

Accident Report
Fatality
Unnamed Canadian Canoe
23 May 2008



Maritime New Zealand

Maritime New Zealand (MNZ) is a Crown entity established in August 1993 as the Maritime Safety Authority and renamed with effect from 1 July 2005. Safety, security and marine protection are its core objectives.

Section 431 of the Maritime Transport Act sets out MNZ's functions. One of those functions is to investigate and review maritime transport accidents and incidents.

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1. EXECUTIVE SUMMARY

- 1.1 On 23 May 2008 two friends, Allan William Hill, and the survivor, went duck shooting on Lake Poerua on the West Coast. Shortly after launching their Canadian canoe on the relatively calm lake they were hit abeam by a water spout. The canoe tipped over and threw both men into the lake. The canoe did not sink, but it was swamped. However both men managed to cling to the sides of the canoe.
- 1.2 A strong wind picked up in the wake of the water spout and started blowing the men and their canoe across to the uninhabited and densely bush-covered west side of the lake. They realised that it would be extremely difficult to walk around that shoreline and out of the bush and no one knew they were on that lake at the time. They tried to swim while holding onto the canoe towards the safer eastern shore from where they had launched.
- 1.3 With the wind now blowing strongly they were unable to take the canoe with them but it had flotation devices built into it so they attempted to swim for the shore using those for assistance. Mr Hill did not make it to the shoreline and drowned. The survivor eventually made it to shore and raised the alarm.
- 1.4 Investigations were initiated by the Police and Maritime New Zealand (MNZ), and this report is based on the investigation file compiled by MNZ.
- 1.5 Mr Hill's body was recovered the following day by Coastguard and Police divers. The canoe and almost all of the equipment carried within it was also recovered.
- 1.6 The MNZ investigation identified several causation factors that have contributed to this accident. The primary factor appears to be the absence of lifejackets. Neither of the men were wearing lifejackets and nor did they have them in the canoe.
- 1.7 The canoe itself was in good condition with no discovered faults or damage that may have contributed to this accident. Communications were poor in the region making standard equipment such as a cell phone or VHF radio redundant. If an Emergency Position-Indicating Radio Beacon (EPIRB) or personal locator beacon (PLB) had been carried and activated, Search and Rescue (SAR) may have been alerted sooner. If emergency flares had been carried and set off, they may have assisted an earlier response.

2. THE CANADIAN CANOE

- 2.1 The expression 'Canadian canoe' is a generic term that refers to most open-topped canoes, whereas a kayak normally refers to canoes that have a closed deck or cockpit. That is, they are covered over at the top as in *Figure 1*. The open-topped Canadian canoe that was involved with this accident is pictured, in *Figure 2*.
- 2.2 Canadian canoes are common in New Zealand. Closed-top kayaks are more resilient to the effects of swamping than open-top Canadian canoes. Canadian canoes are popular for recreational use, such as fishing, because they are generally capable of carrying heavy or bulky loads and equipment. For that reason they are popular with duck shooters.



Figure 1
Closed top kayak



Figure 2
Canadian Canoe involved in this accident

- 2.3 The design of Canadian canoes is extremely old, probably dating back hundreds of years when Native Americans originally constructed their canoes from timber and covered them in birch bark or animal skins. Traditionally canoes are paddled but it is not uncommon for a small outboard motor to be fitted to the stern. Canoes with a square back are ideally suited for a motor because it can be centrally-mounted contributing to an even lineal weight distribution concentrated along the centre line of the canoe. The thrust and torque of the engine is also evenly dispersed along the length of the vessel.
- 2.4 However, where the stern is not flat, mounting the engine on a bracket so that it sits to one side of the hull, as it was in this case, is also an acceptable method. The main consideration with this arrangement is that the load, usually comprising the passengers and their equipment, may have to be distributed to compensate for the off-set engine.
- 2.5 Another issue with mounting an engine on a canoe is that the extra weight may tend to lift the bow, presenting a greater surface area of hull to any cross winds, increasing the risk of capsizing. In this case the outboard motor only weighed 12kg and it does not appear to have been a contributing factor. That problem is normally offset in the same way as above – by repositioning the load so that the hull is correctly positioned in the water. Investigations conclude that the load was correctly positioned on this trip.

- 2.6 Canoes have inherent buoyancy that is directly proportional to the design and materials from which it is constructed. It is not uncommon for additional buoyancy devices to be fitted inside the hull and these are important in the event of a capsize. Without the fitted buoyancy, the canoe may sink if swamped, with the additional devices it will tend to float. Fitted buoyancy takes many forms, from purpose made inflatable devices, moulded polystyrene, and even expanding foam installed into voids under the gunnels.
- 2.7 In this case, the canoe had two 20 litre plastic containers fitted under the seats.

