Nationwide News Ltd v Power & Water Authority [2006] NTSC 32

PARTIES:	NATIONWIDE NEWS LTD (ACN 008 438 828) trading as NORTHERN TERRITORY NEWS v POWER AND WATER AUTHORITY
TITLE OF COURT:	SUPREME COURT OF THE NORTHERN TERRITORY
JURISDICTION:	SUPREME COURT OF THE NORTHERN TERRITORY EXERCISING TERRITORY JURISDICTION
FILE NO:	No 7 of 1998 (9800429)
DELIVERED:	11 April 2006
HEARING DATES:	6, 7, 8, 9, 10, 14 and 15 June 2005
JUDGMENT OF:	SOUTHWOOD J

CATCHWORDS:

TORTS – NEGLIGENCE – DUTY OF CARE – breach – damages - reasonable foreseeability of damage – general matters – Power and Water Authority – electricity supplier – statutory powers - duty of care to whom it supplies electricity – duty to inspect – breach of statutory duty – standard of care – due care and skill – reasonable steps to minimise danger – causation – overhead power lines – short circuits created by flying fox – damage to property

QUANTUM – restitutio in integrum – depreciated replacement value

Crown Proceedings Act (2002): s 5
Electricity Act 1978: s 14, s 32

Government Owned Corporations Act (2001): s 55(2), s 55(2)(b), (c), (d)
Power and Water Authority Act 1987: s 4(d)(2), s 14, s 15, s 16, s 17
Power and Water Authority Amendment Act (2001)
Supreme Court Act (2003)*:* s 84

Australian Standard 4262.2 – 1999 *Telecommunications Over-voltages Part 2: Protection of Equipment:* p 7
New South Wales Industry Safety Standards Committee: EC4 *"Guide to Inspections of Overhead Lines"*

Australian National Airline Commission v Newman (1987) 162 CLR 466; *Birch v Central West County District Council* (1969) 119 CLR 652; *Brodie v Singleton Shire Council* (2001) 206 CLR 512; *Dungog Shire Council v Babbage* [2004] NSWCA 160; *Georgopoulos v Telstra Corporation Ltd* [2004] NSWCA 266; *Hampton Court Ltd v Crooks* (1957) 97 CLR 367; *Henderson v Jenkins & Sons* [1970] AC 282; *Hoad & Anor v Scone Motors Pty Ltd* [1977] 1 NSWLR 88; *Rickards v Australian Telecommunications Commission* [1983] 3 NSWLR 155; *Sovar v Henry Lane Pty Ltd* (1967) 116 CLR 397; *Spencer v The Council of the City of Maryborough* [2002] QCA 250; *Staines v Commonwealth of Australia* (1990) 100 FLR 242; *Wyong Shire Council v Shirt and Others* (1980) 146 CLR 40 - applied

Burnie Port Authority v General Jones Pty Ltd (1992-4) 179 CLR 520 - distinguished

Hartley v Mayoh & Co [1954] 1 QB 383; *Heard v Brymbo Steel Co Ltd* [1947] 2 KB 692; *Midwood & Co Ltd v Manchester Corporation* [1905] 2 KB 597; *North Sydney Municipal Council v Housing Commission of New South Wales* (1948) 48 SR (NSW) 281; *Prospect County Council v Blue Mountains City Council* (1992) 28 NSWLR 301; *Schwartz v RESI Corporation* (2003) 85 SASR 357; – cited

Clive Boddington v Southern Mitchell County Council BC9002541 (1990) NSWSC; *Phillis v Daly* (1988) 15 NSWLR 65; *Telfer & Anor v Flinders Ranges Council and Ors* [1999] SASC 42; *Thompson v Bankstown Corporation* (1953) 87 CLR 619; *Thompson v The Council of the Municipality of* Bankstown (1952) 87 CLR 619; - considered

REPRESENTATION:

Counsel:

Plaintiff:	J Reeves QC and G Clift
Defendant:	S Walsh QC and M P Grant

Solicitors:

Plaintiff:	De Silva Hebron
Defendant:	Hunt & Hunt

Judgment category classification:	B
Judgment ID Number:	Sou 0624
Number of pages:	72

IN THE SUPREME COURT
OF THE NORTHERN TERRITORY
OF AUSTRALIA
AT DARWIN

Nationwide News Ltd v Power & Water Authority [2006] NTSC 32
No. 7 of 1998 (9800429)

BETWEEN:

NATIONWIDE NEWS LTD
(ACN 008 438 828) trading as
NORTHERN TERRITORY NEWS
Plaintiff

AND:

POWER AND WATER AUTHORITY
Defendant

CORAM: SOUTHWOOD J

REASONS FOR JUDGMENT

(Delivered 11 April 2006)

INTRODUCTION

[1] The plaintiff claims damages against the Power and Water Authority for negligence and breach of statutory duty. On 26 June 1996 various electrical and telephonic plant and equipment owned by the plaintiff and located in its business premises in McMinn Street in Darwin were damaged as a result of three electrical disturbances in the electricity grid that was controlled and maintained by the Power and Water Authority. The electrical disturbances occurred when a flying fox that was hanging from a live high voltage electric cable twice came into contact with the pin of a line pin insulator that was on a steel crossarm on top of a power pole. Each time it did so an

electric arc or short circuit was produced. The two short circuits caused a high voltage red phase cable to part inside a parallel groove (PG) clamp. The separated end of the cable fell onto a low voltage electric cable that was suspended below it and then onto the ground.

[2] The plaintiff says that the Power and Water Authority was negligent and also breached the statutory duty of care it owed to the plaintiff because the Power and Water Authority failed to: provide wooden crossarms on the power poles; underground the electricity reticulation system; place flying fox foils or sheaths on the electric cable conductors; provide suspension insulators; provide fog insulators; implement an adequate system of inspection that would have identified a defect in the PG clamp; and, it used a PG clamp in the wrong circumstances. The proceeding is primarily concerned with alleged omissions. With the exception of the last two allegations of breach of duty, the plaintiff's allegations amount to a contention that the Power and Water Authority ought to have exercised its statutory powers to change or modify the existing electricity grid that was inherited from the Commonwealth Department of Works.

THE PLEADINGS

[3] The contentious pleadings in the plaintiff's further amended statement of claim are as follows. First, the Power and Water Authority owed a duty of care to the plaintiff to: take all reasonable steps to prevent damage to property as a result of the Power and Water Authority's supply of

electricity; take all reasonable care in the supply of electricity; and, supply services for the connection and supply of electricity with due care and skill. Secondly, as a result of the functions vested in it by s 14 of the Power and Water Authority Act 1987, the Power and Water Authority was under a duty to the plaintiff to supply electricity safely and ensure that appropriate equipment was used in that undertaking. Thirdly, the Power and Water Authority breached its duty of care and its statutory duty because it failed to: take all reasonable precautions to ensure that contact would not be made between the high voltage cable and the steel crossarm on power pole No 3138; conduct adequate maintenance inspections; provide polythene or other covers or insulating sleeves on the high voltage cable; place the high voltage cable underground; use a full strength compression sleeve within the span of cables; use wooden crossarms on the power pole; use suitable insulators including fog or suspension insulators; and, installed a PG clamp in unsuitable circumstances. Further, the Power and Water Authority failed to: install a conductor adequate to cope with the increased flow of the electricity following the incident; and maintain the conductor in a condition which would enable it to cope with the increased flow of electrical current.

[4] The Power and Water Authority denies each of the above allegations. In addition, the Power and Water Authority pleads that it enjoys statutory immunity under s 32 of the Electricity Act 1978; and that the plaintiff is guilty of contributory negligence in failing to install an appropriate surge protection device in the main switch board at its premises.

THE POWER AND WATER AUTHORITY

[5] The Power and Water Authority was established by the Power and Water Authority Act (the Act). The Act commenced on 1 July 1987. The Power and Water Authority was a body corporate with perpetual succession. By s 4(2)(d) of the Act, the Power and Water Authority was declared to be the same body corporate known immediately before the commencement of the Act as the Northern Territory Electricity Commission.

[6] The functions of the Power and Water Authority were to: supply electricity within the Northern Territory; plan and coordinate the generation and supply of electricity in and for the Northern Territory; promote the safe use of electricity in the Northern Territory; control the supply of electricity in the Northern Territory; purchase and sell electricity; set and enforce standards of electrical installation, apparatus, equipment, implement or thing used or available for use within the Northern Territory in the generation, reticulation or consumption of electricity; enforce standards set under any law in force in the Northern Territory relating to electrical workers or contractors; advise the Minister on all matters concerning electricity; evaluate the present and future needs of the Northern Territory in respect of fuel, energy and power for the purposes of generating electricity; investigate, research and evaluate the optimum utilisation of fuel, energy and power for the purposes of generating electricity; consult with the Commonwealth or a State or an instrumentality, body, corporation or person on matters relating to the fuel,

power or energy which is being used, or has the potential to be used, for the generation of electricity: s 14 Power and Water Authority Act.

[7] The Power and Water Authority had the power to do all things necessary or convenient to be done in connection with or incidental to the performance of its functions. The powers of the Power and Water Authority included power to: generate electricity in and for the Northern Territory; transmit and reticulate electricity in the Northern Territory; determine the conditions, other than tariffs, upon or subject to which any electricity will be supplied or provided by the Power and Water Authority; acquire hold or dispose of real or personal property, rights, privileges, permits and authorities; construct, improve and maintain plant, equipment and buildings for the purposes of carrying out the functions of the Power and Water Authority; collect fees and charges for the supply of electricity provided by the Power and Water Authority; engage such employees or other persons as it requires to carry out its functions; at the expense of the consumer, install electrical or reticulation equipment on the premises of the consumer upon such terms and conditions as may be agreed between the authority and the consumer; and, to enter into agreements with persons permitting those persons to re-sell electricity supplied by the authority or the licensee, as the case may be: s 15 Power and Water Authority Act; s 14 Electricity Act.

[8] In the exercising of its powers and the performance of its functions, the Power and Water Authority was subject to the directions of the Minister administering the Power and Water Authority Act: s 16 Power and Water

Authority Act. The Power and Water Authority was a servant or agent of the Crown and, as such, was entitled to the immunities of the Crown: *Prospect County Council v Blue Mountains City Council* (1992) 28 NSWLR 301; *North Sydney Municipal Council v Housing Commission of New South Wales* (1948) 48 SR (NSW) 281. These immunities do not necessarily extend to immunity against suit for negligence: s 5 Crown Proceedings Act. Whether the plaintiff has an action for negligence and breach of statutory duty against the Power and Water Authority will depend upon the provisions of the Power and Water Authority Act and the Electricity Act read as a whole and the common law applicable to statutory authorities.

[9] Subject to the Act and within a budget approved by the Minister, the Power and Water Authority was required to act in a commercial manner. However, where the Minister considered it necessary or desirable for electricity to be provided in any area and where the Power and Water Authority considered it appropriate to seek a contribution from the Northern Territory to provide the services, the Treasurer of the Northern Territory could make such contribution towards the capital outlay necessary to provide the services or towards their operation as was estimated by the Power and Water Authority and agreed by the Treasurer of the Northern Territory: s 17 Power and Water Authority Act.

