Pencarrow Lighthouse
Wellington
CONSERVATION PLAN

December 2009
Prepared for the
New Zealand Historic Places Trust
with the assistance of the Department of Conservation
Pencarrow Lighthouse Conservation Plan

Prepared by Paul Cummack and Helen McCracken with Alison Dangerfield

for

the New Zealand Historic Places Trust / Pouhere Taonga and the Department of Conservation

December 2009

Cover. A group of people gathered in front of Pencarrow Lighthouse c.1900. (Alexander Turnbull Library, Kenneth Wilson Collection, F13602-F)
## Contents

1. **Introduction**  
1.1 Commission  
1.2 Executive Summary  
1.3 Management and Legal Status  
1.4 Acknowledgements

2. **History**  
2.1 History of Pencarrow Lighthouse  
2.2 Engineer – Designer - Edward Roberts, R. E.  
2.3 Engineer - Builder – Edward George Wright (1831-1902)  
2.4 Chronological Summary of Events

3. **Description**  
3.1 Setting  
3.2 The lighthouse

4. **Assessment of significance**  
4.1 Statement of cultural heritage significance  
4.2 Heritage inventory

5. **Influences on conservation policy**  
5.1 Terms of acquisition  
5.2 Objectives of Owner  
5.3 Compliance with the Historic Places Act 1993  
5.4 Compliance with the Reserves Act 1977  
5.5 Compliance with the Resource Management Act 1991  
5.6 Compliance with the Building Act 2004  
5.7 Compliance with the Health and Safety in Employment Act 1992  
5.8 Compliance with the Occupier’s Liability Act 1962  
5.9 Compliance with the Maritime Transport Act 1994  
5.10 Threats

6. **Conservation policy**  
6.1 General statement  
6.2 NZHPT General Policy for Historic Places  
6.3 Appropriate Conservation Standards - ICOMOS New Zealand Charter  
6.4 Extent of physical intervention  
6.5 Interpretation  
6.6 Future uses

7. **Building condition and work required**

8. **Future use**

9. **Maintenance**

10. **Bibliography**

**Appendix 1:** ICOMOS New Zealand Charter
<table>
<thead>
<tr>
<th>Appendix 2: Cast Iron and its use in New Zealand Lighthouses</th>
<th>81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix 3 - History of the Pencarrow Lantern Room and Light</td>
<td>84</td>
</tr>
<tr>
<td>Appendix 4 – Cast Iron and Paint Calculations</td>
<td>89</td>
</tr>
<tr>
<td>Appendix 5 - ICC Paint Coatings</td>
<td>90</td>
</tr>
</tbody>
</table>
1. Introduction

‘It would be a great pity to see this landmark go, and I for one should certainly be sorry to know that it was to be removed’, said a prominent local shipping man to a ‘Post’ reporter today. ‘It has a definite place in the hearts of many skippers and also, I imagine, with the public. Wellington has come to regard it as a historic building, and it would be a good idea, I think, for it to be kept as a national belonging. It is the oldest light in New Zealand, and something should be done to preserve it…. ’ Pencarrow Light – Oldest in Dominion - What Shall be its fate - Use as a Day-Mark, Evening Post, 19 January 1935.

1.1 Commission

This report is the result of collaborative research and documentation. Paul Cummack, then of Studio Pacific Architecture (SPA) was engaged by the New Zealand Historic Places Trust (NZHPT) in 2006, with assistance from the Department of Conservation, to investigate and comment on the existing condition of Pencarrow Lighthouse, using the report format set out in the NZHPT ‘Guidelines for Preparing Conservation Plans’.

The NZHPT separately commissioned a history to be included in this document. The history of Pencarrow Lighthouse was prepared by Peter Cooke, and revised and expanded by Helen McCracken, heritage consultant. The latter was aided by Emma Meyer and Paulette Wallace, who undertook research of material held in Archives New Zealand, Wellington.

The plan was substantially updated and revised by Helen McCracken and Alison Dangerfield, heritage advisor – architecture, NZHPT Central Region. Included in this revision was additional information on the predicted future maintenance of the building, with an emphasis on the special construction techniques required for a historic, graphite rich, cast iron lighthouse in an extremely harsh environment.

Figure 1-1 Photo of Pencarrow Lighthouse with trawler entering the harbour. (Paul Cummack, January 2006)

1.2 Executive Summary

The original Pencarrow Lighthouse is positioned at the mouth of Wellington Harbour, at the top of the cliffs at Pencarrow Head, and was officially commissioned on the 1st January 1859. It is of great heritage significance as it was the first permanent lighthouse established in New
Zealand, and one of the few remaining built structures erected by the Wellington Provincial Council.\(^1\)

An additional Lower Pencarrow Lighthouse was built at the base of the cliffs in 1906, and Pencarrow Lighthouse was decommissioned when a replacement lighthouse was built at Baring Head in 1935. Over the following few years all internal equipment was removed from lighthouse, the light being removed in 1941. This report does not cover the later Pencarrow lighthouse or beacon.

Pencarrow Lighthouse has been appropriately maintained. The cast iron panels, and the new paint coatings completed in 1980, when all old surface coatings were removed, have fared well, considering the severe environment and the propensity of the construction materials to rust. However there are areas of repair work that are essential to undertake and continue.

- Essential regular protective coatings should be applied. This work should be implemented by tradespeople with the appropriate skills, knowledge, and work experience, and with adequate observation. Professional consultation for paint system selection should continue to ensure a successful and long-term coating solution.

- Secondly, erosion of the ground surfaces around the lighthouse will continue to be of concern. The ground conditions which promote pooling water will need to be monitored long term and rectified. The effects on the internal moisture levels and subsequent loss of integrity of the historic building fabric need to be anticipated.

- Repairs to the material fabric of the lighthouse are essential to undertake as they become apparent on regular inspection. All parts of the lighthouse building fabric should be scrutinised for corrosion, damage ingress of water or other deterioration and steps taken to rectify without delay.

With maintenance items addressed, and with the continuation of a preventative maintenance programme, Pencarrow Lighthouse will remain as a well preserved structure.

### 1.3 Management and Legal Status

The Pencarrow Lighthouse and an area of 2044 square metres of land on which it is located, described as Section 3, Block V, Pencarrow Survey District, Part Proclamation 517577, S.O. Plan 25401, constitute an Historic Reserve under the Reserves Act 1977. The Pencarrow Lighthouse Head Historic Reserve is owned by the Crown and control and management is vested in the New Zealand Historic Places Trust (New Zealand Gazette 1979 p.211). The Department of Conservation is the administrator of the Reserves Act and has an overarching responsibility to ensure the reserve is managed effectively.

Pencarrow Lighthouse is registered as a Category I historic place by the New Zealand Historic Places Trust under the Historic Places Act 1993. The registration number is 34.

The Pencarrow Lighthouse is also listed on the Hutt City Council District Plan as a Heritage Building and Structure, Category 1, in section 14F, of appendix 1.

The Pencarrow Lighthouse has been recorded as an archaeological site by the New Zealand Archaeological Association. The site record number is R27/199.

The majority of the remains of the Pencarrow Lighthouse Station (including the lighthouse keepers' house built in 1871, and the grave of a lighthouse keeper's child) are outside the historic reserve and are on land managed by the Greater Wellington Regional Council (GWRC) as part of a recreation reserve included in the East Harbour Park.\(^2\) Any other features associated with the lighthouse station that may exist on the coastal margin strip below the lighthouse are on land owned and managed by the Hutt City Council.
Figure 1-2, Location of Pencarrow Head Historic Reserve (Courtesy: Terralink)
1.4 Acknowledgements

The authors would like to gratefully acknowledge a number of people who have assisted in the preparation of this report:

Ann Neill, David Watt, Alison Dangerfield, and Xanthe Howes of the NZHPT for facilitating information from NZHPT files.

Jim Foye, lighthouse engineer from Maritime New Zealand, for helping identify maintenance issues on-site.

Ken Belt, lighthouse engineer from Maritime New Zealand, for advice on painting cast-iron lighthouses.

Paul Cummack, who donated the completed measured drawings, using base information obtained from an architectural student employment scheme run by the Ministry of Works in 1979.

The following commented on various drafts of this report:

David Watt, area co-ordinator, Central Regional Office, NZHPT

Michael Kelly, heritage consultant

Elizabeth Cox, heritage destinations manager, central region, NZHPT

ENDNOTES

1 Helen McCracken., Register number 34, Pencarrow Lighthouse (Former). Historical narrative. Register of Historic Places. Completed 2001. (Page 7 – Historical Significance)

2. History

2.1 History of Pencarrow Lighthouse

Pencarrow Head Lighthouse, or more commonly known as Pencarrow Lighthouse, was New Zealand’s first permanent lighthouse. For 150 years it has been a feature of the entrance to Wellington Harbour, and for 75 of those years its light guided shipping into port.

Sometime prior to organised European settlement the headland was occupied by Maori. Archaeological evidence suggests the existence of a pa on Bluff Point, a promontory not far from the present day lighthouse. To the east of the headland midden and ovens, terraces have been recorded as well as karaka groves around Lakes Kohangapiripiri and Kohangatera. Although there is no evidence for Maori occupation where the lighthouse is located it can be assumed that the site was valued for the views of the entrance to the harbour and the coastal route connecting Heretaunga (Hutt Valley) with the Wairarapa.¹

After the arrival of New Zealand Company settlers in 1840 the coastline became a key route for the surveyors, explorers and pastoralists searching for new land to settle. In 1843 the first flocks of sheep to be introduced to the Wairarapa were driven around this headland. The new arrivals were to give the headland a new name. Pencarrow Head was named after Pencarrow, in Cornwall, England, the home of Sir William Molesworth, a director of the New Zealand Company.² It is named as such on Captain Edward Chaffers’ first map of Wellington harbour, dated 1839.³

As the infant New Zealand Company settlement of Wellington grew so too did the amount of shipping entering and leaving Port Nicholson.⁴ Many mariners, unaccustomed to the hidden dangers of the harbour and in the absence of detailed charts and navigational aids, struck trouble off Wellington’s treacherous reefs. By the end of the first year of the infant colony two ships had been wrecked at the harbour entrance for ‘want of pilots and a lighthouse’.⁵ However, building a lighthouse was not that simple.

At this time there was considerable debate over who should have responsibility for the construction and maintenance of lighthouses. The newly arrived settlers believed that they should have greater autonomy in the running of their affairs. However, the Colonial Office in England maintained that this was the role of central government through the office of the Governor. Colonial Secretary Willoughby Shortland did agree that a lighthouse would aid night-time passage into Wellington, but nothing was to come of it.⁶ In November 1841, the New Zealand Company offered to erect a lighthouse on Pencarrow Head at a cost of £1500, to be charged against future dues,⁷ but little came of the offer.⁸ The following month, Governor Hobson finally gave way to the settlers’ demands and passed the Ordinance for the Regulation of Harbours. This gave settlers at outports the right to erect beacons and lights. The ordinance was extended to Wellington in May 1842.⁹

In 1842, Wellington settlers raised a public subscription to erect two wooden beacons on both sides of the harbour entrance. The beacon on Pencarrow Head was described as an open three-sided pyramid, 21 metres high.¹⁰ A timber structure, it was soon demolished in a gale. By June 1844 another beacon had been built, this time funded by Governor Robert FitzRoy. Nine metres high, it was painted white and surmounted by a red flag.¹¹ Unfortunately the beacons didn’t bring an end to the loss of shipping, and the calls for a light continued, especially after 30 people were lost in the Maria off Terewhiti in July 1851.¹²
The construction of the Pencarrow Head Lighthouse

Following representations from members of the Wellington settlement, Governor George Grey agreed to meet the cost of a lighthouse, and initiated inquiries in England for one to be made and shipped to Wellington. The Colonial Engineer Edward Roberts R. E. inspected the site in April 1852, recommending an oil-burning light 10.6 metres off the ground and 122 metres above sea level. He recommended a ‘revolving white light of the second order [of brightness], on the dioptric or lenticular principle, or that by which the rays of light from the lamp are collected by lenses instead of being projected by reflectors.’ A cast-iron tower was recommended as a deterrent against Wellington’s known earthquake risks. The Governor approved this proposal on 6 May 1852. Edward Roberts’ Pencarrow lighthouse plans, which had been modified over time, were sent to England in March 1853 for quotations.

In the meantime a temporary keeper’s house had been built. This building, erected probably in 1852 or early 1853, served as a temporary lighthouse, the light and reflectors being in an enlarged front window. George White Bennett, a settler who farmed at Lowry Bay and who had previously worked as a clerk in Wellington was appointed the first lighthouse keeper. The lighthouse keeper’s family shared a two-roomed cottage, described as ‘a miserable shed’. In a heavy squall, wind and rain came in from all quarters and ‘it rocked and shook so much as to frighten the keeper and his family out of it’, at which point they retired to a covered dugout (with a stove) created for this eventuality.

Differences of opinion over design, site and cost between the General and Provincial Government delayed the project. A Select Committee hearing in July 1854 looked into the question of lighthouses throughout New Zealand, giving Wellington’s first priority. It also recommended control of harbour lights (as opposed to sea lights, such as proposed for Stephens Island in Cook Strait), be vested in Provincial Governments. The 1852 Constitution Act had previously ruled out Provincial Governments erecting sea lights and, while the Wellington government was delighted to accept ‘the entire responsibility of having erected the lighthouse’, central government held on to the belief that the action was bordering on illegal.
Notwithstanding what lawmakers in Auckland thought, Superintendent Dr Isaac Featherston seized the initiative and his Provincial Government finally ordered the permanent lighthouse in England in 1857, based on Roberts’ design. The original cost estimate had been £2600 (including a new keeper’s cottage), but Wellington’s Superintendent had been prepared to borrow up to £4,000 to include spare parts, freight and erection. The lighthouse was to be cast in iron in an octagonal shape, 4.42 metres in diameter at the ground. The light room was 6.25 metres above the ground, and the structure 10.36 metres in height overall. A bedroom for the duty keeper was to be built into the tower above the ground-floor workshop (though this was soon dispensed with). An internal ladder provided access to the lamp room, with a balcony outside the glass for cleaning.

Tenders were assessed in London by Roberts and the New Zealand agent John Gladstone, and accepted from Cochrane & Co of Woodside Iron Works, Dudley, for £2,435. Under Roberts’ supervision the lighthouse was largely complete by the end of December 1857. The firm prepared to send it to New Zealand – along with Edward G Wright to supervise its erection. On 21 June 1858, 480 packages containing the kitset lighthouse arrived in Wellington, per the barque *Ambrosine*. The 61 tonnes of parts were offloaded at Rhode’s Wharf, then reshipped (on a local brigantine *Caroline*) to the Heads in September. The heavier parts were dragged up the hillside on a tramway by steam-driven winch (though bullock teams had originally been envisaged doing this, on an enlarged track). This is a very early use of steam haulage in New Zealand. The existing beacon was dismantled (it occupied the proposed lighthouse site) and a temporary flagstaff erected with white flag and red ball to warn mariners. The weather (and therefore progress) was good, such that by 20 October the Provincial Government advised the General Government that the light would be ready on 1 January 1859. The Board of Trade was also notified (to alert ‘home’ vessels). Edward Wright stayed in New Zealand, rising to prominence in Canterbury (especially with the Christchurch Gas Company) until his death in 1902.

Much festiveness surrounded the inaugural illumination. Members of Wellington Assembly and guests were taken out to the Heads on the steamer *Wonga Wonga*, enjoying music, dancing and drink. Steamer were soon to surpass windjammers in carrying New Zealand trade, and Wellington had wanted to become the ‘acknowledged centre for steam service in the country.’ The light was lit at nightfall on New Year’s Saturday, 1 January 1859, competing only with a full moon. With much provincial pride, it heralded further development of the harbour – a deep-water wharf and quay-side reclamations following in the 1860s.

Once completed, the light was visible for 48 kilometres in ordinary weather (spanning Cook Strait, well into Cloudy Bay). The entire structure, weighing 61 tonnes, was bolted to an octagonal ring buried 80 centimetres into the ground and covered with masonry. It operated a system of eclipsing every two minutes (a small ‘eclipsing screen’ orbited the lamp on an arm, breaking the beam every two minutes before it entered the lenses). This clockwork revolving apparatus was removed in September 1859, leaving the beam a fixed one. Its cost had been over £5,700 though a later account has it at £6,422. The structure was painted white to also serve as a visual daytime beacon.

The Early Years: Wellington Provincial Government

The first principal keeper of the new Pencarrow Lighthouse was Mary Bennett, widow of George Bennett (who had drowned in 1855). Mary Bennett had taken on the role of lighthouse keeper following her husband’s death, making her the first woman in New Zealand to do so. When she was given principal responsibility for the new lighthouse, she became New Zealand’s first keeper of a permanent lighthouse. Mary Bennett was aided by a male assistant, William Lyall. Mary Bennett’s role is believed to have ended in 1865 (though her son William also served the light (as assistant) from 1880-85).

For its first four years the Wellington Provincial Council administered the lighthouse. In 1862 the Marine Board Act transferred control of the harbours and shipping in New Zealand from the Colonial Secretary to a chief Marine Board. This board was also responsible for the construction and maintenance of lighthouses on the coast. Responsibility for the Pencarrow Lighthouse was passed to the board in 1863. The Wellington Province’s role with Pencarrow
ended in 1865, when the lighthouse was sold to the General Government (which had moved its seat to Wellington). New lamps were installed four years later.

Shortly after the transfer, it was found that the land on which the Pencarrow Lighthouse stood was still owned by Maori, as it had been awarded to them by Colonel McCleverty following the adjustment of land claims. In the 1870s Major Charles Heaphy, commissioner for native reserves, undertook the negotiations to acquire the land for the government and to settle the rent for the period that the land had already been occupied.

The day to day running of the lighthouse.

The lighthouse keepers' living conditions were to improve with the construction of two new dwellings designed in the Colonial Architect's Office, headed by William Clayton. The contract to erect the cottages was awarded to Thomas D Scoular and R Archibald of Scoular & Archibald and specified that the dwellings were to be completed by 31 May 1871. Scoular & Archibald were employed by the government to build a number of buildings, the most notable being Government Buildings in Wellington.

