

Gazette Fire Ignition

17 March 2018

**Tree failure 992 Twomeys Bridge
Road, Yatchaw**

Technical investigation report

Preface

This technical investigation report has been prepared by Energy Safe Victoria (ESV) pursuant to the objectives, powers and functions conferred on it by The Electricity Safety Act 1998 (Act).

Specifically, these include, amongst other things, to investigate events or incidents, which have implications for electricity safety and to regulate, monitor and enforce the prevention and mitigation of bushfires that arise out of incidents involving electric lines or electrical installations and to monitor and enforce compliance with this Act and the regulations.

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Summary

On 17 March 2018 a high wind event passed through Victoria's South West Region caused a tree to fail. Part of the tree fell and contacted the electrical network and is the most likely source of ignition of a fire known as the Gazette fire.

The fire originated close to Pole two of the Ellburger spur on Powercor Australia Limited 22 kilovolt (kV) High Voltage (HV) Hamilton 003 feeder (HTN 003). The location is in a plantation easement accessed from Twomeys Bridge Rd, Yatchaw.

Upon Energy Safe Victoria (ESV) review of the incident notification report from Powercor Australia Limited two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the incident site on 13 April 2018.

The tree that had failed was identified by Powercor during a patrol of the overhead power line.

Fire ignition is possible either by the tree contacting the 22kV HV conductors or the broken conductor hitting the ground. Both circumstances could release enough electrical energy to ignite a fire on the ground.

The Powercor HV electrical protection records identified a phase to phase fault event on the HTN003 22kV circuit breaker. The time stamp recorded against this event in Table 1 is consistent with the time when damaging winds were experienced in the region.

From its investigation, ESV determined it is likely a tree in the plantation failed and fell onto the 22kV HV conductors, breaking the conductors and bringing them to ground. This resulted in the ignition of a fire at approximately 23:28 Australian Eastern Standard Time¹ (AEST) on 17 March 2018.

The base of the tree was measured as approximately 22 metres horizontally away from the closest conductor. The tree was estimated to be 28.5 metres high. This means that when the tree fell it was possible for it to contact the powerline.

From the evidence observed on site and review of Nearmaps, and LiDAR information provided by Powercor ESV determined that the tree that failed was at a distance greater than the minimum clearance required by the Electricity Safety (Electric Line Clearance) Regulations 2015, however due to its height it was able to contact the powerlines when it fell.

Based on the findings of this investigation, ESV concluded no further investigation into this incident is warranted.

¹ All time references in this report refer to Australian Eastern Standard Time

Introduction

Scope

This report details the findings of an Energy Safe Victoria (ESV) technical investigation of the causes of, and contributing factors to, a fire that originated close to the location of Pole two of the Ellburger spur on Powercor Australia Limited's distribution network on the 22 kilovolt (kV) Hamilton 003 feeder (HTN 003). The location is within an easement next to Twomeys Bridge Road, south of the intersection of Burgers Road, Yatchaw.

The investigation details the evidence gathered to support the technical conclusion reached and outlines the relevant standard that applies to vegetation management near the distribution network at this location.

Objectives

ESV's investigative objectives were to:

- identify the entities involved
- establish the initial facts and possible causes of the incident
- source information from the Country Fire Authority (CFA)
- identify any standards relevant to the incident.

To meet these objectives, ESV sourced specific information that included:

- Bureau of Meteorology (BOM) data from the Hamilton weather station (closest to the ignition source)
- 22kV HTN 003 feeder protection equipment operation records
- the Powercor Australia Limited:
 - incident report
 - protection equipment operation records
 - accepted Electric Line Clearance Management Plan.
 - LiDAR records of the incident site.
- CFA information and photographs
- Nearmaps images.

