WHAKARATONGA IWI

FIRE EMERGENCY NEW ZEALAND

The Lake Ōhau Fire

A Summary of Events

The information for this summary of events was compiled from the Lake Ōhau Wildfire Investigation and the Lake Ōhau Operational Review and is not intended to be used for evidential purposes.

At 3:06am on Sunday 4 October 2020, Fire and Emergency received a call reporting a vegetation fire to the northwest of Lake Ōhau Alpine Village, a small settlement on the edge of Lake Ōhau. Severe winds were driving the fire toward the village. The village community had a plan in place which they activated, and some residents began an immediate evacuation.

When the Twizel Volunteer Fire Brigade arrived first at 3.39am, followed a short time later by the Omarama Volunteer Fire Brigade, firefighters were confronted with a fast-moving fire through the village and surrounding area. Crews and the Omarama Police Officer, along with support from some residents still in the village, completed the final evacuations. All people in the village were safely evacuated.

Firefighters then worked to defend the houses they could save. 48 residential buildings were lost to the fire and six were significantly damaged.

It took nine days to extinguish the vegetation fire. At the peak of the fire there were 11 helicopters and more than 100 people deployed to support the response.

An area of approximately 5043 hectares encompassing farmland and private properties both within the Lake Ōhau Village and surrounding area, along with Department of Conservation land was burnt.

Fire and Emergency investigators have determined the cause of the fire was accidental and caused by an electrical short circuit on a power pole several kilometres upwind of the village. Fire and Emergency New Zealand Wildfire Investigation Report.

Our investigations found the fire was caused by a cross-arm failure on a power pole that was part of a section of powerlines crossing conservation land approximately two and a half kilometres north-west of Lake Ōhau Village. The powerlines were standard 11kV lines consisting of three powerlines spaced across cross arms on top of concrete and wooden poles. Due to nuts and bolts that had come loose, the cross-arm detached from the pole and flipped, causing one of the powerlines on the cross-arm to touch a metal stay-arm, resulting in an electrical fault at 2.10am on the morning of Sunday 4 October 2020. The fault resulted in an arc or repeated arcs between the powerline, metal stay arms, bolts and the pole. The investigators concluded that particles of molten aluminium, steel or concrete falling to the ground caused ignition of vegetation below.

Weather conditions and fire spread

Despite significant rainfall leading up to the night of the fire, there was little change to the degree of curing (drying) in the grass cover. Warm weather and frosts assist with reducing the moisture content of grass.

The high winds, low moisture in this vegetation and local topography along with a good cover of grass and shrubs to fuel the fire, assisted in the ignition and resulted in a high intensity, fast moving fire.

The fire spread rapidly from its origin under the powerlines. With the wind blowing from the north down the lake and west through the gullies above the mountain range, the fire was pushed in an east south east direction towards the village. The fire moved across the grass and tussock lands before jumping Freehold Creek.

Once over the creek, and onto private land, the fire moved across grass and areas of planted trees and wilding pines.

This map identifies Department of Conservation land in blue and the yellow ellipse is the approximate location of the general origin of the fire area.

Once the fire reached the trees, the fire dynamics changed and the fire intensified. The fire crowned, meaning it burned through the tops of the trees, creating an ember storm. Areas of wilding pines increased the intensity of the fire. This is due to the small lower branches which naturally die off as the trees grow, leaving at least two metres of dry dead branches available to burn from the ground upwards.

The above photograph shows the dry dead branches within the wilding pines to the east north east of Lake Ōhau village.

There was no Remote Automatic Weather Station (RAWS) at Ōhau at the time of the fire, but three stations nearby provided insight into the weather at Ōhau. The wind was variable, a westerly was blowing over the top of the mountain and a northerly was also blowing down Lake Ōhau. The winds were very strong with extreme gusts at times. Data from a local home weather station recorded wind speeds ranging from 60-90km/h gusting 80km/h to over 100km/h. A station set up at Ōhau after the fire recorded gusts of up to 167km/h between 5 and 6 October.

High mountains to the west and steep hills to the east both assisted the strong wind to be funnelled down the lake and out across the surrounding flatter land driving the fire in front of it towards Lake Ōhau Alpine Village.

Fire scene investigation

Two investigators were appointed to determine the origin and cause of the fire.

In the days following the fire, the investigators examined the fire ground. Based on fire pattern indicators and supporting witness reports of the direction the fire came from, the investigators tracked across the landscape from southeast of the village towards the mountain range in the west.