![Image of dwelling houses and Pencarrow Lighthouse]

Figure 2.2, Lighthouse Keepers’ Cottages and (most likely) the schoolhouse at Pencarrow Lighthouse [ca.1910]. The dwellings were built in 1871 and demolished in 1963. F -112305-1/2, Alexander Turnbull Library, Wellington. Part of Hart, Roger: Photographs of Somes Island and other subjects (PAColl-5479, ATL).

Although located across the harbour from the settlement of Wellington, the lighthouse was not easily accessible. For many years supplies (including oil for the lighthouse and coal for domestic use) had to be brought by boat, which could be delayed for weeks on end by adverse weather. Once landed, the supplies would either be stored in the landing store or would be hauled up the cliff via a small tramway (the remains of which can still be seen today). They were then dragged across to the required location by horse. Everything brought onto the site required a degree of planning. In 1911 the keepers constructed a trolley with wooden wheels to convey the assistant keeper’s piano from the landing store to the foot of the tramline, and from the top of the tramline to his house. Food supplies were augmented by the keeping of hens, cow(s) and even a pig, as well as vegetable gardens. From at least the 1930s onwards the keepers made a weekly trip by horse along the coastal track to Eastbourne to collect supplies and mail. Tanks were built to hold water.

The remoteness of the lighthouse station meant that schooling of the keepers’ children had to be provided on-site in a purpose built school house. It is not known when the school was built,
but it was certainly open by April 1899 when it was reported that the inspector of schools had visited to examine the children. The number of students attending the school was boosted by children from the nearby sheep stations. For example, at the beginning of the new term in September 1910 there were 10 children attending, three children from the keepers' families, one from Edward Riddiford's station at Orongorongo and six from ‘Mr Lee’s at Wainui’.  

A sad reminder of the presence of children at Pencarrow is the grave of one of the lighthouse keeper’s children located just north of the station. The grave, surrounded by a picket fence, is marked by a plain wooden cross with the words ‘In memory of Evelyn Woods, 9 March 1896, 6 years, 11 March 1896.’ The current picket fence may date to August 1928 when there is a record of the keepers constructing a small picket fence around the grave. In 1949 the Marine Department received an enquiry from a H.G. Lawrence who was researching the history of the eastern shores of Wellington. He had come across a reference to an entry in the *Evening Post* recording the death of an infant daughter of Sidney and Sarah Woods aged 7 months and 28 days and wanted clarification on the child’s name and age. In 1984 the NZHPT received a further enquiry regarding the identity of the child buried at Pencarrow. The Registrar General confirmed that an ‘Evelyn Violet Amy Wood, aged 7 months’ died on 9 March 1896.

Daily maintenance of the lighthouse involved keeping the all-important lenses clean and the light mechanism working. Initially the illuminant used was the relatively new colza oil (rapeseed oil). This was changed to paraffin when doby burners were introduced. Over 40 years of burning oil to illuminate the light took its toll on the lantern. By 1891 the glass panes of the lantern had assumed a yellow amber colour, and it became necessary to obtain new panes from England. These panes of plate glass (1.25 centimetres thick) arrived in Wellington by *S.S. Doric* 10 March 1892.
In January 1907 the illuminant was again changed, this time to kerosene, when an incandescent apparatus was installed. When the latter was introduced it was lauded by the Principal Lighthouse Keeper who reported that ‘it is a very brilliant light and a great improvement on the light shown from the old lamp and the consumption of oils is less than half a gallon and one point per night.’ However, a few days later the keeper’s correspondence records that they had problems maintaining the lamp at full power. The problems continued. At one point the feed valve broke and stopped the flow of oil to the condensing tubes and rendered the light useless. For two nights the keepers had to use an old paraffin lamp. Later that year they had to use an old kerosene lamp.

Less regularly, but of no less importance, was the maintenance brought about by the harsh environment. Rust was one of the main concerns. In 1912 the keepers requested a new door for the lightroom and new iron shields for the outside of the ventilators as they had rusted. Seven years later, in 1919, it was reported that the revolving cowl and ventilators of the tower needed repairs. The iron floor of the tower basement was rusted through in places, and rats gained access to the tower through holes. The iron balcony door and the dormer panes were rusty and in bad condition. The tower needed chipping clear of paint where the coating was cracked, and red lead was used to paint over where the iron was exposed.

Seven years later, in 1919, it was reported that the revolving cowl and ventilators of the tower needed repairs. The iron floor of the tower basement was rusted through in places, and rats gained access to the tower through holes. The iron balcony door and the dormer panes were rusty and in bad condition. The tower needed chipping clear of paint where the coating was cracked, and red lead was used to paint over where the iron was exposed.

Painting both the tower (as it was referred to in the correspondence and journals of the keepers) and the surrounding buildings was a common task at the station.

The harsh environment, and particularly the windswept nature of the site, brought other problems. In 1902 the Principal Keeper reported that they were making asphalt paths around the dwellings and laying a strip around the tower, the foundations of which had been exposed. In March 1908, the keepers requested 30 yards of coconut matting for the lighthouse floor to cut out the drafts that made the lighthouse bitterly cold. The daily journals record the efforts made to protect the dwellings from the harsh winds. In 1910 the keepers requested an assortment of native shrubs to plant on the south side of the Principal Keeper’s dwelling, in the hopes that they would grow quickly and break the southerly wind. In 1913 five chimneys were destroyed in a gale. In the following year the keepers tried erecting break winds to protect the gardens.

Another threat was the risk of lightning striking the tower. In 1919 the keepers requested that ‘a lightning conductor to be put on the tower, there is not one at present and this being an iron tower it is somewhat dangerous. Keeper got a nasty shock the other night while pumping oil into the container.’

Although wind was a major factor there were also days when fog obscured the cliff-top light from shipping. When the nearly constant sea temperature is warmer than the fluctuating temperature of the rocky sea cliffs, a southerly wind will bring sea fog to the top of the cliffs. In response, an audible guncotton fog signal was established beside the lighthouse in 1898 with a range of 11-12 kilometres. This was eventually replaced in 1927 by a compressed-air diaphone signal.

Visibility was rarely impaired at sea level, so a second light or beacon was built at the bottom of the cliffs by the Wellington Harbour Board in 1906. Construction of the lighthouse, known as Lower Pencarrow, required blasting the top of outlying rocks. The new tower was positioned so that both lighthouses could provide a day mark to locate the linear extent of the dangerous rocks along the south coast of Wellington. Approaching shipping could then time their turn around the rocky reefs of Sinclair Head and Thom’s Rock in Cooks Strait. Refer figure 2-4 below.

From lighthouse to day marker

From as early as the mid 1920s there had been discussions regarding the closure of the Pencarrow Lighthouse Station in favour of a new light elsewhere. Growing suburbs on Wellington’s hills led to increasing light pollution and the risk of Pencarrow’s fixed beam being indistinguishable to ships seeking the entrance. Also the location was now considered too close to harbour-mouth hazards, such as rocks and reefs, and larger faster vessels were starting their run-in for the entrance from further out in Cook Strait. With the idea that
Pencarrow would eventually be replaced, maintenance on the dwellings was reduced to what was absolute necessary. According to Helen Beaglehole in her book *Lighting the Coast*, by the late 1920s there was little consensus among the ship owners, government officials and the Wellington Merchant Service Guild as to whether a new light was required. The latter, along with small boat owners, favoured extending the range of the lower Pencarrow lighthouse and retaining the original upper Pencarrow light. However, the ship owners wanted a new light.\(^55\)

![Figure 2-4](image)

*Figure 2-4. The relative position of the lighthouses ensures the safe bearing and course of a ship around the south coast of Wellington. When Pencarrow Lighthouse (Former) is to the right or south of the lower Pencarrow lighthouse, (As in sketch 'B') ships will miss the rocks on Wellington’s south coast.*

In 1932 the Marine Department finally commissioned a replacement light to be situated at Baring Head, and from which the Karori Rock light to the west could also be sighted.\(^56\) The Baring Head light was lit for first time on 18 June 1935, the day after Pencarrow was decommissioned.\(^57\) However, the lighthouse at Pencarrow Head was to be maintained as a day marker and some personnel stayed on at Pencarrow to operate the fog horn.

The light apparatus remained in the lighthouse until the early years of the World War II. In 1941 concern was raised that the firing of the guns from the recently constructed coastal battery at Godley Head, Banks Peninsula, would damage the delicate light apparatus of the Godley Head Lighthouse. In addition, the position of the lighthouse was considered a hindrance to the operation of the guns. It was decided to demolish the lighthouse and build a temporary structure lower down Godley Head. Instead of using the Godley Head apparatus, the old second order lantern from Cape Foulwind was erected on a high concrete base to house the second order fixed lens from Pencarrow Head. The light apparatus at Pencarrow was removed at the end of 1941, and the new light (albeit temporary) first shone at Godley Head on 8 January 1942.\(^58\) The current location of the Pencarrow light apparatus is uncertain at this time. (See Appendix Three for more information).
Maintenance of the Pencarrow lighthouse station was kept to a minimum and practically no maintenance was carried out during World War II. By the mid 1940s the keepers were complaining about the living standards at the station. One particular complaint was that the wash house where the bath was located was 18 metres from the dwellings. The wash house was unlined and draughty and 'almost precludes bathing during the winter months.' In 1946 it was decided that establishment of the light at Baring Head would not enable the Marine Department to do away with the Pencarrow fog signal. The Public Works Department, who were asked to carry out an inspection of the dwellings, reported that 'the existing dwellings are worth renovating and repairing to give a 'reasonable standard of comfort for the men in charge of Pencarrow.' Repairs were eventually undertaken during 1947 and 1948.

Maintenance of the tower was also kept to a minimum. In 1951 the Principal Keeper reported that the woodwork of the frames in the middle and bottom floors of the tower were rotten and letting in water. In the lightroom the floor on the inside of the doorway which opens on to the balcony had rusted through. The bottom floor was also rusted through. In 1957 the roof of the tower received a coat of paint along with a number of other buildings on the site. A year later a request was sent for paint for the spare house and tower. The keeper also reported that the tower needed 'a good clean up inside as it's not been looked after for some time now. For as you are aware the later keeper did let the station go and it's up to me to get the place cleaned up.'

One item of maintenance that featured in correspondence was the previously mentioned lightening conductor (described as a 2 inch steel cable running from the tower to the beach, at the tower end). In February 1948 the keepers reported that a piece was missing from the dome down to the front of the tower where the steel cable had rusted and broken away from the tower. The cable went down the cliff to the beach. At about the high water mark the cable had rusted right through and they could not find any sign of the earth plate. For at least the next three years this situation remained unchanged. Interestingly, images of the lighthouse taken at this time (or perhaps slightly later) show the lantern partially boarded up, as well as the tower windows covered. It is not known when this occurred.
In 1953 the Hutt Valley Drainage Board was given approval to enter the lighthouse reserve and to construct an access roadway. In 1956 the Drainage Board needed to widen the road to lay pipes. As a result a section of the rail (trolley track) needed to be removed altogether. The keepers were concerned that this would leave a big drop and make it almost impossible
to load coal from the bottom. It was proposed that the track at the south of the station could easily be made wider with a bulldozer and the track could be cut right up to the house, meaning that supplies could be driven right up to the station.\textsuperscript{70} It is not known whether this happened.

**Pencarrow Lighthouse - historic place**

In February 1959 a plaque was erected on the site, marking 100 years since the light first shone. It was unveiled by the Minister of Marine, Hon. W. A. Fox, and the event was recorded by the New Zealand Broadcasting Service. The ceremony was attended by a number of guests including A. C. Bennett, the grandson of the first lighthouse keepers. The event also celebrated the site being the first in Wellington to be officially marked by the recently formed National Historic Places Trust. The lighthouse was recognised as an historic place under the Historic Places Act 1954.

In that same year the Wellington Harbour Board replaced the fog horn mechanism with an automated device using the existing fog horn tower. There was now no longer any need to man the Pencarrow station. The Marine Department began the process of disposing of the site. By August 1960 the last keeper had been transferred from the station, the buildings secured and the land and buildings were either transferred or in the process of being transferred to the Lands and Survey Department.\textsuperscript{71} The lighthouse was to be retained as a day marker.

In 1963 all the station buildings were demolished. This included the cowshed, fowl houses, two timber frame dwellings, wash house and tank stands. Material was either carried away by contractors or burnt and buried on site.\textsuperscript{72}

Without the resident keepers the lighthouse became an easy target for vandalism. A report completed in 1965 found that four windows were broken at the top of the tower. The main door had been burnt off and missing.\textsuperscript{73} The floor was rotten in places, and the pit (or weight well) housing the original chain gear had been uncovered.\textsuperscript{74} The NHPT plaque was also missing from the base of the tower outside the main entrance.\textsuperscript{75} In response it was decided to secure the lighthouse both from the threat of vandals and in the interests of public safety. It was recommended that the lens panes be fixed with 1/8" iron plates which were to be painted white. The main entrance doorway was to closed with 3/16" iron plates on 2"x2" angle irons and painted white. The openings of the well housing (both top and bottom) were to be covered. It was considered that the handrail fence and posts on the path to the tower were beyond repair and should be removed from the site. Finally the two concrete water tanks were to be broken open at bottoms and allowed to drain out, so that they would not be a danger to the public.\textsuperscript{76} This work was probably carried out in the latter half of 1966 and early 1967.\textsuperscript{77} It may have been at this time that the ventilators were removed from the first floor. Historic images of the lighthouse dating to at least the early 1900s show ventilators on two of the first floor 'windows' as well as ventilators for the lamp room. The ventilators still appear in images as late as 1959. Today the ventilators on the first floor have become windows.\textsuperscript{78}

**The New Zealand Historic Places Trust 1966 - today**

In 1966 the Marine Department finally decided that the tower was no longer required, as it was considered that there were enough aids in navigation available in the approaches to Wellington Harbour to safely guide vessels in and out. The Marine Department had approached the NHPT as early as 1960 to take on the lighthouse. However, the latter was uncertain of the title and status of the lighthouse and the surrounding land. The NHPT was happy to take on responsibility for the tower as long as the land remained in the ownership of the Crown.\textsuperscript{79} Finally, in November 1966, the offer of the Marine Department to transfer ownership of the Pencarrow Lighthouse to the renamed New Zealand Historic Places Trust (NZHPT) was accepted.\textsuperscript{80} The Minister of Marine consented to the transfer the following month.\textsuperscript{81}

When the NZHPT was first established it had no specific policy (or indeed money) to acquire properties.\textsuperscript{82} Instead it had initially focused on recording and placing plaques. In 1959-1960
the NZHPT made its first acquisitions. However, it was not until the mid-1960s with the commissioning of the Waimate Mission House restoration, the acquisition in 1966 of Pompallier House, Russell, Old St Paul’s Wellington, and Hurworth, New Plymouth, that the NZHPT began to acquire and develop a portfolio of properties. Between 1965 and 1975 the NZHPT acquired most of its properties. The transfer of Pencarrow Lighthouse to the NZHPT was during this period.83

Figure 2.8, Maintenance work on Pencarrow Lighthouse - Photograph Taken by Ian Mackley [ca 7 March 1980], EP/1980/0706/19A, Alexander Turnbull Library, Wellington.
One of the main issues the NZHPT faced with its new responsibility at Pencarrow was the high level of maintenance required to protect the tower from the weather and the ongoing vandalism. Not long after the NZHPT took over management the lighthouse was sealed against entry. NZHPT correspondence from the period 1967 to 1974 details the various efforts to weatherproof the building. At the end of 1974, the building was once again broken into and it was discovered that the tower roof was leaking.

In 1975 the Ministry of Works undertook an inspection of the lighthouse. The tower was found to be in a ‘very bad state of repair’ including the main door having been ripped of its hinges. It was eventually decided that the Ministry of Works would undertake the necessary repairs. The work proposed included repairs to the concrete base, repairs to spouting and panels, repair of steelwork (doors, floors etc), complete sandblasting of the structure and painting. However, the work did not go to plan. In the middle of 1976 concerns were raised that the Ministry of Works was not carrying out the work to the specification. It is difficult to ascertain what work was carried out from the records held by the NZHPT. There is a hand written note on the NZHPT file which suggests that the ground floor was concreted at this time, and steel plates placed on top. The note makes the comment that the ground floor ‘originally had wooden chocks supporting steel beams.’

By the middle of 1977 the NZHPT wrote to the Ministry of Works stating that the progress of the repairs was unsatisfactory. In response a new restoration programme was drawn up by the Ministry of Works and Development. The restoration programme involved considerable repair and replacement of fabric. The work included repairing doors, installation of new floor plates (top and ground floor), a new galvanised balustrade utilising some of the old components, installation of new windows and a new ladder, reglazing of the lighthouse lantern using 12mm armour tough glass, new down pipes, sandblasting and finally painting. To enable the work to be completed the access road to the lighthouse had to be upgraded. The entire work, completed in December 1980, was estimated to cost $27,000 – but the final cost is not known.

At the same time the restoration programme was being carried out, moves were underway to gazette the historic reserve. In about 1975 a joint report was prepared by the Department of Lands and Survey and the Wellington Regional Planning Authority on the proposed Pencarrow Regional Park. Part of this report considered the land status of the lighthouse reserves. Finally in 1979 the lighthouse was included in a historic reserve of 2044 square metres, (Section 3, Block V, Pencarrow Survey District). The remaining land of 14.3158 hectares was set aside as a Recreation Reserve. The NZHPT was appointed to control and manage the historic reserve.

Since the 1980s the NZHPT has undertaken a regular painting programme. In 2000 a condition report was prepared by Salmond Architects, which identified a number of repairs required. In the following year Strait Engineering repaired the ladder, reglazed the lantern sections and undertook further repairs to the doors. An annual programme of external maintenance has been carried out since 2001.

In February 2008 it was found that the roof had corroded to such an extent that the copper roofing and selected rafters had to be replaced. At the same time, the iron ceiling and weather vane were repaired. Wall panels were also repaired and replaced where necessary. The work was undertaken by by Arfi Architectural Roof & Façade Innovations.