Methodology

ESV's investigative methodology involved a combination of practices, procedures, and processes that included:

- requiring and analysing specific information (including the incident report) from Powercor Australia Limited
- reviewing and analysing 22kV HTN 003 feeder protection equipment operation records
- reviewing weather records from the closest BOM weather stations
- reviewing photos taken at the site on the day of the ESV site visit
- reviewing photos provided by the Country Fire Authority (CFA)
- reviewing photos provided by Powercor Australia Ltd
- reviewing LiDAR information provided by Powercor
- reviewing images from Nearmaps.

Background

On 17 March 2018 a high wind event passed through Victoria's South West Region and caused a tree to fail. Part of the tree fell and contacted the electrical network and is the most likely source of ignition of a fire.

The fire originated close to Pole 2 of the Ellburger spur on the Powercor Australia Limited distribution network on the 22 kilovolt (kV) Hamilton 003 feeder (HTN 003).

Upon ESV's review of the incident notification report from Powercor Australia Limited, two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the incident site on 13 April 2018.

Figure 1: Incident site



Declarations

The declarations relating to the period of the incident involved a Total Fire Ban (TFB) day, a Hazardous Bushfire Risk Area (HBRA), and Powercor Australia Limited special protection settings for TFB days.

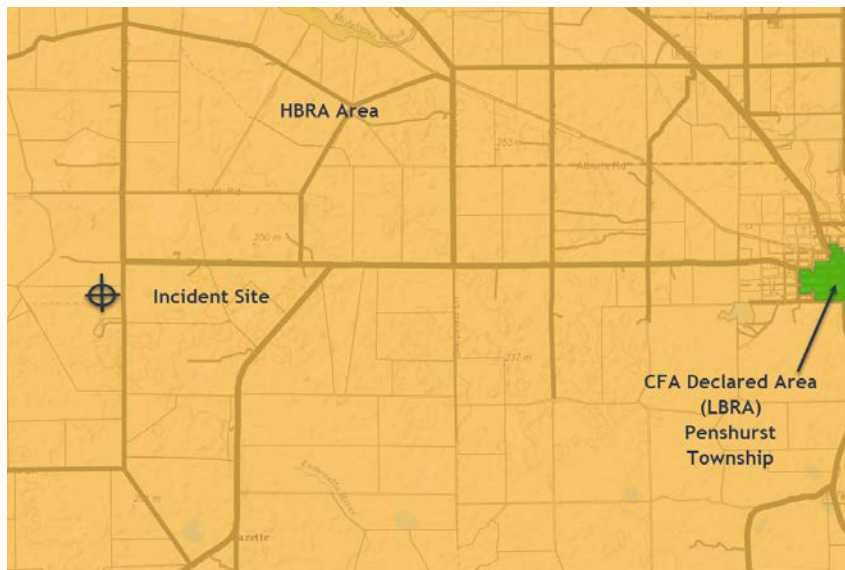
Total Fire Ban day

On 17 and 18 March 2018, TFB days were in place for the Southwest Fire District, which includes the Laang area².

Hazardous Bushfire Risk Area

Figure 2 shows a map of the incident site in relation to the CFA declared Low Bushfire Risk Area (in green) and the HBRA area (in amber).

² Country Fire Authority 2018, State Government of Victoria, Melbourne, viewed 7 May 2018, www.cfa.vic.gov.au/warnings-restrictions/history-of-tfbs.

Figure 2: Incident site map

Powercor Australia Limited special protection settings

Powercor Australia Limited has an accepted (by ESV) Bushfire Mitigation Plan (including any actions required) for managing risk on TFB days. The plan, which considers a number of factors (including environmental) involves initiating enhanced protection setting functionality for listed assets in a document referenced in the plan.

For the Hamilton 003 (HTN 003) Zone Substation feeder circuit breaker the settings that were applied were “Low Set Inv.Time O/C In Service, Reclose Normal”. The TRG 005 protection settings were logged as applied on 17 March 2018 and removed on 18 March 2018 (as per Table 1).

This terminology means that the protection was set to operate in a faster than normal timeframe, with a 1 fast, 1 slow circuit breaker reclose as the HTN 003 circuit breaker was listed as an asset to which TFB day settings should be applied³.

