profiles

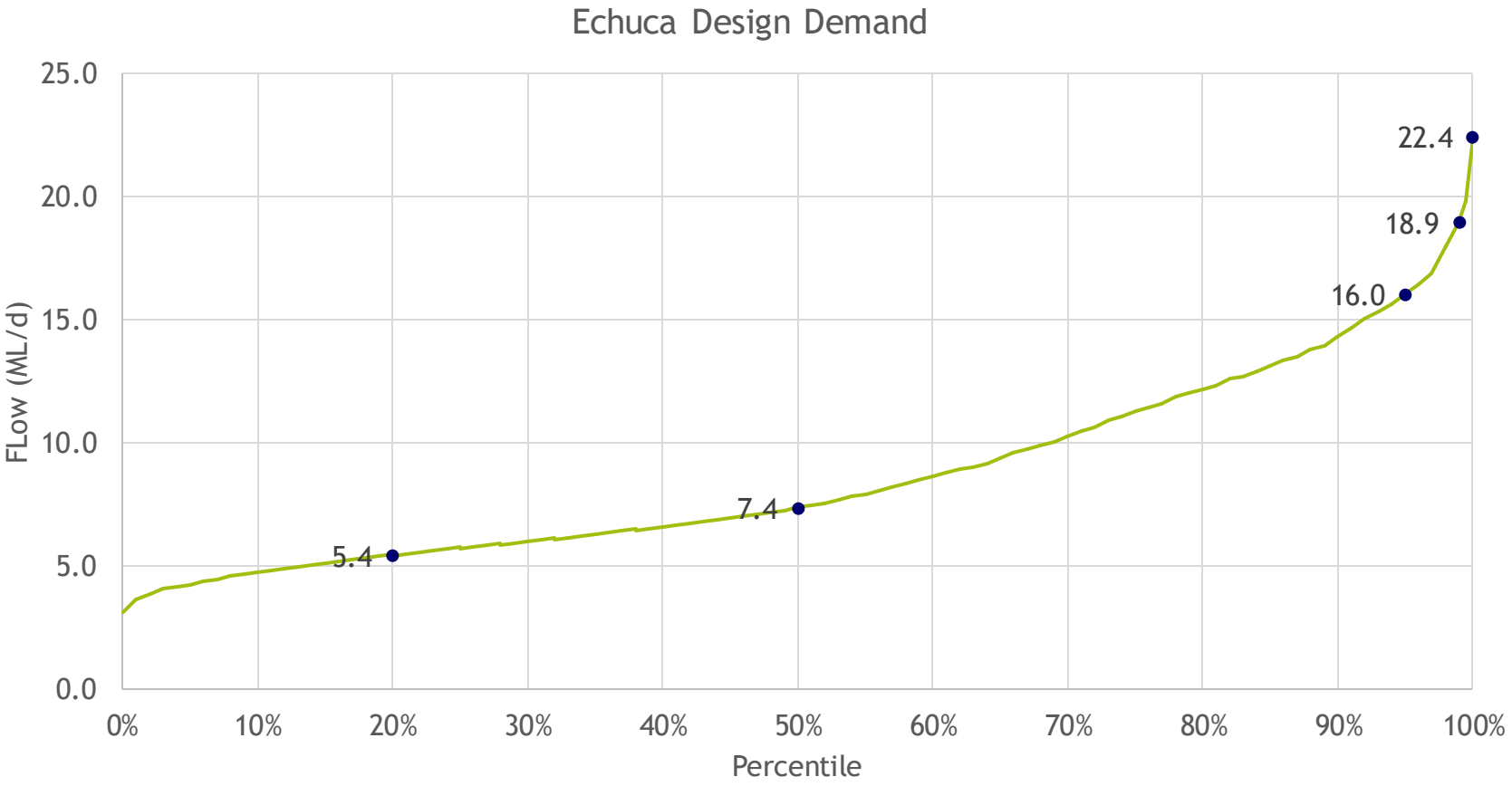
Process overview:

- Classify observed daily demands into a percentile rank for each DMZ.
- Calculate diurnal profile for each of the 5 design demand percentiles.
- Allocate DMZ demand to customers with demand categories.