Looking northwest from the south side of Lake Ōhau village with the power line at bottom right

The investigators found clear indicators the fire had come from a northerly direction. They mapped the indicators of where the fire had been as they went, noting any areas of interest. The fire pattern led them towards a spur along which ran 11kV power lines. The investigators identified this section of the power line on conservation land as the general origin area of the fire. The length of the electrical network in question covers approximately 560m and covers five spans between six power poles. This network is operated by Network Waitaki.

Each pole supports three 11kV power lines running through insulators attached to its wooden cross-arm which is bolted to the top of the pole. Each cross-arm is supported by two metal stays which are bolted to the cross-arm and to the centre of each pole.

The investigators identified five areas of interest along the general origin area of the fire that required further investigation.

Elimination of possible causes

Before a cause could be established, investigators carried out a thorough process of elimination. Ignition sources such as deliberate lighting, cigarettes, burning debris, electric fences, and lightning were considered and eliminated.

The investigators could not eliminate an electrical fault or faults. The electrical network became the focus of the investigation and, in particular, the five identified areas of interest along the power line.

Areas of interest

Of the five areas of interest identified by the investigators as warranting further investigation, three were eventually ruled out as an ignition source for the fire.

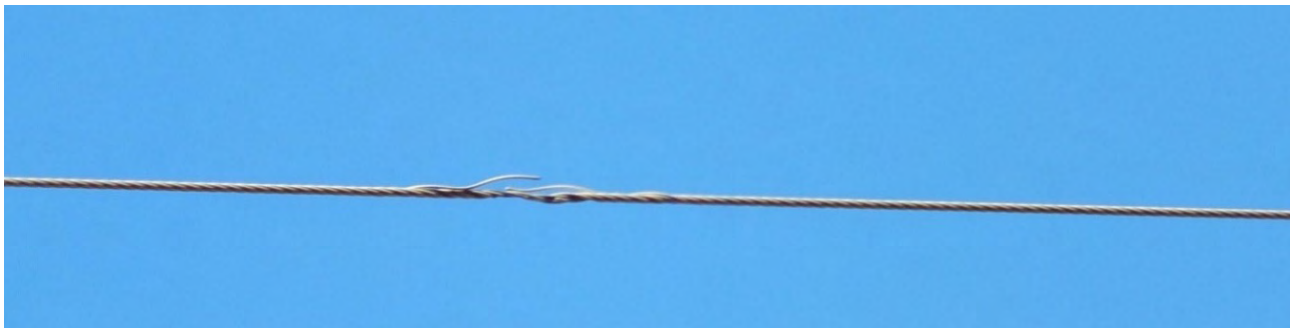
Span from Pole 870452 to Pole 821215 - 175m

Damage to two powerlines was identified on the span between two poles identified as pole 870452 and pole 821215.

These powerlines spanned a gully. Fire and Emergency secured the powerlines as exhibits. However, when compared against data showing faults on the lines on the night of the fire, there was no supporting data to suggest this damage could have created an ignition source.

Further, the investigators concluded the damage was an unlikely ignition source due to the height of the powerlines over the gully which meant molten aluminium globules would have cooled down before they hit the ground. Lastly, they concluded there was minimal back burning which they would have expected to see had the fire started in this location.

Span from Pole 870452 to Pole 821215 - 175m



Damage to two powerlines was identified on the span between two poles identified as pole 870452 and pole 821215.

Span between pole 35693 and pole 17408 where electrical conductors have twisted

Network Waitaki advised they had inspected the three powerlines on the span between pole 35693 and pole 17408 and had reported no damage. This span is still in place. With no damage being found on the span and the fact the fire pattern demonstrated the fire had come from the north, the investigators ruled this span out as a possible ignition source. The evidence suggested the front of the fire had burned through beneath the lines, rather than a fire starting under the twisting powerlines.

Span between pole 35693 and pole 17408 shows twisted lines

Pole 40456 broken insulator on the ground

The investigators located a broken insulator on the ground underneath pole 40456 as they tracked across the fire ground in the days after the fire. They noted due to its colour, the insulator looked as if it had broken recently.

Broken insulator located on the ground near pole 40456 (old pole number 17406).