On 1 January 2009 the NZHPT celebrated Pencarrow Lighthouse’s 150th anniversary. A series of events was held over Wellington Anniversary weekend, including a reunion of the family of Mary Jane Bennett, the opening of on-site information panels by Chris Finlayson, Minister for Arts, Culture and Heritage, and a walk and guided tour.
2.2 Engineer – Designer - Edward Roberts, R. E.

Not a great deal is known about Edward Roberts, R. E., the engineer who designed the Pencarrow Lighthouse. According to F. W. Furkert, Roberts was a civilian member of the Royal Engineers who was sent to New Zealand in 1847 to undertake work for the military - primarily the construction of barracks. In 1850 he won a competition with his plans to rescue the first Hutt River Bridge. He was later awarded the contract to design the second Hutt River Bridge when the first was destroyed by the 1855 earthquake.

In January 1851 he was seconded to the New Zealand Government as Colonial Engineer. In that year he prepared plans for improving Wellington’s harbour, including the first government reclamation. In 1851 he began preparing plans for a lighthouse at Pencarrow Head. In February 1852 he called for tenders for the Wellington gaol to be built at Mount Cook. In 1853 he sent his plans for the Pencarrow Lighthouse to England to obtain quotes on the necessary materials. In 1856 he returned to England, this time on the Provincial Government (est.1853) payroll. Roberts supervised the manufacture of the lighthouse. However, the construction of the lighthouse in New Zealand was undertaken by E. G. Wright (see below), who came to New Zealand especially for the purpose. It is not known what happened to E. G. Roberts after this time, although it is assumed that he returned to his Royal Engineer duties and never returned to New Zealand.92

2.3 Engineer - Builder – Edward George Wright (1831-1902)

Edward George Wright was born in England in 1831. In 1847 he joined Fox, Henderson and Company, a firm of engineers and contractors and in 1853 he was appointed engineer in charge of the construction of Rome’s gasworks. He later worked in England on the naval dockyards.

In 1857 Wright and his family emigrated to New Zealand following his engagement by the Wellington Provincial Government to oversee the construction of the Pencarrow Lighthouse. When the lighthouse was completed in 1859, Wright took up the position of director of harbour improvements and public works at Hawke’s Bay. In 1862 he moved to Christchurch setting up in business as a private engineer and contractor. In that same year Wright helped found the Christchurch Gas Coal and Coke Company, and, as its first engineer, was responsible for the switch from oil to gas for lighting Christchurch. He was the company’s chairman from 1877 until his death in 1902. Wright was also responsible for building many of Canterbury’s roads and bridges, as well as the West Coast Road, and the Ashburton to Rangitata section of the South Island main trunk line.

Wright became a large landowner in the Ashburton area and in 1879 became the member of the House of Representatives for Coleridge (1879-81) and, later, Ashburton (1881-84, 1890-93 and 1896-99). He was also involved in a number of local bodies and other organisations, including a member of the Lyttelton Harbour Board, the Ashburton County Council, North Canterbury Education Board and the Christchurch Drainage Board. He died at his Windermere property on 12 August 1902.93
### 2.4 Chronological Summary of Events

<table>
<thead>
<tr>
<th>DATE</th>
<th>EVENTS</th>
<th>COMMENTS</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>June/July</td>
<td>Modification of door – ventilation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>January 2009</td>
<td>Celebration of 150 years since construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb 2008</td>
<td>Roofing maintenance contract</td>
<td>Work undertaken by Arfi Architectural Roof &amp; Façade Innovations, Hartmut Reichelt, MD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Copper roofing and corroded rafters replaced; iron ceiling &amp; wall panels repaired and where necessary replaced, diagonal braces repaired, vane repaired</td>
<td>Scaffolding braced off lantern balcony Stairs covered while work undertaken</td>
<td></td>
</tr>
<tr>
<td>Sept 2007</td>
<td>Wash down &amp; surface preparation</td>
<td></td>
<td>Year 1 PMS</td>
</tr>
<tr>
<td></td>
<td>Resene ArmourZinc 110 to bare iron</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resene Armourchlor HB-P intermediate coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resene Polymeric AV-8 to spot primed area</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resene Polymeric AV-8 full topcoat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 2007</td>
<td>Contract PMS for 6 year maintenance programme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb 2007</td>
<td>Geotechnical assessment by A G Mahoney, Connell Wagner</td>
<td>Assessment and options for correction of ground water issues</td>
<td></td>
</tr>
<tr>
<td>Jan 07</td>
<td>Paint coating assessment by John Kilby, Corrosion Consultant</td>
<td>Recommended coating system for lighthouse</td>
<td></td>
</tr>
<tr>
<td>Mid 2006</td>
<td>Last maintenance delayed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb 2006</td>
<td>Adhesion Tests undertaken.</td>
<td>Top coat has little adhesion, and is delaminating with tape only.</td>
<td>Paul Cummack, SPA</td>
</tr>
<tr>
<td></td>
<td>Dry Film Thickness readings.</td>
<td>Typically around 1100 to 1250 µm. Waiting table of test areas.</td>
<td>Bill Koelman</td>
</tr>
<tr>
<td>2004</td>
<td>Timber ladder removed and placed in NZHPT Antrim Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 2004</td>
<td>Washed down. Spot primed with chlorinated rubber system.</td>
<td>Spot paint rust spots only. Resene Transcoat, Armourchlor, then AV8</td>
<td>Year 4. PMS cyclic maint.</td>
</tr>
<tr>
<td>July 2003</td>
<td>Washed down. Spot primed with chlorinated rubber system.</td>
<td>Spot paint rust spots only. Resene Transcoat, Armourchlor, then AV8</td>
<td>Year 3. PMS cyclic maint.</td>
</tr>
<tr>
<td>June 2002</td>
<td>Washed down. Spot primed with chlorinated rubber system.</td>
<td>Spot paint rust spots only. Resene Transcoat, Armourchlor, then AV8</td>
<td>Year 2. PMS cyclic maint.</td>
</tr>
<tr>
<td>June 2001</td>
<td>Exterior ladder repaired, Glazed lantern sections, doors??</td>
<td>Includes both top door, &amp; entrance door.</td>
<td>Strait Engineering</td>
</tr>
<tr>
<td>June 2001</td>
<td>Washed down. Recoated with chlorinated rubber, AV8</td>
<td>Quantities. (June 2001-PMS)</td>
<td>Year 1. PMS cyclic maintenance</td>
</tr>
<tr>
<td></td>
<td>Partial second coat of AV-8 then ‘Mr Blobby’ painted on lighthouse.</td>
<td>68 litres, Resene AV-8, for recoats.</td>
<td>Ian Bowman</td>
</tr>
<tr>
<td></td>
<td>Blobby paint stripped then third (or 2(^{nd})) coat of AV-8. Total, 250-375 µm</td>
<td>8 litres lumbesider, for concrete.</td>
<td></td>
</tr>
<tr>
<td>DATE</td>
<td>EVENTS</td>
<td>COMMENTS</td>
<td>SOURCE</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>May 1989</td>
<td>Waterproof layer coated over path.</td>
<td>Emken Industries Emerclad 1989 Spec, J.H.</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>Classified as an Historic Place under the Historic Places Act 1980</td>
<td>Registration number 34</td>
<td>NZHPT. 2001 McCracken Helen.</td>
</tr>
<tr>
<td>1979</td>
<td>Historic Reserve gazetted</td>
<td>Historic Reserve of 2044 square metres. (Section 3, Block V, Pencarrow Survey District) set aside. (Remaining land of 14,3158 hectares set aside as Recreation Reserve). NZHPT appointed to control and manage the reserve.</td>
<td>NZG 1979, p.211</td>
</tr>
<tr>
<td>1978</td>
<td>3mm of paint on lighthouse.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1974-1980</td>
<td>Major restoration work undertaken by Ministry of Works.</td>
<td>Work included repairing doors, installation of new floors, repair of balustrade, installation of new windows and a new ladder, reglazing of the lighthouse, sandblasting and painting.</td>
<td>NZHPT 12016-015</td>
</tr>
<tr>
<td>December 1970 – January 1971</td>
<td>Failure of weatherproofing</td>
<td>Further weatherproofing undertaken by Ministry of Works. Previous method of repair thought to be unsuccessful, proposal made to make the lighthouse weather tight with a metal sheeting.</td>
<td>NZHPT 12016-015</td>
</tr>
<tr>
<td>DATE</td>
<td>EVENTS</td>
<td>COMMENTS</td>
<td>SOURCE</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>February 1969</td>
<td>Weatherproofing</td>
<td>Weatherproofing undertaken by Ministry of Works Carpentry Workshop Staff, Trentham.</td>
<td>NZHPT 12016-015</td>
</tr>
<tr>
<td>1966-1967</td>
<td>Repairs made after vandalism and general deterioration of lighthouse.</td>
<td>Building sealed against entry. Upper level windows shuttered in two cases and a further two given metal hoods to allow air circulation and still prevent entry of weather and access to interior.</td>
<td>AAPR W3282 M1 8/45/14 ANZ NZHPT 12016-015</td>
</tr>
<tr>
<td>November 1966</td>
<td>Transfer from the Marine Department to NZHPT</td>
<td></td>
<td>NZHPT 12016-015</td>
</tr>
<tr>
<td>1965</td>
<td>Report of Vandalism</td>
<td>Four windows broken at top of tower. Main door burnt off and missing. Floor rotten in places. Pit housing the original chain gear uncovered. NZHPT plaque missing from the base of the tower outside the main entrance.</td>
<td>AAPR W3282 8/45/14 ANZ (18 June 1965)</td>
</tr>
<tr>
<td>1964</td>
<td>Fire at Pencarrow</td>
<td>Report of fire started at base of door.</td>
<td>AAPR W3282 8/45/14 ANZ</td>
</tr>
<tr>
<td>1963</td>
<td>Pencarrow Lighthouse Station closed down</td>
<td>All buildings demolished (cowshed, fowl houses, two timber frame dwellings, wash house, tank stands). Material either carried away by contractors or burnt and buried.</td>
<td>M1 8/45/11 ANZ</td>
</tr>
<tr>
<td>1960</td>
<td>Transfer of Land from Marine Department to Lands and Survey (Crown Lands Department)</td>
<td></td>
<td>NZHPT. 2001 McCracken Helen</td>
</tr>
<tr>
<td>February 1959</td>
<td>Centennial Celebrations and recognition by National Historic Places Trust</td>
<td>Plaque erected on the site to mark 100 years since the light first shone. Recognised as an historic place under the Historic Places Act 1953.</td>
<td>M1 8/45/14/1 ANZ</td>
</tr>
<tr>
<td>1958</td>
<td>Fire at Pencarrow</td>
<td>Wash house destroyed by accidental fire.</td>
<td>M1 8/45/11</td>
</tr>
<tr>
<td>1957</td>
<td>Maintenance</td>
<td>Schoolhouse, harness shed, top store room, ammunition hut and roof of old tower painted.</td>
<td>Outward Correspondence 1956-59 (ML-Pencarrow 3/6)</td>
</tr>
<tr>
<td>1947-1948</td>
<td>Renovations and repairs to dwellings and associated buildings/structures</td>
<td>Work included new concrete water tank, work on dwellings including (installation of bath and wash house in each, concrete coal bunkers), old cow shed demolished, two stall cow bail built, old landing store on beach demolished and new store built, new hen house for</td>
<td>M1 8/45/11 ANZ</td>
</tr>
<tr>
<td>1941-1942</td>
<td>Lens removed from Pencarrow Lighthouse</td>
<td>The lens at Pencarrow was dismantled by the Public Works Department and installed at Godley Head. The light first shone at Godley Head on 8 January 1942.</td>
<td>AAPR 8/45/14 W3282 ANZ M 8/30/13 prt. 2, ANZ</td>
</tr>
<tr>
<td>1935</td>
<td>Light ceases operation.</td>
<td>Replaced by Baring Head lighthouse.</td>
<td>NZHPT. 2001 McCracken Helen</td>
</tr>
<tr>
<td>DATE</td>
<td>EVENTS</td>
<td>COMMENTS</td>
<td>SOURCE</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1933</td>
<td>Maintenance</td>
<td>Hinges replaced on tower door</td>
<td>Daily Journal, – 1933-1934, ML-Pencarrow 1/5, ANZ</td>
</tr>
<tr>
<td>1931</td>
<td>Maintenance</td>
<td>Lenses and lantern panes changed</td>
<td>Daily Journal, 24 Nov 1930-21 Dec 1931, ML-Pencarrow, 1/2, ANZ (12 December 1931)</td>
</tr>
<tr>
<td>1928</td>
<td>Fire accidentally started on edge of reserve</td>
<td>‘Keepers spent nearly 3 hours beating at the fire which was got under control within less than 100 yards from the oil store.’</td>
<td>M 1 8/45/15 ANZ, (25 March 1928)</td>
</tr>
<tr>
<td>1927</td>
<td>Explosive-type fog signal ceases operation.</td>
<td></td>
<td>NZHPT. 2001</td>
</tr>
<tr>
<td>1916</td>
<td>Addition to school</td>
<td>Built by Principal Keeper ‘will be a great improvement.’</td>
<td>Outwards Correspondence 1898-Dec 1920, ML-Pencarrow 3/1</td>
</tr>
<tr>
<td>1916</td>
<td>Station upgraded to third grade</td>
<td>Upgrade was requested by the keepers (17/3/1916) because extra workload (same as Godley Head). Agreed to by Public Service Commissioner (13/4/1916). Keeper to receive a yearly allowance of £10.</td>
<td>Outwards Correspondence 1898-Dec 1920, ML-Pencarrow 3/1</td>
</tr>
<tr>
<td>1914</td>
<td>Landscaping</td>
<td>Concrete laid at the at the back of the dwelling houses and break wind erected around the gardens.</td>
<td>Outwards Correspondence 1898-Dec 1920, ML-Pencarrow 3/1, 1 December 1914</td>
</tr>
<tr>
<td>1907</td>
<td>Incandescent Apparatus installed</td>
<td>The illuminant changed from paraffin to kerosene.</td>
<td>George Tanner, M1 8/45/14/1 ANZ</td>
</tr>
<tr>
<td>1906</td>
<td>New lighthouse or beacon built at the base of Pencarrow.</td>
<td>Built by the Wellington Harbour Board. Required the blasting the top off outlying rocks.</td>
<td>NZHPT. 2001</td>
</tr>
<tr>
<td>1898</td>
<td>Explosive-type fog signal begins operation.</td>
<td>Explosive cotton-powder fog signal established on cliff below lighthouse. 11 July 1898.</td>
<td>George Tanner, M1 8/45/14/1 ANZ NZG 1898, p.1057</td>
</tr>
<tr>
<td>DATE</td>
<td>EVENTS</td>
<td>COMMENTS</td>
<td>SOURCE</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>1892</td>
<td>Replacement of glass lantern panes</td>
<td>In 1891 discovered that glass panes were assuming a yellow amber colour with age, and it became necessary to procure new panes from England. These panes of ½ inch plate glass arrived in Wellington by S.S. Doric 10 March 1892.</td>
<td>George Tanner, M1 8/45/14/1 ANZ Evening Post 5 June 1935</td>
</tr>
<tr>
<td>1873</td>
<td>General Government acquires land from Maori living at Petone</td>
<td>Following acquisition from Provincial Government in 1865 it was discovered that land was originally set aside by Colonel McCleverty in 1849 for Maori at Petone. General Government required to purchase land and pay rent for the period that the site had been occupied.</td>
<td>George Tanner, M1 8/45/14/1 ANZ</td>
</tr>
<tr>
<td>1871</td>
<td>Tenders invited to erect new dwellings at Pencarrow (24 January 1871)</td>
<td>The contract to build two cottages at Pencarrow Heads for lighthouse keepers was let to Thomas D Scoular and R Archibald of Scoular &amp; Archibald. The dwellings were designed in the Colonial Architects Office, headed by William Clayton. The contract specified that the dwellings were to be completed by 31 May 1871. [Note: the firm of Scoular &amp; Archibald were employed by the government to build a number of buildings, the most notable building being Government Buildings in Wellington.]</td>
<td>George Tanner, M1 8/45/14/1 ANZ W32 Box 2 CA 331 ANZ Pencarrow Dwellings Specifications</td>
</tr>
<tr>
<td>1865</td>
<td>Pencarrow Lighthouse acquired by the General Government from Provincial Government.</td>
<td></td>
<td>George Tanner, M1 8/45/14/1 ANZ</td>
</tr>
<tr>
<td>1862</td>
<td>Act transfers control from Wellington Provincial Council to Marine Board</td>
<td></td>
<td>NZHPT. 2001 McCracken Helen</td>
</tr>
<tr>
<td>1 September 1859</td>
<td>Light no longer subject to eclipses</td>
<td></td>
<td>NZG 1859, p.71</td>
</tr>
<tr>
<td>1 January 1859</td>
<td>Lighthouse officially came into operation.</td>
<td>Lighthouse Keeper, Mary Bennett, wife of previous lighthouse keeper.</td>
<td>NZHPT. 2001 McCracken Helen</td>
</tr>
<tr>
<td>Feb 1858 to June 1858</td>
<td>Lighthouse shipped out from England on the barque Ambrosia.</td>
<td></td>
<td>NZHPT. 2001 McCracken Helen</td>
</tr>
<tr>
<td>July 1857</td>
<td>Tender for Lighthouse officially accepted.</td>
<td></td>
<td>NZHPT. 2001 McCracken Helen</td>
</tr>
<tr>
<td>June 1857</td>
<td>Lantern in temporary lighthouse bow window changed from ‘black’ oil to ‘sperm’ oil.</td>
<td>Burnett, NZHPT, 1979 [ Pg 8, ref (30) ]</td>
<td></td>
</tr>
<tr>
<td>1853</td>
<td>Plans and specifications for lighthouse developed.</td>
<td>For a Light with a total height of 34 feet, for a top ‘Light room’ middle ‘bedroom for the keeper or his relief’ and lower ‘storeroom and workshop’</td>
<td>Burnett, NZHPT, 1979</td>
</tr>
<tr>
<td>ca1852</td>
<td>Temporary House, with ‘bow’ window where lamps could be added to act as a ‘light’.</td>
<td>Burnett, NZHPT, 1979</td>
<td></td>
</tr>
<tr>
<td>1844</td>
<td>Beacon erected on Pencarrow Head</td>
<td>Beacon described as 37 ft high, painted white, and surmounted by a red flag.</td>
<td>NZG 1844, p. 115</td>
</tr>
</tbody>
</table>