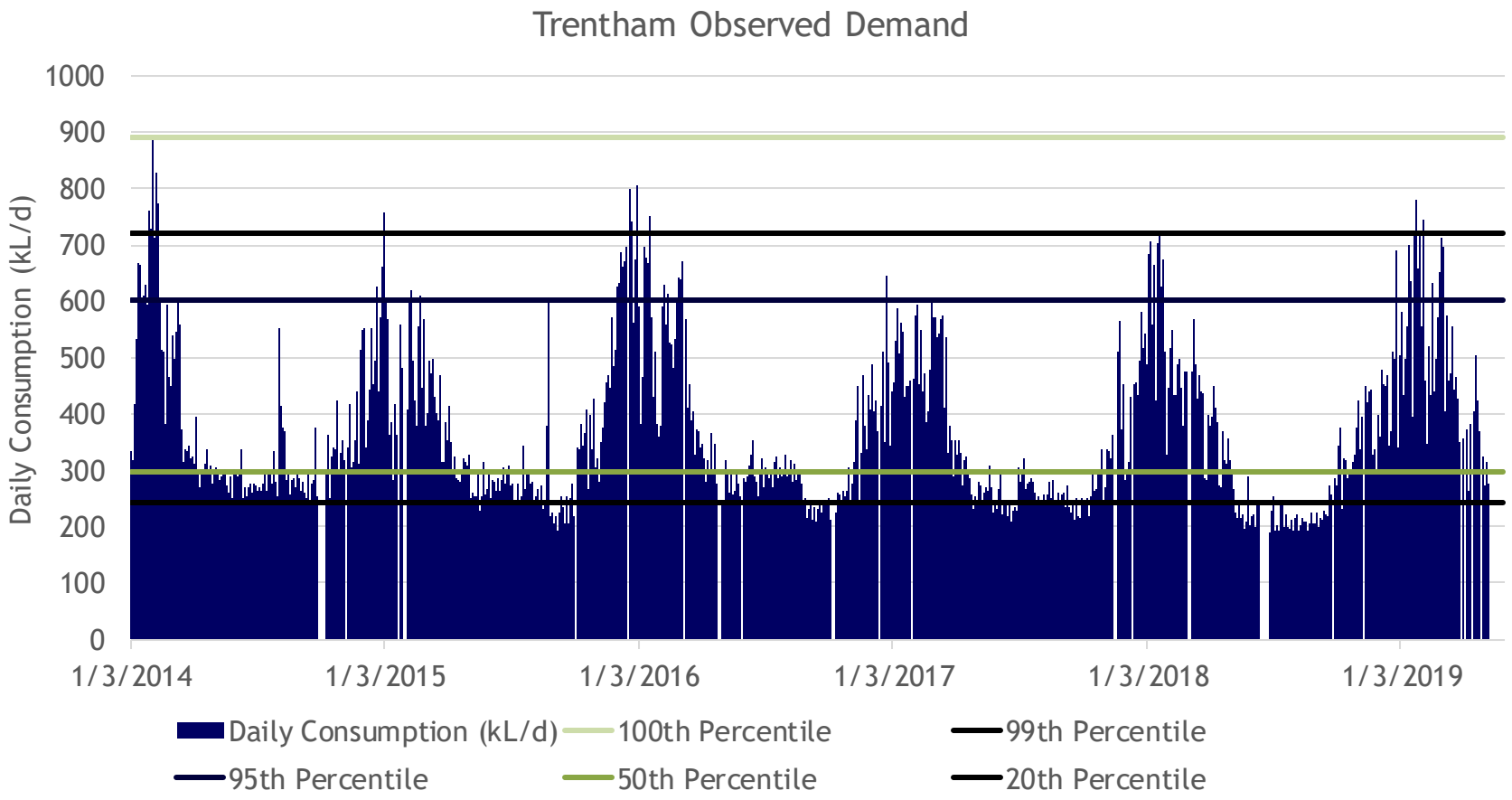
Percentile demand method

- Calculate daily demand, for each DMZ, for the period reflecting current network demand behaviour.
  - Generally PWSR period from November 2010
  - Consider arrival or departure of large customers
  - Scale for growth in customer numbers
- Remove days which have anomalous data
  - Flow monitor error
  - Data of insufficient quality (ie >2 hours between data points)
  - Water main burst
- Calculate percentiles for processed data