The Powercor HV electrical protection system records identified a phase to ground fault event on the time stamps recorded against this event which is consistent with the time when damaging winds were experienced in the region.

³ Powercor Australia Limited, Total Fire Ban Action Plan, Attachment A, 2018.

Technical investigation

Powercor post event actions

Powercor isolated the local section and repaired the HV Overhead line on 18 March 2018.

CFA site observations

CFA fire investigators attended site on 19 March 2018 and photographed the incident scene in the plantation easement. Copies of these photos were provided to ESV to assist with the investigation.

These photos show the:

- tree stump with broken tree trunk
- overall scene view showing the length of the tree
- top section of tree showing it under the powerline.

Figure 3: Tree stump failure point



Figure 4: Tree failure complete section



Figure 5: Image showing top of tree under powerline



A review of the photos provided by CFA indicates that there is significant clearance between the plantation trees and the HV conductors.

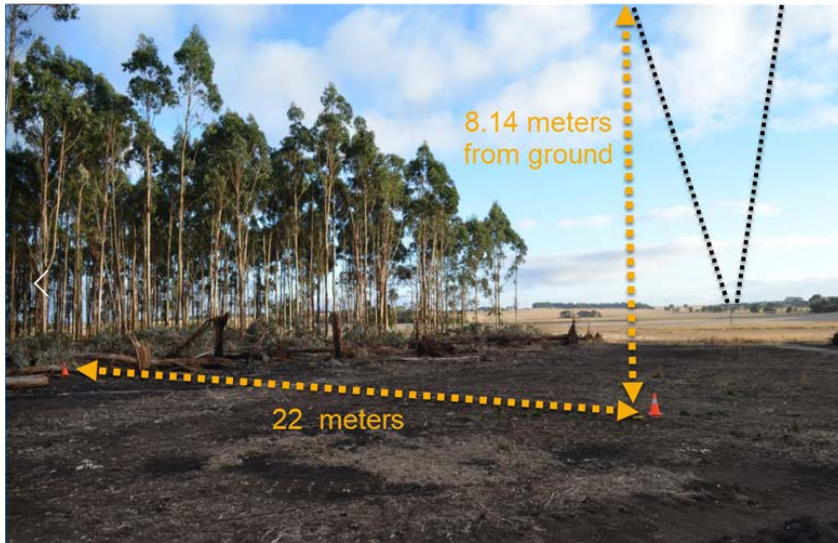
ESV site observations

Two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the site on 13 April 2018.

Site observations:

- the trees in the photograph are Eucalyptus species (Tasmanian blue gum) which are part of a plantation where a powerline easement is present
- there were two rows of trees on either side of the plantation that had been pushed over after the incident (*CFA confirmed that this was completed by plantation owners*)
- a tree base had been cut to near ground level; it was assumed to be the remaining tree stump as displayed in Figure 2 above
- a tree was cut into sections lying on the ground that appeared to be the one suspected to have contacted the overhead line (*It was subsequently confirmed that these were the sections of the failed tree*)
- the combined length of these sections was measured at 27.0 metres. The stump in the picture above was measured at 1.5 metres in height. This means the estimated height of the tree would be 28.5 metres
- a section of the top of the tree that was significantly burnt was positioned under the HV conductor. This placement was directly beneath the section of HV line where new conductor had been repaired. The position also correlated with a burnt section on the ground. This was assumed to be the potential ignition point
- the distance measured from the tree stump to the closest HV conductor was 22 metres
- the tree fell in the direction of the powerline
- given the estimated height of the tree it could be expected to make contact with HV overhead conductors when it fell
- the falling tree is likely to have caused the fire ignition
- the post event removal of the first two rows of trees has reduced the risk of any further contact with the powerlines due to falling trees
- the height of the HV conductor at the repaired section was 8.14 metres
- the tree was within the middle two thirds of the span (which is used to calculate the electric line clearance requirements)
- the fire ignition point was approximately 80 metres north of pole 2.

