LLOYD MANDENO OBE - PIONEER ENGINEER

Text of an address written by John Mandeno of Te Kuiti and delivered to the Tauranga branch of NZ Historic Places Trust on 21 April 1996.

Firstly may I say how much I appreciate the fact that you have chosen to honour my father, Lloyd Mandeno, and that you have offered me the privilege of speaking about his life and work.

I will not attempt to compress 85 years into half an hour. I will speak a little of our family heritage, and of Dad's life before and after Tauranga. Most of my address is related to Tauranga, where in fact I am no stranger. I was born here in 1919. I was married here in 1943. At present I have no plans to die here.

The name Mandeno is derived from a French Huguenot name. "Huguenot" was a nickname given to members of the early Reformed Church in France. Persecution of Protestants in the 16th and 17th centuries resulted in the emigration as refugees of hundreds of thousands of French people to England and Prussia. The church marriage register at Spitalfields in London records on 4 March 1736 the marriage of Jean Mandineau, a pastor from western France, to Anne L' Homme from near Paris.

James Francis Mandeno was born in London in 1807, a great grandson of the original refugee. He trained as a Congregational minister and served for 28 years in Shropshire and Northamptonshire. He had married Jane Lloyd and they had 10 children two of whom died in infancy. The family migrated in 1855 arriving after a 100-day voyage at Auckland then a town of 7,000 people. After settling in Remuera J.F., my great grandfather, served as a minister until 1872 when he retired to live with two of his sons who had settled in Te Awamutu. He was invited to become the first Presbyterian minister in Te Awamutu, serving almost until his death in 1986.

William Henry, the youngest son of J.F., moved in 1872 to Tauranga where he farmed at Te Puna and then at Aongatete. Here he built the home to which he brought his bride in 1883. Mary Graham Snodgrass was the daughter of John Snodgrass of Renfrewshire and Barbara Graham of Lanarkshire. They

emigrated to NZ in 1860 with nine children. A couple of years later they took up 500 acres at Otumoetai. Thus a strong Scottish element with a well established tradition of farming entered our heritage. In 1884 my grandparents moved their home to a 240 acre property at Rangiaohia near Te Awamutu. Here my father was born in 1888 and nurtured with his three sisters by parents whose basis for life was their Christian faith.

Lloyd grew up experiencing all the jobs and chores of farm life. In addition to running his farm my grandfather had become Supervisor of the newly constituted Waipa County. Thus my father had his first experience of engineering which he realised interested him more than farming. After six years' primary schooling he was sent to St John's Collegiate school in Auckland. At this time there was no secondary school in the Waikato. It was unusual for a country boy to receive any secondary education but after four years' Latin, English, Physics and Mathematics, Dad went on to Auckland University College for one year in 1905 and then on the School of Engineering at Canterbury University College from whence he graduated in 1909 B.Sc (Engineering) later to become BE. There followed two years practical experience in electrical engineering with Turnbull and Jones and a year at the Horahora hydroelectric project before taking up an appointment as Engineer to Frankton Borough Council.

During his year at Auckland University College Dad had met Constance Woodward whose father, William Woodward was a graduate of Cambridge University and whose mother, Laura Young was a school teacher. They had emigrated in 1870 and were farming and teaching in East Tamaki. Over the years the friendship between my future parents blossomed. They married and set up their first home in Frankton in 1913. Two years later Dad hiked over the Kaimai Track for an interview prior to his appointment as Borough Engineer in Tauranga whose population at that time was about 1600 people.

As the 150 kilowatt Omanawa Falls hydroelectric power station was nearing completion, one of Dad's responsibilities was to encourage residents to become electricity consumers. Few had had any experience with the new form of energy and most were afraid of it. He set up a shop in Devonport Rd as a

demonstration room which derived its electricity from a dynamo driven by a diesel engine. By the time power became available from Omanawa 100 homes had been wired for electricity. Mr R S Ready who was building a new home in Fifth Ave became interested in electric cooking and an electric hot water system which my father had invented. This house became the first all electric home in NZ - the first home in NZ, and perhaps the world, which had been built without a chimney. The development and manufacture of cooking and water heating equipment occupied Dad's attention with the result that by 1923 he reported in a paper read to the NZ Institution of Engineers that, whereas not a single electric stove or oven was in use in Auckland, 10% of Tauranga consumers were using them.