3. EVENTS LEADING UP TO THE ACCIDENT

- 3.1 Both Mr Hill and the survivor were born and grew up on the West Coast of New Zealand and were reasonably familiar with the area at which this accident took place.
- 3.2 On Thursday 22 May 2008, the survivor travelled down from Nelson with the intention of staying at his bach at Moana and going out for a morning of duck shooting with Mr Hill the following day. The survivor stated that while he was driving down he remembered that he had left his lifejacket behind. He considered this to be out of character for himself, and he later stated that he never goes out on the water without his lifejacket.
- 3.3 The survivor arrived at Mr Hill's house the previous evening and confirmed that Mr Hill was still keen to go shooting the next day. The survivor mentioned to Mr Hill that he had forgotten his lifejacket and asked if he could provide him with one for the trip. Mr Hill agreed to do so.
- 3.4 The survivor then drew a map on a small pad so that Mr Hill could find his bach in Moana the next morning. After the survivor left, Mr Hill wrote the words "Life Jacket" on that map to remind him to bring the lifejackets the next day, then left that pad on his dining room table.

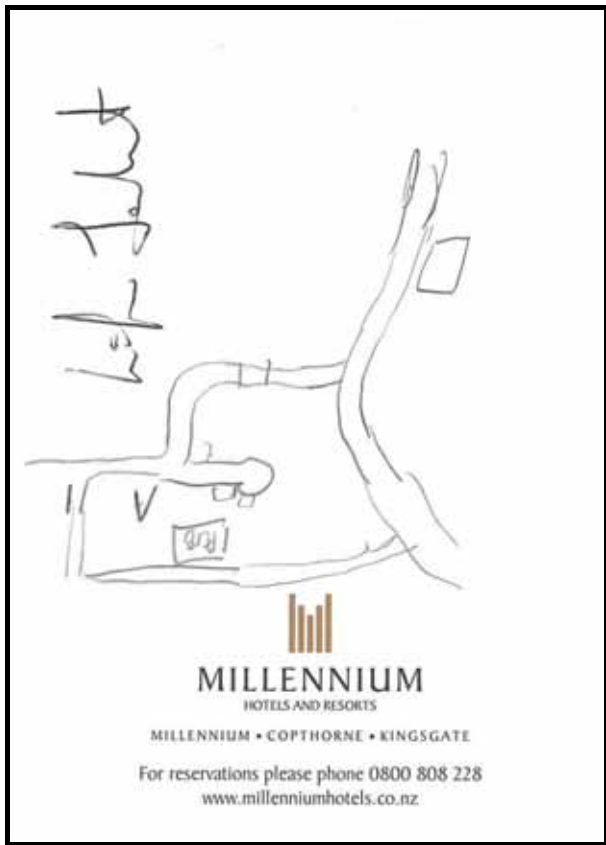


Figure 3
Diagram showing Mr Hill's "lifejacket" notation

- 3.5 The following morning, Friday 23 May, Mr Hill arrived at the bach at Moana at approximately 0630 and they prepared for their morning of duck shooting. It was at that point that they realised that Mr Hill had also forgotten to bring lifejackets and the decision was made by both men to continue the trip without them. The survivor later stated that:

"We realised that [Mr Hill] had also forgotten the lifejackets – we didn't discuss it – it was obvious that we'd both stuffed up – me leaving mine in Nelson and [Mr Hill] that day. I've thought about this a lot since the accident – why we decided to carry on the trip without lifejackets? I mean, we always wear lifejackets, we never go out without them, and if there had been children in the group we definitely wouldn't have gone out on this trip. I guess we were two grown men making adult decisions for ourselves."

- 3.6 The decision to carry on with the trip without lifejackets was, according to the survivor, based on information which included the fact that the survivor had scouted the area two weeks earlier, and had noted that the water levels were low. They knew there had been no rain in the area since. The survivor said they reasonably expected the water levels to be very low and the need for lifejackets to be significantly less than if the conditions had been different.
- 3.7 At about 0700 hours, they left the bach and drove two vehicles down to the Lake Brunner Yacht Club and Coastguard building. Mr Hill was a member of the Yacht Club and they parked his vehicle there with the expectation that they would arrive back at the car park, in the canoe, at around lunchtime.