Figure 6: Distance from tree base to OH Line



Powercor incident report

ESV received an incident notification (20180423PWA_03) from Powercor on 24 April 2018 regarding the failure of a tree branch causing a fire. The report states that the HV overhead line was contacted by a tree falling from outside the required clearance requirements.

The details of the notification report are consistent with observations made by ESV during its site visit on 13 April 2018.

Powercor Protection equipment operation information

The Powercor HV electrical protection system records identified a red phase to blue phase event on the HTN 003 22kV feeder circuit breaker at 20:42 AEST that reclosed and then went to lockout.

Table 1: Excerpt HTN 003 circuit breaker – 17 March 2018

Time (UTC)	Time (AEST) (+11)	Type	Magnitude @ Trip	Reclose
9:42:53.068	20:42:53.068	Red to Blue (Ph-Ph)	649 A	Yes

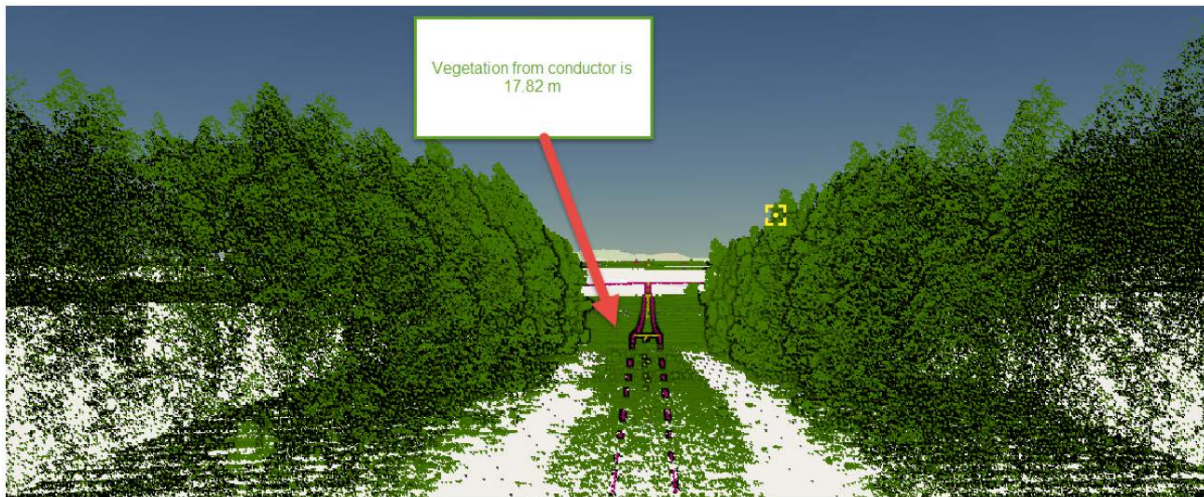
This information has been provided by Powercor following a request from ESV. This confirms that the HTN 003 Zone Substation circuit breaker tripped to isolate the fault, then unsuccessfully attempted to reclose/re-energise, then ultimately locked open until the line had been inspected in line with Powercor policy.

LiDAR Information

Powercor provided ESV with a copy of the most recent LiDAR (Light Detection and Ranging) measurements that were recorded for the incident site. The information/data comes from flight data recorded on 2 March 2018.

This indicates that the closest vegetation was assessed at 17.82 metres away from the HV conductor as per Figure 6.