The generation of electric power from water power was always at the forefront of his mind. To meet the rapidly increasing demand for electricity he designed and supervised the installation of a 600 kW generator at Omanawa in 1921. This entailed tunnelling into a rock cliff to extend the power house which thus became the first underground power station in NZ. One of my earliest memories is a large photograph depicting the generator being lowered by aerial ropeway to the station, one wall of which was just visible in the depths of the gorge. Distribution of electricity went hand in hand with its generation. The power line network was extended to Papamoa and later Te Puke to supply the township, a small goldmine and the first sawmill in NZ powered with electricity. Dad personally pegged pole positions for all high tension lines.

Initial steps were taken for the constitution of Tauranga County as a power district. Plans were well advanced for the development of falls at the confluence of the Mangapapa river and the Mangakarengarenga river to form the Wairoa river. To make sure that he did not overlook a better site Dad undertook a strenuous cross country exploration up the Omanawa river and across a ridge to the upper reached of the Mangapapa, taking altitude readings down about seven miles of that river to the Wairoa falls which he named McLaren's. In passing, we should remember that the records obtained that day remained in Dad's mind for 50 years when they were applied to the design of the more recent Mangapapa development.

Preliminary design and cost estimates of the McLaren Falls proposal were accepted by borough councillors. However there was opposition in Wellington. Government engineers planning the Arapuni scheme claimed that sufficient power would be developed there to supply the Auckland province for 50 years. After several trips to Wellington, during which Dad overcame the opposition, a licence was granted. The next step was to gain ratepayer approval to the raising of a loan of £90,000. This meant that the borough ratepayers were asked to service a loan 216 times greater than any other NZ community.

The poll was carried in December 1922 by a 10 to 1 majority. In January Dad set up camp for our family beside the river while he surveyed the site. Construction proceeded despite some serious floods, and the first of two 1350 kW generators was running in June 1925. Successful completion of negotiations for the sale to NZ Electricity Department of surplus power resulted in the council authorising in January 1926 the purchase of the second machine. It was operating within 12 months. Thus 2700 kW of generating capacity was provided for £90,000.

At today's costs of generating capacity the station would cost $7 million.

For the next five years the government purchased every unit of energy which could be spared from Tauranga, with the result that Tauranga consumers enjoyed the lowest electricity charges in NZ. During prolonged shutdowns at Arapuni Auckland received power from Tauranga. Dad records that even in 1971 the cost of power in Tauranga was 20% lower than the average cost for all power authorities in NZ. Omanawa and McLaren Falls produced every 2 years power valued as equal to their total original cost of construction.

In addition to his duties as Tauranga Borough Engineer, Dad was retained as Consultant to Te Puke Town Board and the newly constituted Tauranga Power Board for the distribution of electricity throughout the County. To make the supply of power to remote sparsely settled areas economically feasible, Dad invented the Single Wire Earth Return system, known affectionately by its beneficiaries and derisively by its detractors as the

“Mandeno clothesline”.

Instead of the conventional three overhead wires which require shorter spans between poles, Dad’s system used the earth as a return conductor. Spans could be over half a mile in length between poles. Thus the line could be erected at about one quarter the cost of three phase lines. Initial problems with the build up of voltage in telephone lines running parallel to power lines were soon overcome. Rules for design were formulated and accepted by Post and Telegraph engineers and government electricity engineers.

In later years the system was used to bring power to settlers in Northland, King Country, Taupo and some South Island areas. In 1950 Dad introduced the system to Australia where it is now used in all states except possibly Western Australia. By 1984 15,000 km of single wire earth return system lines had been erected in NZ and Australia. Furthermore the system originally developed in Tauranga, is widely used in South America, South Africa, India and Russia. This worldwide application of the system arose from a paper Dad read to the annual conference of the NZ Institution of Engineers in 1947.