Key,  PMS cyclic maint.  Programmed Maintenance Services cyclic maintenance.
4. For a detailed history of the efforts to construct the lighthouse, see Robert Burnett, ‘Pencarrow Lighthouse’ Records & Classification Committee proceedings, NZHPT, unpublished TS, 1979[?], held on NZHPT 12016 015.
13. ‘Correspondence Relative to the Harbour Lighthouses’ in *Proceedings of the Provincial Council of Wellington*, 1857, session 5.
18. Entry Book of Outwards Letters, 1 April 1857, p.230, Wellington Province (WP)6/1, ANZ, Wellington
21. Deputy Superintendent to Colonial Secretary, 20 October 1858, 60/530, Internal Affairs (IA) 1/174, ANZ, Wgtn
22. Furkert, p.299; Roberts is believed to have stayed in England.
24. This actually took it beyond the horizon.
26. *Correspondence relating to the Lighthouse on Pencarrow Head*, in *Proceedings of the Provincial Council of Wellington*, 1857, Session 6, p.235; AJHR, 1897, H31, p.6. This later figure may include maintenance.
32. Most of the information for the following section comes form the journals and outward correspondence of the Principal Keepers of Pencarrow Lighthouse, starting in 1898 and ending in the 1960s.
33. Tenders invited to erect new dwellings at Pencarrow (24 January 1871) Pencarrow Dwellings Specifications, W32 Box 2 CA 331 ANZ.
34. Principal Keeper to the Secretary, Marine Department Wellington, 30 September 1911, Pencarrow Outwards Correspondence 30 September 1898 – 6 December 1920 (ML-Pencarrow 3 1) ANZ.
35. A pigsty was built December 1931, Daily Journals, ML-Pencarrow 1/2, ANZ.
36. Daily Journals (1930-1958), ML-Pencarrow 1/1 - 1/23, ANZ.
37. Principal Keeper to the Secretary, Marine Department Wellington, 30 April 1899, Pencarrow Outwards Correspondence 30 September 1898 – 6 December 1920, ML-Pencarrow 3/1, ANZ.
38. Principal Keeper to the Secretary, Marine Department Wellington, 1 September 1910, Pencarrow Outwards Correspondence 30 September 1898 – 6 December 1920, ML-Pencarrow 3/1, ANZ.
39 1 August 1928, Pencarrow Outwards Correspondence 1 March 1928 – 1 April 1935, ML-Pencarrow 3/2, ANZ.
40 H.G. Lawrence to Marine Department, 17 June 1949, M1 8/8/40, ANZ.
41 Registrar General to C Ross, Advisory Officer, NZHPT, 6 June 1984, NZHPT file 12016-015.
42 Beaglehole, 2006, p.42.
43 George Tanner, M1 8/45/14/1 ANZ, and Evening Post 5 June 1935.
44 Principal Keeper to the Secretary, Marine Department Wellington, 17 June 1949, M1 8/8/40, ANZ.
45 Principal Keeper to the Secretary, Marine Department Wellington, 6 June 1984, NZHPT file 12016-015.
46 29 February 1912, Outwards Correspondence 1898-Dec 1920, ML-Pencarrow 3/1, ANZ.
47 J Ballons to ? 16 November 1919 and 1 December 1919, AAPR 8/45/14 W3282 ANZ, and M1 8/45/11 ANZ.
48 Principal Keeper to the Secretary, Marine Department Wellington, 31 August 1906, Pencarrow Outwards Correspondence 30 September 1898 – 6 December 1920, ML-Pencarrow 3/1, ANZ.
49 Principal Keeper to the Secretary, Marine Department Wellington, 11 November 1919, Pencarrow Outwards Correspondence 30 September 1898 – 6 December 1920, ML-Pencarrow 3/1, ANZ.
51 Evening Post 5 May 1927.
52 See correspondence on file March 1947-1948, M1 8/45/11, ANZ.
53 1 March 1957, Outward Correspondence 1956-59, ML-Pencarrow 3/6, ANZ.
54 24 November 1958, M1 8/45/11, ANZ.
55 16 August 1960, AAPR 8/45/14 W3282 ANZ.
56 This may have happened in 1964, see AAPR W3282 8/45/14, ANZ.
57 A weight well is a cylindrical pit in the centre of the tower foundation designed to house the descending clock work counter weight as it rotates the lantern.
58 Twice in the 1960s this plaque (and a replacement) was removed from the building by vandals, and on one occasion it was found in a Newtown second-hand dealer’s shop. Director NZHPT to District Commissioner of Works, 15 Sept 1981, NZHPT 12016-015.
The report describes seven small windows, four in the middle (or first floor) floor and three on the ground floor. In 1977 it was considered that only one had its original oak frame. The Ministry of Works and Development specifications required that six new frames be made up to match the original one exactly and then glazed with 6mm toughened plate. Although the windows were replaced, it is not known whether the original window frame remains. See Pencarrow Lighthouse Restoration Programme, prepared by C. C. Cochran (Architect) and J.R. Drabble, MOWD, attached to correspondence dated 13 December 1977, NZHPT 12016-015.

89  Director General, Department of Lands and Survey, to Director, NZHPT, 15 April 1975, NZHPT 12016-015.
90  NZG 1979, p.21.
92  Furkert, pp. 251-252.
3. Description

3.1 Setting

Location

Pencarrow Lighthouse is located on Pencarrow Head about eight kilometres south of Eastbourne. On its west and south facing flanks the headland rises abruptly to 130 metres above sea level and overlooks the entrance to Wellington Harbour. On its east and north facing flanks the slope is gentle before falling away. Immediately around the lighthouse the ground is severely eroded. Elsewhere the headland is primarily covered in long grass with the occasional gorse bush.¹

Positioned at the highest point of the headland, the lighthouse is far more prominent and has a much greater geographical range compared to other lower locations at the mouth of the harbour. The lighthouse is visible from numerous parts of the city and from a large part of Cook Strait, east of the Wellington Harbour mouth. Figure 3-1 shows how height plays a vital part in the placement of a lighthouse. Pencarrow had a geographical range ‘… in ordinary weather (of) up to 30 English miles.’²

![Diagram of Geographical Range](image)

*Figure 3-1, Definition of Geographical Range as the height on the hill increases. Source: New Zealand Marine Department Lighthouse Service. Technical Manual and Maintenance Instructions, Wellington, 1970, Fig 3, Geographical Range, section 5.68, 1.3.1>*

Associated structures and archaeological remains

As well as the lighthouse, there are a number of structures and archaeological remains associated with the lighthouse station and earlier occupations located on or near Pencarrow Head.³ (See Figure 3-2 for an aerial overlay of archaeological sites associated with the lighthouse.) To the north east of the lighthouse are the terraces on which the lighthouse station buildings, including dwellings, stores and school house, were located. On the far south western point of the headland are the remains of the tramway and winding engine foundation. Approximately 170m north of the lighthouse is the marked grave of the child of a lighthouse keeper. These sites are located outside the historic reserve, and are managed as part of a recreation reserve by the GWRC. (The fence around the grave has recently been repainted.
and the site weeded. Maintenance methods have been discussed with the NZHPT Regional Archaeologist.)

The New Zealand Archaeological Society (NZAA) has identified a large number of sites (28) associated with Maori occupation along the nearby coastline and inland to the west of the lighthouse near lakes Kohangapiripiri and Konangatera. These sites include karaka groves, pits, ovens, terraces, stone rows and middens. In the immediate vicinity of the lighthouse there are four sites of note. These are two pa (R27 64 and R27 65) and two midden (R27 110 and R27 111). These sites are listed on the Hutt City District Plan.

<table>
<thead>
<tr>
<th>Map/Site No.</th>
<th>Description</th>
<th>Easting/Northing</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINZ Map R27-HDP#199.</td>
<td>Pencarrow Head Lighthouse</td>
<td>2664700/5981400</td>
</tr>
<tr>
<td>LINZ Map R27-HDP#64</td>
<td>Pencarrow Head Pa</td>
<td>2664900/5981700</td>
</tr>
<tr>
<td>LINZ Map R27-HDP#65</td>
<td>Pencarrow Head Pa</td>
<td>2664900/5981000</td>
</tr>
<tr>
<td>LINZ Map R27-HDP#110</td>
<td>Pencarrow Head Midden</td>
<td>2664800/5981700</td>
</tr>
<tr>
<td>LINZ Map R27-HDP#111</td>
<td>Pencarrow Head Midden</td>
<td>2664700/5981200</td>
</tr>
</tbody>
</table>

**Features on Pencarrow Head**

A  Pencarrow Lighthouse  
B  Path leading north from the lighthouse  
C  House Platform and drain  
D  Ditch  
E, F, G  Terraces on the eastern slope  
H  House platform c 1870  
I  Midden  
J  Dump  
K  Possible terrace  
L  Grave

*Figure 3-2 From Simon Duff, ‘Pencarrow Lighthouse Archaeological Assessment’ NZHPT, May 2006. Aerial View of Pencarrow, Alison Dangerfield, 2006*

Note that in 2008, four interpretation panels were installed on site. These are located: just past the stile at the bottom of the hill; below the gravesite (C above); on the house site (H above); and on one of the terraces (F above).
3.2 The lighthouse

Pencarrow Lighthouse consists of one unitary two storey high octagonal drum, with a glass lantern room and a copper roof above. The lighthouse's considerable height was required to reduce reflection from the ground. According to early records, the lighthouse was split into three levels; the ground floor workshop and entry, the second floor bedroom, and the third top level for the lantern room, deck and light.

Figure 3-3: Pencarrow Lighthouse Floor Plan (Barnes & Vause, architectural students on Ministry of Works Architectural Student Employment Scheme, 1979)
Figure 3-4: Pencarrow Lighthouse Elevation (Paul Cummack, 2006)
Figure 3-5: Pencarrow Lighthouse Section (Barnes & Vause, architectural students on Ministry of Works Architectural Student Employment Scheme, 1979)
Figure 3-6 (above): Lantern level (second floor) north view. (Alison Dangerfield, 2007)

Figure 3-7: Lantern level (second floor) looking south-west, A Dangerfield, 2007
The building materials are consistent over the two lower rooms, and are as follows:

<table>
<thead>
<tr>
<th>Building material</th>
<th>Where used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast iron</td>
<td>Walls and floors</td>
</tr>
<tr>
<td>Wrought iron</td>
<td>Interior items in tension e.g. braces and stair string</td>
</tr>
<tr>
<td>Timber</td>
<td>Stair treads, drum windows, roof sarking</td>
</tr>
<tr>
<td>Concrete</td>
<td>Poured around existing cast iron floor joists</td>
</tr>
<tr>
<td>Copper</td>
<td>Roof cladding</td>
</tr>
<tr>
<td>Bronze</td>
<td>Window mullions</td>
</tr>
</tbody>
</table>

**Cast Iron**

**Central Column, Floor and Wall Structure:** Pencarrow Lighthouse is made up of rows of flat cast iron wall plates, each with a gusseted flange fixed to a central column. The parts are bolted together to form a tapering octagonal cylinder. Radial joists support the first floor, the second lantern floor and (until removed) the clockwork mechanism and lens.

On the ground floor, eight cast-iron floor joists span radially from a central cast iron hollow cylindrical column. Segmented steel plates attach to the joists to form an enclosed space. At first floor level, four more rows of plates are added and another radial array of floor joists are fixed to the cylindrical column, supporting the floor above. Timber windows and doors are fitted in the panels as required.
Above the lantern room floor there is another row of eight more flat cast iron plates, with each plate made shorter so that cast iron cantilevered posts can be sandwiched between each panel. These posts cantilever up past the lantern room glass to the gutter at the roof eaves.

Due to the taper of the lighthouse each row of panels is a slightly different shape, and with panel variations for the door and windows the lighthouse required 144 cast iron pieces, made from 26 different timber moulds or patterns. Most of the cast iron pieces would have been constructed using a timber pattern sandwiched between sand moldings. After the sand had set, the timber pattern would have been removed, creating a cavity that was the exact negative of the shape required. This cavity would be filled with molten cast iron.

**Roof Structure:** The cast iron gutters are structural, and have mortice and tenon end joints to house the radial rafters that form the octagonal pyramid roof. The rafters are connected to a hollow circular cowl collar, of approximately 300mm in diameter, that allows for a ventilation cowl and wind vane to provide circulated air to the top centre of the lantern room. In early 2008 work to repair the copper roof revealed extensive corrosion of the radial rafters to the point of complete structural failure. The rafters were replaced.

**Balcony:** Cast iron balcony brackets have been bolted to the joints between the cast iron panels below the lantern room. Cast sheets of balcony grating are inlaid between the brackets, providing a mounting for the cast newel posts, cast balcony handrail, and balcony uprights.

Figure 3-9: Pencarrow Lighthouse, middle level, A Dangerfield, 2007

Figure 3-10: Pencarrow Lighthouse, lower level, A Dangerfield, 2007
Figure 3-11: Pencarrow Lighthouse, Exploded Axonometric, P Cummack 2006

Figure H6 Exploded Axonometric
Cast iron pieces only shown.
Shows construction of lighthouse.
One segment of the octagonal cylinder of the lighthouse is exploded out from the lighthouse, then exploded again to show each individual part.
Each part was imported from England as a kit to be bolted together.
The overly large central cylinder, and the long spindly lantern room posts and rafters where altered in later designs.
Wrought Iron

Braces: Since cast iron is brittle, wrought iron braces, with hammer marks still visible, were used for the elements under tension inside the lantern room.

Balcony Rails: The exterior balcony rails would most likely also have been of wrought iron construction, but these no longer remain.

Stair Stringers: Wrought iron was also used for the ladder sides or stringers. The ladder has angle brackets fixed with heated rivets, closed with a dolly (a portable anvil used to clench a heated rivet). Timber steps would have then been added to the brackets.

Figure 3-12: Pencarrow Lighthouse, lantern level, A Dangerfield, 2007

Timber

Stairs: The timber steps on the internal ladder are well worn, but in reasonable condition. Some steps have been turned upside down to provide an additional wearing surface.

Sarking: Timber sarking below the roof providing support for the copper pan roof above was repaired and partially replaced during 2008 roofing maintenance.

Windows: The shape of the timber mouldings on the original windows would typically include some decoration or fluting. A sunken chamfer was common, together with a rebate to accept the glass. Planted stops were not used on exterior windows as they leaked when the paint broke down. Because of this, it must be assumed that these windows are a modern addition. They also match the profile drawn in 1979 by Tim Barnes and Peter Vause when they were students at Victoria University School of Architecture, and employed under a scheme operated by the Ministry of Works at that time. The windows can be internally glazed, but would be prone to leaks, as they rely solely on paint and sealant to provide weatherproofing.
Copper and Bronze

Cowl and Weather vane: The copper ventilation cowl was made from a copper spherical dome and boxed leeward facing intake, which revolves to always face leeward away from the wind. Both are mounted on a fixed tapering hollow copper cylinder. The rotating shaft is extended for a copper weather vane above. The cowl, vane and central pivoting arm inside this cowl received attention during the 2008 roof maintenance.

That the cowl itself spun freely in the wind when checked in early 2006 but was inoperable by 2007 suggests that regular checks and maintenance of this feature will be necessary.
Roof: Triangular copper pans covered all eight sides of the roof. These pans were turned up at the ridge and down at the gutter. The pans were 1300mm wide at the base at the gutter and 1950mm high measured along the fall of the roof with fixings at 100mm centres. The copper was hand beaten and by 2008 required extensive attention to its corrosion. The copper pans have been replaced with new copper gauged to match in 2008.

Glazing Bars: Bronze transoms (horizontal bars) are rebated on both sides to accommodate the glass that spans between the transoms and cast iron cantilevered posts. A copper shallow ‘U’ glazing cover holds the glass, glazing gaskets (‘U’ shaped), and sealant into the edge rebates. These covers do not seem to fit well.

Glass

The lighthouse is glazed in part. Typically, glass panes were replaced with steel panels on the land side of the lighthouse. The gasket and sealant fixing system used typically on other lighthouses has not been followed here, and the steel panels have started rusting at the edges.

Twelve millimetre thick float glass was found on the ground near the lighthouse. An early 1980s report recommended the replacement of the existing glass, which on other lighthouses is typically 6mm thick, with 12mm float to reduce damage by vandalism.

Concrete Slabs

A concrete slab has been poured over the structural hold down bolts on the lowest row of cast iron wall panels. Steel plates have been laid over this concrete slab. The hold down bolts cannot be checked visually even though they are one of the most important structural components of a lighthouse.

Internal Equipment

All the interior equipment, including lens, lanterns, kerosene and oil tanks, maintenance equipment, and clockwork turning mechanisms, has been removed.

Internal Moisture

The moisture content of the internal steps was used as a diagnostic measure or barometer of the average internal environment of the lighthouse over the last few weeks. Readings were taken on 16 February 2006 after an extended period of warm summer weather with no rain.

<table>
<thead>
<tr>
<th>Level</th>
<th>Wall Panel Row Number above ground</th>
<th>Moisture Content on timber step 300mm away from cast iron</th>
<th>Moisture Content on timber step 100mm away from cast iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2</td>
<td>8</td>
<td>14%</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14%</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>15%</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td>Level 1</td>
<td>4</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>20%</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18%</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>16%</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16%</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20%</td>
<td>30+%</td>
</tr>
<tr>
<td>Ground</td>
<td>30+%</td>
<td>30+%</td>
<td></td>
</tr>
<tr>
<td>Concrete Floor</td>
<td>85 RH+</td>
<td>85 RH+</td>
<td></td>
</tr>
</tbody>
</table>
The timber moisture readings, expressed as a percentage, show that excessive dampness, most likely from condensation on the inner face of the cast panels, is forming in the lighthouse. Investigations were completed on where this water comes from.