Design demand distribution

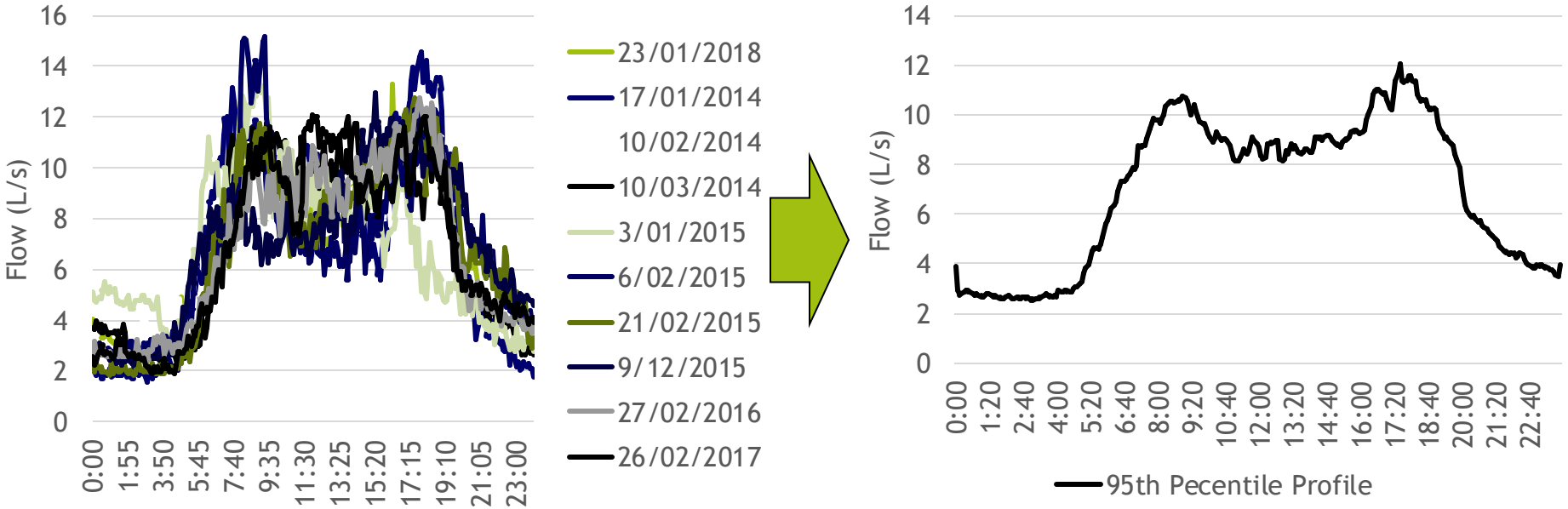


Design demand

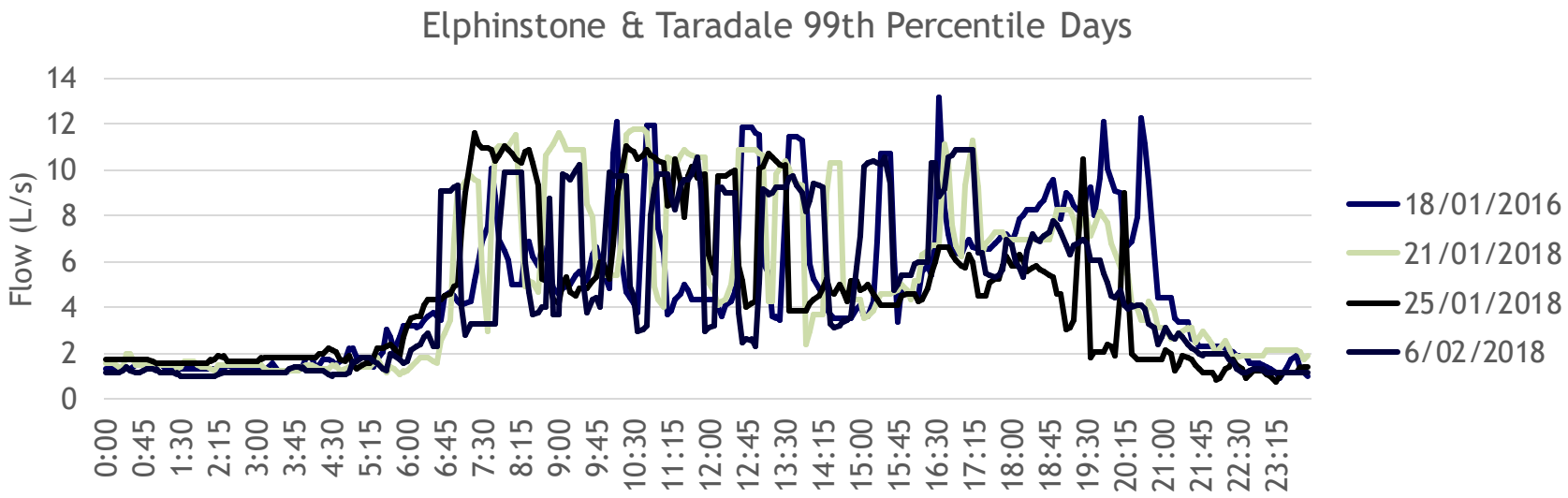


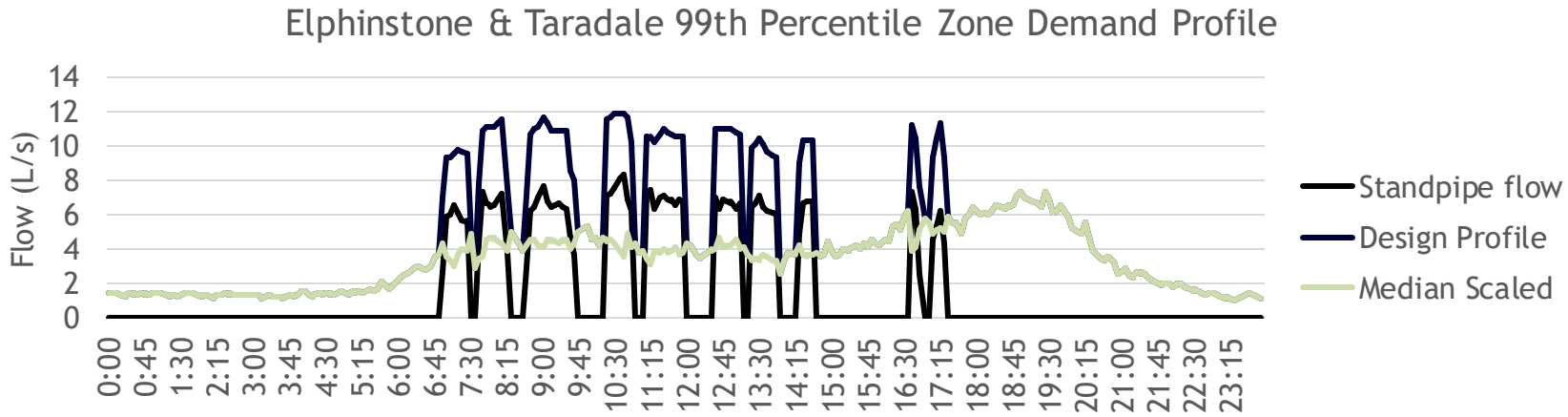
Diurnal profile for each demand scenario

- Based on observed data from days which had a demand close to the specified percentile.
  - Median of 5 to 10 days with a demand equal to that percentile