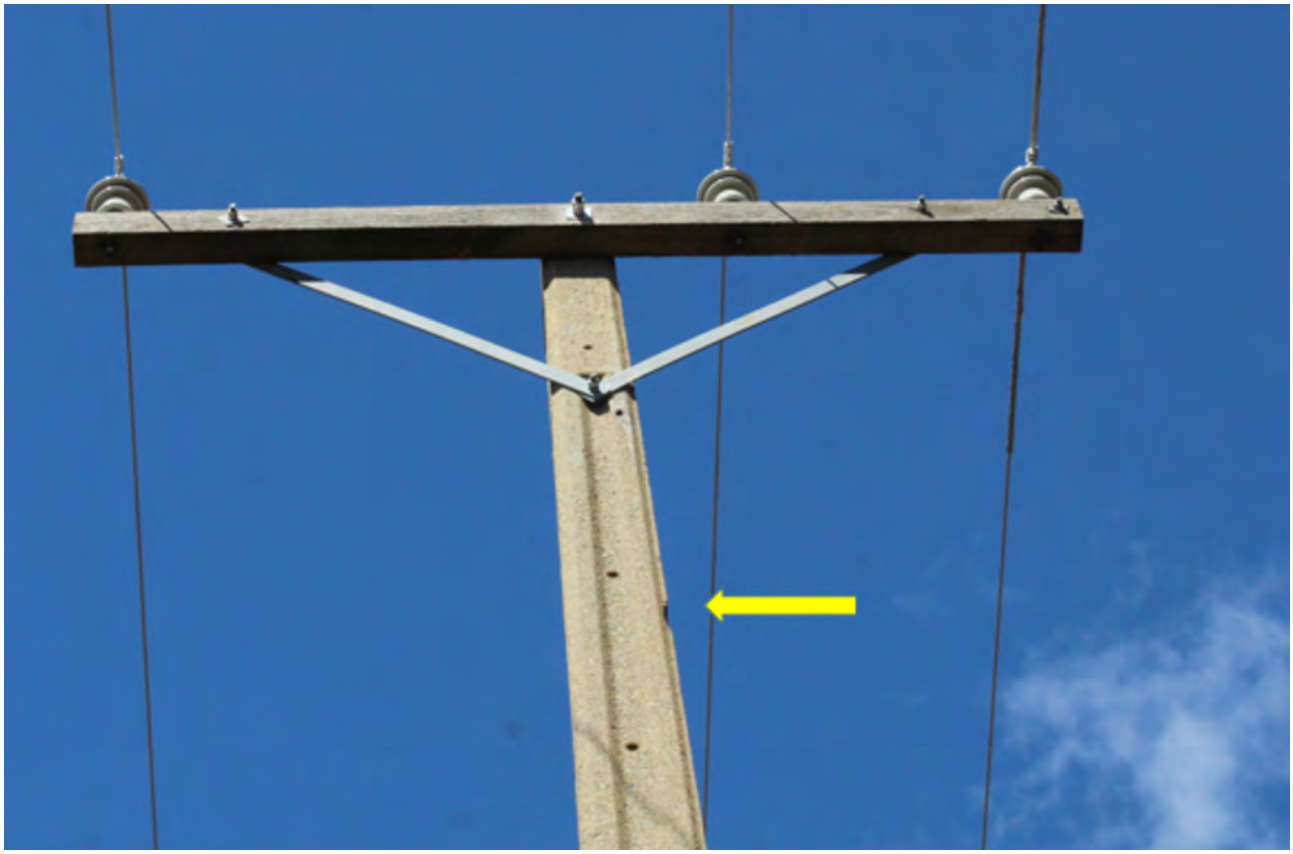
However, the investigators found fire indicators in the area which demonstrated the front of the fire burning through the area, rather than a fire starting here.

The investigators were confident nothing occurred at this pole to cause the initial fire.

This left two areas of interest which could not be ruled out.

Pole 35693 and surrounding area

When tracking the fire ground on 7 October, the investigators noticed pole 35693 appeared to have arc or heat damage on both metal stay arms. Other than the arc marks, the pole appeared in good condition. There also appeared to be damage to the concrete pole below where the two metal stay arms are secured to the centre of the pole (yellow arrow). This appeared to the investigators to be old damage.



Upper section of pole 35693 when it was located on 7 October.

The investigators confirmed this pole had been repaired by Network Waitaki (with Fire and Emergency's approval) on 4 October as the cross-arm had lost a bolt. Network Waitaki staff had made the power lines safe for fire crews and had undertaken some repair work to allow for the lines to be made live.

