Vegetation Management

Around Power Lines

Wellington Electricity / Treescape

wellington electricity

Treescape

WE* Vegetation Management

Topics:

Who WE* are:

Overview of the Wellington Electricity network

Challenges:

How WE* work to manage trees and vegetation

Network Reliabity:

SAIDI impact of vegetation in the network

Your thoughts:

Discussion and questions

Who are WE*?

WE* covers Wellington, the Hutt Valley and Porirua:

Maintaining the:

- poles
- wires (lines)
- other equipment

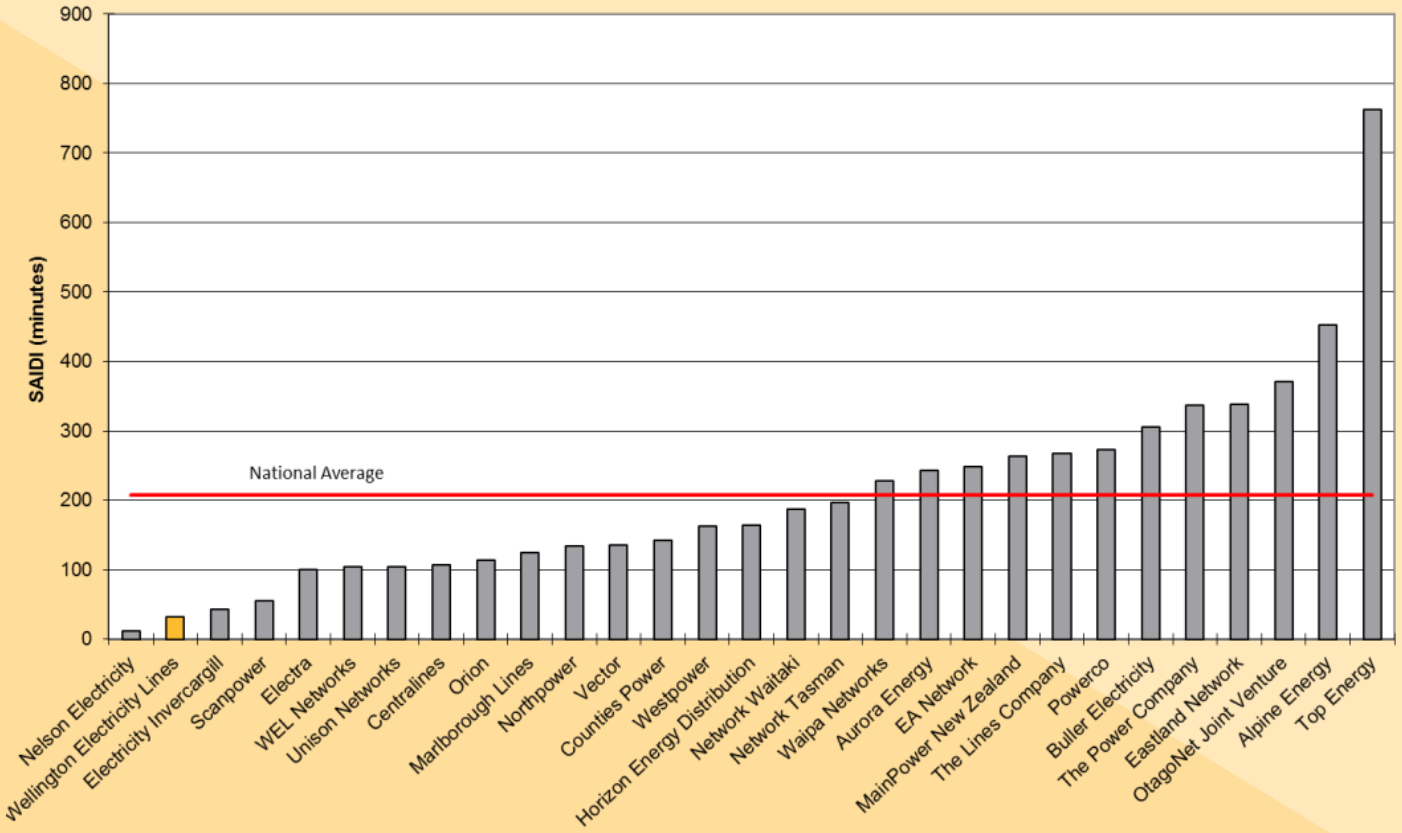
powering approx.