[10] The powers and functions of the Power and Water Authority to generate and transmit electricity are comparable to the powers and functions of the road authorities in relation to roads that were considered by the High Court of

Australia in *Brodie v Singleton Shire Council* (2001) 206 CLR 512. The Power and Water Authority is sued as the entity in control of an electric power grid that supplied power to the plaintiff's business premises: cf *Thompson v Bankstown Corporation* (1953) 87 CLR 619.

[11] Prior to 1978 the Commonwealth Department of Works designed, constructed and maintained the electricity grid in Darwin. When the Northern Territory was granted self-government in 1978 the Northern Territory Electricity Commission took over the electricity grid. The Power and Water Authority inherited the original electricity grid from the Northern Territory Electricity Commission. The Power and Water Authority had possession and control of the electricity grid in Darwin from 1987 to 2002. During that time the Power and Water Authority undertook work to affect repairs, maintenance and improvements to the electricity grid.

[12] In 2002 the Power and Water Corporation took over the electricity grid from the Power and Water Authority. On 1 July 2002, under the Power and Water Authority Amendment Act, 2001, No 70, the Power and Water Authority became the Power and Water Corporation. The Corporation is a Government owned corporation for the purposes of the Government Owned Corporations Act. Under s 55 (2) of the Government Owned Corporations Act, the Northern Territory is liable for any liability or obligation of the Power and Water Authority before it became the Power and Water Corporation. Subsections 55(2)(b), (c) and (d) of the Government Owned Corporations Act provide as follows:

> (2) If legal proceedings are at any time instituted by or against -
>
> (b) a statutory corporation … that becomes a Government owned corporation before the conclusion of the proceedings,
>
> in relation to an act performed or not performed by the corporation … before the corporation became a Government owned corporation then -
>
> (c) the Government owned corporation … [is] within the shield of the Crown and represents the Territory in relation to the proceedings; and
>
> (d) the Territory is liable for the debts, liabilities or obligations of the corporation … in relation to the proceedings,
>
> to the same extent as would be the case had the Government owned corporation not become a Government owned corporation.

THE FACTS

[13] Having considered all of the evidence I make the following findings of fact. Obviously I so do on the balance of probabilities. The findings of fact are dealt with in five parts: (1) the admitted facts; (2) the electricity reticulation system in which the incident that is the subject of this litigation occurred; (3) causation; (4) surge protector; and (5) the risk of damage.

Part 1 – The Admitted Facts

[14] So far as is relevant to causation, the following facts are admitted: there was no damage to the electrical plant unconnected to the telecommunications system apart from the line conditioner, the UPS system and a power outlet; two of the thyristors which were situated on inverter output of the UPS were

out of tolerance after the incident on 26 June 1996; and, the plaintiff's premises were built as a Faraday cage.

Part 2 – The Electricity Reticulation System

[15] The plaintiff conducts a newspaper and publishing business at its premises in McMinn Street. The plaintiff's premises comprise a separate building known as the old printing building or paper store on lot 1621 and two interconnected buildings that have been built on two adjoining allotments, lot 5414 and lot 3476. The building on lot 5414 is known as building A and the building on lot 3476 is known as building B. As is to be expected the plaintiff's premises are supplied with all the usual services including water and sewage. They are equipped with electric circuits and connections and Telecom circuits and connections. There is a water meter connected to the water supply going into building A and another water meter connected to the water supply going into building B. The electrical main switch board is on the southern side of building A, the UPS is at the bottom of a set of stairs in building A. The stairs are near the boundary of building B. The PABX is towards the front of building A. The Telecom earth is near the boundary of buildings A and B. The water meter to building B is in a corner of lot 1621.

[16] At all material times the Power and Water Authority supplied electricity to the plaintiff's premises. It did so within the electric power grid that had been inherited from the Commonwealth Department of Works. A very large part of the electric power grid in Darwin is constructed of steel power poles

with steel crossarms and overhead cable conductors. However, the plaintiff's premises are located at the edge of Darwin's Central Business District. For the purposes of this proceeding the Central Business District is bounded by McMinn Street, The Esplanade and Daly Street. The part of the electric power grid that services the Central Business District is almost exclusively underground.

[17] Electricity for Darwin is generated at the Channel Island power station where three phase power is produced by electrical generators. It has an alternating current (AC). Electricity is transmitted from Channel Island to Hudson Creek Terminal Station along conductors at 132,000 volts. At the Hudson Creek Terminal Station the electricity is stepped down from 132,000 volts to 66,000 volts. It is then distributed to a number of zone substations in Darwin. One of these substations is the City Zone substation. It is located in McMinn Street.

[18] A zone substation typically does two or three things: it has transformers that step transmission voltages down to distribution voltages, it distributes electricity off in multiple directions, and it has circuit breakers and switches so that either the substation can be disconnected from the electricity grid or the separate distribution lines can be disconnected from the substation when necessary. Commonly a substation produces two different voltages, a high voltage (11,000 volts) and a low voltage (240 volts). The high voltage electricity is stepped down again before it is used by consumers. This is often done in small transformers located down the distribution line. From

these transformers electricity is supplied to consumers. At the City Zone substation electricity is stepped down from 66,000 volts to 11,000 volts and distributed out on a number of transmission lines.

[19] Electricity is distributed to the plaintiff's premises in McMinn Street as follows. Three phases of electricity are transmitted by underground cables from the City Zone substation to power pole No 2335 on the corner of Carey Street and McMinn Street. Electricity is then distributed by overhead cables from power pole No 2335 to power pole No 3559 before going under Tiger Brennan Drive and overhead again behind Harbour View Plaza to the Frances Bay area. There are three spans of overhead cables that run from power pole No 2335 along McMinn Street to power pole No 3559. The first span of overhead cables runs from power pole No 2335 to an unidentified power pole. The second span of overhead cables runs from the unidentified power pole to power pole No 3138 which is in front of the plaintiff's premises. The third span of overhead cables runs from power pole No 3138 to power pole No 3559. At power pole No 3138 there is a tee-off of high voltage electricity from the 11,000 volt transmission lines. The tee-off is used to transmit electricity to the plaintiff's premises. The three phase cables comprising the tee-off pass through a set of fuses on a wooden crossarm on power pole No 3138 and then down an orange cable sheath to padmount transformer TX2055 which is located on the ground near the base of power pole No 3138. The casing of the transformer is mounted on a small concrete plinth. The transformer steps the electric power down from

11,000 volts to 415 volts before it is fed into the main switch board in building A in the plaintiff's premises. Three active electricity cables and a neutral line, which is connected to the overhead earth wire that runs from the unidentified power pole to power pole No 3138, run from transformer TX2055 to the main switch board in the plaintiff's premises.

[20] In the main switchboard electricity goes into a main circuit breaker and is then distributed to final sub-circuits that are made up of the individual runs of wiring to the power points and lights in the plaintiff's premises. It is possible to derive 240 volts, which is the standard voltage in the Northern Territory, from the 415 volts of electricity supplied to the plaintiff's premises. The subcircuits in the plaintiff's premises are also earthed. The plaintiff's premises and electrical equipment are connected to a multiple earth neutral system. An earthed stake is driven into the ground and the neutral wires are connected to that stake. There is also a connection between the multiple earth neutral wires and the water pipes in the plaintiff's premises. Earths ordinarily operate to trip protection, whether a fuse or a circuit breaker, and disconnect the supply of electricity. The earth wire exists as a safety precaution. At all material times there was no surge protection installed in the plaintiff's main switchboard.

[21] There are six active conductors and one neutral line (seven overhead cables in all) in the first span of overhead cables. Three of the overhead conductors are high voltage (11,000 volt) cables and three of the overhead conductors are low voltage (250 volt) cables. The high voltage cables are

suspended from the power poles on steel crossarms. They are suspended above the three low voltage cables and the neutral line which are also suspended from the power poles on steel crossarms. The three high voltage overhead cables supply three phases of electricity as do the three low voltage cables. The three phases of electricity are known as the red phase, the white phase and the blue phase. The high voltage overhead cable closest to the road that is McMinn Street transmits red phase electricity, the middle cable transmits white phase electricity and the cable furthest from the road transmits blue phase electricity. The low voltage cables are arranged in the following sequence from the road: red phase cable (closest to the road), white phase cable, neutral or earth cable and blue phase cable. The six active cables terminate at the unidentified power pole at the end of the first span of cables. The dead ends of the three high voltage cables are attached to ball and socket disc insulators which are attached to the crossarm on top of the unidentified power pole. The ball and socket disc insulator connections ensure that the unidentified power pole is not live. Only high voltage electricity is distributed beyond the first span of over overhead cables to the second and third spans of overhead cables. Cable bridges have been constructed on the unidentified power pole to transmit electricity from the high voltage cables in the first span to the high voltage cables in the second and third spans of overhead cables. The neutral line continues to run onto and beyond power pole No 3138 which is located in front of the

plaintiff's premises. It is connected to power pole No 3138. The neutral line is also earthed at the City Zone substation.

[22] The second and third spans of high voltage overhead cables were constructed after the first span of overhead cables in this particular distribution line that runs along McMinn Street. The electricity distribution line originally ended at the unidentified power pole at the end of the first span of overhead cables. The cables used to construct the second and third spans of high voltage overhead cables are larger than the high voltage cables in the first span of overhead cables. The three high voltage cables in the second and third spans of overhead cables also transmit three phases of electricity. They are arranged in the same sequence throughout the distribution line. All of the electric cables in the distribution line are suspended under tension.

[23] When the second and third spans of high voltage overhead cables were constructed the starting ends of the cables were attached to ball and socket disc insulators which were in turn attached to the steel crossarm on top of the unidentified power pole. Cable bridges are used to transmit electricity from the first span of high voltage overhead cables to the second and third spans of high voltage overhead cables. The cable bridges run from the start of each high voltage cable in the second span, over the line pin insulators on the crossarm on top of the unidentified power pole, back to the dead end of each high voltage cable in the first span of overhead cables. The cable bridges were all originally comprised of the one metre long wire tails of

each of the three high voltage cables that form the second and third spans of overhead cables and a second piece of cable that was used to connect the cable tails to the dead ends of each of the three high voltage cables in the first span of overhead cables. The second piece of cable that was used to make each cable bridge was connected to each of the cable tails by a PG clamp. The final connection between the bridge cables and the high voltage cables in the first span of overhead cables was also made by PG clamps. Two PG clamps were used to make each of the three cable bridges. The bridge cables are not under tension.

[24] When the cable bridges were originally constructed there were different kinds of PG clamp connections between the blue and white phase bridges, on the one hand, and the red phase bridge, on the other hand, and the dead ends of three high voltage cables in the first span of overhead cables. In the case of the blue and white phases, the PG clamp at the end of each cable bridge was clamped to the very short tails (about 5 centimetres long) at the dead end of the blue and white phase cables in the first span of overhead cables. In the case of the red phase, there was no short tail at the end of the first span of cables and the end of the cable bridge was clamped onto the red phase high voltage cable with a PG clamp at a position about 400 millimetres from where the dead end of the cable was connected via the disc ball and socket insulator to the unidentified power pole. The PG clamp was clamped onto the red phase cable at a position within a distance of about 50 millimetres from the end of the wire wrap at the dead end of the red

phase cable in the first span of overhead cables. The PG clamp was not clamped on the wire wrap because the wrap is not sufficiently conductive of electricity.