Figure 4
The Lake Brunner Yacht Club where Mr Hill left his vehicle.
Ref: DSCF0358 - Photograph taken on 27 May 2008 at 1256



Figure 5

Lake Brunner was calm at the time Mr Hill left his vehicle there and a local resident who was a witness, stated that it was similar to the conditions shown in this photograph.

Ref: DSCF0362 - Photograph taken on 27 May 2008 at 1302

- 3.8 The men then took the canoe in the survivor's vehicle up to Lady Lake about 20 kilometres away, a journey that took approximately 45 minutes.
- 3.9 They took their canoe out onto Lady Lake and shot that. The survivor was the helmsman, sitting aft and operating the Suzuki 2.2hp outboard motor. Mr Hill was sitting in the bow, shooting at the ducks. They had one shotgun between them.
- 3.10 Mr Hill shot two Paradise ducks, and they moved down towards the Crooked River with the intention of travelling down it to Lake Brunner. It was so shallow that they realised they would bottom out and would have to carry the canoe too much.
- 3.11 They made a decision to deviate from their original plan. They loaded the canoe back onto the survivor's van and drove to Lake Poerua, a journey of approximately 15 kilometres which took around 40 minutes.
- 3.12 Significantly, the men's wives knew of their original intended expedition, but were not informed of the change of plans as there was no cell phone coverage.



Figure 6

The Crooked River where the men originally intended to go duck shooting was very shallow at the time of the accident, so they decided to go to Lake Poerua instead.

Ref: DSCF0364 - Photograph taken on 27 May 2008 at 1354

4. LAKE POERUA

- 4.1 Lake Poerua is a shallow lake located approximately 13 kilometres south-east from Lake Brunner. Many small streams flow into the lake from the surrounding areas and the Poerua River flows from the lake into the Crooked River which, as noted earlier, leads eventually into Lake Brunner. The lake is located at the coordinates 42° 42' S 171° 30' E, just to the north of the settlement of Inchbonnie. Lake Brunner Road, which links State Highway 7 and 73, and the midland line railway both run along the flat, inhabited, eastern shore of the lake.
- 4.2 The lake is approximately two and a half hectares in area and is located in a depression between the Alexandra Range and the steeply forested slopes of Mount Te Kinga, which rises 1204 metres above sea level to the north of the lake. Lake Poerua is part of a network of fluvio-glacial lakes that includes the much larger Lake Brunner. The accessible area around Lake Poerua is sparsely populated with only a few farm houses and baches in the immediate area.
- 4.3 Boating is a popular recreational activity in the area with an estimated 300 recreational vessels being regularly used predominantly by visitors to the region as opposed to the relatively small number of local people. Lake Poerua is popular with trout fishermen and it is easily accessible from the adjacent road. There are inherent physical hazards within the lake. Those hazards include some ancient white pine tree stumps, some of which can be seen above the surface, that create a hazard to boats, especially those below the waterline. On the western side of the lake, at the foot of Mt Te Kinga, large granite boulders are at or below the water level and in some cases 30 to 40 metres from the shoreline, and again these present a significant hazard to vessels. That western side of the lake is uninhabited with the rough shoreline and no tracks through the dense bush making it extremely difficult to negotiate on foot. This became a significant factor after the canoe capsized and was being blown to that shore.

5. THE ACCIDENT

5.1 The two men launched their canoe at about 1015 hours, at the southern end of Lake Poerua using a boat launching facility at Te Kinga reserve, which is just off Lake Brunner Road. The survivor stated a breeze there that went, *"from nothing, so it was calm on the lake, to gusts which made it a bit rougher in parts of the lake."* For that reason they decided to keep to the eastern windward shore, intending to keep about 30 metres out, just past the white pine tree stumps that were just protruding above the surface, but in fact they travelled anywhere up to approximately 70 metres off the shoreline.

5.2 On this lake it was Mr Hill's turn to drive the canoe operating the outboard motor while the survivor had a turn at shooting. They decided to drive towards the northern end of the lake where they could see it was calmer. The survivor, who is very experienced in boats, assessed their buoyancy and decided to sit down low on the hull of the boat instead of up on the seat so that the centre of gravity would be lower helping to make the canoe more stable and maintain an even profile while travelling along the lake. He later stated;

"It was pretty cold out there so we had plenty of clothes on but there wasn't much in the canoe as such. We had the outboard motor, two paddles, a thermos flask, a small three litre fuel container for the outboard, a pair of vice-grips, my red camera bag that also had our ammo and lunch in it, and the shotgun.