Day demand profile - impact of large demand





Allocate demand to demand categories

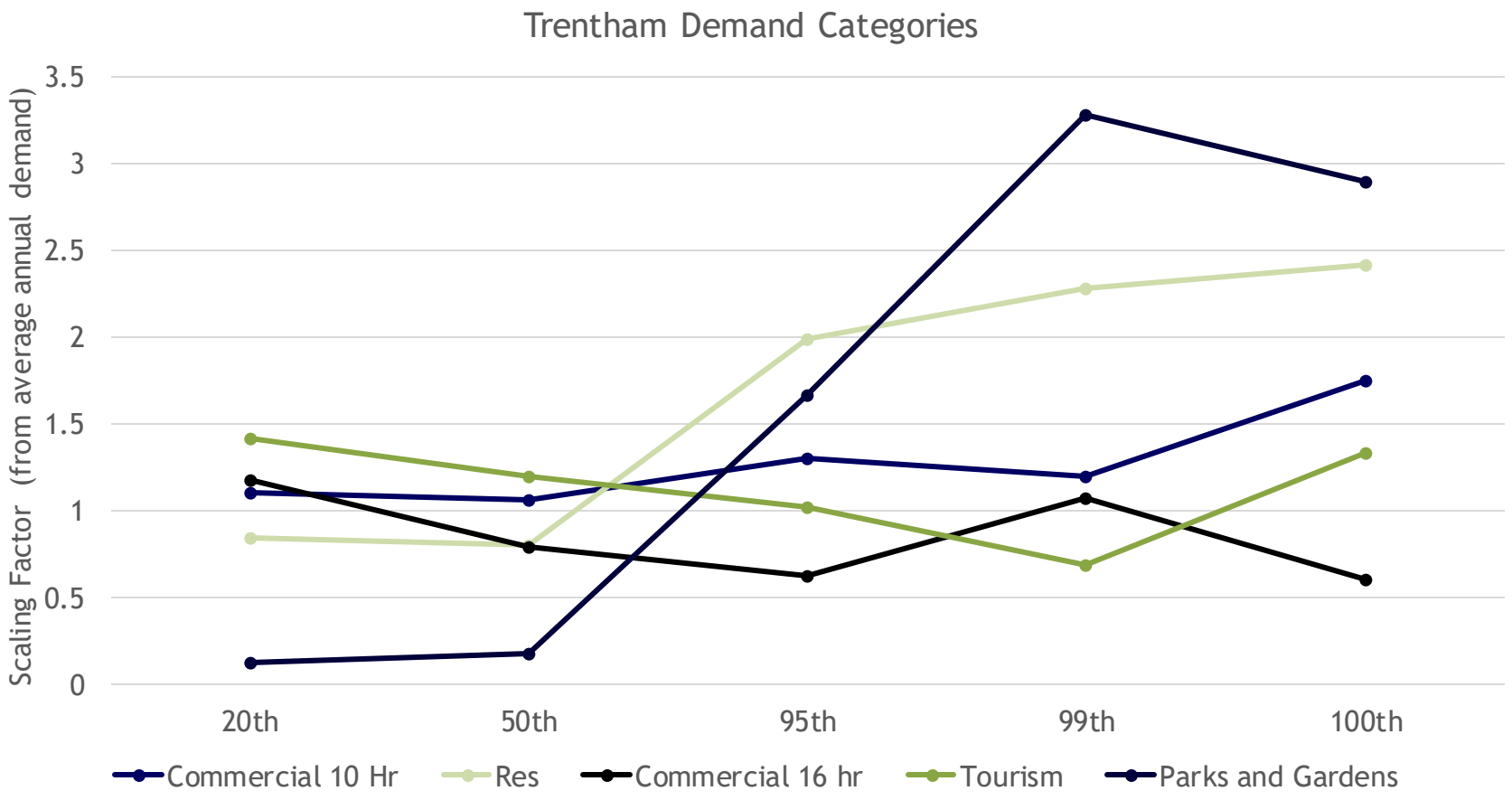
Current:

- Scaling factors based on quarterly billing data
  - ie Commercial customers use 1.4 times their Q3 demand on a 99th percentile day
  - Estimate non-residential demands, then allocate remainder to residential customers
- Some monitoring data from large customers