As new power boards were established in Bay of Islands, King Country and Taupo farmers in areas adjacent to these power districts, watched enviously as the “Mandeno clothesline” reached to the last farm in the remotest valley. In Northland and King Country isolated farmers gladly cooperated with power board employees in the erection of the single wire system. After linesmen had fitted insulators to poles, farmers would drag the poles and erect them at the pegged sites. The linesmen then ran out the wire and secured it to the insulators. Small transformers were installed close to each homestead. All this development originated in Tauranga.

By 1926 the work of generation and distribution of electricity throughout Tauranga Borough and County was complete. Dad was looking further afield for the exercise of this experience in civil and electrical engineering. In August of that year the family moved to Auckland where Dad established the consulting practice which he conducted for 47 years. Because Northland

beyond Whangarei was without power, Dad made many trips to the area to explore possibilities for hydro generation and the establishment of a power authority. Small hydro schemes were designed and constructed for the infant citrus industry at Kerikeri and for the Onekaka Steel Co in Golden Bay.

He became consultant mechanical and electrical engineer to Auckland Hospital Board as well as a number of public companies including NZ Newspapers. At the time all heating of hospitals, government and commercial buildings depended for heat distribution on the principle that hot water rises. From the boiler large pipes were fitted at carefully calculated gradients to facilitate the circulation of water. Dad invented and installed in the Auckland Star building a forced circulation system using a small pump and small diameter copper pipes. This system was proposed for use in the Auckland Hospital. But it was not approved until a Wellington based Health Dept engineer travelled to Auckland to inspect the Star installation - the first of its kind in NZ.

In 1929 Mr Allen Lee and Mr Cree Brown joined Dad in the long lasting partnership, Mandeno Lee and Brown. From the time our Auckland home was established in Highwic Ave our family were closely associated with Epsom Presbyterian Church where Dad served as an Elder for 45 years. In 1932 he was elected to One Tree Hill Borough Council and rendered service in this office for 25 years, the later years as Deputy Major. The depression which commenced in 1930 resulted in the virtual cessation of engineering work except mining. Thus, while Mother held the fort with her three sons and the financial assistance of four boarders, Dad was away in the South Island, for long periods exposed to extreme physical privation as he engaged in the design and construction of engineering works related to gold mining in Central Otago and Southland.

By 1935 the depression was lifting and engineering work was resuming. The Bay of Islands Electric Power Board was established in 1938. Construction of power lines was expedited by the importation of a pole erecting machine - the first to be used in NZ. It could dig a 6ft hole in 60 seconds and drop a 35ft pole in the hole. By 1939 350 consumers were receiving power in Kaikohe,

Kawakawa and Russell.

Kaitaia followed in 1940. Hokianga and Whangaroa Counties joined the power district in 1947. As well as taking power to the North Dad designed water and sewage systems for Kaitaia. Four hydro sites had been explored but no development of these was undertaken after government engineers decided to extend a high voltage line north from Whangarei.

Also in 1935 Dad become Consultant to the Wairere Power Board in Northwest King Country. Application of the single wire system resulted in the reticulation of an enlarged district notable as having the least number of consumers per mile of line of any power authority in NZ, A small hydro station on the Mokau river was enlarged and a new one designed and build on the Mokauiti stream. This was the first remote controlled power station in NZ.

In 1938 the King Country Power Board was established to provide electric power for the Taumarunui, Ohura and Kaitieke Counties. In 1961 a 6,000 kW station was designed and built on the Kuratau river at a cost of $1M. The design of this project included a rock fill dam - another first for NZ. Another challenging innovation in the King Country was the 11,000 volt supply to the chairlifts at an altitude of 7,000 ft on Ruapehu. Taupo was another district to benefit from Dad's advice. For 30 years he served the Taupo Town Board and Taupo Borough Council establishing an electric power supply system which included the first of three hydro stations on the Hinemaia in 1952, and a water supply system in 1957.