"I was wearing gumboots, socks, track pants, polypropylene thermals, a t-shirt, woollen jersey, lined jacket, and over the top of all that I had on a pair of short sleeve cotton overalls. [Mr Hill] was wearing long cotton pants, sandals, socks, several layers of jackets, hat and mittens. But of course neither of us had lifejackets on."

5.3 The two men had only travelled a few hundred metres into their journey when they were suddenly hit by a gust of wind, accompanied by a water spout, that tipped the canoe over. There followed a sequence of events best described in the survivor's own words:

"It was only about five minutes after we'd launched that we were hit directly abeam by a "Willy-Worl" that's a water spout from a violent gust of wind, and we were flipped straight over. As we went over I turned around and saw [Mr Hill] go over and into the water and I went in next. I don't think that the canoe went all the way upside down. I think that it went over far enough to throw us out, then the water poured into it and filled it to the gunnels [gunwales] and it rolled back upright again. It didn't sink but it was completely filled with water right up to the gunnels. All the gear was still inside it and it was still afloat, but obviously we couldn't drive her or bail her out.

"We were ok at that stage. We were wet. It was cold, but we were ok. We were close to the [east] shore and could easily see my van where we'd launched from. We were probably about 70 metres off the [eastern] shore when we went over. I wasn't worried at all. Maybe a bit embarrassed but this wasn't a great emergency – it was survivable.

"The canoe had enough buoyancy to not sink and we were holding onto the gunnels. We were going to be ok, but [Mr Hill] really freaked out which surprised me. His reaction was to climb back into the boat but it was so submerged that we were better off holding onto the gunnels and staying on opposite sides, that way we could swim for the shore taking the canoe with us. That's what it was like at that stage; we were taking the canoe with us. But [Mr Hill] was freaking out and kept trying to come around to my side of the boat. I don't know if this is true, but talking about it later with different people, apparently no-one's ever seen him swim. I know I never have. He's had heaps of experience in boats but no-one's ever seen him swim before, so maybe that's why he was panicking.

"I shouted at him, "Chill! Chill! Chill! Everything's ok!" He calmed down a bit and we talked about swimming but that we would need to get rid of some clothes for that to happen. I needed to get my overalls off but I couldn't get them off my shoulder. That's all I needed but I couldn't do it. [Mr Hill] tried to pull them off my shoulder but he couldn't get it either.

5.4

While this was happening, the wind had developed and it was pushing the men and the canoe away from the eastern shore from where they had launched, towards the inhospitable western shore. They realised that if they allowed themselves to be blown west it would be difficult to negotiate the shoreline on foot, especially after being in the cold lake. They realised that no one knew they were on Lake Poerua, so if a SAR operation was initiated it would be focussed on Lady Lake and the Crooked River. The only way anyone would realise they were at Lake Poerua would be if the survivor's van was discovered in the car park at the southern end of the lake. The survivor continued:

"We realised that we couldn't take the boat but I was still confident that we could get ourselves to shore ok. We then talked about the fact that I had a sharp pocket knife and I could cut the lashings on the buoyancy devices under the seats of the canoe, then use those to help us get ashore. I got my gumboots off and [Mr Hill] kicked his shoes off, and we got the 20-litre containers out, and I was confident that we weren't going to sink. It was only 70 metres to shore so I said to [Mr Hill] "Forget the boat and get to shore."

"I was on my back holding the float to my chest, kicking so that I was heading backwards towards the shore. I was fine but [Mr Hill] didn't do it that way – he was facing forward trying to climb up onto it. Several times I got him onto his back but then he spied a car driving down the road so he tried to climb up on the float and wave to the car. Suddenly the float popped out from under him and the strong wind blew it just out of reach.

"He then tried to climb up on me and we floundered around for a bit until he managed to climb onto the float with me under it again hanging on tight. I still thought we were ok but this was the last chance. There were no more options. I told [him], "This is it. Kick for your life. Kick for your kids. Kick for your wife. Kick!"

"He tried. He really did try but I think he still wanted to be saved. He saw a truck on the road and climbed up again to wave to it and that pushed me under the water. Next thing, with him up high waving to the truck, the flotation device shot out from between his legs and I popped up above the surface again. We both saw the float about 10 feet away but with the wind we couldn't get to it.

"There was nothing more I could do. I was so exhausted. I was stuffed but [he] was shagged. Totally knackered. I knew he'd drowned but I still had to try and save myself. I struck out for the shore but I honestly thought they'd find my body 25 metres out and [Mr Hill] at 70 metres. But I had to keep going so I kicked and swam and somehow eventually dragged myself crawling up onto the beach.