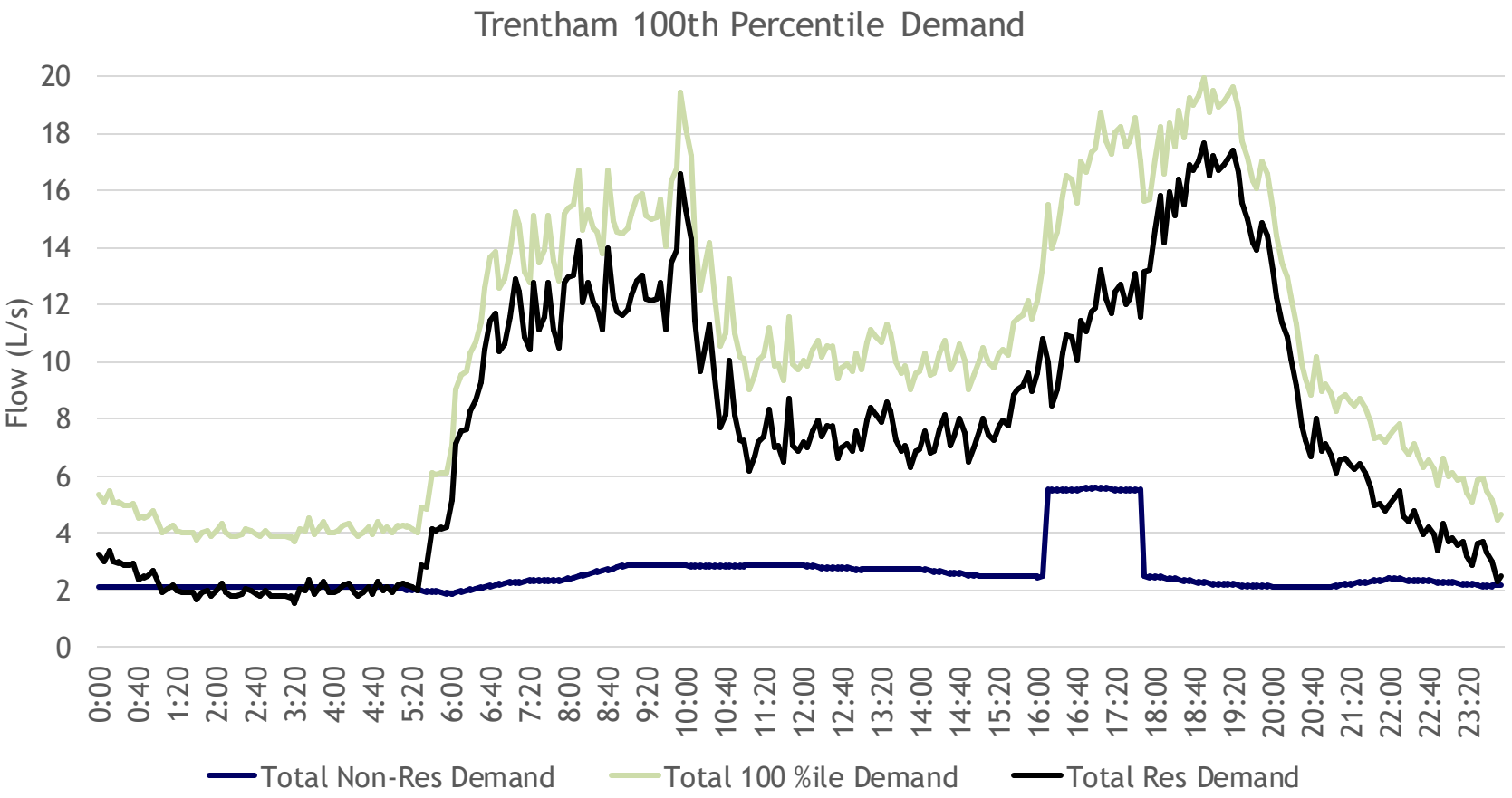
Future:

- Use digital metering data (Smart Meter) from all customers

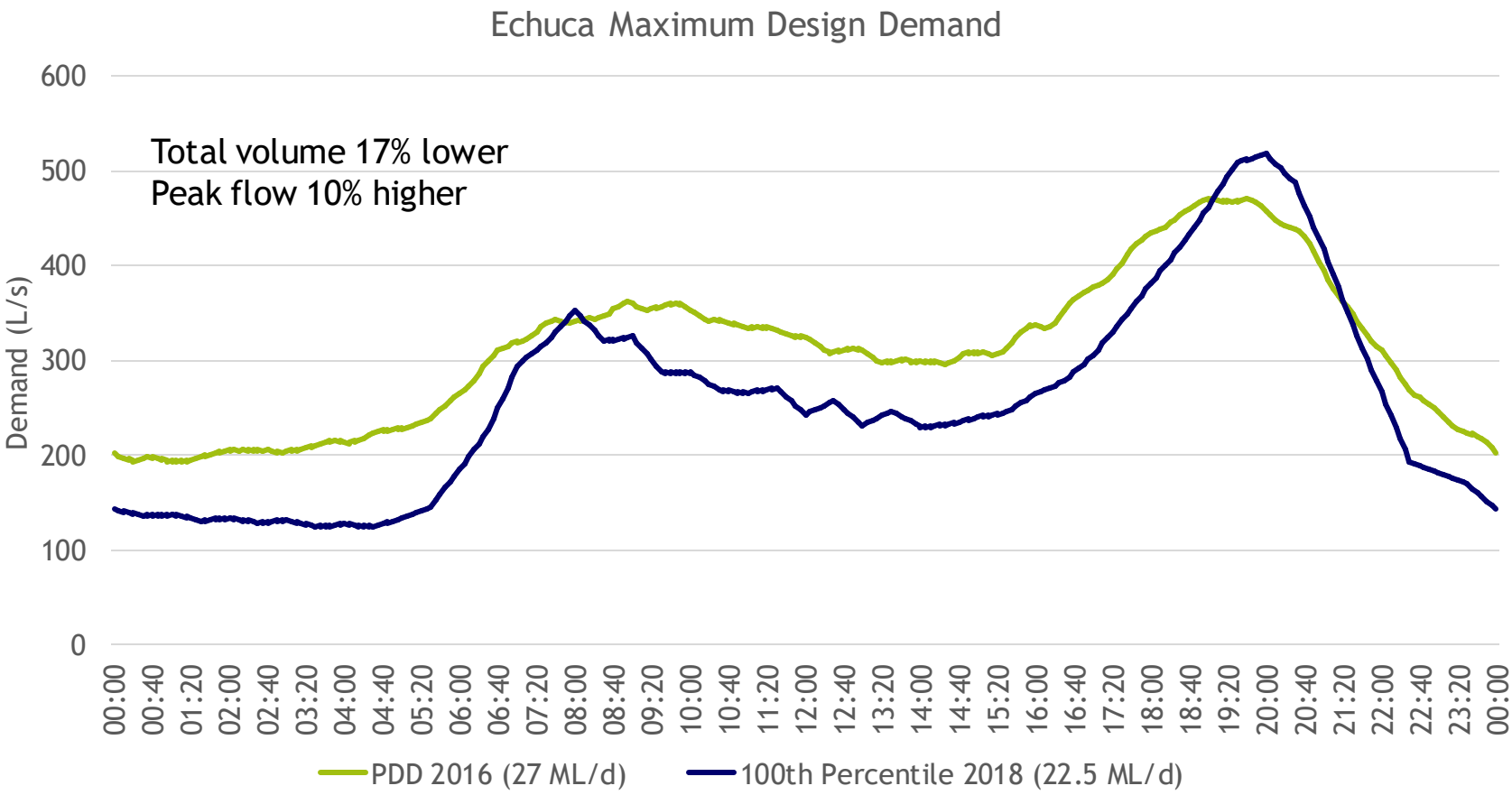
Digital metering demand scaling



Demand allocation



Old v new method



Advantages

- Negates the need (almost completely) for design factors to be selected.
- Naturally accounts for coincidence of different demands types.
- Reflects network's demand behaviour (due to demographic, environmental factors etc).
- Flexibility in selecting scenario when designing upgrades, or assessing current capacity.
- Observed demands can be compared to demand percentiles.

Limitations and opportunities

- Not all of our networks have all boundary points metered (ie inlet and outlet of large tanks)
- Quality and availability of flow monitoring data
- Needs multiple years of data to be reliable.

- Use digital metering to better classify demand categories and refine demand profiles.
- Optimise the processing of flow data and analysis

Questions?