[25] Power pole No 3138 is constructed of steel with a concrete base. The power pole has three steel crossarms and one wooden crossarm. The highest steel crossarm is on top of the power pole. It supports three pairs of line pin insulators that in turn support the three high voltage cables that transmit the three phases of electricity. One pair of line pin insulators is located at each end of the crossarm and one pair of line pin insulators is located in the middle of the crossarm. Two line pin insulators are used to support each cable. The wooden crossarm is the second crossarm from the top of the power pole. The wooden crossarm in conjunction with the second and third steel crossarms support the fuses and cables that are part of the tee-off of active cables that transmit three phase electricity to the main switchboard in the plaintiff's premises. The cables go into an orange cable sheath that runs down the power pole and into padmount transformer TX2055. Also attached to power pole No 3138 is the neutral or earth cable that runs from power pole No 2335 on the corner of Carey Street and McMinn Street. There is a neutral line tee-off which is connected to the overhead earth line. The neutral line runs down the orange cable sheath on power pole No 3138 and through the padmount transformer and into the plaintiff's premises where it is connected to the earth wires in the plaintiff's premises.

[26] There was a dispute between the parties about where the PG clamp, which is the subject of the plaintiff's claim, was located and whether the PG clamp had been used to join two pieces of cable that were then suspended under tension. It was contended by the plaintiff that the red phase conductor in the first span of overhead cables was made of two pieces of cable joined together by a PG clamp at a position approximately four or five metres from the unidentified power pole. I do not accept the contentions of the plaintiff. Compression sleeve joints are used to join two pieces of cable that are to be suspended under tension. Mr Kirby's testimony about how he arrived at this conclusion based on his reading of Mr Wright's report is unsustainable. He overreached himself in a partisan manner. The evidence flies in the face of commonsense. Nowhere in the electricity grid are PG clamps used in such a manner. Mr Kirby's evidence substantially detracted from the serious question of whether the PG clamp was located in an inappropriate position in any event. The PG clamp that is the subject of the plaintiff's claim was used to connect a bridge cable to the high voltage red phase cable in the first span of cables. In his report dated 8 December 1997 Mr Wright (now deceased) stated that he repaired the "conductor and bridge". It would not have been necessary to repair the bridge if the PG clamp was in the position contended by the plaintiff. As this distribution line originally terminated at the unidentified power pole at the end of the first span of overhead cables, the dead ends of the cables were not left with long tails. This meant that when the distribution line was extended it was necessary to use cable

bridges to transmit electricity from the existing high voltage cables to the high voltage cables that were used to construct the extension of the distribution line. Connections between the cable bridges and the dead ends of the high voltage power cables in the first span of cables are logically made at or near the dead end of the existing high voltage power cables. Efficiency, cost and commonsense dictate a relatively short cable bridge. As no wire tail was left at the dead end of the high voltage red phase cable in the first span of cables for later connection and extension of the distribution line, electricity was transmitted by connecting the cable bridge from the new cable to the existing high voltage red phase cable with a PG clamp. In the circumstances it is much more likely that the PG clamp referred to in the report of Mr Wright dated 8 December 1997 was located at the position suggested by Mr Pemberton in his testimony. I accept his evidence in this regard.

[27] It is probable that the compression sleeve joint that was made by Mr Wright when he repaired the high voltage red phase cable and can now be seen towards the middle of the red phase high voltage cable in the first span of overhead cables, was made in that location for reasons other than that was the location where a PG clamp had been originally inserted and had failed. I accept Mr Pemberton's evidence that usual practice upon repair would have been to splice onto the damaged conductor some distance from the point of damage.

[28] There is nothing remarkable about the use of the PG clamps in the construction of cable bridges. It was the uncontradicted evidence of Mr Pemberton that there are many places in the Darwin electricity grid including tee-offs and crossovers where bridge cables that are not in tension are connected by PG clamps directly onto cable conductors that are in tension. The Power and Water Authority also had established an appropriate system of inspecting PG clamps. PG clamps throughout the electrical reticulation system were inspected annually by thermographic (infrared) scanning. All of the PG clamps connecting the bridge cables at the unidentified power pole at the end of the first span of overhead cables were inspected in May 1996. No defects were detected in the PG clamps by that inspection. The reason no defects were detected in the PG clamp that failed is the very light load on the electric circuit at that location. It was Professor Stokes evidence that the ordinary load on the electric circuit was unlikely to produce a temperature rise sufficient to cause observable problems even in a high resistance joint.

[29] The telecommunications circuit that was installed in the plaintiff's premises was part of the copper telecommunications network as opposed to the fibre optic network. With the copper network there are many hundreds or thousands of pairs of copper cables going out from the telephone exchange to each individual consumer. The lines are distributed to the plaintiff's premises by feeding them into the main distribution frame at the plaintiff's premises. From the main distribution frame they are connected to the

plaintiff's PABX and then to various telephone handsets and other equipment. There may also have been dedicated connections to specific devices or pieces of equipment.

[30] PABX stands for private automatic branch exchange. It is essentially an automatic telephone exchange or electronic switching device that is owned by the plaintiff. Using a PABX saves connecting all of the plaintiff's telephone sets to the Telecom network. It allows the plaintiff to fully utilize the lines it has going out to the Telecom network.

[31] Parts of the surge protection system of the telecommunications system are earthed. The earth is a different earth to that used for the electrical circuits in the plaintiff's premises.

Part 3 - Causation

[32] At 4.20 am on 26 June 1996 the 11,000 volt feeder circuit breaker No 11CZ20 tripped at the City Zone substation. The operator recorded a minor disturbance to the system. A remote close was attempted by the operator at the Hudson Creek terminal station. This resulted in the feeder holding for about eight minutes and then tripping again, also with only a minor disturbance. A second remote close was attempted by the operator at the Hudson Creek terminal station and the feeder tripped again, this time with a major disturbance. A major disturbance is consistent with large current flows and it indicates that the resistance in the fault path was very low. No remote re-close was attempted after the major disturbance.

[33] Each time there was a trip the automatic protection system at the City Zone substation operated by opening a circuit breaker. This removes all power from the feeder. The feeder was de-energized. Each time there is a remote close the feeder was re-energized. In layman's language when there is a remote close the power was turned back on. The duration of each fault current was .3 of a second or 300 milliseconds.

[34] After the major disturbance a repair crew was sent to find out what had happened. On inspection, it was found that the 11,000 volt red phase cable, in the first span of overhead cables in McMinn Street, had parted inside a PG clamp and one end of the cable was down on the ground at a location between Carey Street and the plaintiff's premises. On closer inspection a flying fox was found to have caused a flashover between the 11,000 volt red phase cable on which it was hanging and a pin of one of the line pin insulators on the steel crossarm on top of power pole No 3138.

[35] The two minor disturbances were caused by the flying fox providing a path for an electric arc to travel from the red phase cable to power pole No 3138 from which electricity is supplied to the plaintiff's premises. The disturbances occurred when the flying fox made simultaneous contact with the red phase cable and the steel crossarm or the pin of a line pin insulator on top of the power pole. In so doing the flying fox initiated two red phase to earth faults at the top of power pole No 3138. The arc current produced on top of power pole No 3138 by the flying fox damaged the two line pin

insulators that supported the red phase cable and they were ultimately replaced with other line pin insulators.

[36] The flying fox has probably swung from the high voltage red phase cable and made contact with either the steel crossarm or the pin of a line pin insulator on top of power pole No 3138 and then swung back. As it swung back the flying fox brought through a full arc of electric current. Such an arc arises when there is a sufficient voltage for part of the electric current to flow in the air. 11,000 volts is more than a sufficient voltage for this to occur. Professor Stokes said that such an arc is very probing. Once the electric arc established a path between the active red phase cable and the earthed power pole, the electric current travelled down the power pole and through the underslung earth return. The earth return is bonded to the orange sheath of cables that goes to padmount transformer TX 2055 and into the main switchboard at the plaintiff's premises. Once the current got into the earth line it found its way into the electrical installation in the plaintiff's premises. Earth or neutral wires run throughout the whole of the electrical installation in the plaintiff's premises. During the passage of each of the two arc currents created by the flying fox there was a rise in the voltage of all electrical earth wires in the plaintiff's premises of between 1000 and 2000 volts. This voltage rise was impressed upon all of the plant and equipment connected to the earth conductor.

[37] Professor Stokes said once the flying fox created the arcing connection there was a direct connection from the active read phase cable to the crossarm of

power pole No 3138 to the overhead earth cable to the orange cable sheath and then to the main switch board in the plaintiff's premises. During each of the first and second disturbances electrical current passed from the red phase cable through the neutral earth wire into the electrical installation in the plaintiff's premises, through each earth wire and into various items of telecommunications equipment. Damage was caused to the telecommunications equipment because of the difference in potential between the electric earth and other parts of the telecommunications equipment. Once damage was caused to the telecommunications equipment connected to the electrical system in the plaintiff's premises, for example the faxes, it spread through the telecommunications circuit to the other parts of the telecommunications system. Although some of the telecommunications equipment that was damaged was not connected to the electrical system, I accept Professor Stokes' evidence that the damage to such equipment is explained by the fact that such parts of the telecommunications system are interconnected with telecommunications equipment that is connected to the electrical system. Once damage occurred it would have spread to all parts of the telecommunications system. Professor Stokes' evidence is supported by the fact that the damage to the telecommunications equipment that was not connected to the electrical circuit included damage to fuses which is consistent with insulation failure.

[38] Damage occurred to the telecommunications equipment that was connected to the electrical earth in the plaintiff's premises because such equipment is

connected to both the electrical earthing system and to the telecommunications circuit which has a different earthing system. The telecommunications earth is connected to the telephone exchange in Smith Street. When the electrical earthing system was impressed with the 1000 to 2000 volts created by the arc currents this gave rise to a difference in potential between the various components of the telecommunications equipment. The difference in potential arose because the earth of the telecommunications circuit had a significantly lower voltage to the earth of the electrical system. The difference in potential causes a breakdown of the insulation of sensitive electronic components including capacitors and solid state devices that are part of telecommunications equipment and do not tolerate large voltage differences. The higher voltage causes the breakdown of insulation which causes arcing damage to the components of the telecommunications equipment. I accept both the evidence of Mr Kirby that this was an insulation breakdown and the evidence of Professor Stokes as to the mechanism of the breakdown. All three electrical experts agreed that if the voltage of the electrical earth in the plaintiff's premises was increased to a level of 1000 volts or more a potential difference would be created that was sufficient to cause the damage to the telecommunications equipment that was connected to the electrical circuit.

[39] The two short circuits created by the flying fox caused the high voltage red phase cable inside the PG clamp connecting the bridge cable to the high voltage red phase cable at the unidentified power pole to overheat and lose

its tensile strength. As a result the high voltage red phase cable parted and the end of the high voltage red phase cable fell onto the low voltage cables and then to the ground. The sequence of events was as follows. The flying fox made its first contact with the pin of the line pin insulator or the steel crossarm, an arc current was produced, it flowed for 300 milliseconds, it caused the circuit breaker at the City Zone substation to trip, power immediately stopped flowing along the red phase cable, the arc created by the flying fox was extinguished, there was a remote re-close (the first re-close) and current again flowed along the red phase cables. Some eight minutes later the flying fox again made contact with either the pin of the line pin insulator or the steel cross bar and an arc current was produced, it flowed for 300 milliseconds, and it caused the circuit breaker at the City Zone substation to trip again, power immediately stopped flowing and the arc was extinguished. As a result of the two disturbances caused by the flying fox the PG clamp joint heated to the point where the high voltage red phase cable inside the PG clamp parted. This caused the high voltage red phase cable to fall onto the low voltage cables (including the neutral (earth) cable) that were suspended below the high voltage cables. A second remote close was attempted. On the second remote close the neutral or earth wire was energised by contact with the red phase cable that had parted in the PG clamp. This gave rise to a major disturbance. There was a fault current in the order of 6351 amperes, causing the earthing system to rise more than 3175 volts above ground. Approximately 300 milliseconds after the third

electrical disturbance occurred, the circuit breaker tripped and the high voltage red phase was de-energised. The end of the high voltage red phase cable that had parted then fell onto the ground below. The fault was cleared and the high voltage red phase cable was de-energized before it touched the ground below.