On the ground floor one piece of tread plate was loose and was able to be lifted to expose the concrete below. With the dampness clearly visible, the relative humidity (RH) of the concrete would be greater than 85 RH +.

T.A Oxley, in his ‘Dampness Spectrum’ notes that levels around or above 24% of moisture will lead to inevitable decay. A ‘dampness spectrum’ shown below illustrates different ways of expressing water concentrations in various materials. Other references confirm that these elevated moisture levels will lead to inevitable decay.

**Figure 3-14, Dampness spectrum.** From Oxley, T.A. and Gobert E.G., *Dampness in Buildings – Diagnosis, treatments, instruments*, Butterworths, London, 1983

**Foundation and Soils**

The expansive clay soils around the lighthouse have severely eroded away, to a depth of about 300mm below the underside of the newer concrete strip foundations. This depression is collecting water and further softening the clays, thus accelerating the erosion cycle. The rest of the hill is naturally sloped, and thus free draining, and was dry in the summer of the inspection.

Historically there has almost certainly been an issue with the undermining of the lighthouse foundations. In 1902 the Principal Keeper reported that they were making asphalt paths around the dwellings and laying a strip around the tower, the foundations of which had been exposed. It is not clear whether the addition of the concrete foundation skirt, added in about 1980, has exacerbated the problem.

In our studies we have not found out how the lighthouse was anchored to the ground. No original construction drawings exist. In ca.1857 Edward Roberts, of the Royal Engineers Department, noted that ‘...to give added strength to the building and to concentrate its weight as close to the base as possible, the structure ought to be bolted to an octagonal iron ring, buried two feet eight inches in the ground and covered with masonry.’

With the repairs at roof level the levels of rain ingress will be much reduced. Ground stabilisation work around the immediate environ of the lighthouse will also have a positive effect. The moisture levels of materials would be expected to reduce over a period of time. Comparative assessment should be undertaken to determine the improvement.
Latest Paint Layers

Following some breakdown of the paint coating, evident in 2006, the NZHPT engaged a corrosion consultant for advice on the appropriate care of the lighthouse.

Earlier painting has often been to a higher standard. Reviewing the checks made on the 1989 recoat work, T.Slinn, in his 1989 paint inspection report notes that the 1989 painting was ‘…a highly satisfactory job…’ and certainly the NZHPT are still benefiting from this some 15 years later.

The reasons for paint failure were determined as pinpoint corrosion, corrosion expansion and adherence of the top coat. Subsequently consultant’s recommendations for the paint system (including annual wash down and coating maintenance schedule) have been contracted to Programmed Maintenance Services.

ENDNOTES

1 Simon Duff, ‘Pencarrow Lighthouse Archaeological Assessment; Report prepared to assess the impact of proposed foundation improvements’ NZHPT, May 2006
3 For a summary of the known archaeological features in the immediate area of the lighthouse see Simon Duff, ‘Pencarrow Lighthouse Archaeological Assessment; Report prepared to assess the impact of proposed foundation improvements’ NZHPT, May 2006
4 Cummack, Paul . Pencarrow Site Visit Notes. Feb 2006
7 Principal Keeper to the Secretary, Marine Department Wellington, 31 August 31 1902, Pencarrow Outwards Correspondence 30 September 1898 – 6 December 1920 (ML-Pencarrow 3 1), ANZ.
4. Assessment of significance

4.1 Statement of cultural heritage significance

The following statements of cultural heritage significance are based on the criteria used in Greg Bowron and Jan Harris, Guidelines for Preparing Conservation Plans, NZHPT, 2000.

Historic Value
The Pencarrow Lighthouse is positioned at the mouth of Wellington Harbour, at the top of the cliffs at Pencarrow Head, and was officially commissioned on the 1st January 1859. It is of great heritage significance as it was the first permanent lighthouse established in New Zealand, and one of the few remaining built structures erected by the Wellington Provincial Council.

It was built to increase the safety of shipping using Cook Strait and in particular vessels entering and exiting Wellington Harbour, one of the most dangerous of all the country’s harbour entrances. It was intended to give confidence to shipping traffic to use the harbour, which was essential to the future prosperity of the city and region. The lighthouse played a considerable part in reducing shipping losses over the period of its use. It set the scene for a network of lighthouses that eventually dotted the coastline, playing a huge part in improving and maintaining maritime safety.

The lighthouse is closely associated with a century of occupation and use by keepers and their families in what was a harsh and difficult place to live, made all the more so by the tantalising visual proximity of Wellington. While the difficulties of lighthouse station life were shared with most other stations, Pencarrow is especially significant for the six years that Mary Bennett spent as the first keeper following the death of her husband. She was the country’s first permanent lighthouse keeper of either sex, a remarkable feat in Victorian New Zealand.

It has been managed as an historic monument by the NZHPT since 1966. This tenure is significant for several reasons. Firstly, it has ensured the long-term preservation of the lighthouse. Secondly, as the manager of the lighthouse for over forty years, the NZHPT dominates over a quarter of the history of the lighthouse. Lastly, the lighthouse was acquired during the early years of the NZHPT and as such is forms an important part of the history of the NZHPT and, in particular, the NZHPT’s role as a guardian of some of New Zealand’s most significant and outstanding historic places.

Aesthetic Value
Lighthouses are seen by many people as inherently aesthetic structures, occupying, as they generally do, dramatic and beautiful coastal locations. Pencarrow is no exception; perched above the rocky shore, with its simple but brilliantly white form set against the backdrop of hills and mountains. The building itself is not flamboyantly decorative, as many Victorian structures are, but its utilitarian appearance is perfectly suited to its environment and aspect and is broadly typical of lighthouse design in New Zealand. Its solitary and uncluttered setting, viewed from a range of places throughout Wellington, also adds to its aesthetic value.

Social Value
Pencarrow Lighthouse had keeping staff associated with it until 1960, so there are undoubtedly people still alive who had a personal connection with the light when it was performing an (albeit limited) function. Since then, the lighthouse has had no permanent staff associated with it, with the exception of those from the NZHPT. The most significant social value today is derived from the general public attachment to the lighthouse. Those who visit the lighthouse or view it from a distance are familiar with it as a landmark, as an historic place and as an enduring symbol of the country’s attempts to make its coastline safe.

The descendants of Mary Bennett recently honoured her life as part of the 150th celebrations of the lighthouse, demonstrating the pride that her extended family takes in her achievements.
Scientific Value

Pencarrow Lighthouse is a fine example of Victorian engineering. It is both pleasantly designed and superbly constructed. Each cast iron jig saw piece fits accurately and neatly together, showing a high level of skill, especially in the planning and preparation of the moldings. The quality of its construction is evident by the fact that it stands in good repair 150 years after it was erected. There are few buildings of this age in New Zealand, and even fewer made of cast iron. The building can therefore tell us much about Victorian engineering and cast-iron manufacture and construction.

4.2 Heritage inventory

Degree of significance:

For the purposes of this plan it is considered that three degrees of significance are sufficient to delineate the status of the fabric at Pencarrow Lighthouse. Most of the structure is of such an age and integrity that it can be regarded as of exceptional significance. In general, later restoration, particularly that undertaken in 1976-80, can be regarded as being of some significance, in that it ‘restored’ the appearance and form of fabric that had decayed or been removed. All other items are regarded as of little or nil significance.

A Exceptional significance, space, elevation or element is original or early fabric
B Some significance, space, elevation or element a later addition or replication
Neg. Negative significance, space, elevation or element intrusive or historically inaccurate

Tabulation of cultural heritage value:

The following table lists each exterior and interior space or elevation, their ranking and a description of what is significant about each of them.

<table>
<thead>
<tr>
<th>SPACE / ELEVATION</th>
<th>RANK</th>
<th>DESCRIPTION OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior walls</td>
<td>A</td>
<td>Some minor changes, otherwise as original and of exceptional significance</td>
</tr>
<tr>
<td>Lantern Room - exterior</td>
<td>A</td>
<td>Some changes but overall fabric is of exceptional significance</td>
</tr>
<tr>
<td>Roof</td>
<td>A/B</td>
<td>Largely replaced in 2007-08.</td>
</tr>
<tr>
<td>Concrete pad</td>
<td>Neg.</td>
<td>Laid in 1980</td>
</tr>
<tr>
<td>Level 1 room</td>
<td>A</td>
<td>Original space of exceptional significance; some alterations to floor, some other modifications</td>
</tr>
<tr>
<td>Level 2 room</td>
<td>A</td>
<td>Original space of exceptional significance</td>
</tr>
<tr>
<td>Lantern</td>
<td>A</td>
<td>Original space of exceptional significance; some modifications</td>
</tr>
</tbody>
</table>

The following table lists lighthouse elements, their ranking and a description of what is significant about each of them.

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>RANK</th>
<th>DESCRIPTION OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast Iron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wall Panels</td>
<td>A</td>
<td>Some replaced in 2008</td>
</tr>
<tr>
<td>Floor joists</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Cylindrical column</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Balcony</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Lantern Room</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Gutter</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Rafters</td>
<td>B</td>
<td>Replaced in 2008</td>
</tr>
</tbody>
</table>
### Wrought Iron

<table>
<thead>
<tr>
<th>Material</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braces</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Balcony uprights</td>
<td>Neg</td>
<td>Later addition of incorrect material, leading to maintenance problems</td>
</tr>
<tr>
<td>Interior Ladder</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Exterior Ladder</td>
<td>B</td>
<td>Replaced in the 1976-1980 restoration</td>
</tr>
</tbody>
</table>

### Timber

<table>
<thead>
<tr>
<th>Material</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber Steps</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Timber Windows</td>
<td>Neg</td>
<td>Later addition, ‘internal’ detailing adapted and used outside. Relies on paint and sealant. Can lead to problems if paint and sealant not 100% maintained.</td>
</tr>
</tbody>
</table>

### Copper and Bronze (Glass)

<table>
<thead>
<tr>
<th>Material</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation Cowl</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Pyramid pan roof</td>
<td>B</td>
<td>Replaced in 2008</td>
</tr>
<tr>
<td>Capping</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Transoms</td>
<td>A</td>
<td>Original fabric of exceptional significance</td>
</tr>
<tr>
<td>Glass Panels</td>
<td>B</td>
<td>May be a recent replacement of a thicker glass, due to vandalism.</td>
</tr>
<tr>
<td>Concrete Interior</td>
<td>Neg</td>
<td>Evidence shows this concrete, most likely added later, is corroding the cast iron</td>
</tr>
<tr>
<td>Floor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Influences on conservation policy

5.1 Terms of acquisition

The New Zealand Historic Places Trust (NZHPT) Board agreed to accept the transfer of Pencarrow Lighthouse into their care as a building of historic interest at its meeting of 9 November 1966. Confirmation of the Minister of Marine’s consent to transfer the Pencarrow Lighthouse to the NZHPT ‘for safe keeping and preservation’ was given on 2 December 1966. In 1979 the NZHPT was appointed to control and manage on behalf of the Crown the historic reserve on which the lighthouse is situated.

5.2 Objectives of Owner

Although the owner is the Crown, the NZHPT manages the lighthouse in its role as New Zealand’s leading national historic heritage agency. The work of the NZHPT is shaped by the Historic Places Act 1993, the purpose of which (subsection 4(1)) is:

> to promote the identification, protection, preservation, and conservation of the historical and cultural heritage of New Zealand.

It should be noted that the NZHPT is currently considering possible options for creating a revenue stream from this property.

5.3 Compliance with the Historic Places Act 1993

In achieving the purposes of the Historic Places Act 1993 (HPA), the NZHPT is required to recognise the following in all of its work (subsection 4(2) of the HPA):

(a) The principal that historic places have lasting value in their own right and provide evidence of the origins of New Zealand’s distinct society; and (b) The principle that the identification, protection, preservation, and conservation of New Zealand’s historical and cultural heritage should take account of all relevant cultural values, knowledge and disciplines; and (i) Take account of material of cultural heritage value and involve the least possible alteration or loss of it; and (ii) Safeguard the options of present and future generations; and (iv) Be fully researched, documented and recorded, where culturally appropriate; and (c) The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wahi tapu, and other taonga.

Under section 115(2) the Historic Places Act must continue to be interpreted and administered to give effect to the principles of the Treaty of Waitangi, unless the context otherwise requires.

Part I – Protection of Historic Places

The lighthouse together with its curtilage is an archaeological site under Part I of the HPA. Under section 11, authority to modify such a site would be required.
Part II – Registration of Historic Places, Historic Areas, Wahi Tapu, and Wahi Tapu Areas

The Pencarrow Lighthouse is registered a Category I historic place under section 23(2) of the HPA. Category I means that the place is of special or outstanding historical or cultural heritage significance or value.

Part III – New Zealand Historic Places Trust (Pouhere Taonga) and Board of Trustees

The general functions of the NZHPT (or ‘Trust’ in the legislation) in section 39 of the HPA include (39(1)(e)):

To manage, administer, and control all historic places, buildings, and other property owned or controlled by the Trust or vested in it, to ensure the protection, preservation, and conservation of such historic places, buildings and other property.

The management of historic places by the NZHPT contributed to other general functions of the NZHPT listed in section 39 of the HPA, including advocating heritage conservation and protection, fostering public interest and involvement, and furnishing information, advice and assistance.

The powers of the NZHPT in section 54 of the HPA include (54(2)(c), (g) and (j)),

(c) Acquire, restore, conserve, and manage historic places and historic areas, or assist any person or organisation to acquire, restore, conserve, and manage any such area or place;

(g) Enter into agreements with local authorities, corporations, societies, individuals, or other controlling bodies for the management, maintenance, and preservation of any historic place or historic area;

(j) Make accessible to the public, charge fees for admission, lease or let, or use for any suitable purpose, any lands or buildings vested in the Trust or under its control.

Section 57 of the HPA (57(1)) requires the preparation, adoption and amendment of one or more statements of general policy for the management, administration, control, and use of all historic places owned or controlled by the NZHPT or vested in it. A draft policy has been prepared by the NZHPT (see Section 6.2 of this plan).

Section 58 specifically applies to conservation plans. Under subsection 2 the NZHPT shall:

(a) Publicly notify the availability of the draft conservation plan for public inspection; and

(b) Invite persons or organisations to lodge with the Trust written comments on the draft conservation plan before a date specified in the public notice, being not less than 40 working days after the date of publication of the notice; and

(c) Make the draft conservation plan available for public inspection free of charge during the usual business hours at the principal office of the Trust in Wellington and at regional office of the Trust.

The NZHPT must consider any comments received and review the draft conservation plan before adopting the plan. The NZHPT may review and amend a conservation plan adopted by it. Any amendment or review shall follow the notification process set out above, except in the case of an amendment where the NZHPT resolves on reasonable grounds that the notification provisions need not be followed. The NZHPT shall not act in a manner inconsistent with any conservation plan. Once adopted in accordance with section 58 the conservation plan shall be available for public inspection free of charge during usual business hours at the principal office of the NZHPT in Wellington and at regional offices of the NZHPT.
5.4 Compliance with the Reserves Act 1977

The NZHPT as the administering body of the Pencarrow Head Historic Reserve is charged with the duty of administering, managing and controlling the reserve in accordance with the appropriate provisions of the Reserves Act and in terms of its appointment and the means at its disposal, so as to ensure the use, enjoyment, development, maintenance, protection, and preservation, as the case may require, of the reserve for the purpose which it is classified. The general purposes of an historic reserve is to protect and preserve in perpetuity such places, objects, and natural features, and such things thereon or therein contained as are of archaeological, cultural, educational, and other special interests. Under section 18 of the Reserves Act every historic reserve shall be administered and maintained that-

(a) The structures, objects, and sites illustrate with integrity the history of New Zealand;
(b) The public shall have freedom of entry and access to the reserve, subject to the specific powers conferred on the administering body [sections 58 and 58A] of this Act, to any bylaws under this Act applying to the reserve, and to such conditions and restrictions as the administering body considered to be necessary for the protection and general well-being of the reserve and for the protection and control of the public using it:
(c) Where scenic, archaeological, geological, biological, or other scientific features, or indigenous flora or fauna, or wildlife are present on the reserve, those features or that flora or fauna or wildlife shall be managed and protected to the extent compatible with the principal or primary purpose of the reserve:
(d) To the extent compatible with the principal or primary purpose of the reserve, its value as a soil, water, and forest conservation area shall be maintained:
(e) Except where the Minister otherwise determines, the indigenous flora and fauna and natural environment shall as far as possible be preserved:

Provided that nothing in paragraph (c) of this subsection shall authorise the doing of anything with respect to fauna or wildlife that would contravene any provision of the Wildlife Act 1953 or any regulations or Proclamation or notification under this Act, and nothing in this subsection shall authorise the doing of anything with respect to archaeological features in any reserve that would contravene any provision of the [Historic Places Act 1993].

Under the Reserves Act, the Minister of Conservation is required to ensure that all reserves are properly managed. A plan of management is therefore a statutory document and must be approved by the Department (on behalf of the Minister) before it can be formally adopted. This conservation plan will not serve as the statutory management plan but instead a separate management plan will be prepared for the reserve.

However, for a reserve held under the Reserves Act, for which the Department of Conservation is the default management authority, it would be good practice to consult with the Department of Conservation in the preparation of the conservation plan and also to provide a draft of the conservation plan to the Minister of Conservation to give a formal opportunity to comment. This consultation would happen under section 58(2) b and 58(3) of the Historic Places Act, as mentioned above. Although there is no statutory requirement, it would also be good practice to inform the relevant area office of the Department of Conservation, in this case the Wellington Conservancy, in advance of any work intended to be carried out on the lighthouse.

5.5 Compliance with the Resource Management Act 1991

The purpose of Resource Management Act 1991 is to promote the sustainable management of natural and physical resources (section 5(1)). In this Act sustainable management means (section 5(2)):
managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while—

(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment.