Other work in this period included the design of electrical and mechanical services for new hospitals in Auckland and Tauranga.

In 1965, at the age of 77, Dad was awarded the royal honour OBE for his services to the electric power industry. Surely he was entitled to retire with honour. But he still had in his mind the Mangapapa river which he had first explored 45 years earlier. This scheme, virtually a mini Tongariro project, would bring together the water of ten streams by a network of canals and tunnels, storage areas, dams and spillways. The water would pass through

three power stations to produce 32,000 kW. An Act of Parliament, 'The Tauranga City and Tauranga Electric Power Board Bill', authorised the creation of the Tauranga Joint Generation Committee which became the authority for the construction of Dad's project. Civil engineering called for 8.8 km of tunnelling through difficult country. For this work the first electric tunnelling machine to be purchased by a local authority in NZ was employed. The first section, opened by the Prime Minister John Marshall on 2 September 1972 bears the inscription,

"Name in honour of Lloyd Mandeno, OBE.
A pioneer in power development and utilisation".

At this time Dad was suffering from a painful fatal disease. Nevertheless he continued to supervise the Mangapapa project almost until his death at the end of 1973. The Lower Mangapapa station was commissioned in April 1979. It uses water discharged from Lloyd Mandeno station. Below this the Ruahihi station which uses Lake McLaren as its storage was commissioned in May 1981. The failure of the Ruahihi canal four months later has been shown to be due to a variation from Dad's original design and specification.

So the story of Lloyd Mandeno's involvement with a broad spectrum of engineering/electrical, civil, mechanical and mining - came to an end. The range of projects which he conceived and achieved now require teams of engineers. Lindsay Bell, one of his partners has written that he was an innovator. Rather than accept convention he preferred to try something new to his own design. All his projects were stamped with his unique individual approach to the problem in hand. Like all innovators, he aroused controversy amongst his many detractors and those far sighted ratepayers and councillors and board members who recognised his genius. He came under continual criticism, - some of it malicious, most of it ill informed. He bore it was amazing forbearance as he preserved with absolute dedication to serve the people whose needs he could meet. As Ken Stewart, Electrical Engineer Taupo Borough Council wrote after his death, "There never was a problem to defeat this remarkable engineer. Many of us, like myself, counted it a privilege to be associated with the 'Old Man'. There will never be another like him".

Dad's life was based on a deep rooted Christian faith which was constantly nurtured by his church involvement and by his private reading, which included theology, philosophy, archaeology, astronomy and world affairs. Because he spared little time for rest and recreation his health was seriously impaired during the 1930's. But he was nursed by his devoted wife. In later years his physical stamina was an embarrassment to younger men as they tried to keep up with him on a cross country traverse. On one occasion when I accompanied him on an exploration of the upper Waipa river I caught him slipping an anginine tablet under his tongue. I said to him, "Dad, your epitaph will be 'He died looking for a waterfall' ".

My mother was a most remarkable woman who bore cheerfully the burden of caring of a genius. Inevitably our life revolved around Mother because Dad was away so much - exploring, reporting and supervising the construction of the projects he had designed.

As he went off to do battle with obstructive government officials and difficult local body board members, she would say "Confound your enemies!". She helped him patiently in his disappointments, and shared proudly in his triumphs.

Her times of refreshment were when Dad was away, and these times she called her "Desert Isle". And always our home was warmed by the radiance of her love as she nurtured husband and her three sons.

How do we summarise the life and work of Lloyd Mandeno?

He was a modest person. He sought no honour for himself.

He would listen courteously to people with local knowledge, and pay generous tribute to the foresight and courage of community leaders who shared his vision of the benefits power would bring. Tauranga, Bay of Islands and Taupo are three areas in NZ whose rapid development followed by the ready availability of electrical energy. Many thousands of country women in NZ and

overseas have had the trials of pioneering in isolated places lightened by the supply of electric power. This has been made possible by the economical generation distribution and utilization of electricity by methods which originated in Tauranga.

THE END