Fire patterns around pole 35693 were patchy with areas of unburnt grass.

The investigators determined the fire had not burnt through this area because if it had, they would have expected it to have burnt all the grass and vegetation around it. However, there was nothing else obvious regarding the pole at this point in the investigation.

On revisiting the fire site on 16 November 2020, the investigators learned pole 35693 had been replaced which caused them to question why. Looking back through the photographs they had taken on 7 October, they identified there was more damage than just the arc marks on the metal stay arms of pole 35693 and the previously identified damage in the concrete pole. (See above photo)

There also appeared to be a scrape mark above and below the old damage on the surface of the concrete. They also identified some damage to the centre bolt and washer holding the two metal stay arms to the pole, along with scrape damage to the edge of the metal stay arm on the opposite side of the pole.

Close up of stay arms on pole 35693 showing the lower arc mark on the right metal stay arm, a hole below the stay arm and what appears to be a scrape mark below this stay arm.

On closer inspection of the photographs, they found the damage on the pole appeared to be caused by arcing which had burnt a hole into the concrete 25mm deep.

The investigators suspected a catastrophic failure at pole 35693. They requested photographs and fault data from Network Waitaki to test their hypothesis.

Photographs provided by Network Waitaki confirmed a metal stay arm had come free.

The cross-arm and stay bolts and nuts had also dislodged causing the cross-arm to partially detach from the pole and rotate from a fixed horizontal position and swing down to a vertical position against the pole.

Pole 35693 with the cross-arm rotated over.

Pole 35693 showing the lakeside metal stay arm hanging in the centre of the pole and the centre bolt that secured the wooden cross-arm to the pole has moved backwards but remains in the pole (note bolts have a single nut).

The investigators concluded that when the storm hit the Ōhau area in the early hours of 4 October 2020, wind pressure on the powerlines began to move the dislodged cross-arm resting on the centre bolt. As the cross-arm rotated upwards one of the power lines contacted with one of the metal stay arms. This contact resulted in the metal stay arm becoming live causing the electric current to earth and create three burn holes in the concrete pole.

When the holes were created, the edges of the hole melted like glass and hot liquid concrete and steel most likely fell to the ground causing ignition of the vegetation below.

It is also highly likely the contact between the stay arm and the powerline would have caused arcing on the insulator binder wire, or the line. This would have sent molten aluminium to the ground.

The dry vegetation around the pole along with the wind meant the fire ignited and spread rapidly.

Data provided by Network Waitaki shows an earth fault was recorded at 2:10:03am and again at 2:11:15am. These may be two separate faults or one continuous fault.

Fire modelling took into account the 111 callers' evidence, local conditions on the night and fire patterns. The modelling supported that in conditions similar to those on the night, if a fire had started around pole 35693 at 2.10am on 4 October 2020 it could have advanced to the point it where it was first seen by witnesses.

The fire modelling supports the investigator's findings.

Close up of the burn hole on pole 35693 below the centre bolt holding the metal stay arms to the pole. It has been exposed to intense heat.

Arc damage on pole 35693.

Close up of the burn hole which has melted like glass.

Span between pole 35693 and pole 870452

The area between pole 35693 and pole 870452 was also not eliminated as a source of ignition for the fire. The investigators concluded the flipped cross-arm caused the powerlines to twist and come into contact with each other.

Span between Pole 35693 and Pole 870452 showing the twist in the lines.

The powerlines show arc damage where they have twisted together. This is consistent with data provided by Network Waitaki which records faults with these lines at 3.23am on 4 October.

The investigators concluded the arcing of the twisted powerlines possibly resulted in a secondary ignition. This occurred after the initial fire started at around 2.10am. Fire patterns in this area also support low intensity burning, indicating a fire spreading out from this location.

Microscope images of arcing damage on twisted lines.

Conclusion

Fire and Emergency would like to acknowledge not only the loss of property suffered but also the psychological stress this incident has had on the Lake Ōhau Community.

Full recovery from such incidents for communities can be complex and take years.

This will be a journey for both the community and supporting agencies such as Fire and Emergency where we will need to engage and work closely together.

We would also like to acknowledge the support received from community members who shared their local knowledge of the area and who provided information about what they witnessed on the morning of the fire.

Their information, along with the comprehensive investigation, has assisted to formulate the final report.

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