Figure 7: LiDAR image of site provided by Powercor



Nearmap image review

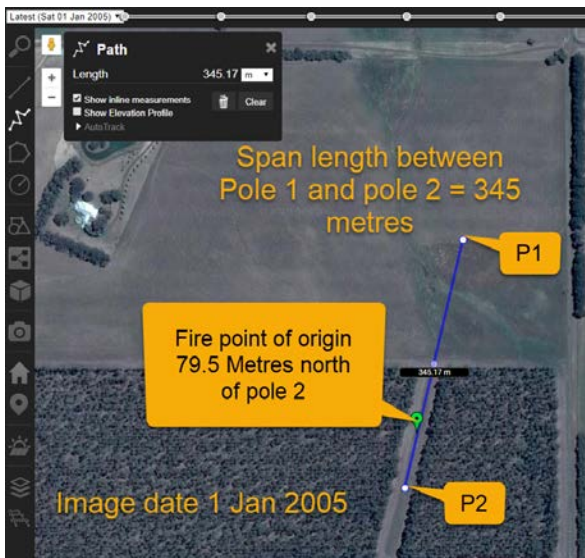
A search and review of images provided by Nearmap⁴-Photomaps shows the site and span dimensions (1 Jan 2005). The ignition point is approximately 79.4 metres from pole 2 and easement width at approximately 30.20 metres.

Figure 8: Nearmaps image of area



Span length between P1 and Pole 2 is an estimated 345 metres and vegetation contact is in the middle two thirds (2/3) of the conductor span used for calculating the electric line clearance requirements.

Figure 9: Span information



⁴ [https:// http://maps.au.nearmap.com](https://http://maps.au.nearmap.com) as viewed 20 June 2018

Analysis of photos and images

Photos taken at the site by ESV on 13 April 2018 indicate:

- adjacent trees were of similar height
- the easement was clear of vegetation.

Further reviews of images from other sources indicate:

- Nearmaps images show significant clearance from HV conductors at that time.
- recent (to the incident date) LiDAR data provides measurement of clearance from trees to the HV conductors and confirms that regulatory requirements were met.

Electric Line Clearance Regulations 2015

Section 84 of the Electricity Safety Act 1998 identifies Powercor as responsible for keeping trees appropriately clear of the electric line that is the subject of this technical investigation report. The electric line has been identified to be an uninsulated high voltage electric line that existed in a hazardous bushfire risk area (HBRA) as defined by the CFA.

Section 28 and Graph 5 of the Code of Practice for Electric Line Clearance (the Code) prescribes the minimum distance that trees should be kept clear from uninsulated high voltage electric lines (other than a 66,000 volt electric line) in HBRA. The Code is a schedule to the Electricity Safety (Electric Line Clearance) Regulations 2015.

Section 28 (4) states that “*The applicable distance for the middle two thirds of the span is-*“ and the user then applies either paragraph (a) (b) or (c)

In this situation the span length is 345 metres and the contact position was within the middle two thirds of the span. Therefore paragraph (b) applies.

Section 28 (4)(b) states “*if the span distance is greater than 45 metres and less than or equal to 500 metres—the distance calculated in accordance with the following expression—*”

$$1500 + ((SD - 45) \times (500 \div 303)) \text{ where — } SD \text{ is the span distance}”$$

Therefore the applicable minimum regulatory clearance distance by calculation is;

$$1500 + ((345 - 45) \times (500 \div 303)) = 1995 \text{ mm}$$

The tree of concern existed within the middle two thirds of the span therefore a minimum clearance distance of 1995 mm was required in all directions from the HV overhead conductors.

From the evidence gathered and analysed, site observations made and review of available images ESV estimates the tree was more than 17 metres from the HV conductor and therefore ESV is satisfied that the minimum clearance distance has been maintained prior to the incident.

Prevailing weather information

Prevailing weather information

Bureau of Meteorology Information

On the afternoon of 17 March 2018 damaging winds had passed though the Hamilton area and South West region of Victoria.

The closest weather station to the investigation site was Hamilton. The information from this station has been collected by accessing the Bureau of Meteorology Internet site.

Figure 9 shows that Hamilton weather station records recorded on 17 March 2018 at 19:00 AEST winds with a maximum gust of 109 km/h coming from a West North Westerly direction.