[40] Contact between the earth or neutral wire and the live red phase cable caused current to flow in the direction of power pole No 3138 and the flying fox. When the current reached power pole No 3138 some of the current again flowed into the plaintiff's premises via the connection between the neutral wire and the orange cable sheath containing the three phases of electricity which travel to transformer TX2055 and then into the plaintiff's premises. As I have said above, an earth or neutral cable enters the plaintiff's premises along the same route as the three phase electric power that is supplied to the plaintiff's premises. Subject to the extent of any damage caused by the two arc currents, damage would have occurred to the telecommunications equipment in the plaintiff's premises for the same reason and in the same manner that I have stated in pars [37] and [38] above. I accept the evidence of Professor Stokes and Mr Pemberton that the vast majority of damage that occurred to the plaintiff's telecommunications plant and equipment was caused by the first two electrical disturbances. However, it cannot be said that no damage was done by the third and final electrical disturbance.

[41] The conclusion that the red phase cable came into contact with the neutral or earth conductor is supported by the following facts. When the disturbances were investigated, it was observed that on power pole No 2335 at the corner of Carey Street and McMinn Street the neutral bond was burnt off and the neutral bridge on this power pole was burnt and had to be replaced. It is also supported by the fact that there was a major disturbance. A major disturbance indicates that the resistance in the fault path was very low. This is consistent with the red phase cable coming into contact with the neutral cable. During his testimony Mr Kirby said whether the red phase cable falling to the ground constituted a major disturbance or not depended upon what the cable came into contact with when it fell to the ground. There is no evidence that the cable came into contact with anything metallic when it fell to the ground.

[42] The fact that the PG clamp connection failed indicates that the PG clamp was faulty. If a PG clamp is starting to fail due to the build up of aluminium oxide a very heavy current passing through the PG clamp can cause a conductor to part as a result of the higher than normal resistance. The red phase cable probably parted due to a high resistance within the clamping area. The resistance within the PG clamp would have been building up for some time as a result of a build up of aluminium oxide. The PG clamp would have been suitable to withstand the normal current path for some considerable time. However, it was not suitable to withstand the increased current caused by the short circuits. There is a risk that PG

clamps used in this manner will cause fatiguing of the conductor through vibration.

[43] Damage was done to the plaintiff's PABX switchboard, macrolink, microlink, krone strips, facsimile line, water metre, five facsimile machines, digital and analogue telephone units, modems, computers, telephone outlets and sockets, DEC server, line conditioner and main distribution frame.

[44] Contrary to what I have found above, the plaintiff contended that: when the high voltage red phase cable fell to the ground it did not come into contact with the low voltage cables that were suspended below it; the third and major disturbance occurred when the red phase cable was on the ground and energized and it came into contact with a metal conductor such as the power poles or metal piping; the fault electric current produced by the third and major disturbance entered the plaintiff's premises by either the Telecom lead-in cables or the copper water pipe that ran through lot 1621; and, the third and major disturbance caused the damage to the plaintiff's telecommunications equipment.

[45] Mr Kirby, the electrical expert called by the plaintiff, stated that the additional current flow produced by the arc current that was initiated by the flying fox caused the high voltage red phase cable to sever at a defective PG clamp located in the first span of overhead cables. The red phase cable then fell to the ground. When it fell the red phase cable did not come into contact with the low voltage cables that were suspended below the three

phase high voltage cables. Mr Kirby gave the following reasons for his conclusion. First, gravity would have been the primary force acting on the red phase cable when it fell. Consequently there would have been very little, if any, horizontal movement in the red phase cable when it fell. As the red phase cable was some horizontal distance away from the low voltage neutral cable, Mr Kirby did not say what distance, it could not have fallen on that cable. Secondly, there was no evidence to suggest that the low voltage neutral cable was damaged. In his report dated 8 December 1997, Mr Wright reported that only one metre of the high voltage red phase cable had been damaged. Mr Kirby believed that there would have been significant damage done to both the high voltage red phase cable and the low voltage neutral cable if the two cables had come into contact with each other.

[46] Based on his calculations of the trip protection time and his determination of when the red phase cable parted in the PG clamp Mr Kirby concluded that the third and major disturbance occurred immediately after the second manual re-close of feeder circuit breaker No 11CZ20. Mr Kirby believed that the major disturbance occurred when the red phase cable was on the ground and energized and it came into contact with a metal conductor. He said that a probable cause of the major disturbance was the fallen red phase cable coming into contact with metal piping or one of the steel power poles or some other metal object. A major disturbance indicates a high current flow with very low resistance in the fault path. Mr Kirby said that the first

two faults did not create such a disturbance. However, when the red phase cable was on the ground and energized, the immediate vicinity of the red phase cable would be raised to approximately 6300 volts above normal earth potential. The red phase cable would remain at a dangerous voltage until the circuit protection operated and tripped the feeder circuit breaker at the City Zone substation. According to Mr Kirby's hypothesis it followed that while the red phase cable was on the ground the electric current that it conducted must have been transmitted to a metal object that was somehow connected to either the copper water pipe or related to the Telecom lines.

[47] Mr Kirby said that the electrical current caused by the third and major disturbance had entered the plaintiff's premises by either the Telecom lead-in cables or the copper water pipe that ran through lot 1621. In his second report he stated that contact with the water main was more likely as it is normal practice to join the electrical system earth within a building to the water mains. The reasons given by Mr Kirby for his opinion about the path of entry of the fault current into the plaintiff's premises were as follows. First, the original water metre on lot 1621 had melted. This meant that a significant amount of electric current had reached the water meter. Secondly, damage had been done to telecommunications equipment that was unconnected to the electrical earth. Thirdly, damage had been done to telecommunications equipment including modems, the telephone outlet at the front of the building and numerous hand sets that were unconnected to the electrical system. The modems had been fused. Fourthly, damage had

been done to electrical equipment including the PABX power outlet, the UPS and the power line conditioner and the damage was at the opposite end of the equipment to the point of entry of the fault currents that was postulated by the Power and Water Authority.

[48] Mr Kirby said that the damage to the plaintiff's plant and equipment was more likely to have occurred at the time of the third or last electrical disturbance because the disturbance of the system was higher during the last disturbance and there was more current flow in the plaintiff's premises at that time. He said that at the end of the third disturbance the red phase cable was on the ground. If the red phase cable had not fallen the escape of electric current would have only been via the arcing mechanism which would reduce the amount of escape of current because it involves a higher resistance.

[49] Mr Kirby's opinion about the cause of the damage to the plaintiff's plant and telecommunications equipment was based on the nature, type and extent of the damage reported to have occurred rather than an existing and identifiable path for the electric current. He could not identify a current path between the fallen high voltage red phase cable and either the water meter or the Telecom cables. He said that it was more probable that the electric current came in via the water system or the telecommunications system than via the power supply provided by the Power and Water Authority because there was little or no damage to the clock radios, the electronics on the battery chargers and the electronics on the stand-by diesel

system, whereas there was significant damage to the telecommunications system. The metallic connection between the electricity system and the telecommunications system was only via the power that feeds the telecommunications system which comes via the UPS and through the power line conditioner. There was damage in the main distribution frame, in the PABX, in the power line conditioner, and in the output stage of the UPS. There was no damage to the front of the UPS and no damage to other general electrical equipment within the building. Mr Kirby said that therefore it must be assumed that the fault current had come "in the backdoor" rather than the electric power supply to the plaintiff's premises.

[50] I accept Mr Kirby's evidence that the damage done to the plaintiff's telecommunications plant and equipment was insulation damage caused by a potential difference across the components of the plant and equipment. However, I do not accept his opinion about how such damage occurred to the plaintiff's plant and equipment. I prefer the evidence of Professor Stokes and Mr Pemberton about how the fault electrical current entered the plaintiff's premises and how the overvoltage that caused the damage to the plant and equipment occurred.

[51] There are a number of fundamental difficulties with Mr Kirby's hypotheses as to the cause of damage. First, the horizontal distance between the high voltage red phase cable and the low voltage neutral cable was not proven. The horizontal distance between the two cables may have been insignificant and the falling cable may well have been affected by other forces such as

wind. No evidence was led from Mr Kirby about how the ends of such cables could fall. Professor Stokes gave evidence that if the red phase cable was still energized when it fell there may well have been galloping movements which caused the cable to go in the direction of the low voltage neutral cable.

[52] Secondly, there was evidence that attachments to the neutral cable were damaged. Mr Pemberton stated in his first statement that following the incident the earth connections were observed to have blown off the aerial earth run in the same span and a neutral pole connection had been blown off in the span running to the nearby distribution substation. Mr Wright stated in his report dated 8 December 1997, that on the power pole at the corner of Carey Street the neutral bond was burnt off and the neutral bridge on this power pole was burnt and had to be replaced.

[53] Thirdly, in addition to the evidence of Professor Stokes and Mr Pemberton there was evidence in Australian Standard 4262.2 – 1999, "Telecommunications overvoltages Part 2: Protection of equipment" at p 7, which was tendered by the plaintiff, that the most likely cause of severe damage to telecommunications equipment is contact or breakdown between low and high voltage power lines. Mr Kirby conceded that, if there was a connection between the failed high voltage red phase cable and the low voltage earth or neutral cable, the electric current could find its way down to the earthing connection that then found its way into the main switch board of the plaintiff's premises.

[54] Fourthly, the part of the high voltage red phase cable that was on the ground would have been some 50 metres distant from the melted water meter on lot 1612.

[55] Fifthly, at no stage was it established that there was a metallic path or indeed a conductive path of any sort by which the fault electric current could have travelled from the fallen end of the cable to either the melted water meter or the Telecom wires. Mr Kirby agreed that the soil in the area of the fallen end of the cable was a poor conductor.

[56] Sixthly, the high voltage red phase cable could not have touched power pole 2335 at the corner of McMinn Street and Carey Street either during or after its fall. If the high voltage red phase cable fell in the manner suggested by Mr Kirby it would have been prevented from touching power pole No 2335 by the cable bridge which is connected to the tail of the high voltage red phase cable at power pole No 2335, the disc ball and socket insulators and the low voltage red phase cable.

[57] Seventhly, even if the fault electric current had entered the plaintiff's premises via the water meter and copper pipes, as Mr Kirby suggested in his second report, the fault current would still have travelled along the earth wire in the plaintiff's premises and the damage would occur in the same manner suggested by Professor Stokes and similar issues would arise as to what was the full explanation of all of the damage. Professor Stokes said that the damage to the water meter and copper pipes was explained by

current returning to the source after it had passed through the plaintiff's premises. All experts were agreed that the earth wires were connected to the water pipes.