In achieving the purpose of the RMA, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the matters of national importance listed in section 6(a)-(g), including (section 6(f)):

(f) The protection of historic heritage from inappropriate subdivision, use, and development.

Local authorities can protect specific historic places and areas by listings and rules in the district and regional plans. After a historic place, historic area, wahi tapu or a wahi tapu area is listed in the District Plan, a Resource Consent is required for any alteration not requiring a building consent.

Under section 88 of the Act, an application for a resource consent for work on a listed building will include an assessment of any actual or potential effects of the work. Matters that should be included in an assessment of effects are covered in the Fourth Schedule of the Act; they can include ‘any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural, or other special value for present or future generations’ (Fourth Schedule of the Act). This Act covers any modifications to Pencarrow.

Section 189 of the act describes how a Heritage Protection Authority (such as the NZHPT, Department of Conservation or any Local Authority) may take steps to have additional areas of special interest, character, or significance included in the District Plan for protection, using a heritage order.

**District Plan Provisions – Hutt City Council**

Pencarrow Lighthouse is listed in ‘Appendix Heritage 1’ of section 14F, page 5, of the Operative Hutt City District Plan under ‘Heritage Buildings and Structures’ updated on 18 March 2004. As such, under rule 14F2.1:

Any alteration, repair or modification of any building listed in Appendix Heritage 1 or 2 involving either-

(i) Redecoration, repair or alterations which are internal and not visible from the road frontage; or

(ii) Minor repair, alteration or maintenance to the exterior of a building or structure which do not require a building consent is a permitted activity.

Any other alteration, repair or modification of any building or structure listed in Appendix Heritage 1 is a discretionary activity, and a Resource Consent must first be sought from Hutt City Council.

The lighthouse is part of the General Recreation Activity Area (Ch. 7A) in the District Plan; it also lies within the SNR9 - the coastal significant natural resource area. The Significant Natural Resource provisions are under review at the time of writing.
5.6 Compliance with the Building Act 2004

The purpose of the Building Act is to provide for the regulation of building work, the establishing of a licensing regime for building practitioners, and the setting of performance standards for buildings to ensure that:

(a) People who use buildings can do so safely and without endangering their health; and
(b) Buildings have attributes that contribute appropriately to the health, physical independence, and well-being of the people who use them; and
(c) People who use a building can escape from the building if it is on fire; and
(d) Buildings are designed, constructed, and able to be used in ways that promote sustainable development.

Under the Building Act 2004 the following matters are of particular relevance to existing buildings.

Repair and Maintenance (Schedule 1 Exempt Building Work)

Schedule 1 of the Building Act, 2004, under Exempt Building Work, states; a Building Consent is not required for the following building work:

(a) Any lawful repair and maintenance using comparable materials, or replacement with a comparable component or assembly in the same position, of any component or assembly incorporated or associated with a building, including all lawful repair and maintenance.

The Building Industry Authority (BIA) issued a determination, number 2000/1, stating that ‘comparable’ refers to ‘…replacement components or assemblies…..(that are) akin to or like the originals, in the sense of being made of similar materials and similar configuration; and….. performance in terms of the Building Code was equivalent to or as good as that of the originals…’

All work is required to comply with the Building Code.

Historic Places (Section 39)

When a territorial authority receives an application for a project information memorandum for a registered historic place, historic area or wahi tapu, it must inform the NZHPT.

Building Consents (Section 40 - 41)

It is an offence to carry out building work not in accordance with a building consent (except for exempted buildings in Schedule 1 of the Act). Section 41(c) allows for urgent work, such as emergency repairs, to be carried out without a consent, but such work is required to obtain a Certificate of Acceptance directly after completion.

Compliance Schedule and Warrant of Fitness (Sections 100 – 111)

A compliance schedule is required for a building that has specified systems relating to means of escape from fire, safety barriers, means of access and facilities for use by people with disabilities, fire fighting equipment and signage.

Such systems must be regularly inspected and maintained, and an annual building warrant of fitness supplied to the territorial authority. The purpose of the warrant of fitness is to ensure that the systems are performing as set out in the relevant building consent. A copy of the warrant of fitness must be on public display in the building.

As Pencarrow does not have any ‘specified systems’ these regulations do not apply.
Alterations to Existing Buildings (Section 112)

If alterations were considered for Pencarrow, then section 112 of the Act would also apply. Section 112 states that:

1. A building consent authority must not grant a building consent for the alteration of an existing building, or part of an existing building, unless the building consent authority is satisfied that, after the alteration, the building will:

   a. comply, as nearly as is reasonably practicable..., with the provisions of the building code that relate to-
      i. means of escape from fire; and
      ii. access and facilities for persons with disabilities (if this is a requirement in terms of section 118); and
   b. continue to comply with the other provisions of the building code to at least the same extent as before the alteration.

2. Despite subsection (1), a territorial authority may, by written notice to the owner of a building, allow the alteration of an existing building, or part of an existing building complying with the provisions of the building code specified by the territorial authority if the territorial authority is satisfied that,-

   a. if the building were required to comply ... the alteration would not take place; and
   b. the alteration will result in improvements to attributes of the building that relate to -
      i. means of escape from fire; or
      ii. access and facilities for persons with disabilities; and
   c. the improvements referred to in paragraph (b) outweigh any detriment that is likely to arise as a result of the building not complying with the relevant provisions of the building code.

Additional new buildings would also comply with any requirements of the Building Act. No such buildings are contemplated at the time of writing.

5.7 Compliance with the Health and Safety in Employment Act 1992

The purpose of the Health and Safety in Employment Act (HSEA) is to promote the prevention of harm to all persons at work and other persons in, or in the vicinity of a place of work. It requires that the person or persons in charge of a place of work take all practicable steps to ensure that the health and safety of all employees, volunteers and visitors are protected from any hazards that may present themselves.

The NZHPT has an operative Health and Safety Policy (November 2006) which applies to all staff.

Pencarrow Lighthouse has the potential to present a number of hazards to staff and contractors working on the structure, particularly when remedial work is being undertaken. In such cases the NZHPT would need to ensure that a safety plan is prepared and in place.

5.8 Compliance with the Occupier’s Liability Act 1962

The Occupier’s Liability Act 1962 outlines the obligations of an ‘occupier’ of land and buildings with regard to protecting any persons (including visitors) who enter any land or building under the occupier’s control.

The NZHPT can be regarded as the occupier of the Pencarrow Lighthouse. As such it has a duty of care to ensure that all reasonable steps are taken to keep visitors to the lighthouse
safe for the activities or purposes for which they have been invited or permitted by the NZHPT to be there.

5.9 Compliance with the Maritime Transport Act 1994

Maritime New Zealand has advised that as this lighthouse is not officially used for navigational purposes under section 200 of the act, then there are no requirements under the Maritime Transport Act 1994, and subsequent amendments up to the Maritime Transport Amendment Act (No.2) 2005, No 108, dated 14 December 2005.

5.10 Threats

Loss of purpose or incompatible use

The present use of this structure is as a heritage destination. The loss of this presently sustainable use or the imposition of an incompatible use would pose a significant threat, as identified in article 7 of the ICOMOS New Zealand Charter. This could lead to a lack of support and funding, and might allow other threats to manifest. The present use must be maintained and enhanced to ensure the long-term survival of this important historic structure.

Natural processes

Lighthouses, located as they are very near the sea, are particularly susceptible to deterioration by natural processes. Pencarrow Lighthouse is washed by sea spray and rain and buffeted by high winds. Wind and water ingress are helping to create a cavity beneath the platform. The site and the structure require regular monitoring and maintenance to ensure its ongoing viability.

Visitor hazards and impacts

Pencarrow is a remote structure and is particularly vulnerable to vandalism. Regular visitor use could lead to some wear and tear but this is likely to be relatively minor given that the structure is very robustly constructed and the interior is not open to the public.

Management impacts

Poor of management of this place may constitute a threat. This includes inadequate planning, delays in commencing work, undertaking inappropriate remedial work or maintenance, the erection of inappropriate structures, and the failure to act on known threats.

Disaster

As a robustly built structure, Pencarrow Lighthouse is better equipped to resist disaster than other structures, but fire, storms and earthquakes all have the potential to cause damage.

Climate change

The extent to which climate change might present a threat to the lighthouse is not known, but there is potential that some of the threats described above under ‘Natural Processes’ and ‘Disaster’ might be exacerbated by climate change.

Information loss

Good conservation practice relies on a good understanding of a place and that in turn requires the best available information. The loss of important archival sources such as old documents and photographs, and the loss of unrecorded oral history sources all constitute a threat.
ENDNOTES

1 R.I.M. Burnett, Secretary National Historic Places Trust, to Director –General, Lands and Survey, 15 November 1966, NZHPT 12016-015
2 Secretary of Marine to Secretary of National Historic Places Trust, 2 December 1966, NZHPT 12016-015.
3 NZG 1979, p.211
6. Conservation policy

6.1 General statement

Pencarrow Lighthouse should be managed in a manner that conserves this structure for future generations, and which is entirely consistent with best conservation practice.

The lighthouse has been managed as a monument since it came under the care of the NZHPT. It is most likely that this will remain the role of the structure for the foreseeable future, although other options are explored in this document.

6.2 NZHPT General Policy for Historic Places

This conservation plan has been written in line with the general policies outlined in the General Policy for the Management, Administration, Control, and Use of all Historic Places owned or controlled by the New Zealand Historic Places Trust or vested in it (Draft 12 June 2007). Any subsequent changes to this policy may require the amendment of this conservation plan.

6.3 Appropriate Conservation Standards - ICOMOS New Zealand Charter

ICOMOS Charter
Conservation Architect Chris Cochran has summarised the relevant portions of the ICOMOS New Zealand Charter, and with his permission, we repeat his summary here, to clarify these principles. Important conservation principles contained in the charter are explained below. The full text of the charter is included in the appendices.

Carry Out Regular Maintenance
Regular maintenance is essential to the long life of heritage buildings. If maintenance is not carried out on a planned basis, repairs become progressively more difficult and expensive, and fabric of heritage value can be lost, thus diminishing the significance of the building. A well maintained building will survive the effects of earthquakes, storms and other natural disasters better than one that is poorly maintained.

Repair Rather than Replace
When repairs are necessary, cut out and replace only decayed material. It is better to have fabric that is worn and carefully patched than modern replica material, however faithfully copied.

Repair in Compatible Materials
In carrying out repairs, materials matching the original should generally be used if they are available. Work to a higher technical standard than the original construction is good practice in some circumstances, and may be required by the Building Code.

Restore with Care
Restoration of lost features should be carried out only if there is clear evidence of the original form and detail. Such evidence should come from original drawings, early photographs or elements relocated to other parts of the building. Detailed examination of the fabric of the building can often reveal information that is not available from other sources.

Keep Change to the Minimum
Where additions and alterations are carried out to fit a building for a new use, change should be the minimum necessary to suit the new functional requirements. There should be the least possible loss of building fabric of heritage value.

Find a Compatible Use
Ideally, the original use of a heritage building should be continued. As this is often impracticable, compatible and economically feasible use should be found. A compatible use is one that can be incorporated into the building without excessive change, and without significant reduction of heritage significance.
Make New Work Reversible
Where possible, new work should be reversible so that change back to the present form remains a possibility, should this be required in the future. This can sometimes be difficult, particularly with major work such as earthquake strengthening. Recycle or store early fabric that has to be removed, and make new junctions with the old fabric as lightly as possible.

Respect Alterations
Additions and alterations to heritage buildings can have historic or aesthetic significance in their own right. Returning a building to its original form is recommended only when the significance of the original structure is outstanding and later alterations have compromised its integrity.

Distinguish New from Old
Growth and change are natural parts of the life of any building. Major changes, especially additions, should be able to be seen as such so as not to confuse the new with the old. Compatible design, where the new does not dominate or conflict with the old, should be the aim.

Document Changes
Changes should be fully documented in drawings and photographs, with the latter taken before, during and after conservation work. New materials should be identified by date stamping.

Respect the Patina of Age
Patina, the visible evidence of age, is something to protect carefully. Buildings should look old as they mature, as age is one of the qualities we value them for.

Respect the Contents and Setting
The contents and setting of a heritage building can often have heritage value in their own right and both should be regarded as integral with the building.

6.4 Extent of physical intervention
Appropriate conservation processes for the various assigned cultural heritage values (see section C.3) are as follows:

Cultural Heritage Value A
This means the elevation, space or element is of considerable cultural heritage value. Modification should be allowed only for the purpose of safeguarding the building, or to meet statutory requirements. Any such modification should be carried out only if no other reasonable option is available; it should be as discreet as possible and the minimum necessary.

Allowable processes of change include maintenance, stabilisation, repair and restoration.

Cultural Heritage Value B
This means the elevation, space or element is of some cultural heritage value. Adaptation, or removal and reuse may be allowed for the reasons given above and to effect functional improvement.

Allowable processes of change include maintenance, stabilisation, repair, restoration and adaptation.

Neg.
For elevations, spaces or elements of little or no cultural heritage value, their adaptation or modification may be carried out to effect any improvement. However, wherever work is undertaken in these spaces, consideration should be given to reinstating original fabric where this is known and where appropriate.
6.5 Interpretation

Historic places of great value, and accessible to the public, require interpretation of distinction and quality to improve the visitor experience and to assist in promoting the conservation of those places. The interpretation at Pencarrow has recently been improved with the installation of new signage. There is still potential to augment this by using a variety of interpretation options other than on-site panels.

If additional interpretation is sought, or is upgraded in the future, it should:

- Be based on sound research
- Explore themes and stories from all eras of the lighthouse’s history, including its period as an historic place
- Be based on an interpretation plan
- Include interpretation of the wider area

As any interpretation other than that located at the lighthouse itself will have to go on land managed by the GWRC it should be consulted on any future interpretation plans and their permission sought for the construction of any signs or panels. GWRC expects that any signage conforms to their standards for regional parks and complements and enhances any other information and signage in the area.

6.6 Future uses

The Pencarrow Lighthouse was transferred to the NZHPT in 1966 ‘for safe keeping and preservation’ and since then the NZHPT has managed the lighthouse more or less as a monument. This approach is consistent with the NZHPT’s role and responsibilities under the Historic Places Act and also recognises the severe limitations that the site imposes on the NZHPT as the administrator of the structure and Historic Reserve.

Any new use proposed by the NZHPT must ensure that the fabric of the lighthouse is not exposed to new threats, that its obligations under the Reserves Act are met, and that its responsibilities to adjacent landowners are also adhered to.

ENDNOTES

7. Building condition and work required

**Cast Iron**
Wall Panels, interior floor joists, and the cylindrical column (hollow counterweight enclosure) are all in good condition. No work is required except for that referred to under painting and foundations.

Balcony brackets, balcony grating, and the balcony top rail are all very intricate castings and suffer problems of corrosion similar to other lighthouses. The shape is complex and recoating is difficult. Paint films should be applied in thin, even coatings around all corners and on the ends of all naturally forming drip lines. These require regular touch up maintenance.

The cantilevered posts around the lantern room are attached to bronze transoms. These two elements together are subject to galvanic corrosion from dissimilar metal contact. The junction between the bronze and the cast iron needs to be checked regularly. At present they seem to be in reasonable order.

The U shaped gutters above the cantilevered posts are acting as a top plate beam. The outside gutter surface has been painted but the inside gutter surface has remained unpainted for about 25 years. Because of the natural durability of cast iron, the gutters remain in relatively good order, though paint is required inside to help prevent further corrosion. This should be completed as soon as possible and could be done as an extra item with the soon to be completed repaint.

The ends of the gutters are morticed to accept the tenon of the rafter ends. Corroded rafters that have blown the tenon and mortice apart have been part of the roof maintenance work of early 2008. Once fixed, junctions will need to be cleaned, and inspected regularly.

**Wrought Iron**
The diagonal lantern room braces have been inspected and repaired in the 2008 roof work and the ladder sides are in good order. No remedial action is required.

Balcony uprights were replaced in 1980, and hot dip galvanized steel was specified. The zinc galvanised coating appears to have been damaged at some stage as repeated ongoing maintenance has been required in the last 25 years. To reduce this repeated maintenance cycle we suggest careful attention is paid to the spot painting of these areas in the short term. Ensure the full three coat zinc, epoxy, urethane system is applied with the complete preparation procedure executed before painting, and between coats. On other lighthouses it has been found to be more cost efficient to replace these elements with stainless steel 316L, which is then painted.

**Timber**
Timber steps are evenly spaced from the ground to the second floor. They are worn but in good order. More splitting is occurring on the end of the steps closest to the cast iron and the appearance of green moss or fungi indicates high moisture levels inside the lighthouse. Adding ventilation to the base of the lighthouse can lower the present high moisture content of timber elements in the building, caused by internal condensation, and reduce further splitting in this area. The repair and the waterproofing of the roof is expected to make a gradual and increasing difference to the internal moisture levels. Moisture should be assessed on an annual basis.

The partially painted timber roof sarking has been repaired and rotten parts replaced in the 2008 roof maintenance.

The window design installed recently is not typically waterproof if the paint or sealant layers break down. Checks on the paint and sealant are required each year to ensure the windows maintain weathertight.
Copper and Bronze (Roof & Glass)
The ventilation cowl performs an important role maintaining the correct atmosphere in a ‘moth balled’ lighthouse. A check each year that the cowl rotates is required. The central pivoting arm and the copper triangular roofing have been repaired with the 2008 roof maintenance programme. In 2008, the copper pans were replaced with new copper gauged to match.

Care must be exercised when removing the glass on the transoms. Maritime New Zealand will not allow a glazier to replace the glass in the lantern room, and employs a specialist engineer, familiar with this work, to complete these tasks. About fifteen years after Pencarrow lighthouse was built a special tool was developed by the Lighthouse Service to remove the glazing fixings without stripping the head off the fixings each time the glass was replaced. On other lighthouses the glazing systems have been irreplaceably damaged by the work of inexperienced glaziers.

Concrete and Foundations
A concrete slab poured over the main lighthouse hold-down bolts is unusual practice. Old diary notes show the ground floor steel plates had badly corroded and the addition of concrete may have been a temporary fix for rust holes in the steel ground floor plates.