170,000

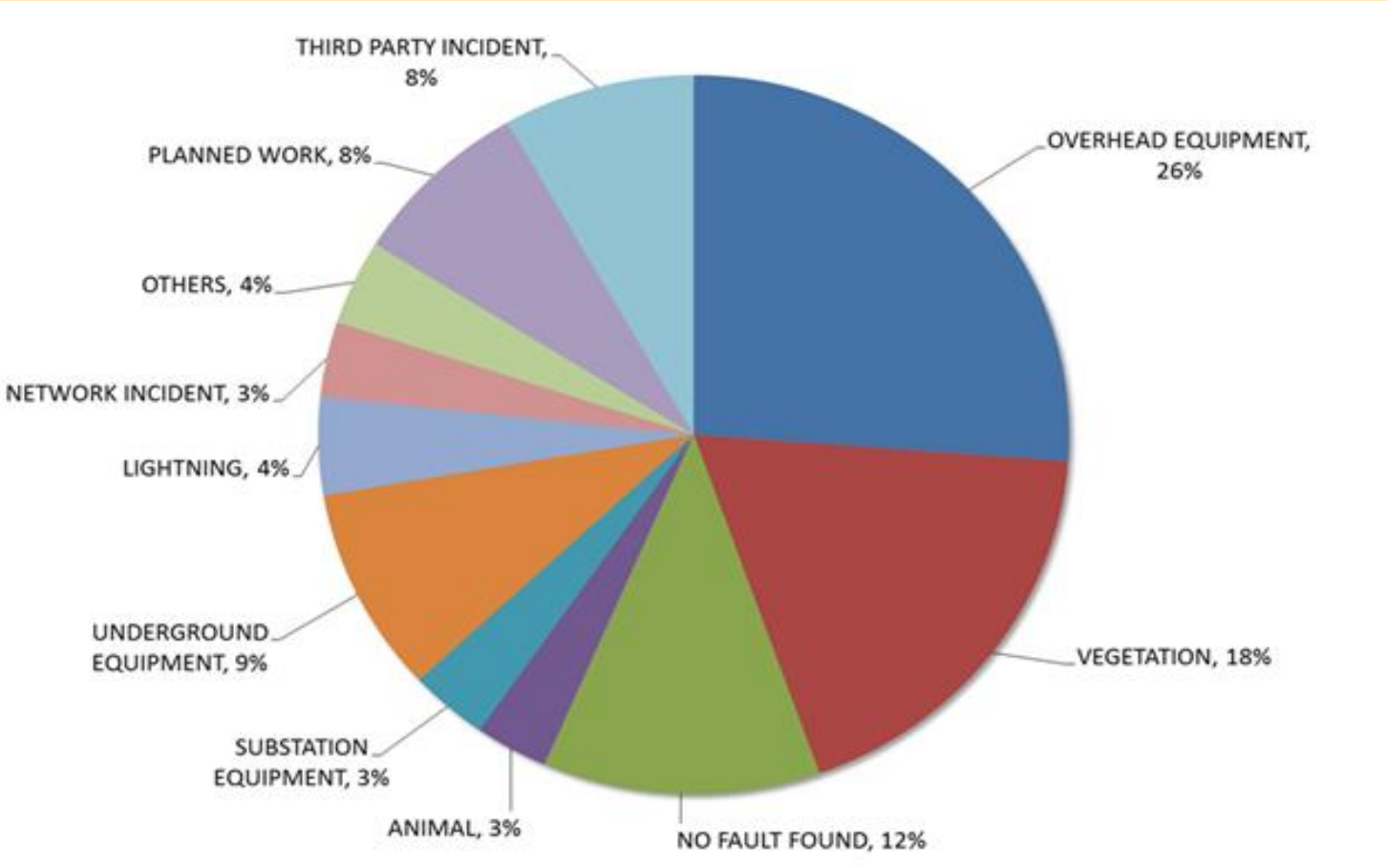
homes and businesses

64% Underground
High Density

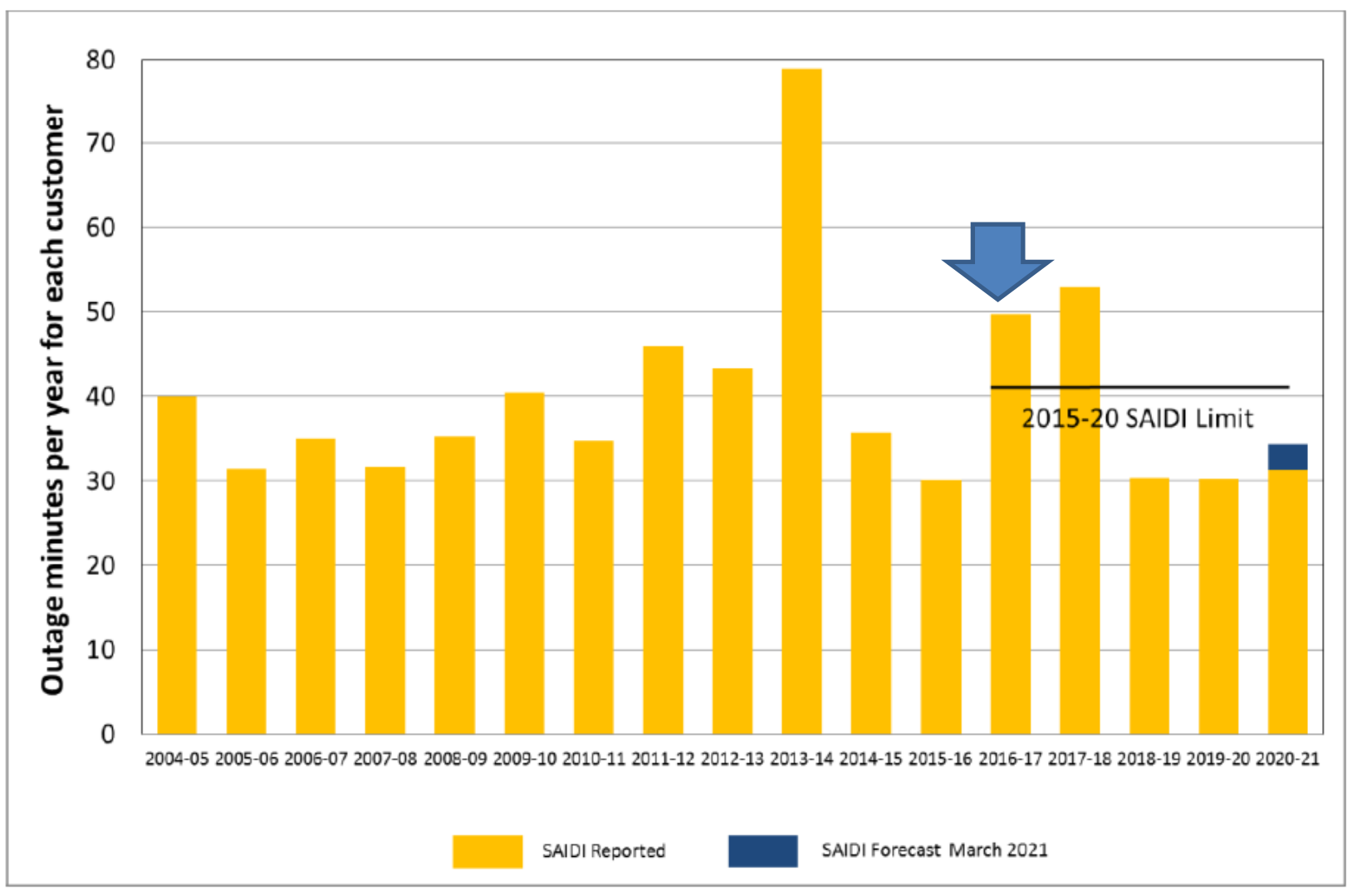
2015/16 Performance



2016/17 Performance



2016/17 Performance



What did WE* do?

- Fortnightly reliability Meetings
- Emphasis to quickly return network to normal
- Ramped up work on worst performing feeders
- Increase use of Generation
- And