[58] Eighthly, Mr Kirby agreed that if there had been direct metal contact with the Telecom cables leading into the main distribution frame the Telecom cables would have been damaged and this was not the case.

[59] Ninthly, sound reasons were given by Professor Stokes as to why certain plant and equipment was damaged and other plant and equipment was not damaged. It was an admitted fact that the plaintiff's premises are built as a Faraday cage. This is achieved in part with the use of the multiple earth neutrals and the earth system that envelopes the building and in part by the steel or reinforced steel which was used to construct the plaintiff's premises. All things being equal, a Faraday cage enables the whole of the potential of the plaintiff's premises to be raised equally. If the potential of the plaintiff's premises is raised equally the increase in potential should not cause any damage. For damage to occur a potential difference is required. The effect of a Faraday cage is like a bird sitting on a power line, as long as the bird is sitting on the power line and not touching another potential, there is no potential difference and the bird will not cause any damage to itself or anything else. The effect of the fault current entering the electrical system in the plaintiff's premises along the earth wire was to raise the potential of the whole of the electrical system to a certain voltage. No damage was done to most of the electrical equipment because, unlike the telecommunications

equipment which was also connected to another earth unconnected to the electrical earth system, there was insufficient difference in the voltage or potential across the electrical equipment for damage to occur. The three disturbances had a similar effect on the electrical system as a car being struck by lightning. People inside a car that is struck by lightning usually survive because the whole of the car gets raised to the increased voltage. In addition it was the evidence of Professor Stokes that the components in the electrical equipment are built to withstand 2500 volts which is more than the potential difference that would have existed in the electrical equipment during any of the disturbances. The fact that damage was done to some electrical equipment does not mean that it is necessary to identify another source of entry for the fault current. A commonsense approach should be adopted. The entry of the fault currents into the plaintiff's premises did not occur in experimental conditions. There was no control testing done of the electrical equipment before the incident occurred. Some of the electrical equipment may have been damaged or defective prior to the incident on 26 June 1996. Some of it may have been vulnerable to an electrical surge of the kind that occurred. Professor Stokes stated that the electric switch that was damaged may well have been either defective or dirty and the thyristors on the UPS were likely to have always have been out of tolerance. It should not be forgotten that there were three occasions on which there were very significant increases in voltage in the electrical equipment.

[60] As to the damage to the telecommunications equipment that was unconnected to the electrical earth system in the plaintiff's premises, Professor Stokes said that once damage had occurred to some parts of the Telecom network those parts provided a path through the internal Telecom network, which was all interconnected, for the damage to spread further. He stated that only if a telephone is unplugged does it become truly disconnected to the rest of the Telecom network. When it was suggested to Mr Kirby in cross examination that once a problem like the one in this proceeding occurs all sorts of equipment could well be affected no matter what the hypothesis, he made the partial concession that in the forensics of lightning surges there can be unexplained circumstances. However, when the faults are not as great as the faults that occur when lightning strikes, there are usually (not invariably) more logical conclusions.

[61] Finally, the fact that the damage to the telecommunications plant and equipment was insulation damage caused by a potential difference across the components of the plant and equipment is consistent with Professor Stokes opinion as to how the damage was done.

[62] There are two problems with Mr Kirby's assertion that the damage to the plaintiff's plant and equipment was more likely to have occurred at the time of the third or last electrical fault because the disturbance of the system was higher and therefore there was more current flow in the plaintiff's premises at that time. First, the damage was caused by over voltage not the supply of electric current. Second, Mr Kirby's statement begs the question of whether

the potential difference in the telecommunications equipment caused by the two arcing events was sufficient to cause the damage. Mr Kirby acknowledged that the arcing caused by the flying fox caused an escape of electricity. He said that the electricity goes into a certain amount of resistance which has been tested at .5 ohm and that therefore the electricity would have been at high voltage and high current and he agreed that the first and second arcing incidents could have produced an earth potential rise of at least 1000 volts. Mr Kirby also accepted that the first two arcing incidents could account for a number of the items that were damaged. Both Professor Stokes and Mr Pemberton were of the opinion that the earth potential rise caused by the first and second arcing incidents would have been sufficient to cause the damage that was sustained by the plant and equipment within the plaintiff's premises.

[63] In addition to the difficulties that I have referred to above Mr Kirby made a number of concessions during his testimony which may be summarised as follows: he could not say during which of the three events the melting of the red phase cable occurred; whether the contact between the red phase cable and the ground resulted in a major disturbance depended on what the red phase cable came into contact with after it touched the ground; he did not know how the current got into the building; he did not know where there would have been a connection between the fallen cable and the metal water pipe; if the water mains were underneath the ground it was unlikely that a conductor touching the surface of the ground would provide electricity that

would get down to the mains; the only metal in the area appeared to be the metal top of the Telstra pit and the power poles; it was highly unlikely that a current of any significance transferred from the metal plate on top of the Telecom installation near power pole No 2335 through the concrete and into the Telecom cables; he did not see a metallic path that would have come from the failed water meter through the telecommunications system; he was not able to identify a path that would have come from the failed water meter through to the telecommunications system; nor was he able to identify a path either via the water pipes or some other similar means for a current to pass from the damaged water meter to the earth peg near the drain pipe in the proximity of the main distribution frame; if there was direct metallic contact between the high current flow generated by the third fault and the Telecom cable then it could have been sufficient to cause the Telecom cable to explode; he had not suggested that there was direct metallic contact with the Telecom lead-in cables; it was feasible that 140 amps could have come through the water pipe to the water meter that melted on the basis of the current finding its way back to the substation or source after going into the system through the main neutral earth wire and the main switch board in the plaintiff's premises as postulated by Professor Stokes and Mr Pemberton; a flying fox could cause the high voltage conductor to fall on a low voltage conductor and thereby create a surge in the low voltage system; the neutral line coming into the plaintiff's premises was connected to the overhead earth wire; the low voltage neutral line or the earth line would provide a

ready access for electricity in the event of arcing; if there was a connection between the failed red phase cable and the low voltage earth or neutral cable the electric current could find its way down to the earthing connection that then found its way into the main switch board of the plaintiff's premises; there was a path within the low voltage line to elevate the electrical system within the building; there is a path along the low voltage line that would have allowed the electricity to pass into the PABX; it was highly likely that the Telecom equipment was at a different voltage; the reason the damage occurred was because there was a difference between the elevated voltage due to the outside incident that was introduced into the Telecom system on the one hand and the lesser voltage at some point within that system; if the Telecom cables within the plaintiff's premises represented a different potential then the Faraday cage within the plaintiff's premises would not prevent the damage from occurring; it was conceivable that the first two arcing incidents could have resulted in damage to some of the telephone equipment.

[64] All of the experts agreed that the damage to the plant and equipment in the plaintiff's premises was insulation damage that was caused by a potential difference across the components in the plant and equipment. The fault current raised the voltage levels across the plaintiff's telecommunications equipment well above those for which this type of equipment is designed. The over voltage caused the damage to the plaintiff's plant and equipment.

Part 4 – A Surge Protector

[65] It is unlikely that if the plaintiff had installed a surge protector in its main switchboard that it would have been of assistance in reducing the damage to the plant and equipment that occurred in this case. I do not accept the Power and Water Authority's contention in this regard. I accept Mr Kirby's evidence that power surge equipment would be ineffective if electrical current was introduced into the plaintiff's premises along the neutral line because power surge equipment reduces a power surge from each of the three phases down to earth. Mr Kirby said that what was being postulated lifted the whole earth up and therefore the power surge equipment would be ineffective. Professor Stokes conceded that surge protection equipment would not prevent the appearance of the 1000 to 2000 volts on the neutral line because surge protection was installed within the conductors which would not see the same elevation in volts as the neutral line. He agreed that it would be necessary for the voltage level of the three phase conductors to be elevated to a level closer to the voltage level that he estimated came in on the neutral line for surge protection to operate at all. He also agreed that surge protection in the Telecom main distribution frame in the plaintiff's premises would not have prevented the damage that occurred because the fault currents did not come in via the Telecom cables.

Part 5 – The Risk of Damage

[66] The risk of a flying fox landing on a bridge cable and causing the first two arcing incidents and the damage to the plant and equipment in the plaintiff's

premises was extremely small. It follows that the risk that the first two arcing incidents initiated by the flying fox would occur and would cause the high voltage red phase cable to part within a defective PG clamp and land on the low voltage neutral cable was also very small. No other equivalent incident has been recorded by the Power and Water Authority.

[67] As to the likelihood of a flying fox hanging from a conductor and causing the damage which occurred in this case, the plaintiff tendered a report of Mr Michael Vardon and various business records of the Power and Water Authority. In his report Mr Vardon stated that the black flying fox is usually the species seen in Darwin and there are several daytime roosts for groups of flying foxes in Darwin. These roosts are located at Rapid Creek, Mandoora, Sadgroves Creek and Coomalie Creek. In addition small groups of flying foxes can be found roosting in suburban backyards and in some mangroves, coastal and monsoon forests around Darwin. In general the black flying fox is more abundant in Darwin over the wet season.
Mr Vardon stated on an anecdotal basis that it was a common occurrence for flying foxes to make contact with power lines, as is indicated by electrocution being a very common cause of mortality in these animals. However, Mr Vardon stated that he knew of no quantitative information on the frequency of electrocution of black flying foxes or any other flying foxes in Darwin. He said that he believed it was foreseeable that black flying foxes and to a lesser extent little red flying foxes would from time to time make contact with overhead power lines in McMinn Street in Darwin.

The closest roosts to McMinn Street are Rapid Creek, Sadgroves Creek and Mandoorah. Each of these roosts provided easy access to the Darwin Central Business District.

[68] The business records tendered by the plaintiff showed that over a number of years the unplanned electrical outages caused by flying foxes varied between .4 per cent for flying foxes specifically and whatever proportion of the 3.8 per cent for animals generally was made up of flying foxes. The system of recording outages caused by flying foxes was unlikely to be 100 per cent correct because the manner of recording such kinds of outages was not always as detailed and precise as it should have been.

[69] In his original report Mr Pemberton stated that to his knowledge there has never been a flying fox invasion of the Darwin city area. The Darwin metropolitan area suffers one or two electrical faults a year as a result of flying fox strike. With the exception of the damage sustained by the plaintiff's plant and equipment, flying fox strike has not previously caused a significant problem. In his statement in reply to the oral evidence of Mr Kirby, Mr Pemberton stated that in the 12 months prior to 9 June 1998 there were a total of 1148 unplanned outages. Only 0.4 per cent of the unplanned outages were attributable to flying foxes or bats. In the 12 months prior to 9 June 1998 there were a total of five interruptions caused by flying foxes and none of these were in the city area.

[70] The evidence of Mr Pemberton which was based on the records of the Power and Water Authority is of more assistance than the evidence of Mr Vardon which was very general.

[71] The plaintiff failed to prove that there was a significant failure rate of thermoscanned but undetected defective PG clamps. There were no adequate statistics on the failure rate of thermoscanned but undetected defective PG clamps. The May 1996 Thermoscan report showed that two of the serious problems the scanning revealed were identified as involving PG clamps. Mr Pemberton agreed that it was well known that PG clamps were a cause of failure in the electricity system. He said that, if it could be avoided, it was preferable not to clamp a PG clamp on a conductor. Such connections are potential points of failure.