This concrete contributes to an increased decay rate of the important structural hold-down bolts and cast iron surround. Concrete can act as a blotter and suck ground water up from the water table below and also has a corrosive effect on cast iron. In the United States, the cast iron lighthouse wall panels that were butting against concrete were shown to corrode faster than the same panel exposed to the exterior.

This concrete should be removed to allow the steel structure to dry out.

Further investigation of the concrete and foundations was considered in the 2007 geotechnical assessment by Tony Mahoney of Connell Wagner. Reference should be made to his recommendations.

The condition of the hold-down connections should be ascertained and be checked every year.

Steel
The steel checker pattern tread plate was replaced after 1999 from the basket weave steel tread plate design previously installed. If the ventilation rates were increased and drainage added, then the expected life of these plates would increase.

An external steel ladder hung from the copper roof loosely. This rusting ladder was removed during roof maintenance work in early 2008 and not reinstalled for safety reasons.

Internal Moisture & Earth Foundations
The timber moisture test results, indicated previously in this report are high and indicate inevitable decay in the area close to the ground floor. All steel, and to a lesser extent the timber and cast iron components is at risk. When timber moisture readings are taken some distance away from the concrete slab (0.5 metres) lower results are obtained.

Advice from the U.S Coast Guard’s report on Protection and Stabilization (moth balling) of Historic Lighthouses indicates that ‘the vents (including doors) should remain operable (or vents added) to allow the maximum amount of air flow through the lantern.’

In a similar situation, New Zealand Standard 3604:1999 in Section 6.14.3 notes ventilation of 700mm per square meter of floor area is required for sub-floor spaces. With a floor area of about 20 square meters at Pencarrow, an opening 120mm x 120mm square, or a 15mm gap under the door, is required. This ventilation is very important as in this area the main hold-down bolts are presumed to be positioned, and the area must be kept as dry as possible.
It has been common practice when repainting a lighthouse in New Zealand to remove any redundant ventilation as all lighthouses have now been electrified and/or solarised. This practice is contrary to recommendations noted in articles from
- New Zealand and Canadian building authorities;³
- United States Coast Guard on Historic Lighthouse Preservation;⁴ and
- Australian Heritage authorities.⁵
They all stress the importance of ventilation in situations where complete water-tightness cannot be guaranteed.

**Foundations**
The only source of water found that could cause excessive dampness in the concrete were the puddles in the eroded sections of earth directly adjacent to the building. The puddles were partially full during a ‘height of summer’ site visit. Water pooling in the eroded hollows close to the foundations can wick through the clay and concrete and keep the ground floor area constantly wet.⁶

It is recommended that the following alterations are completed in the next year:
- A drain is added around the lighthouse to lower the level of moisture below the height of the ground floor slab, and above the height of the base of the foundations.
- The lightening protection cable (removed before 21 January 1986) is reinstated, with an earthing pad set into the ground where the earth has already eroded. Specialist advice would need to be obtained to indicate if this is suitable, and for the design of the cable. Refer Internal Equipment. Nearly all other lighthouses of this height have some form of lightening protection.
  - The eroded earth around the foundation is replaced and built up to a level where it is free draining.
- Ventilation is added to the front door.
- Recommendations by geotechnical engineer Tony Mahoney of Connell Wagner after his assessment carried out in 2007 should be considered.

---

**Figure 7-1.** Drainage patterns of water. Shows how the addition of a geotextile drain around one building lowered the original level of damp in the walls from above floor level to below the floor, and thus protected the floor hold down bolts. From, David Young, ‘Rising Damp and Salt Attack’. City of Adelaide State Heritage Branch (University of Canberra, Cultural Heritage Research Centre), 1997.
Figure 7-2. Shows how a well ventilated under floor space will carry moisture laden air to the outside. (See Young, above)

Figure 7-3. Shows how a concrete fill below a floor can act as a blotter to cause rising damp. (See Young, above)

Paint
The excellent condition of the lower coats of paint on the exterior cast iron panels, (over and above other similar historic cast iron lighthouses), is due to the ongoing wash down and maintenance completed on an annual cycle. As a result any major recoating can be delayed for some years.

However, the standard of workmanship needs to be observed before, during, and after the application of the paint. An independent person, with suitable qualifications, can help ensure that the high performance coatings specified are applied correctly.

ENDNOTES

1 US Coast Guard. *Protection and Stabilisation (moth balling) of Historic Lighthouses*. USA. ca1997 (Part iv G Page 14)

3 Ibid.

4 US Coast Guard. *Protection and Stabilisation (moth balling) of Historic Lighthouses. USA* ca1997 (Part iv G Page 14)

5 Young, David. *Rising Damp and Salt Attack*, City of Adelaide State Heritage Branch (University of Canberra, Cultural Heritage Research Centre) 1997, p.10.

8. Future use

While the NZHPT’s main objective is the identification, protection, preservation, and conservation of the lighthouse, it is also interested in establishing a revenue stream from the building.

Access
Any future use of Pencarrow Lighthouse will need to take into account that the historic reserve is bounded by a recreation reserve managed by the GWRC as part of the East Harbour Park, as well as a coastal margin strip managed by the Hutt City Council. As such the Lighthouse has no legal access and is a land-locked site. The GWRC requires notification to enter the park. In addition the main road out to the lighthouse is owned by the Hutt City Council, access to which is controlled by a locked gate. There is a strict limit on the number of vehicle movements per day and who can be a keyholder. As the guardian of the Crown-owned site the NZHPT has authority for 4WD vehicle access up to the Lighthouse.

Landmark
This is a current use and remains the only present viable use that incurs little attendance or monitoring. As a striking landmark structure, the lighthouse is attractive as a place to visit (historical groups, school parties etc) and to record (in publications, film and television). There are many opportunities to increase this. However, it is also important to protect the landmark value of the lighthouse and views to and from it by protecting the uncluttered nature of the peninsula.

Lookout
Lookouts typically rely on a small entrance price and a large number of people entering the building. At Pencarrow the revenue gathered would be small.

A discussion about visitation was held with several four wheel drive tour tourist operators and they noted that their biggest demand is for tours around the south coast of Wellington, west from Owhiro Bay to Sinclair Head (Hells Gate). One prominent operator does not travel to Pencarrow at all, and another would take 10 people there once a week in summer. In winter trips to Pencarrow are ‘on demand’, which requires a person to book and organise the group, as there is insufficient demand for the tour operator to do this. There would be some wear and tear on the lighthouse, and custodian remuneration.

In any case, any commercial venture operated on (or across) GWRC managed lands requires consent through the council’s concession process. Any tour operator would need to gain permission and pay a fee per customer. A commercial operator is unlikely to be granted vehicle access.

Museum
A major part of any museum is its displays and interpretation. Pencarrow has been stripped of all its historic equipment and fittings. Visitation levels are increasing however and occur as individuals and more often as organised busloads. Interest is in understanding the role of the lighthouse in navigation, Wellington history and special events such as Wahine commemoration.

Café
A café has high set up and on-going costs. Regulatory restrictions along with low visitation levels makes this an unlikely prospect.

Accommodation
The Maritime New Zealand web site notes under frequently asked questions that there are no lighthouses available for overnight accommodation. Pencarrow is not a good candidate for use as accommodation. In addition to the practical issues, new buildings should not be
allowed on or near the lighthouse to protect its landscape values, and such a venture would require new buildings/structures.

It should be noted that any proposal to allow permanent or temporary accommodation on a reserve would require the consent of other authorities.

**Descendants of the Bennett Family**

The descendants of Mary Bennett are interested in erecting a plaque at Pencarrow to celebrate Mary Bennett’s role as New Zealand’s first lighthouse keeper.

**Interpretation**

New interpretation has now been installed on-site at Pencarrow. However, interpretation of the lighthouse could still be promoted at other suitable locations in the Wellington area in the form of panels, signage and written material. Interpretation material could be placed in the Petone Settlers Museum, the Museum of Wellington - City and Sea, or even at the ferry terminals or on the ferries themselves. Websites such as the Hutt City i-site also offer a vehicle for interpretation.

Interpretative panels could be placed at viewpoints around Wellington such as Breaker Bay on Wellington’s south coast where the lighthouse can clearly be seen. Such sites offer an opportunity to tell the story of Pencarrow in the context of the wider harbour and in an area frequently visited by the public.

The internet is already used to promote and tell the story of Pencarrow Lighthouse through a dedicated webpage, but opportunities exist to expand and refresh that coverage.

**Registration**

The opportunity should be taken to review the registration with a view to including the entire area that encompasses the lighthouse station.
9. Maintenance

The following work is required to reduce and mitigate any future wear and damage to the historic fabric of the building. The nominated dates are estimates. The details of the work required are not full specifications.

Maintenance - regular cyclic tasks to prevent deterioration.

Immediate Maintenance Required - one-off tasks, for immediate completion, to prevent damage to other parts of the historic fabric. Sheets 1 - 3.

Special Equipment - equipment and tools not normally associated with these construction tasks, but that are required here.

**Maintenance Summary**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SHEET</th>
<th>MAINTENANCE TYPE</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1,2,3,4</td>
<td>Immediate maintenance required Annual Maintenance.</td>
<td>Clean and inspect. Eroded ground, Copper roof Exterior paint maintenance <strong>DONE</strong></td>
</tr>
<tr>
<td>2007</td>
<td>1,2,3,4</td>
<td>Immediate maintenance required Annual Maintenance</td>
<td>Clean and inspect, spot paint. Complete un-programmed maintenance. <strong>DONE</strong></td>
</tr>
<tr>
<td>2008</td>
<td>1,2,3,4</td>
<td>Immediate maintenance required Annual Lubricate &amp; Clean Annual Paint Maintenance.</td>
<td>Clean and inspect. Eroded ground, Copper roof Exterior paint maintenance Exterior clean <strong>DONE</strong></td>
</tr>
<tr>
<td>2009</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate Annual Paint Maintenance</td>
<td>Clean and inspect, spot paint. Complete un-programmed maintenance.</td>
</tr>
<tr>
<td>2010</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate Annual Paint Maintenance</td>
<td>Clean and inspect, spot paint. Complete un-programmed maintenance.</td>
</tr>
<tr>
<td>2012</td>
<td>3,4,5</td>
<td>Annual Clean &amp; Lubricate Annual Paint Maintenance Six Year Maintenance</td>
<td>Clean and inspect. Full exterior top coat</td>
</tr>
<tr>
<td>2013</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate Annual Paint Maintenance</td>
<td>Clean and inspect, spot paint. Complete un-programmed maintenance.</td>
</tr>
<tr>
<td>2015</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate Annual Paint Maintenance</td>
<td>Clean and inspect, spot paint. Complete un-programmed maintenance.</td>
</tr>
<tr>
<td>2016</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate Annual Paint Maintenance</td>
<td>Clean and inspect, spot paint. Complete un-programmed maintenance.</td>
</tr>
<tr>
<td>2017</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate Annual Paint Maintenance</td>
<td>Clean and inspect, spot paint. Complete un-programmed maintenance.</td>
</tr>
<tr>
<td>2018</td>
<td>3,4,5</td>
<td>Annual Clean &amp; Lubricate Annual Paint Maintenance Six Year Maintenance</td>
<td>Clean and inspect. Full exterior top coat</td>
</tr>
<tr>
<td>2019</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate</td>
<td>Clean and inspect, spot paint. Complete un-</td>
</tr>
<tr>
<td>Year</td>
<td>Years</td>
<td>Maintenance Type</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>2020</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate</td>
<td>Clean and inspect, spot paint. Complete unprogrammed maintenance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual Paint Maintenance</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate</td>
<td>Clean and inspect, spot paint. Complete unprogrammed maintenance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual Paint Maintenance</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>3,4</td>
<td>Annual Clean &amp; Lubricate</td>
<td>Clean and inspect, spot paint. Complete unprogrammed maintenance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual Paint Maintenance</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>3,4,5,6</td>
<td>Annual Clean &amp; Lubricate</td>
<td>Clean and inspect. Full exterior top coat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual Paint Maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Six Year Maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eighteen Year Maintenance</td>
<td></td>
</tr>
</tbody>
</table>

**REPEAT**

Repeat from 2006, maintaining the same two year cycle for cleaning, then cleaning and spot painting. Also maintain the same 6 year cycle for a complete new top coat of the entire lighthouse.

<table>
<thead>
<tr>
<th>Year</th>
<th>Years</th>
<th>Maintenance Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2050</td>
<td>8</td>
<td>Strip back all paint to bare cast iron, and recoat.</td>
<td></td>
</tr>
</tbody>
</table>
Sheet 1 Immediate Maintenance Required - Eroded Ground

Reinstatement of the natural ground level of around the lighthouse requires the careful specification and will require the use of a specialist consultant. Lightening protection design could be incorporated into this geotechnical specification.

Description
The ground levels around Pencarrow have eroded to about 400mm below the base of the slab. Puddles in this eroded depression were the only source of water found around the site. High moisture content exists in the building, sufficient to produce ‘inevitable decay’ of building materials within 200 to 300mm of the ground floor slab. This includes the area around the hold-down bolts.

The ground needs to be filled to remove the depression, and the puddles. Before filling the low levels of the soil around the lighthouse provide a good opportunity to add drains and lightening protection.

Design
- Check depth of existing foundations.
- Lift steel panels on ground floor to check damage.
- Obtain expert geotechnical advice on drain location, drain size, soak pit design, imported fill types.
- Obtain archaeological checks on drain.
- Check addition of lightening pad.
- Obtain all required statutory approvals for construction.
- Design ventilation to door.

Construction (minimal)
- Complete ground works.
- Add drains.
- Add fill to hollows.
- Complete vent to ground floor door or window.
- Remove, if required, the concrete around the hold down bolts.

Construction (recommended)
- Add lightening protection plates as required.

Monitor
- Designer to check the following items:-
  - Check moisture levels in the building one year later.
  - Check condition of hold down bolts.
  - Monitor removal of ground floor concrete.
Sheet 2  Immediate Maintenance Required - Copper Roof

Description
- The fixings at the gutter edge and parts of the copper pan roof have corroded through so that the roof edge can lift. This lets in water and has resulted in the possible destruction of one structural cantilevered lantern room post / roof rafter joint. Upper iron panels of the lighthouse have corroded..
- To complete these maintenance items, safe access is to be provided to the roof. This would be a good opportunity to add lightening protection, repair the ventilation cowl, and maintain the existing sloping roof ladder.

Design
- Discuss scaffolding requirements and safety aspects for access to gutter
- Discuss folding techniques for copper pan roof.
- Research and specify paint suitable for immersion, for the gutter.
- Research Health and Safety of maintaining existing ladder system to roof.
- Check purpose of lead roofing collar around cowl.

Construction (Minimal)
- Complete painting of inside of gutter except top coat.
- Remove recent ladder addition and lead collar, label, and store inside Pencarrow, with suitable laminated labels.
- Add new copper under flashing, and fix copper roofing.
- Add isolating strip between copper roofing and cast iron.
- Clean exploded rust off post / rafter cast iron mortice and tenon joint.

Construction (Recommended)
- Add lightening protection to roof.
- Hot dip galvanise existing roof ladder, paint with epoxy / urethane system, and re-bolt with stainless steel bolts to copper structure, using a plastic membrane separator to stop galvanic corrosion between dissimilar metals.
- Add standard timber wall ladder from base of roof ladder to gantry walkway. Ensure this ladder is made from ground treated timber. Discuss safety aspects of leaving such a hazardous ladder on site.

Monitor
- Designer to check the following items:-
- Structural engineer to check stability of roof rafter joint at eaves, which has exploded because of rust heave.

Note: This was completed in 2007/08.
Sheet 3  Annual Clean & Lubricate

Description
- To inspect the entire lighthouse, and note any remedial action required.
- To clean all surfaces.

Suggested timing
- In summer while the access road to the lighthouse is not slippery.

Design
- Unusual ‘special equipment’ required:
  - Spare padlock, hacksaw, keys to gate and lighthouse
  - Abseil shunt, (rope crabs) with full harness, fall arrest device
  - Full harness, and safety personnel, familiar with rope procedures.
  - Camera to record condition of paint work.
  - wheel drive vehicle with water tanks aboard.
  - Moisture levels on timber.
  - Mobile scaffolding.
  - Grease gun for grease nipples.
  - Notification and permission from Hutt City and Department of Conservation that contractor will be travelling over the drainage reserve, then over the recreational reserve.

Construction (Checks and tasks)
- Doors operate freely.
- Gutters free, and roof fixings intact.
- Climb, with full harness, onto roof. Cowl can spin freely, and internal air intake not blocked.
- Hold down bolts, 80% steel to remain.
- Glass intact.
- Dissimilar metal contact areas, check for corrosion.
- Windows and metal plates fully sealed and edges painted.

Construction (Tasks)
- Fresh water, soft brooms, water-blower NOT more than 300 lbs per sq inch, with detergent, maximum 1 teaspoon Lissapol or Terric to 10 litres water.
- Clean both sides of glass.
- Oil and grease doors, hinges, and moving parts of handle, clean. CRC to locks.
- Grease gun door nipples.
- Grease spindle of cowl.
- Then wash and clean entire building.

Monitor
- Designer to check the following items:-
- Saline levels of substrate after cleaning, less than 7 micro gm sq cm
Sheet 4  Annual Paint Maintenance  - Spot Paint

**Description**  To spot clean, sand & feather rust, then apply full paint system to spots.

**Suggested timing**  
- In summer while the access road to the lighthouse is not slippery. Complete in addition to the work described on Sheet 3

**Design**  
- The lighthouse has been painted with a high performance paint coating. These coatings are hard and durable, and as such require care when recoating:
- Discuss recoating techniques with specialist paint inspector, then list all paint types required in table format, as shown below.
- Give NZHPT inspector 2 weeks notice of time of completion of works.
- List all batch numbers and quantities of paint, do NOT throw out empty paint cans until Practical Completion given and inspector checked work.
- Visit site with inspector to confirm extent of works before proceeding.