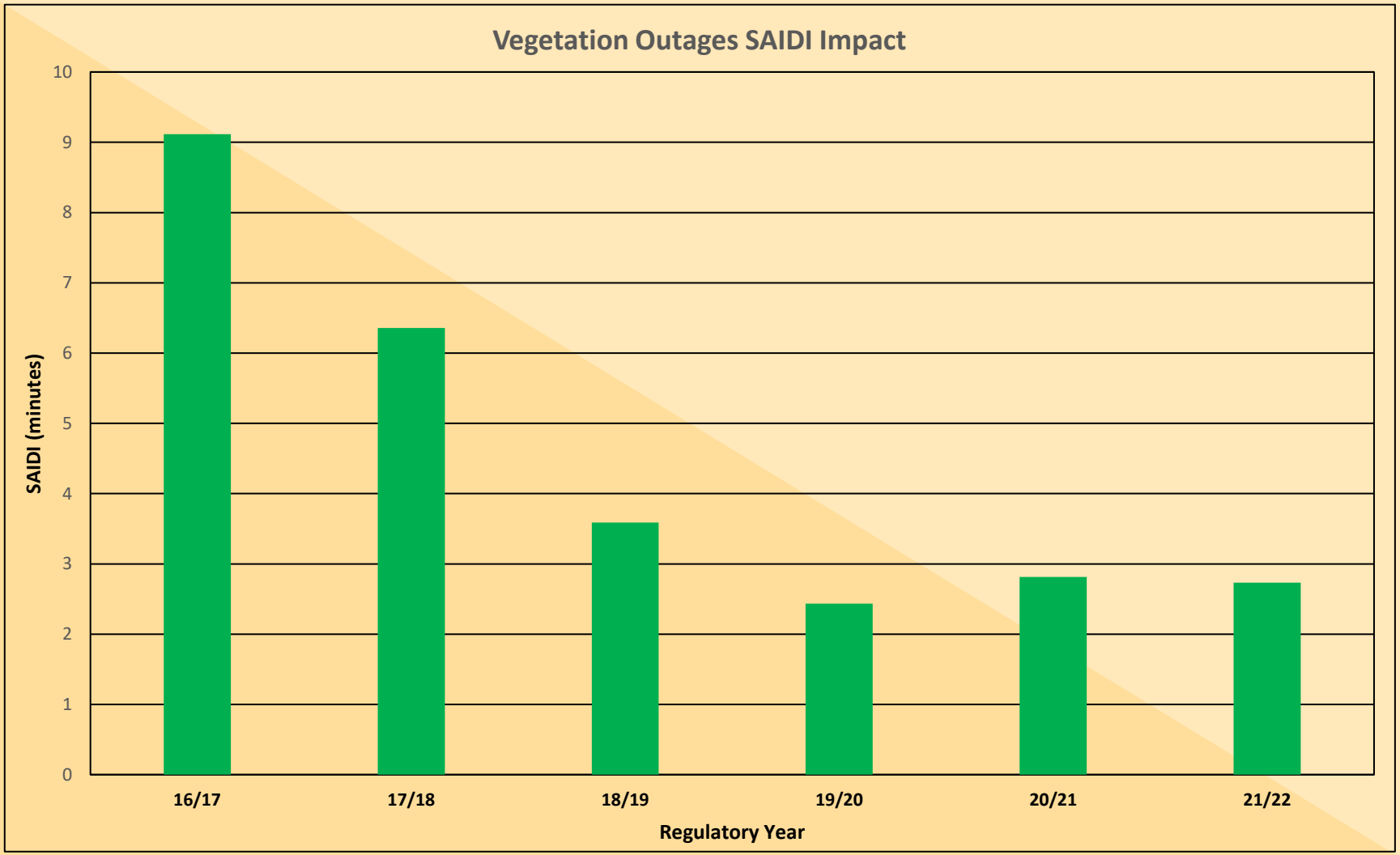
What WE* have done

Specific controls for vegetation events:

- Radio safety campaigns
- Greater engagement with tree owners
- Installation of covered conductors
- Improvements in the way vegetation related outages are recorded

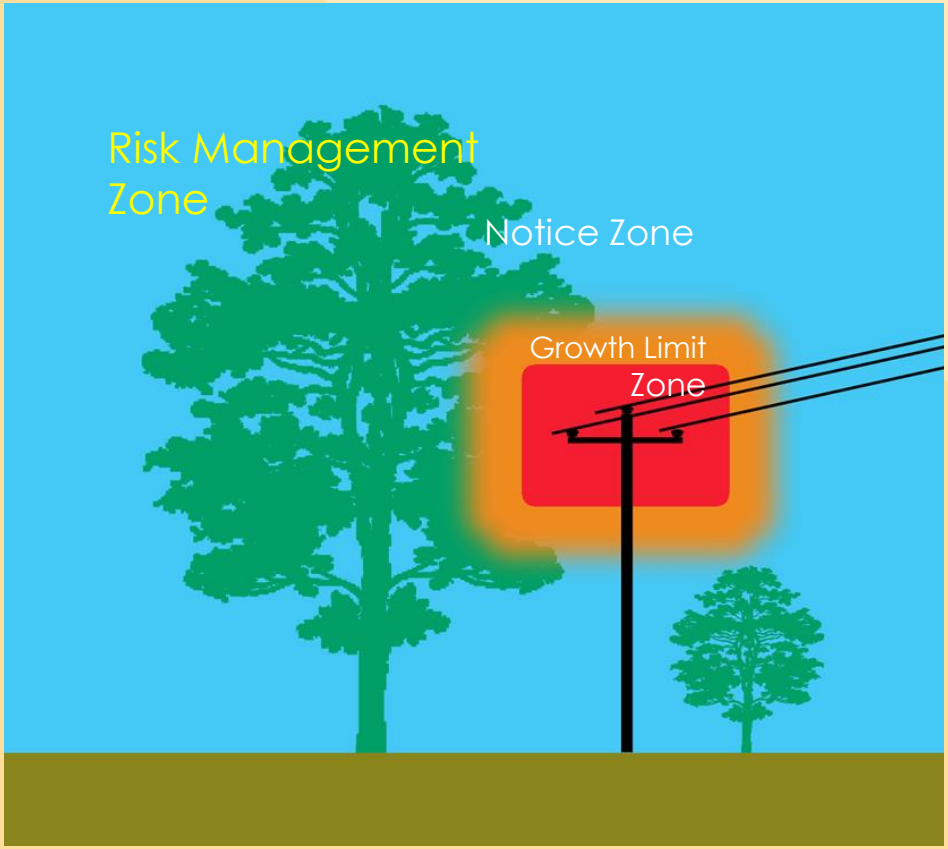
- Reduced cycle vegetation cutting programme
- Risk-based approach to tree trimming

Vegetation Faults SAIDI impact



Vegetation Outages Statistics

Outage statistics 2013 - 2017



- 650km of overhead HV network
- 20 outages caused by trees within the Growth Limit zone (20%)
- 100,000 thousand trees within the risk management zone
- 100 outages caused by trees in the risk management zone (80%)