STATUTORY DUTY

[72] The provisions of the Power and Water Authority Act and the Electricity Act do not give rise to an action for breach of statutory duty. Whether a statute confers a private cause of action in tort to recover damages for breach of a statutory duty is to be determined by the construction of the relevant statute as a whole: *Sovar v Henry Lane Pty Ltd* (1967) 116 CLR 397 at 405. The nature, scope and terms of the relevant statutes in this proceeding do not give rise to a private cause of action. The powers and functions granted to the Power and Water Authority are granted for the benefit of the public generally.

DUTY OF CARE

[73] The Power and Water Authority has similar statutory powers and functions to those statutory powers and functions that are conferred on shire councils to design construct and carry out road works or road repairs as were considered by the High Court in its decision in *Brodie v Singleton Shire Council* (supra). The Power and Water Authority controlled and maintained the electricity grid. There is a direct physical link between the electricity distribution line controlled and maintained by the Power and Water Authority and the plaintiff's premises and electricity was supplied to the plaintiff on a commercial basis. In the circumstances the Power and Water Authority is obliged to take reasonable care that the exercise or failure to exercise its powers does not create a foreseeable risk of harm to a class of persons (consumers of electricity) which includes the plaintiff. Where the state of the electrical power grid or reticulation service, whether from design, construction, works or repair, poses a risk to that class of persons, then, to discharge its duty of care, the Power and Water Authority with power to remedy the risk is obliged to take reasonable steps by the exercise of its powers within a reasonable time to address the risk. If the risk be unknown to the authority or latent and only discoverable by inspection, then to discharge its duty of care the Power and Water Authority having power to inspect is obliged to take reasonable steps to ascertain the existence of latent dangers which might reasonably be suspected to exist: *Brodie v Singleton Shire Council* (supra) at 577 to 582.

[74] The perception of the response by the Power and Water Authority calls for, to adapt the statement by Mason J in *Wyong Shire Council v Shirt and Others* (1980) 146 CLR 40 at 47 and 48, a consideration of various matters; in particular, the magnitude of the risk and the degree of probability that it will occur, the expense, difficulty and inconvenience to the authority in taking the steps described above to alleviate the danger, and any other competing or conflicting responsibility or commitments of the authority. The duty does not extend to ensuring the safety of consumers of electricity in all circumstances: *Brodie v Singleton Shire Council* (supra) at 577.

[75] In the application of principle, much will turn upon the facts and circumstances disclosed by the evidence in each particular case. The question of whether due care and skill was taken will require consideration of all of the circumstances of the case. The circumstances will include the type and volume of power being distributed. The cost and practicality of any alternative and safer design or construction, if one be available, may be weighed against the funds available to the construction authority. It may also be that although a power line is in a dangerous condition, the authority will have discharged its duty of care by taking reasonable steps to minimise any danger or to prevent it arising: *Brodie v Singleton Shire Council* (supra) at 577 to 582.

[76] There are a considerable number of authorities that recognise that an electricity supplier owes a duty of care to those consumers who it supplies electricity: *Birch v Central West County District Council* (1969) 119 CLR

652; *Thompson v The Council of the Municipality of Bankstown* (1952) 87 CLR 619; *Schwartz v RESI Corporation* (2003) 85 SASR 357; *Telfer & Anor v Flinders Ranges Council and Ors* [1999] SASC 42; *Clive Boddington v Southern Mitchell County Council BC 9002541* (1990) NSWSC; *Midwood & Co Ltd v Manchester Corporation* [1905] 2 KB 597; *Heard v Brymbo Steel Co Ltd* [1947] 2 KB 692; *Hartley v Mayoh & Co* [1954] 1 QB 383. The statements in these cases about the duty of care owed by a supplier of electricity to a consumer are consistent with the duty of care I have found that the Power and Water Authority owes to the plaintiff in this proceeding.

[77] I agree with the submissions of the Power and Water Authority that neither the scope of the duty of care nor the standard of care is to be viewed in the same way as in *Burnie Port Authority v General Jones Pty Ltd* (1992-4) 179 CLR 520. The facts of that case are quite different to the facts in this case. That was a case of the escape of fire due to the negligence of the owner's subcontractor, as opposed to the present proceeding where the cause of the damage was the electrical arcs initiated by the flying fox.

BREACH OF DUTY

[78] I find that the Power and Water Authority did not breach the duty of care that it owed to the plaintiff. As to the seven or so allegations of breach of duty, I largely accept the written submissions of Senior and Junior Counsel for the Power and Water Authority much of which I have summarised and incorporated in my reasons below. In assessing whether there was a breach

of duty I have had regard to the fact that there are invariably going to be fluctuations and disturbances in the transmission and distribution of electricity and that it is necessary for an electricity supplier to weigh up a large number of variables when determining what kind of an electricity grid should be constructed and how it should be maintained. There are many human, animal, climatic and geographical factors that may cause interference with the transmission and distribution of electricity and fixing one perceived problem may give rise to many others. It is necessary to look at the electricity grid as a whole and to ensure that a single isolated incident does not give rise to wholesale changes that may have far reaching and unforseen consequences.

[79] I have also had regard to the following principles. The law does not impose a standard of care that is impracticable or impossible to discharge. The standard of care does not require the adoption of measures that bring greater risk, and the defendant is not required to adopt measures which give rise to expense, difficulty or inconvenience disproportionate to the magnitude of the risk to be guarded against: *Wyong Shire Council v Shirt and Ors* (supra*); Phillis v Daly* (1988) 15 NSWLR 65.

Wooden crossarms

[80] The installation of wooden crossarms was not feasible, necessary or appropriate in the circumstances of this case. The failure of the Power and Water Authority to install wooden crossarms does not amount to a breach of

the Power and Water Authority's duty of care to the plaintiff. If the plaintiff's argument was accepted, all the steel crossarms of the 8000 existing power poles in the Darwin region would need to be replaced. Such a step would be unreasonable. It is disproportionate to the magnitude of the risk to be guarded against. The area around the plaintiff's premises is no different to many other localities in the Darwin region which contain various commercial and industrial enterprises, and/or residential premises. Mr Pemberton's evidence was that since the mid-1970s good quality timber crossarms have become virtually impossible to buy. Tallow wood is practically impossible to obtain and the use of Malaysian hardwoods as an alternative has been unsatisfactory because of splitting, deformation and failure due to rot. Crossarms constructed with Malaysian hardwood in the 1980s are being replaced by the Power and Water Authority with steel crossarms because of their accelerated deterioration. The only alternative crossarms are low durability timbers treated with creosote, or laminated material treated with CCA. Low durability timbers are unsatisfactory because of health hazards in handling creosote. Laminated materials are unsuitable because of poor lightning performance and susceptibility to fire damage. These matters were all effectively conceded by Mr Kirby.

[81] Wooden crossarms become conductive when wet. In the wet season, therefore, they do not provide the protection that Mr Kirby asserts ought to have been provided. South Australia and the Northern Territory have always used metal poles, as metal is more hardy than wood.

[82] The statement in Mr Kirby's first report that wooden crossarms are used in the high voltage switch assemblies does not lead to any different conclusion about the use of wooden crossarms. Mr Pemberton said that timber crossarms used for mounting drop out fuses have not been replaced in bulk because they provide an additional measure of protection to linesmen and because there is little mechanical stress on such arms. The same cannot be said for crossarms that are required to support conductors under significant mechanical stress. This distinction is conceded by Mr Kirby.

[83] Mr Kirby agreed that electricity outages and surges occur in Queensland even though wooden crossarms are used in Queensland. He conceded that outages and surges occur in Queensland and New South Wales as a result of fruit bats and flying foxes. He also conceded that throughout Australia there continue to be power outages and events that cause power surges which, on occasion, cause damage to consumer appliances.

Flying fox covers

[84] Flying fox covers or foils are made of a sheath or sleeve of non-conductive material through which electricity cables may be threaded at strategic locations along distribution lines. They are usually placed on cables at the top of power poles. The cover or foil prevents flying foxes from coming into direct contact with electricity cables and thereby prevents the kind of arcing that occurred during the first two electrical disturbances that are the subject of this proceeding.

[85] The installation of flying fox cable covers was not feasible, necessary or appropriate in the circumstances of this case. The failure of the Power and Water Authority to install flying fox covers or foils did not amount to a breach of the Power and Water Authority's duty of care to the plaintiff. Fitting flying fox covers or foils to each of the 8000 poles in Darwin would be expensive and would cause significant disruptions to power supply during the course of the fitting process. Such a step would be unreasonable. It is disproportionate to the magnitude of the risk to be guarded against. The flying fox covers are also likely to result in a number of conductor failures. Both Professor Stokes and Mr Pemberton gave evidence that the installation of flying fox covers and foils give rise to greater difficulties than those caused by the very irregular incidence of flying fox strike.

[86] The Power and Water Authority first used polyethylene covers in Adelaide River to combat a flying fox invasion. While the covers were reasonably effective in reducing the incidence of fault caused by flying foxes, it was found that cables were still parting and falling. Investigation revealed that this was because the covers operated in such a way that fault currents could not move freely along the cable conductors. Both Professor Stokes and Mr Pemberton said that when a flashover arc occurs, due to lightning strike for example, it travels along the cable away from the source. If fault current is able to move freely, it dissipates and no problem arises. If the fault current is stopped by some interference along the length of the cable, the point of interference causes the arc to stop at that point, which in turn may

melt the cable conductor and cause failure and consequent disruption to supply.

[87] Flying fox covers are only used in areas where flying foxes are a significant problem because the disadvantages of their use far outweigh the advantages. Mr Pemberton estimated that the Darwin metropolitan region only suffers one or two faults per year as a result of flying fox strike. With the exception of the incident which is the subject of this proceeding, flying fox strike has not previously caused any significant problem in Darwin.

[88] There was some evidence in the business records of the Power and Water Authority that were tendered by the plaintiff of an improved design for the manufacture of flying fox foils. However, Mr Pemberton said that flying fox foils were never manufactured in accordance with the improved design. Although no clear or satisfactory explanation was given for this non event, it was not established that flying fox foils manufactured in accordance with the new design would overcome all of the disadvantages of the old flying fox protectors. Mr Pemberton said that the only means of obviating the interference caused by the foil itself was the provision of a gap or slit along the length of the sheath. The introduction of that gap or slit may allow flying foxes and other species of bat or birds to take purchase on the electric cable, thus undermining the purpose and utility of the foil. Professor Stokes had never heard of an improved flying fox foil that would avoid the problems referred to above. There was no evidence that flying fox covers or foils were widely used interstate.

PG clamps

[89] Parallel groove clamps are aluminium clamps that are used to connect electric cables. Each PG clamp is comprised of two rectangular pieces of aluminium and devices that are used to clamp the two pieces of aluminium together. Both rectangular pieces of aluminium have two parallel grooves on one side. The electric cables are placed inside the grooves when the two pieces of aluminium are clamped together.