"I reckon I was in the water for about half an hour and they told me later that it was about 10°C. My head was spinning. I couldn't see. I was shaking. I was frozen, but I was alive.

"I waited until my vision cleared and my head stopped spinning but I was still shaking intensely. I was shocked but I knew my best bet was to head up to the road about 100 metres away and flag down a car. The first car came along and I tried to stop it – I waved out – but he didn't stop. I had two options – go left up to some nearby farm houses or right, back to my van. I still had the van keys in my pocket. I got to the van then drove down to the first farmhouse on the right. The house had smoke coming out of the chimney but there was no-one home.

"I got back in my van and drove to the next house on the left. I saw people there and it turned out that the house was empty and for sale, but the farmer there helped me. He called 111 and I spent the next half hour in his shower until I'd emptied the cylinder – I used up all his hot water. That's about it really. That's what happened."

5.6 The Police and Coastguard instigated a SAR operation, and were soon on the scene. Mr Hill's body was recovered the following day after the Coastguard and Police divers conducted a search of the lake. The canoe and almost all of the equipment carried within it was also recovered.



Figure 7

Lake Poerua looking north from the boat ramp where the canoe was launched. The men headed up the lake approximately in line with this track down to the lake's edge.

Ref: DSCF0322 - Photograph taken on 24 May 2008 at 1635



Figure 8

Lake Poerua looking south from the beach where the survivor eventually made it to shore. The red arrow indicates the boat ramp from where the canoe was launched, and it capsized to the right of this photograph.

Ref: DSCF0312 - Photograph taken on 24 May 2008 at 1616

6. LEGISLATIVE REQUIREMENTS

- 6.1 Recreational boating activities are covered by a range of statutory requirements included in the Maritime Transport Act 1994 (MTA).
- 6.2 The MTA stipulates broad principles of maritime law and they are based on international ship safety conventions. Section 34 of the MTA allows for Maritime Rules to be made and these contain detailed technical standards and procedures for achieving the principles of the MTA.
- 6.3 Maritime Rule 91 came into force on 21 March 2003 and it relates to navigation safety. That rule includes the requirement for the carriage of personal flotation devices (PFDs) on pleasure craft such as the canoe involved in this accident. PFD's are buoyancy aids that are designed to be worn on the body and are more commonly known as lifejackets. The rules also make the wearing of PFD's mandatory in some circumstances.
- 6.4 Maritime Rule 91.2 contains definitions that are relevant to this case, including the definition of "pleasure craft," which includes this canoe, and "owner" to which the term is only loosely applied to the canoe as it was collectively owned by a group of friends. The definition of a "person in charge of a vessel" means the Master and in this case there was no Master as such, as both men who occupied the canoe were equally responsible for the operation of the vessel and any decisions made in relation to their journey. In relation to those rules, both men were probably in charge insofar as their actions or inactions only applied to themselves as individuals and not to each other.
- 6.5 Rule 91.4(1) relates to personal flotation devices and it states that:
- No person in charge of a recreational craft may use it unless there are on board at the time of use, and in a readily accessible location, sufficient personal flotation devices of an appropriate size for each person on board.*
- 6.6 Rule 91.4(2) gives some exceptions to that rule. However, in this case, there was no applicable exception and it was a mandatory requirement for PFDs (lifejackets) to be carried on board in a position that was readily accessible to the men in the event that an accident of this nature occurred.

7. CAUSATION FACTORS

- 7.1 Accidents are rarely the result of a single factor. They are usually the culmination of a chain of inter-related events, and this accident is consistent with that tenet. Investigations often focus on distinct aspects that are common across most accident scenarios, assessing the interrelationship between the people involved and their decision-making processes; their environment; and the physical elements they were dealing with at the time.
- 7.2 In this case several issues that could be considered causative or contributory have already been mentioned earlier in this report. The NPBSF has reviewed the investigations of many recreational boating fatalities, and they have identified four common causation factors that contributed to those accidents, namely:
- the absence of lifejackets
 - poor communications
 - failure to check and act upon up to date marine weather forecasts
 - alcohol consumption.
- 7.3 In this case the failure to wear or at least carry lifejackets has already been identified as a significant - if not the primary - causation factor of Mr Hill's drowning.
- 7.4 Alcohol was not a contributing factor. The post mortem examination report concluded that "alcohol and other mind altering drugs played no part in this death."
- 7.5 It is worth exploring in more detail the other two causation factors identified by the NPBSF, being weather and communications. There is the question of why Mr Hill drowned when the survivor did not. These specific issues are analysed in the following sections of this report.