Figure 10: Excerpt from the Hamilton weather record for March 2018

Hamilton, Victoria March 2018 Daily Weather Observations									
Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust		
		Min	Max				Dirn	Spd km/h	Time local
		°C	°C						
1	Th	12.6	22.9	1.0			SSE	33	14:39
2	Fr	10.1	30.0	0			ENE	30	10:50
3	Sa	12.8	24.6	0			SW	44	14:33
4	Su	9.8	20.1	0			SW	39	13:16
5	Mo	7.1	20.4	0			SSE	46	14:45
6	Tu	8.6	25.4	0			SSE	48	16:01
7	We	10.8	30.8	0			S	46	17:21
8	Th	12.2	32.7	0			SSE	39	16:52
9	Fr	13.5	33.8	0			SSE	44	17:21
10	Sa	15.1	35.3	0			WNW	44	14:02
11	Su	14.0	22.8	0			S	44	12:38
12	Mo	11.3	21.3	0			S	43	15:03
13	Tu	11.8	21.6	0			SSE	52	12:22
14	We	11.7	23.5	0			S	31	14:33
15	Th	8.2	21.4	0			SW	31	11:29
16	Fr	7.7	24.8	0			NNW	43	13:37
17	Sa	12.8	31.6	0			WNW	109	19:00
18	Su	11.6	20.2	1.6			WNW	72	09:08

Findings and conclusions

ESV's findings and conclusions specifically relate to the source of the Gazette Fire and the role played by the electricity infrastructure.

The source of the Gazette fire

The most likely source of the Gazette fire ignition was either from the contacting the 22kV HV conductor or after the broken HV conductors hitting the ground on the North side of pole 2 of the Ellenberger spur of the (HTN003) 22kV feeder. Either of the circumstances could have released enough electrical energy to ignite a fire on the ground.

Auto Circuit Recloser operations

The protection settings on the Hamilton 003 22kV feeder Circuit Breaker were set to trip to isolate the fault, then attempt to reclose/re-energise, then ultimately lock open until the line had been inspected. Whether or not the reclose operation on the line contributed to the ignition of the fire is unknown. The fault location was identified during the line patrol in accordance with the current approved Powercor Bushfire Mitigation Plan.

Vegetation clearances

From the evidence gathered and analysed, ESV concludes that it is highly likely that a tree failed and made contact with the 22kV HV conductors near Pole two of the Ellenburger Spur.

From the evidence remaining on site it appears that the base of the tree was approximately 22.0 metres from the closest conductor, however its height was sufficient to contact the powerlines when it failed. Despite this observation ESV determines that the tree that failed was compliant to the minimum clearance requirements of the Electricity Safety (Electric Line Clearance) Regulations 2015.

Therefore ESV will not be investigating this incident further.