Causes of vegetation outages

- Pines (33%). Gums (12%).
- Wind blown debris 40%
- Broken branches directly above the wires 29%.
- Fallen trees in strong winds (20%).
- Shedding Bark (< 5%).
- Tree Owners performing felling (<5%)

Treescape Risk Assessment Strategy

Getting smart about what we cut outside the clearance zone:

Risk Assessment by:

- Risk Modelling
  - Line strike Probability
  - Debris trajectory in windy conditions
- Visual Tree Assessment
  - Tree Condition
  - Predictive failure analysis
- Quantifying the Risk
  - Consequence mapping
  - SAIDI Impact

Tree Risk Modelling

Risk modelling - Debris Trajectory in windy conditions

- Vegetation can travel considerable distances in high winds.
- Impractical to increase clearance zone to accommodate this.
- Outage probability increases as winds exceed 35km/hr.
- Debris mainly consists of smaller branches and bark strips, ie. From Gum trees

Tree Assessment

Visual Tree Assessment

- Trees in good health are inherently reliable.
- Failure is usually due to some condition or defect.
- Many defects can be detected using visual techniques.
- Trained arborists have skills in identifying defects.

Approach:

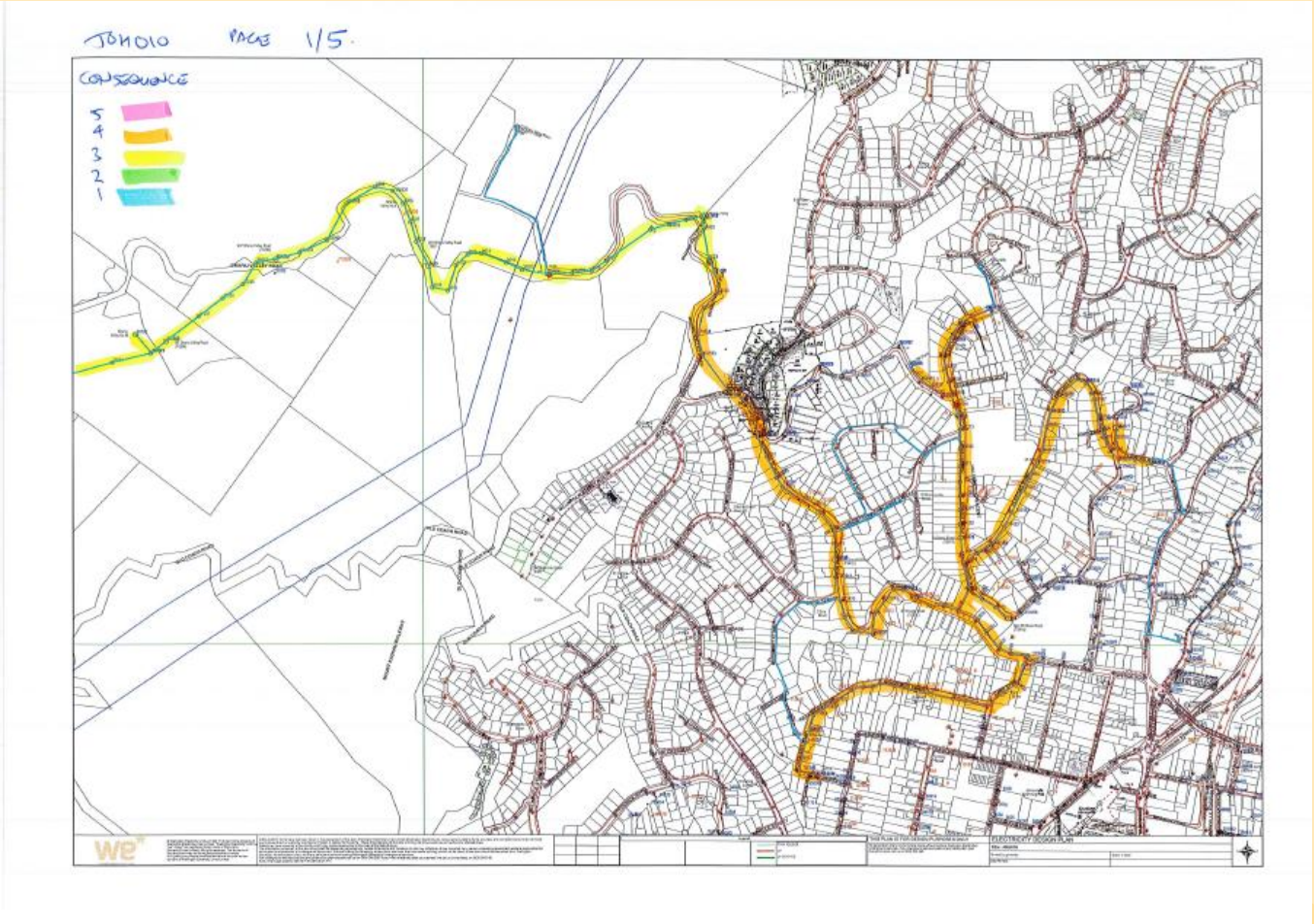
- Learn to identify “high risk” vegetation and remove it.
- Match removal effort with network impact