8. COMMUNICATIONS

- 8.1 As noted earlier in this report, the respective spouses of the two men involved in this accident knew of their trip as it was intended, but they could not be informed of the decision to change locations. After the canoe capsized and was being swept to the uninhabited and inhospitable western shore of the lake, the men realised that rescue would be unlikely. If a SAR operation was initiated when the men failed to return home, it would be centred on Lady Lake and the Crooked River, approximately 15km away. Therefore preparation as a causation factor was an issue.
- 8.2 Lake Poerua, and indeed many areas around the West Coast away from major towns, are notorious for their poor cell phone coverage. Lake Poerua has no cell phone coverage and Lady Lake and the Crooked River are also not covered by this facility. This was well known to both men according to the survivor.
- 8.3 The men did not carry a cell phone on this occasion because they knew that it would not work.
- 8.4 Another common form of communication for mariners is the use of VHF radios. Channel 16 is the emergency channel that is constantly monitored by the Rescue Coordination Centre of New Zealand (RCCNZ) in Avalon, a service that is managed and operated by MNZ. The channel 16 service covers approximately 98% of the New Zealand coastline, but any coverage inland is coincidental rather than intentional and is limited to areas that are generally covered by cell phones. VHF coverage on Lake Poerua and many other lakes and rivers in the area is generally not available, although in certain circumstances it may still be possible to communicate by VHF radio. VHF works by line-of-sight so, if the radio is not obstructed by physical features like mountains, then communication is possible. Where an obstruction exists for one user, but a second person within line-of-sight of that first person is able to use their radio, then the first person is also able to use theirs, by way of a type of relay system. Clearly this scenario is highly circumstantial and cannot be relied on as an effective communications method.
- 8.5 A third method for communicating with other people beyond the vessel is the use of distress flares. These can be set off in times of emergency where they either glow brightly or they give off clouds of orange smoke in the hope they will be seen and the alarm raised.
- 8.6 In this case, in addition to not having cell phones or VHF radios, which as noted earlier would probably not have worked anyway, the men were not carrying distress flares. It is possible that if distress flares had been carried and set off at the time the canoe capsized, they may have been noticed by others. This is by no means a certainty, especially given the sparse population and the relatively low number of vehicles that use Lake Brunner Road, but it cannot be ignored. The chances of an earlier response may have been increased by the use of distress flares.
- 8.7 The fourth common method for communication is the use of an EPIRB (Emergency Position-Indicating Radio Beacon). These are designed for the marine environment and when activated they send a signal to a satellite alerting RCCNZ of an emergency. Similar to an EPIRB, but not specifically intended for maritime use, is a Personal Locator Beacon (PLB) that are increasingly popular with trampers. These are small hand held devices and, again, when activated they emit a signal from which rescuers can pin-point the location of the person in distress. In this case, it is possible that an EPIRB or PLB could have alerted Search and Rescue (SAR) sooner than actually occurred. Many brands are readily available and - given the increased chances of being saved when they are used - they are not cost prohibitive. They are priced at approximately \$600 to \$1000 for models that would be suitable for this application.

- 8.8 It is not a mandatory requirement for recreational vessels to carry any of these forms of communication equipment (except for offshore pleasure craft heading overseas). These PLB units are clearly important safety devices and have enormous benefits when carried on all types of vessels.

9. WEATHER

- 9.1 A local resident, who is also the MNZ Safe Boating Advisor (SBA) and Lake Brunner Coastguard member, lives in Moana and is locally regarded as an expert on the weather in that area.
- 9.2 He takes a keen interest in the local conditions and in his statement he explained that the national weather forecasts sometimes bear little resemblance to the local situation. He noted that the weather forecast for the period around the time of the accident indicated that there had been rain for several days prior to the accident and that it would be clearing at the time of the accident. He pointed out that in fact there had been no rain in the weeks following his scouting trip up to Lady Lake and the Crooked River with the survivor two weeks earlier, and suggested that those weather reports were potentially misleading.
- 9.3 His interest in the local weather led him to accurately assess what happened at the time of the accident although he was in Moana at the time. He distinctly recalled standing outside at the time of the accident when he felt the first gusts of wind from an easterly. He noted that the easterly wind is not the most common wind on the West Coast, and he remembers thinking that there would be several days of fine weather as a result of this easterly.
- 9.4 It is also apparently well known that variations in weather exist as a result of the distinctive geological features, including Lake Poerua and its surrounding mountains. The weather can be different from one end of the lake to the other. This was similar on the day of the accident, as described by the survivor, when he said that the weather could be calm in one part of the lake and quite a bit rougher in other parts.
- 9.5 During the investigation by MNZ, this phenomenon was observed and filmed by the investigator where gusts of wind could be heard coming down the valley from the east and striking the lake with significant force. While waves were whipped up and water spouts created in some parts of the lake, only metres away other parts of the lake remained calm. Given this local variation to the forecasted weather conditions, it would appear that any consideration given to that forecast was not an influencing factor in this accident.
- 9.6 The water spout, although not uncommon on this lake, was in effect an isolated incident on what was an otherwise reasonably calm body of water before the canoe capsized. While the weather, (in the form of the water spout and gust of wind) that struck the canoe, was a significant contributing factor in this accident, it was not necessarily avoidable by the men. The survivor stated that he considered the weather conditions that day to be near to ideal for their expedition.