[90] The question whether the location of the PG clamp on the high voltage red phase cable at a position about 400 millimetres from the dead end of the cable at the unidentified power pole amounted to a breach of the Power and Water Authority's duty of care to the plaintiff is the most critical question in this proceeding. The location of the PG clamp is of concern because the location of the PG clamp was not in accordance with the Power and Water Authority's Standards Manual, even with the most up to date inspection systems defective PG clamps may not be detected, Mr Pemberton agreed that it was well known that PG clamps were a cause of failure in the system and that it was preferable not to use a PG clamp on conductors if you could avoid it because they are potential points of failure and Mr Kirby said that there was a risk that PG clamps used in the same manner as the PG clamp which is complained about in this proceeding may cause fatiguing of the conductor through vibration. No satisfactory explanation was given as to why the high voltage red phase cable alone did not have a short wire tail to which a later installed bridge cable may be connected by a PG clamp. It

would have been relatively simple and inexpensive to install a new high voltage red phase cable with a short wire tail in the first span of overhead cables when the distribution line was extended.

[91] After considerable deliberation, I find that the use of a PG clamp to connect a bridging conductor to an existing conductor which was under tension did not amount to a breach of the appropriate standard of care in the construction of an extension of an electricity distribution line. Such a clamping arrangement appears to be commonly used to construct distribution tee-off lines. The evidence from Professor Stokes and Mr Pemberton is that this method is common in the industry and is not a defective or substandard practice. PG clamps, including the one in use in this proceeding, are designed to connect conductors under tension.

[92] Mr Kirby acknowledged that there are many circumstances in electricity grids and distribution lines throughout Australia where PG clamps were used to construct a distribution line tee-off from a conductor which was under tension. He also accepted that the use of the PG clamp in this instance was similar to its use in the construction of a tee-off distribution line. He acknowledged that if the dead end of the high voltage red phase cable did not have a sufficient wire tail then it was feasible to connect the bridge cable to the red phase cable by a PG clamp. While Mr Kirby said that such an arrangement was not in accordance with the Power and Water Authority's Standards Manual, he did not say that the use of a PG clamp to connect a bridge cable to an existing high voltage cable which was under tension was

in breach of the appropriate engineering standard required in the construction of an extension to an existing distribution line.

[93] The Power and Water Authority has about 100,000 PG clamps in use in the electricity grid. They are generally reliable, and are the most cost-effective way of connecting aluminium conductors. Like all connectors on overhead lines, however, they are subject to environmental conditions and failures can occur.

[94] Further, the parting of the high voltage red phase cable did not cause all of the damage to the plaintiff's plant and equipment. Virtually all of the damage to the plaintiff's plant and equipment was caused by the fault currents generated by the first and second electrical disturbances which occurred before the failure of the high voltage red phase cable.

Inspection of the PG clamps

[95] The Power and Water Authority discharged its duty of care to the plaintiff to inspect the PG clamps used to construct the cable bridges over the unidentified power pole. It did so by implementing a system of annual thermographic scanning of overhead lines with the use of an infrared camera to detect faulty connections. Professor Stokes and Mr Pemberton gave evidence that the inspection system implemented by the Power and Water Authority was both reasonable and ahead of current industry practice. The New South Wales Code only required inspection every 4.5 years except in areas of high fire risk. At the time of the incident which is the subject of

this proceeding industry practice also did not require thermographic inspection, for example, the New South Wales Industry Safety Standards Committee publication EC4 "Guide to the Inspection of Overhead Lines" required only that the connections at the pole top be observed for signs of looseness. Mr Kirby conceded that in New South Wales the supply authorities only inspect every 4½ years, and that the inspection regime implemented by the Power and Water Authority was well above that standard.

[96] Thermographic scanning is a practical and feasible means of inspecting joints and PG clamps. The only other feasible means of inspection is to dismantle the joint assembly. Mr Pemberton stated in his report that the latter means of inspection would entail long disruptions to power supply, a permanent workforce of hundreds of technicians, and many thousands of dollars expenditure per annum. To his knowledge no other supply authority in Australia conducts that form of inspection regime. Mr Kirby acknowledged the dismantling and visual inspection of PG clamps was practically prohibited. The imposition of any standard that would require the Power and Water Authority to dismantle the joint assembly is not warranted in the circumstances: *Dungog Shire Council v Babbage* [2004] NSWCA 160; *Rickards v Australian Telecommunications Commission* [1983] 3 NSWLR 155.

[97] The onus was on the plaintiff to specify in some way what sort of steps beyond those implemented by the Power and Water Authority would have

constituted a proper system of inspection: *Staines v Commonwealth of Australia* (1990) 100 FLR 242 at 243. The plaintiff has not discharged this onus. There is no evidentiary onus on the Power and Water Authority to show that its system was adequate: *Henderson v Jenkins & Sons* [1970] AC 282; *Hampton Court Ltd v Crooks* (1957) 97 CLR 367. Even if there was, the Power and Water Authority has discharged that onus.

[98] In accordance with the inspection system established by the plaintiff, the PG clamp in question underwent thermographic scanning one month before the incident which is the subject of this proceeding. No defect was detected and the inspection did not show the PG clamp to be in need of replacement. But for the arc currents it was likely that the PG clamp could have remained in use for sometime. The reason that the defective PG clamp was not detected was the very light load on the distribution line at that location. It was Professor Stokes' evidence that the ordinary load on the electric circuit was unlikely to produce a temperature rise sufficient to cause observable problems even in a high resistance joint. This is not a case where it was proven that the defects in the PG clamp were negligently ignored or overlooked: *Staines v Commonwealth of Australia* (supra) at 243; *Spencer v The Council of the City of Maryborough* [2002] QCA 250; *Georgopoulos v Telstra Corporation Ltd* [2004] NSWCA 266. That being so, the Power and Water Authority cannot bear any liability for this alleged breach of duty.

[99] In any event, virtually all of the damage caused to the plaintiff's plant and equipment was probably sustained as a result of fault currents generated by

the first and second disturbances that occurred before to the failure of the conductor. Mr Kirby conceded that if the damage to the plaintiff's equipment occurred before the conductor parted then the positioning of and defect in the PG clamp becomes irrelevant.

Underground distribution

[100] The undergrounding of the overhead distribution line that runs from power pole No 2335 on the corner of Carey Street and McMinn Street to power pole No 3559 is not necessary or appropriate in the circumstances of this proceeding. The failure of the Power and Water Authority to underground the overhead distribution line which it inherited did not amount to a breach of the Power and Water Authority's duty of care to the plaintiff. The very small magnitude of the risk of the damage in this proceeding does not justify the expense, difficulty and inconvenience to the Power and Water Authority that the taking of such a step would involve. If the plaintiff's contentions are taken to their logical conclusion all overhead electricity reticulation in Darwin would have to be placed underground. It is not possible to look at the undergrounding of the overhead electricity distribution lines in McMinn Street in isolation.

[101] The undergrounding of all overhead electricity lines in McMinn Street including the 66,000 volt line would cost at least $3 million. The cost of undergrounding all overhead electricity lines for the whole of the Darwin region would be in order of $380 million. There would also be considerable

delays and interruptions to the supply of electricity while such works were undertaken.

[102] The supply system in the Central Business District is underground. However, underground electricity reticulation system within the Central Business District is necessary because buildings are too close to property boundaries and there is a high load density. With the construction of multiple storey buildings in the Darwin Central Business District in the 1960s, and the attendant increase in revenue density, it became necessary and logical to construct a high capacity underground system, including several kilometres of tunnels. These tunnels carry up to 12 circuits, which is not possible with an overhead system.

[103] The same reasons that required underground distribution in the Central Business District do not apply to the overhead electricity distribution line that runs along McMinn Street. The overhead electricity distribution line is at the outer edge of the Central Business District. There is very little high-density development in that area, for most of the length of the overhead electricity distribution line there are no multiple storey buildings encroaching on the boundaries, the road is very wide in the area, the load density is relatively low, and there is sufficient room to run overhead electricity distribution lines. For these same reasons the Central Business District is ringed on all sides by overhead lines in Larrakeyah, The Gardens, Stuart Park and Stokes Hill.

[104] The material contained at Attachment A to Mr Pemberton's report shows that in the 12 months prior to 9 June1998 there were a total of five interruptions caused by flying foxes or bats. None of those disruptions occurred in the Darwin city area. The disruptions were relatively minor. The disruptions occurred primarily in the Coomalie Creek and Adelaide River regions. The frequency of electricity disruption due to fauna strike both in McMinn Street and in Darwin is not such as to require either the undergrounding of the electricity reticulation system in Darwin or the undergrounding of the distribution line in McMinn Street as reasonable responses.

[105] The load along the electricity distribution line in McMinn Street is of relatively low density, easily supplied by one overhead distribution line and there was during 1996, and remains, no technical or operational reason to underground the electricity distribution line.

Fog insulators

[106] Fog pin insulators are a variant of line pin insulators with a deeper underneath section to create a large dry area. This deeper underneath section improves performance in places with high pollution or salt.

[107] The installation of fog pin insulators is not necessary in the circumstances of this proceeding. The failure of the Power and Water Authority to install fog pin insulators did not amount to a breach of the Power and Water Authority's duty of care to the plaintiff. While fog pin insulators reduce the

area between insulators from which a flying fox may hang from an overhead cable immediately above a power pole and increase the distance between the outer edge of the insulator and the pin of the insulator it was not proven by the plaintiff that fog pin insulators provided any significantly greater protection against flying fox strike than the standard line pin insulator. Professor Stokes said that the wider insulator is unlikely to have prevented a flying fox from establishing contact between the conductor and the steel crossarm. Mr Kirby did not put forward any different proposition. His evidence was merely that the wider fog pin insulator might prevent such contact.

[108] The very small magnitude of the risk that a flying fox strike will occur does not justify the expense, difficulty and inconvenience to the Power and Water Authority that the taking of such a step would involve. If the plaintiff's contentions are taken to their logical conclusion a very large number of insulators on power poles in Darwin would have to be replaced. It is not possible to look at the insulators in McMinn Street in isolation.

[109] Mr Pemberton gave evidence that the two principal types of insulators used by the Power and Water Authority before 2000 were "aerodynamic profile" insulators and "line pin" insulators. Both these kinds of insulators were widely used around Australia, although the "aerodynamic profile" insulator was only popular for a few years because of poor lightning performance as a result of the thin porcelain sections used in the construction of this type of insulator. "Line pin" insulators are the most widely used pin insulator in

Australia, and were used in the Northern Territory before, during and after the use of aerodynamic profile insulators. Line pin insulators were the standard insulator used in 1996, and would have been the only insulators in the Power and Water Authority's store. The standard insulator shown on the drawings contained in the Power and Water Authority's Standards Manual going back to 1979 is the line pin insulator.

Suspension insulators

[110] A suspension insulator is a relatively long insulator, the upper end of which is attached to the underneath of the crossarm on the power pole. The lower end of the insulator is attached to the conductor. This type of construction of overhead distribution lines provides superior performance against flying foxes as it increases the distance between the crossarm and the animal hanging from the conductor. The distribution system inherited by the Power and Water Authority did not employ suspension insulators. Suspension insulators were not in common use in the Northern Territory in 1996.

[111] The requisite standard of care did not include the installation of suspension insulators in the vicinity of the plaintiff's premises. The installation of suspension insulators is not necessary or appropriate in the circumstances of this proceeding. There is no technical or operational reason for the conversion to suspension insulators. The failure of the Power and Water Authority to install suspension insulators in the electricity grid that it

inherited did not amount to a breach of the Power and Water Authority's duty of care to the plaintiff.