Tree Assessment

Visual Tree Assessment - Assessing the Hazards:

- Timber decay
- Lightning damage
- Poorly attached branches
- Dead overhanging branches
- Elongated overhanging branches
- Ribbon bark shedding
- Root damage
- Soil Erosion

Tree Criticality



Tree Assessment

Visual Tree Assessment – Tailoring the effort:

Assessment Category	Customers Affected	Assessment Requirements
Category A	> 1,500	Detailed ground-based visual assessment including root to crown. Climbing inspection if estimated cost to rectify >$5,000.
Category B	750 – 1,500	Detailed ground-based visual assessment including root – crown is considered necessary.
Category C	20 – 750	Mixed vehicle/ground-based inspection effort. Detailed ground-based when problems found.
Category D	< 20	Cursory vehicle-based assessment. Detailed ground-based when problems found.

Tree Risk Management

Risk Management Process

- Assess the vegetation risk by estimating the expected value of SAIDI associated with the hazard.
- Compare the cost to treat the risk against a table of threshold values.
- Tree removal proceeds if cost is less than threshold value.

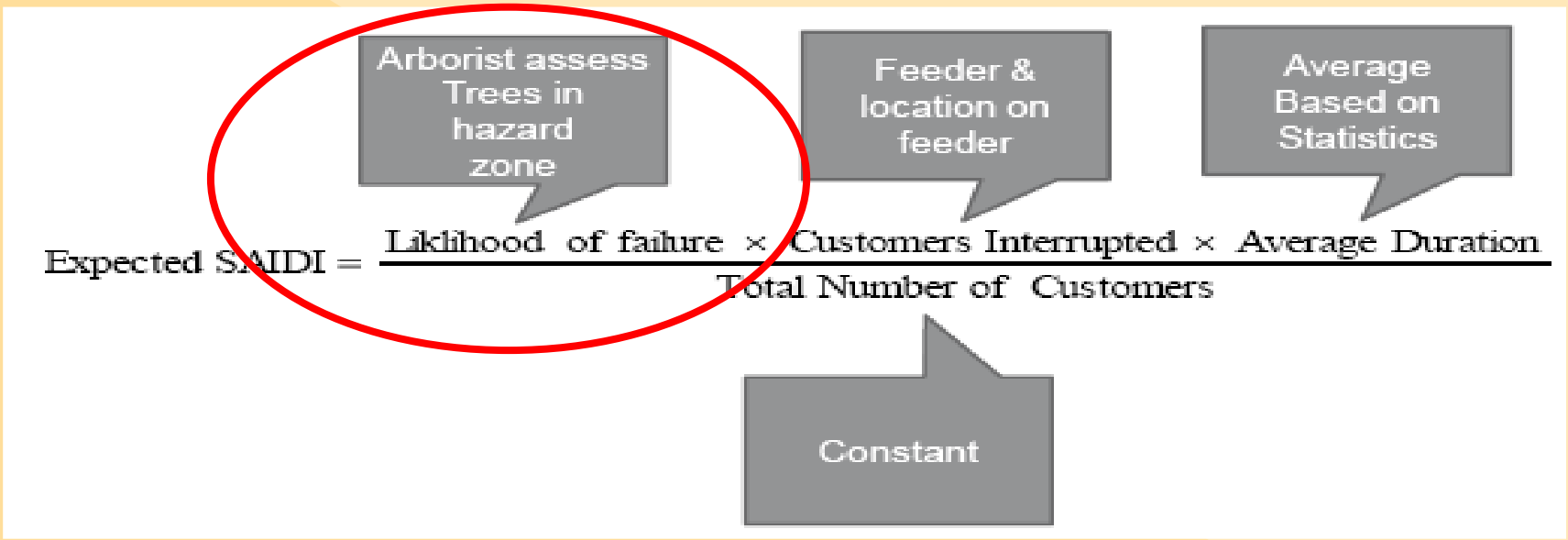
Tree Risk Management

Likelihood of failure

Risk Category	Definition	Approx probability
Almost Certain	Tree shows an obvious defect and presents an immediate risk of failure causing a network outage.	*Approximately one tree in two in this condition would fail and cause an outage in a given year.*
Likely	Tree fails VTA with a significant defect & is in a position where failure would most likely cause a network outage.	*Approximately one tree in 10 in this condition would fail and cause an outage in a given year.*
Possible	Tree fails VTA & is in a position where failure would most likely cause an outage. OR Tree is in a position where failure would be certain to cause an outage	*Approximately one tree in 100 in this condition would fail and cause an outage in a given year.*