10. SURVIVABILITY

- 10.1 An important consideration of this accident was the factor that one man drowned while the other survived. As the survivor stated, when the canoe capsized, his immediate thought was that it wasn't such a big deal - that the capsizing was survivable and they were going to take the canoe to shore suffering little more than a soaking.
- 10.2 Mr Hill, according to the described events from the survivor, was decidedly uncomfortable with the situation, to the extent that he started panicking about their circumstances in the water.
- 10.3 Mr Hill's wife noted that he was confident on the water and a very experienced mariner in a recreational capacity. A keen member of the Lake Brunner Yacht Club, he would take passengers, including their children, in their yacht out on Lake Brunner most weeks. She said that at all times he was confident and in control, even in very rough conditions. She said that her husband would frequently take their children swimming, but he would never enter the water himself.
- 10.4 Mr Hill's wife also noted that she had seen her husband fall into the water on occasions and that he derived some enjoyment from that, laughing and joking about it. This was confirmed by the local SBA resident, who regularly saw Mr Hill at Lake Brunner and he noted in his statement that Mr Hill was the only person he would regularly see who would put on his lifejacket the moment he stepped out of his vehicle, before he even launched his boat. He stated that if every visitor to that lake followed this example, the work of the Coastguard and the wider SAR community would be significantly reduced.
- 10.5 Dr Kevin Moran the principle lecturer in Health & Physical Education at the Faculty of Education at the University of Auckland, reviewed information from the MNZ investigation file and he drew on a wide body of research into this issue, noting that it is an established principle that panic can impair breathing and precipitate the drowning process.
- 10.6 Jonathon Webber, the Resuscitation Officer, Learning & Development, Auckland District Health Board believed that the issue of immersion hypothermia may have been a significant contributing factor with regard to this phenomenon.
- 10.7 Mr Webber explained that the issue of immersion hypothermia is the uncontrolled hyperventilation that occurs when a person is unexpectedly immersed in water. He suggested that Mr Hill may have mistimed a breath as a result of the panic resulting in a laryngospasm which sometimes results in the loss of consciousness. Whereas a swimmer, who does not panic, may simply have to cope with hyperventilation which eventually subsides.
- 10.8 There has been a great deal of research into the issue of survival in cold waters internationally, especially in Canada, where recreational boating activities are a significant national pastime. The Marine Department of Transport Canada undertakes a similar role to MNZ, ensuring the promotion and enforcement of safe and sustainable marine practices. Survival in cold waters occupies a significant part of their safety regime, given that many of their waterways have cold water for a major proportion of the year. At Lake Poerua at the time of the accident, records held by the Regional Council and the Department of Conservation indicate that the water temperature was probably around 10°C. The Canadian research indicates that this is significantly cold water and the chances of survival depend on how the victims cope with four distinct stages:

- initial immersion or cold shock
- short term immersion or swimming failure
- long term immersion or hypothermia
- post rescue collapse.

10.9 Usually on initial immersion there is a large inspiratory gasp followed by a four-fold increase in pulmonary ventilation, or severe hyperventilation. This on its own can cause small muscle spasms and drowning. Along with this, there is a massive increase in heart rate and blood pressure. These latter cardiac responses may cause death, particularly in older less healthy people. These effects last for the first two or three minutes just at the critical stage of vessel abandonment.

10.10 The Canadian research found that short term immersion, or swimming failure, usually results in death between three and thirty minutes after immersion and appears to affect those who try to swim and that even good swimmers may be unable to swim for more than a few minutes in very cold water. The Canadian research also notes one recent case where a good swimmer, aged 20, disappeared within five minutes while he was trying to swim 50 yards from an overturned dinghy in the calm water of a reservoir that was approximately 10°C.