[112] The very small magnitude of the risk of flying fox strike does not justify the expense, difficulty and inconvenience to the Power and Water Authority that the taking of such a step would involve. The cost of converting the power poles in the Darwin region to accommodate suspension insulators would be in the order of $28 million. The installation of suspension insulators results in the cables being lowered more than 600mm. Therefore the conversion to this type of distribution line construction requires increasing the height of the power poles in the existing overhead electricity reticulation system. This was conceded by Mr Kirby during his testimony. It would also be necessary to introduce a much longer crossarm because of conductor "swing". The installation of suspension insulators in the Darwin region would require the replacement of all crossarms. The installation of longer crossarms results in greater problems due to trees interfering with the electricity reticulation system.

CONTRIBUTORY NEGLIGENCE

[113] The allegation of the Power and Water Authority that the plaintiff was guilty of contributory negligence was dependent upon it proving that if a surge protector was installed in the main switchboard in the plaintiff's premises it would have prevented the damage that occurred to the plaintiff's plant and

equipment. As the Power and Water Authority failed to prove this fact, its allegations of contributory negligence are unsustainable.

SECTION 32 ELECTRICITY ACT

[114] Section 32 of the Electricity Act contains the only express statutory immunities of the Power and Water Authority against suit. At all material times, s 32 of the Electricity Act provided, so far as is relevant, that the Power and Water Authority shall not be liable for damages for supplying electricity by an irregular or fluctuating voltage.

[115] The Electricity Act, including the provisions of s 32, was repealed by the Electricity Reform Act which commenced on 1 April 2000. There is now no equivalent provision to s 32 Electricity Act. The present position appears to be consistent with competition policy and the fact that subject to the provisions of the Electricity Reform Act, privately owned entities can now participate in the electricity supply market. The repeal of s 32 does not affect the entitlement of the plaintiff to rely on s 32 of the Electricity Act in an appropriate case. Section 32 of the Electricity Act was in force at the time of the incident which is the subject of the proceeding.

[116] The provisions of s 32 of the Electricity Act do not relate to an escape of electricity from an electricity distribution line as occurred in this proceeding. The supply of electricity intended by the section is a supply of electricity furnished or provided by the Power and Water Authority along the electrical conductors that are provided for the purposes of the supply of

electric current. The provisions of the section are not intended to cover damage caused by a potential difference that is created by an escape of electrical current that runs along the neutral or earth line and into a consumers premises where the escape of electrical current initiated by a flying fox strike. The damage was not caused by the supply of electricity by an irregular or fluctuating voltage.

[117] Provisions such as s 32 Electricity Act which derogate from private rights are to be strictly construed: *Clive Boddington v Southern Mitchell County Council* (supra); *Australian National Airline Commission v Newman* (1987) 162 CLR 466 at 471.

QUANTUM

[118] The plaintiff claimed damages for replacement and repair of various plant and equipment, and the interim hire of plant and equipment pending the replacement of plant and equipment. Although pleaded, the plaintiff did not pursue claims for wasted management and staff time and for loss of advertising income.

[119] The parties have agreed the following facts in relation to quantum:

Replacement and repair of the plaintiff's telephone system and other plant

1. PABX switchboard, freight and labour:

    i. The plaintiff expended the total amount of $142,761 in respect of the replacement of the PABX switchboard. That figure is comprised by the amount of $128,481 for the purchase of the plant, the amount

of $3,900 freight for the unit from Sydney-Darwin, and the amount of $10,380 for the services of a PABX technician including accommodation and airfares.

ii. The market value of the old switchboard was $24,065.

iii. The depreciated replacement value of the new switchboard at $71,659.

2. Macrolink, microlink, PABX and krone strips lightning repairs:

i. The plaintiff expended the amount of $5,346.80 for the repair to macrolink, microlink, PABX and Krone lightning strips.

3. Installation of replacement fax line:

i. The plaintiff expended the amount of $95 for the installation of a replacement fax line.

4. Repairs to the water meter:

i. The plaintiff expended the amount of $390 for repairs to the water meter.

5. Repairs to facsimile machines:

i. The plaintiff expended the amount of $4,250 for repairs to five facsimile machines.

6. Replacement of digital and analogue phone units:

i. The plaintiff expended the amount of $4,798.49 for the replacement of digital and analogue phone units.

ii. The market value of the old units was $1,345.

7. Replacement modems:

i. The plaintiff expended the amount of $2,258 for replacement modems.

ii. The market value of the old units was $400.

8. Replacement of personal computers:

i. The plaintiff expended the amount of $7,720 for the replacement of two personal computers.

ii. The market value of the old units was $1,157.50.

9. Rewiring of phone outlets and sockets:

i. The plaintiff expended the amount of $115.80 for the re-wiring of phone outlets and sockets.

10. Communications staff overtime costs:

i. The plaintiff expended the amount of $600 in respect of communications staff overtime costs.

11. DEC server replacement:

i. The plaintiff expended the amount of $1,772 in respect of the replacement of a DEC server.

ii. The market value of the old unit was $395.

12. Line conditioner repairs:

i. The plaintiff expended the amount of $460 in respect of line conditioner repairs.

13. Uninterrupted power supply repairs:

i. The plaintiff expended the amount of $4,373 in respect of uninterrupted power supply repairs.

Interim costs

14. Hire of replacement facsimile machines:

i. The plaintiff expended the amount of $2,480 for the short term hire of five replacement facsimile machines

15. Purchase of additional battery phone chargers:

i. The plaintiff expended the amount of $490.87 in respect of the purchase of additional battery phone charges.

16. Purchase of additional mobile phone batteries:

i. The plaintiff expended the amount of $999.50 in respect of the purchase of additional mobile phone batteries.

17. Mobile phone call charges:

i. The plaintiff expended the amount of $257.91 in mobile phone call charges during the period 26, 27 and 28 June 1996.

It is not agreed that this expenditure was either necessitated by the subject incident or was in excess of the plaintiff's usual phone charges in any event.

[120] As can be seen from the admitted facts, it is common ground that following the incident on 26 June 1996, the plaintiff expended money in relation to the replacement and repair of various plant and equipment, the purchase of additional plant and the hire of plant and equipment pending the replacement of plant and equipment. The parties were unable to finally agree the quantum of the plaintiff's claim because the following issues remain in contention. First, is the plaintiff entitled to damages in the amount of all monies expended for the replacement plant given the depreciation history of the damaged plant? Second, the depreciation issue aside, will the plaintiff receive an unfair advantage if full replacement cost is awarded to the plaintiff because the plaintiff has improved its position by the replacement of old and inferior plant and equipment with new and superior equipment? Apart from the PABX, all replacement plant and equipment was both new and of superior specification and quality.

[121] In determining the above issues I have had regard to Mr Kennedy's evidence. I accept his evidence which was to the effect that the plaintiff acted reasonably in purchasing new plant and equipment. The purchase of the new plant and equipment prevented any loss of advertising and other

income. However, as Moffitt P stated in *Hoad & Anor v Scone Motors Pty Ltd* [1977] 1 NSWLR 88, the principle of restitutio in integrum is the dominant rule of law in relation to the measure of damages. This means that even where a plaintiff has acted reasonably in purchasing new equipment which confers a benefit in excess of the true loss then the benefit is to be brought into account when assessing damages. Virtually all of the equipment which was replaced in this proceeding was equipment that was being depreciated and would have been replaced at some point in the ordinary course of the plaintiff's business. The consequence of the damage to the plant and equipment by the overvoltage was to accelerate the inevitable capital expense of acquiring new plant and equipment.

[122] The plaintiff's claim should be adjusted in order to reflect the plaintiff's true loss. In this regard I accept the written submissions of Senior and Junior Counsel for the Power and Water Authority which are summarised as follows. First, depreciated replacement cost should only be allowed for the PABX switchboard. The agreed depreciated replacement value of the new switchboard was $71,659. The damaged equipment was four years old. It had a normal business life expectancy of only three years, and had been depreciating at the rate of 13 per cent per annum. Having regard to the fact that the plaintiff has recovered more than 50 per cent of the purchase price of the damaged switchboard in taxation benefits, depreciated replacement cost only should be allowed. Secondly, the market value of the old digital and analogue telephone units being $1,345 should be taken as the damages

in relation to this plant and equipment rather than the amount of $4,789.49 which the plaintiff expended on the replacement of the digital and analogue telephone units. The evidence contained in the report provided by Colliers establishes that the telephone handsets are generally upgraded at the same time a PABX system is upgraded and therefore have a similar useful life of seven years. As the analogue and digital telephone handsets were both purchased in September 1992 they are approximately 45 months old as at June 1996 and therefore their remaining life before obsolescence or replacement in the ordinary course of business would also have been approximately three years. The amount claimed for replacement of the digital and analogue telephone units is excessive given their value, their expected life, advances in technology, and the betterment to the plaintiff by reason of purchase of the new units. Thirdly, the amount of $400 only should be allowed in relation to the replaced modems. $400 is the agreed market value of the old units. The modems that were replaced were purchased in April 1993 and June 1994 respectively. The amount claimed for replacement of the modems is excessive given their value, their expected life, advances in technology, and the betterment to the plaintiff by reason of the purchase of the new units. Having regard to the advantages of a faster modem speed and the nature of the plaintiff's business, it is likely that the superseded modems would have been replaced in any event. I accept the evidence contained in Colliers report as to the advances in modem technology over the material time. Fourthly, the amount of $1,157.50 only

should be allowed for damages for the replacement of the two personal computers. The sum of $1,157.50 is the agreed market value of the old computers. The amount claimed for replacement of the personal computers is excessive given their value, their expected life, advances in technology, and the betterment to the plaintiff by reason of the purchase of the new units. The original personal computers were very basic machines that would have been nearing the end of their useful lives due to functional and technological obsolescence. Fifthly, the amount of $395 only should be allowed for the replacement of the DEC server. The sum of $395 is the market value of the old unit. The amount claimed for replacement of the server is excessive given its value, its expected life, advances in technology, and the betterment to the plaintiff by reason of the purchase of the new unit. The original DEC server was purchased in November 1993. Depreciation was claimed for the server at a rate of 27 per cent. Sixthly, no amount should be allowed for the purchase of additional battery phone chargers. The cost of purchasing the additional phone chargers was not thrown away. The additional chargers remained available for the use of the plaintiff. Seventhly, no amount should be allowed for the purchase of additional mobile phone batteries. The cost of purchasing the phone batteries was not thrown away. The additional batteries remained available for the use of the plaintiff. Eighthly, no amount should be allowed for the mobile phone call charges during the period 26, 27 and 28 June 1996. There was no evidence

to establish that this expenditure was in excess of the plaintiff's usual phone charges in any event.

[123] I agree with the Power and Water Authority's submissions that quantum should be assessed as follows: depreciated replacement costs should be allowed for the PABX, market value should be allowed for the other items of replaced plant, allowance should be made for the repairs, and allowance should be made for the hire or replacement facsimile machines but not the other interim costs claimed. In these terms I assess the plaintiff's total damages in the sum of $93,067.10.

[124] Had the plaintiff been successful in this proceeding, which it has not been, then interest would be allowed pursuant to s 84 of the Supreme Court Act. The appropriate rate of interest to be applied is the interest bearing deposit rate. That rate provides a true reflection of and recompense for the loss of opportunity to invest the judgment sum.

ORDERS

[125] I make the following orders:

1. The plaintiff's claim is dismissed.

2. Judgment for the Power and Water Authority

[126] I will hear the parties as to costs