Unlikely	Tree is in a position where contact with mains is possible, however assessment of tree condition suggests that failure is not likely.	*Fewer than one tree in 1000 in this condition would fail and cause an outage in a given year*

Tree Risk Management

Calculating the SAIDI



Calculating the SAIDI

- If a tree was assessed to have a likelihood of failure and outage of 1 chance in 100 in a given year and if the resulting outage interrupted 1000 customers for 2 hours then the expected SAIDI over a 1 year period for that tree would be:

As an example the network has 100,000 customers

$$\text{Expected SAIDI} = \frac{0.01 \times 1000 \text{ customers} \times 120 \text{ minutes}}{100{,}000 \text{ total customers}} = 0.012 \text{ minutes}$$

Tree Risk Management

Evaluating Cost Vs Benefit

- Estimated cost to action is compared against threshold values. If cost is less, then work may proceed.

Likelihood	>1500 customers	750 to 1500 customers	20 to 750 customers	<20 customers
Almost Certain	$35,000	$25,000	$12,500	$2,500
Likely	$10,000	$5,000	$2,500	$500
Possible	$1,000	$500	$250	$100
Unlikely	$200	$100	0	0

- Threshold values based on $xxx,xxx per SAIDI minute

Tree Risk Management

Summarising the process

Prepare
- Identify feeder sections for assessment
- Determine category (cust No.s)
- Prepare marked up maps

Survey
- Perform survey, evaluate hazards
- Compare against thresholds
- Prepare list of action items

Act
- Evaluate and approve
- Procure services and execute

Benefits

Benefits

- Efficient - The amount of vegetation clearing is tailored to the criticality of the feeder.
- Cost effective - Costs are controllable and can be ramped up or down as required.
- Justifiable – requests to remove trees are based on risk as assessed by a qualified arborist.
- Environmentally friendly – we can leave healthy, low risk trees alone.


Questions?