Appendix A – Weather Observations

Hamilton, Victoria
March 2018 Daily Weather Observations



Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am					3pm						
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours	Dirn	km/h	local	°C	%	eighths	Dirn	km/h	hPa	°C	%	eighths	Dirn	km/h	hPa
1	Th	12.6	22.9	1.0			SSE	33	14.39	13.0	93	8	SSW	17	1018.1	20.5	51	4	SSE	19	1017.5
2	Fr	10.1	30.0	0			ENE	30	10.50	12.9	93	1	ESE	17	1014.4	26.0	25		ESE	7	1011.6
3	Sa	12.8	24.6	0			SW	44	14.33	16.9	65		W	19	1009.4	23.3	43	2	WSW	26	1010.4
4	Su	9.8	20.1	0			SW	39	13.16	12.8	92		SSW	9	1017.0	19.2	42	7	S	20	1016.7
5	Mo	7.1	20.4	0			SSE	46	14.45	14.2	73	8	S	17	1020.2	19.5	39	7	S	30	1021.3
6	Tu	8.6	25.4	0			SSE	48	16.01	13.2	77		SE	20	1025.3	24.3	33		SE	30	1023.6
7	We	10.8	30.8	0			S	46	17.21	14.0	88		ESE	17	1025.1	28.9	26		NW	9	1022.8
8	Th	12.2	32.7	0			SSE	39	16.52	20.3	54		NNE	6	1024.5	31.5	18		SW	13	1022.2
9	Fr	13.5	33.8	0			SSE	44	17.21	20.7	46		N	6	1025.3	32.4	17		ENE	9	1023.0
10	Sa	15.1	35.3	0			WNW	44	14.02	22.3	35		NNW	13	1024.0	34.1	14		N	17	1021.8
11	Su	14.0	22.8	0			S	44	12.38	17.4	81	7	S	19	1024.5	21.0	54	4	S	20	1024.4
12	Mo	11.3	21.3	0			S	43	15.03	14.0	67	8	SSW	22	1025.1	19.8	47	1	SSW	24	1023.6
13	Tu	11.8	21.6	0			SSE	52	12.22	13.5	78	8	SSW	15	1024.5	20.4	46	3	SSW	22	1022.8
14	We	11.7	23.5	0			S	31	14.33	14.1	68	8	SSE	17	1021.1	22.6	36		SSE	15	1017.4
15	Th	8.2	21.4	0			SW	31	11.29	10.9	88	5	Calm		1015.8	19.8	49	8	SSW	17	1015.3
16	Fr	7.7	24.8	0			NNW	43	13.37	12.8	95	7	E	13	1015.4	23.5	33	8	NNW	22	1012.5
17	Sa	12.8	31.6	0			WNW	109	19.00	19.1	66	3	N	24	1010.4	30.4	22	4	NNW	44	1006.2
18	Su	11.6	20.2	1.6			WNW	72	09.08	12.9	78		WNW	37	1006.2	18.5	37	8	W	33	1011.7
19	Mo	11.2	21.0	0.2			WNW	52	11.27	13.4	91	7	NNW	28	1014.7	20.1	57	8	WNW	31	1014.9
20	Tu	10.5	16.9	0.8			S	52	15.20	12.8	73	8	SSE	13	1026.8	15.9	43	8	SSW	31	1028.1
21	We	8.8	25.4	0			E	56	18.41	11.2	68		ESE	20	1027.7	21.8	43	6	E	30	1023.9
22	Th	10.8	28.6	0			E	50	23.25	16.4	59	4	ENE	19	1023.2	27.2	32		NNE	26	1020.4
23	Fr	15.2	29.3	0			N	52	13.51	21.5	50	7	N	30	1020.1	28.0	29		N	33	1016.0
24	Sa	16.1	25.9	9.6			SW	59	04.08	16.6	93	8	NE	13	1013.0	25.2	41	8	NW	15	1009.5
25	Su	14.9	21.5	0.2			WNW	80	14.01	16.0	80	5	NW	31	1002.8	20.5	37	8	WNW	46	1000.4
26	Mo	6.8	16.8	3.0			SW	48	10.09	9.7	84		W	17	1010.5	15.3	51		WSW	30	1012.5
27	Tu	6.4	20.4	0			NNW	46	12.27	8.8	89		N	17	1015.1	18.8	42		NNW	28	1012.5
28	We	8.8	24.0	0			N	52	04.00	17.5	47		NW	20	1012.2	22.7	52		SW	19	1014.2
29	Th	10.9	22.1	0			W	39	14.24	13.2	80		W	9	1017.6	21.0	43		WNW	22	1015.4
30	Fr	13.0	22.7	0			W	43	10.05	14.5	87		W	17	1016.7	20.5	46		WSW	24	1017.0
31	Sa	6.2	21.2	0			NW	31	14.33	9.9	95		SSW	2	1019.2	19.4	37		SW	11	1016.6
Statistics for March 2018																					
Mean		11.0	24.5							14.7	75	6		16	1018.3	23.0	38	5		23	1017.0
Lowest		6.2	16.8							8.8	35	1		Calm	1002.8	15.3	14	1	ESE	7	1000.4
Highest		16.1	35.3	9.6			WNW	109		22.3	95	8	WNW	37	1027.7	34.1	57	8	WNW	46	1026.1
Total				16.4																	

Observations were drawn from Hamilton Airport (station 090173)

Some cloud observations are from automated equipment; these are somewhat different to those made by a human observer and may not appear every day.

ICDCJDW3002_201803 Prepared at 13:01 UTC on 21 Apr 2018
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