10.11 That compares with the circumstances on Lake Poerua for the two men, who were a similar distance from the shore in what had been relatively calm waters and with a water temperature of approximately 10°C. In the Canadian case the cause was thought to be due to the respiratory and cardiovascular responses that started in the initial immersion. An alternative theory was that the cold water contact with the nose and mouth induced the so called 'diving response' which causes breathing to stop (apnoea), a slowing of the heart rate (bradycardia), and even cardiac arrest (asystole).

10.12 In this case, in those crucial few minutes after immersion in the lake, they managed to hold onto the canoe and gain their composure, and this may have averted those medical conditions from occurring at that time.

10.13 The Canadian research also suggests that after thirty minutes or more of immersion, death may occur from hypothermia. The cause of this is that water apparently has a specific heat 1000 times that of air. It also has a thermal conductivity of 25 - 27 times that of air. Thus, when a body is immersed in water below body temperature, which is 37°C, it will inevitably cool to hypothermic levels at a rate that it is dependent on:

- temperature differential
- clothing insulation
- rate of agitation of the water
- body heat production produced by shivering and exercise
- ratio of body mass to surface area
- subcutaneous fat thickness
- state of physical fitness prior to immersion
- physical behaviour and body posture in the water.

- 10.14 The deep body temperature falls, humans lapse into unconsciousness and death may occur in two ways; drowning through incapacitation, and cardiac arrest. Death from drowning will apparently occur in a lightly dressed individual, even wearing a lifejacket, approximately one hour after immersion in water at 5°C; two hours in water at 10°C; or in six hours or less at 15°C. If the deep body temperature continues to fall, death occurs on average from cardiac arrest somewhere below a body core temperature of 24°C.
- 10.15 The Canadians recommend that survival times can be extended if the survivor stays still in the water and does not attempt to swim to keep warm. They suggest that adopting a foetal position with legs together and arms to the side, or folded across the chest, may prolong these survival times.
- 10.16 Given these expert assessments, it would appear that Mr Hill's failure to survive this accident was consistent with established medical research in that the clothing he was wearing allowed him to survive as long as he did. But his activity with swimming and attempting to rescue himself while being immersed in a water temperature of only 10°C, may have eventually led to his physical exhaustion and a reduction in his deep body temperature.
- 10.17 The fourth stage of survival in cold waters or, conversely, a failure to survive in cold waters, relates to post-rescue collapse and this is a phenomenon that the survivor appears to have narrowly avoided. Apparently up to 20% of immersion deaths occur after extraction from the water or within hours after rescue. Again a significant body of research has been undertaken into this issue, and the *Wahine* ferry disaster of 1968 in Wellington Harbour features in that international research where, of the 51 lives lost, 12 were alive on rescue but died shortly afterward as a result of post-rescue collapse. In this case the two men were correct to assess being swept to the western shore of the lake as a significant risk. While they may not have drowned if they stayed with the swamped and submerged canoe, but they could have been exposed to the very real risk of hypothermia either while on the lake or after self-extraction on the western shore.
- 10.18 It is a conclusion of the investigation that the survivor may well have narrowly avoided losing his life from hypothermia.

11. CONCLUSIONS

11.1 The MNZ investigation identified several causation factors that may have contributed to this accident:

- The primary factor appears to be the absence of lifejackets. Neither man was wearing a lifejacket and they did not take them on the canoe that day.
- The canoe itself was in good condition with no apparent faults or damage that contributed to this accident.
- Communications were poor in the region making standard equipment such as a cell phone or VHF radio redundant, but if an Emergency Position Indicating Radio Beacon (EPIRB) or personal locator beacon (PLB) had been carried and activated, Search and Rescue (SAR) may have been alerted sooner.
- If emergency flares had been carried and set off, they may have alerted people, traffic or aircraft in the vicinity.

12. RECOMMENDATIONS

12.1 Maritime New Zealand recommends:

- (a) that a summary of the findings of this investigation is published in the MNZ *Lookout!* magazine to highlight the necessity of carrying lifejackets and ensuring that suitable means of communication are always available for use in an emergency
- (b) that MNZ continues to promote these safe practices to recreational boaters through its established forums including the MNZ website, periodical publications, representation at Boat Shows, and through the work of its Safe Boating Advisors
- (c) this report be sent to NPBSF in order for them to use it as part of their ongoing Boating Safety Strategy.