**Construction**  
- After entire lighthouse has been washed as per Sheet 3.
- Sand rusting areas to bright steel, establish key profile for paint.
- Fresh water wash at the start of each day before painting.
- Apply penetrative primer to saturation, and zinc primer to bare steel, allow to dry.
- Apply key coat to existing feathered areas of paint, allow to dry.
- Fresh water wash at the start of each day before painting.
- Apply undercoat.
- Fresh water wash at the start of each day before painting.
- Apply top coat.

<table>
<thead>
<tr>
<th>COAT</th>
<th>TYPE</th>
<th>DATA</th>
<th>SPREAD</th>
<th>DFT</th>
<th>RE-COAT WINDOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fresh water wash</td>
<td>PENETRATING /</td>
<td>To saturation / 30µm</td>
<td>24 Hrs</td>
<td>5 days</td>
</tr>
<tr>
<td></td>
<td>ZINC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fresh water wash</td>
<td>EPOXY–Thin 10%</td>
<td>11.0m²/L?</td>
<td>30 µm</td>
<td>24 Hrs</td>
</tr>
<tr>
<td>3</td>
<td>Fresh water wash</td>
<td>URETHANE Gloss</td>
<td>10.0m²/L?</td>
<td>50 µm</td>
<td>24 Hrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TOTAL 120µm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key**  All the following information needs to be provided to the contractor:

- **Type** refers to the brand name of the paint, add name.
- **Data** refers to the Data sheets the paint companies provide with the paint. Follow the paint manufacturers instructions completely. Add data sheet reference.
- **Spread** refers to the wet spread rate in square metres per litre. Enter correct figure.
- **DFT** refers to the Dry Film Thickness of the Paint, after it has dried. Enter figure.
- **Re-coat Window** refers to the time the next coat of paint is to be applied, after the minimum time specified, and before the maximum time specified. Time starts when last coat applied. Enter correct figure.

**Monitor**  
- Designer to check the following items:-
- Fresh water amounts delivered to site. Saline levels of substrate to be painted.
- Preparation techniques. DFT readings before and after painting.
- Batch numbers of the empty paint cans of the applied paint.
- Spread rates, by dividing the litre capacity of the empty paint cans into the surface area of the building painted.
- Weather conditions at the time of painting.
Six year Maintenance - New Exterior Top coat of paint

Description
- To spot clean, feather, prime, undercoat, all spots of rust.
- Top coat entire lighthouse to the outside.

Suggested timing.
- Confirm the programme two years before. Duration may extend to every 10 years.
  Complete while the access road to the lighthouse is not slippery. Complete in addition to the work described on Sheet 3 & 4

Design
- The lighthouse has been painted with a high performance paint coating. These coatings are hard and durable, and as such require care when recoating.
- Discuss recoating techniques with paint specialist and paint manufacturer.
- Give NZHPT inspector 2 months notice of expected time for completion of works.
- List all batch numbers and quantities of paint, do NOT throw out empty paint cans until Practical Completion given and inspector has checked work.
- Visit site with inspector to confirm extent of works before proceeding.

Construction
- After entire lighthouse has been washed as per Sheet 3
- Complete all work described on Sheet 4, spot priming rusting areas.
- Refer below for painting entire lighthouse
- Sand entire lighthouse to achieve key profile.
- Fresh water wash at the start of each day before painting
- Apply etch coat to key into previous painted surfaces.
- Apply top coat to entire lighthouse.

<table>
<thead>
<tr>
<th>COAT</th>
<th>TYPE</th>
<th>DATA</th>
<th>SPREAD</th>
<th>DFT</th>
<th>RE-COAT WINDOW AFTER to next coat BEFORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fresh water wash</td>
<td></td>
<td>11.0m²/L?</td>
<td>30µm ?</td>
<td>24 Hrs</td>
</tr>
<tr>
<td>2</td>
<td>Topcoat</td>
<td>URETHANE Gloss</td>
<td></td>
<td>10.0m²/L?</td>
<td>50 µm ?</td>
</tr>
<tr>
<td></td>
<td>ETCH PRIMER</td>
<td>11.0m²/L?</td>
<td>30µm ?</td>
<td></td>
<td>24 Hrs</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>80µm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

KEY All the following information needs to be provided to the contractor

**TYPE** refers to the brand name of the paint, add name.
**DATA** refers to the Data sheets the paint companies provide with the paint. Follow the paint manufactures instructions completely. Add data sheet reference.
**SPREAD** Refers to the wet spread rate in square metres per litre. Enter correct figure.
**DFT**. Refers to the Dry Film Thickness of the Paint, after it has dried. Enter figure.
**RECOAT WINDOW**, refers to the time the next coat of paint is to be applied, after the minimum time specified, and before the maximum time specified. Time starts when last coat applied. Enter correct figure.

Monitor
- Designer to check the following items:-
- Fresh water amounts delivered to site. Saline levels of substrate to be painted.
- Preparation techniques. Dry Film Thickness readings before and after painting.
- Batch numbers of the empty paint cans of the applied paint.
- Spread rates, litre capacity of used empty paint cans into the surface area.
- Weather conditions at the time of painting.
Sheet 6  Eighteen year Maintenance - New Exterior & Interior Top coat

Description
- To spot clean, feather, prime, undercoat, all spots of rust.
- Top coat entire lighthouse to the outside.

Suggested timing.
- Confirm the programme two years before. Duration may extend to every 10 years. Complete while the access road to the lighthouse is not slippery. Complete in addition to the work described on Sheet 3, 4, and 5.

Design
- The lighthouse has been painted with a high performance paint coating. These coatings are hard and durable, and as such require care when recoating.
- Discuss recoating techniques with paint specialist and the manufacturer.
- Give NZHPT inspector 2 months notice of expected time for completion of works.
- List all batch numbers and quantities of paint, do NOT throw out empty paint cans until Practical Completion given and inspector has checked the work.
- Visit site with inspector to confirm extent of works before proceeding.

Construction
- After entire lighthouse has been washed as per Sheet 3.
- After entire lighthouse has been spot primed as per Sheet 4.
- After the entire exterior of the lighthouse has been painted as per Sheet 5.
- Refer below for painting inside of the lighthouse.
- Sand entire lighthouse to achieve key profile.
- Fresh water wash at the start of each day before painting.
- Apply etch coat to key into previous painted surfaces.
- Apply top coat to entire lighthouse.

<table>
<thead>
<tr>
<th>COAT TYPE</th>
<th>DATA</th>
<th>SPREAD</th>
<th>DFT</th>
<th>RE-COAT WINDOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Fresh water wash ETCH PRIMER</td>
<td>11.0m²/L?</td>
<td>30µm</td>
<td>24 Hrs</td>
<td>5 days</td>
</tr>
<tr>
<td>2 Fresh water wash URETHANE Gloss</td>
<td>10.0m²/L?</td>
<td>50 µm</td>
<td>24 Hrs</td>
<td>5 days</td>
</tr>
</tbody>
</table>

TOTAL 80µm

KEY  All the following information needs to be provided to the contractor

*TYPE* refers to the brand name of the paint, add name.

*DATA* refers to the Data sheets the paint companies provide with the paint. Follow the paint manufactures instructions completely. Add data sheet reference.

*SPREAD* Refers to the wet spread rate in square metres per litre. Enter correct figure.

*DFT* refers to the Dry Film Thickness of the Paint, after it has dried. Enter figure.

*RE-COAT WINDOW* refers to the time the next coat of paint is to be applied, after the minimum time specified, and before the maximum time specified. Time starts when last coat applied. Enter correct figure.

Monitor
Designer to check the following items:-
- Fresh water amounts delivered to site. Saline levels of substrate to be painted.
- Preparation techniques. Dry Film Thickness readings before and after painting.
- Batch numbers of the empty paint cans of the applied paint.
- Spread rates, litre capacity of used empty paint cans into the surface area.
- Humidity and surface temperature conditions inside at the time of painting.
Sheet 7  Fifty year Maintenance - Strip back and paint

Description
Remove all paint. Paint entire lighthouse to the outside.

Suggested timing. Confirm the programme on every two year cycle before. Duration may extend from every 30 years to every 50 years. Complete while the access road to the lighthouse is not slippery.

Description
Remove all exterior paint. Paint entire lighthouse.

Preparation Procedure
A. Remove where possible all excess existing coating by mechanical means eg. Hand tool chipping. Do not abrasive blast or clean with airtool chippers. High pressure water blasting, with glancing angled head, allowed 500mm below astragal glass.
B. Scrape out all cracks and splits in the substrate Collect all paint and bag. – Wet / dry vacuum lead paint and collect.
C. Thoroughly wash the entire surface by scrubbing or brushing down with Chloro – rid salt remover cleaning solution. Rinse with copious quantities of clean water.
D. The cleanliness of the prepared surface is to be checked using a chloride test kit. The chloride level should measure less than 7 micro gm.sqcm. the cleaning process is to be repeated until the chloride levels are acceptable.
E. The casting pockets and holes visible after the stripping process are to be tapped out with an appropriate engineers hammer and then thoroughly cleaned out with an engraving tool before flushing with clean water.
F. Grind out the edges of all cast iron panels with an engraving tool.
G. The final surface preparation is to be Garnet abrasive blast of the substrate using the C grade Garnet blast media to achieve a surface clean standard of SA 2.5 as specified in ISO 8501-1.
H. The less preferred final surface preparation is to power tool clean the entire substrate to achieve a ‘ST 2’ of the SIS 05 5900 pictorial standard.
I. Achieve 98% paint removal, in any area 100mm x 100mm there will be a total of sound paint no bigger than 2mm x 2mm, for flat surfaces. For the inside of the decking grill holes only, achieve 90% paint removal, for any area 100x20mm in size, there will be a total of sound paint no bigger than 10mm x 20mm, inside the grill holes. The top and bottom of the grills count as a flat surface.
J. Deburr all sharp cast iron edges – these include the grated walkway around the astragal and balcony walkway areas.

Painting Procedure (Generic, as paint systems will alter by 2030)
1. Fresh Water. Flush and scrub with fresh water. Light water blast, fresh water. Allow to dry. Complete this process at the start of each day.
2. 1st coat -Paint Penetrating epoxy into Cast iron and graphite, to saturation.
3. Do not apply coating so that a film is achieved. Leave double the specified time to dry
4. Grind out all non draining pin holes. Grind out all holes and cracks where water cannot drain. Spot prime.
5. 1st Inspection - 50% complete. No paint added.
6. Fresh Water. Flush and scrub with fresh water. Light water blast, fresh water. Allow to dry. Complete this process at the start of each day.
7. 2nd coat zinc primer Zinc cathodic primer.
10. 2nd Inspection
11. Fresh Water Flush and scrub with fresh water. Light fresh water blast. Allow to dry
12. 3rd intermediate coat Epoxy build coat. CHECK FOR PIN HOLES
13. Fresh Water Flush and scrub with fresh water. Light fresh water blast. Allow to dry
14. 3rd Inspection
15. Fresh Water Flush and scrub with fresh water. Light fresh water blast. Allow to dry
16. 4th coat intermediate coat - Second Epoxy build coat.
17. Fresh Water Flush and scrub with fresh water. Light fresh water blast. Allow to dry.
18. **5th coat finish coat**- Uracryl ‘non chalking’ paint. White, with tint
19. 4th Inspection
20. **6th Coat finish**- Uracryl ‘non chalking’ paint. White. No tint
21. Final Inspection
Sheet 8a  Unplanned Maintenance - Lantern Glass

Description
- Replace broken lantern room glass

Design (Special Equipment)
- Abseil access shunt (rope crabs) with full fall arrest harness.
- Mobile scaffold, able to fit onto balcony.
- Sealant
- ‘U’ shaped santoprene glazing blocks.
- Special 1850’s clamping screw drivers (c.f. pulley remover)
- Heat.
- Glass type (12mm thick) - to check with NZHPT

Construction. (Tasks)
- Remove glass.
- Clean and paint frame as per sheet 5, allow to dry.
- Add glass with ‘U’ shaped santoprene setting blocks.
- Fosroc weathering sealant applied all round.

Monitor
- Obtain reference from all staff working on glazing, of their work on previous lighthouse glazing. The removal of Lantern glazing on a lighthouse is a SPECIALIST activity, and MUST be done by staff experienced in lighthouse work and not by general Glaziers.

Sheet 8b  Unplanned Maintenance Timber Window Glass

- Description
  - Replace broken timber window glass

Design
- Check if Lexan MR10mm polycarbonate to be used, or glass.

Construction. (Tasks)
- Remove glass.
- Clean, sand, and feather edges, paint frame, Resene quick dry primer.
- Add glass with setting blocks and stainless steel diamond brads. NOT galv steel.
- Or… add GE Lexan MR10 10mm thick mar resistant polycarbonant
- Sealant applied all round.
- Repaint timber window, Resene Quick dry primer, HiGlo paint.

Monitor
- Tracibility: Provide a copy of the Tax Invoice from the plastics supplier showing GE Lexan MR10 purchase
- Provide sample of glazing brads used.
10. Bibliography

Books
*Appendices to the Journals of the House of Representatives (AJHR)*
*British Parliamentary Papers*
Bowron, Greg, and Jan Harris, *Guidelines for Preparing Conservation Plans*, NZHPT, Wellington, 2000
Ellen Ellis, ‘A First and Only for Pencarrow Lighthouse’, *Historic Places in New Zealand*, No.16, March 1987
Furkert, F. W. Early New Zealand Engineers, A.H. & A.W. Reed, Wellington, 1953
McKinnon, Malcolm (ed.), with Barry Bradley and Russell Kirkpatrick, *New Zealand Historical Atlas*, Bateman/Historical Branch, Department of Internal Affairs,1997
Irvine-Smith, F.L. *The Streets of My City*, A.H. & A.W. Reed, Wellington, 1948
*Proceedings of the Provincial Council of Wellington*, 1857, sessions 5-6.
United States Coast Guard, *Protection and Stabilisation (moth balling) of Historic Lighthouses*, USA, ca1997
Ward, Louis, *Early Wellington*,1928
Young, David, *Rising Damp and Salt Attack*, City of Adelaide State Heritage Branch (University of Canberra, Cultural Heritage Research Centre), 1997

Periodicals, newspapers, articles and chapters
Beaglehole, Helen, ‘Pencarrow Lighthouse’ Wellington Branch Committee Newsletter, NZHPT, February 2004
City of Lower Hutt, District Plan Significant Natural, Cultural and Archaeological Resources. Lower Hutt. Updated 18 March 2004
Ellis, E., ‘A First and Only for Pencarrow Lighthouse’, *Historic Places in New Zealand* No.16, March 1987
Eastbourne Herald, 24 September 1904
*Evening Post* 5 May 1927, 19 January 1935, 5 June 1935
New Zealand Gazette 1844-1979
New Zealand Journal, 29 November, 27 December 1851
Wellington Independent, 26 June 1858, 18 September 1858

Archival material

Internal Affairs, Archives New Zealand (ANZ), Wellington
Deputy Superintendent to Colonial Sec, 20 October 1858, 60/530, IA1/174, ANZ

Marine Department, Archives New Zealand (ANZ), Wellington
Pencarrow –Head Lighthouse – Report on inspection, 1931-1945, M1, 3/45/17, ANZ
Lighthouses- Pencarrow Head- Buildings, repairs and additions, etc. 1917-1963, M1, 8/45/11, ANZ
Lighthouse –Pencarrow Head – Horse, 1914-1957, M1, 8/3/6, ANZ
Pencarrow Head, 1932-1962, Marine Department, M1, 8/8/40, ANZ
Lighthouse: Pencarrow Head –Light Apparatus, Lantern etc., 1915-1975, M1, 8/45/14, ANZ
Lighthouses – Pencarrow Head – Centennial celebrations, M1, 8/45/14/1, ANZ
Pencarrow – Head lighthouse – Report on fire, 1928-1928, M1, 8/45/15, ANZ
Instructions to lighthouse keepers (1886, 1923), ANZ
Daily Journals (1930-1958), ML-Pencarrow 1/1 -1/23, ANZ
Outwards Correspondence 1898 –1959, ML-Pencarrow 3/1- 3/6, ANZ
Pencarrow Lighthouse Images, ABPL 8848 W5221, ANZ

New Zealand Historic Places Trust File 12016-015, Pencarrow Lighthouse, held at Central Region, Wellington

Wellington Province (ANZ) Wellington
Entry Book of Outwards Letters, 1 April 1857, p230, WP 6/1, ANZ
Gladstone to Superintendent, 16 July 1857, 57/752, in WP 3/5, ANZ

There are also a number of historic images held by the Alexander Turnbull Library (ATL), Wellington. Included are:

Pencarrow Lighthouse (MacIntosh Album III, c. 1895?) 38788 ½, ATL
Pencarrow Lighthouse (MacIntosh Album III, c. 1895?) 38789 ½, ATL
Pencarrow Lighthouse, c. 1900s, 71896 ½, ATL
Pencarrow Lighthouse, 61951 ½, ATL
Tutanekai landing stores at Pencarrow Lighthouse, 16 February 1928, F112298 ½, ATL
Tutanekai landing stores at Pencarrow Lighthouse, 16 February 1928, 114603 ½, ATL
Pencarrow Lighthouse F112250 ½, ATL
Pencarrow Lighthouse ca. 1900, G8027 ½, ATL
Pencarrow Lighthouse and the dwelling houses, 112297 ½, ATL
Pencarrow Head, 1936, F35193 ½, ATL
Pencarrow Head, c.1920s [?], F3851 ½, ATL
Pencarrow Foghorn Hut, c. 1955, No Neg, ATL
Pencarrow Low Level Light, c. 1905, 111272 ½, ATL
Unpublished material

Duff, Simon, ‘Pencarrow Lighthouse Archaeological Assessment; Report prepared to assess the impact of proposed foundation improvements’ NZHPT, May 2006

Oral Sources
National Institute of Water and Atmosphere, NIWA, Oceanography Section, Conversation Paul Cummack and Oceanographer, Wellington, 2006

Web-based sources


Ellis, Ellen, “Bennett, Mary Jane1816?-1885” Dictionary of New Zealand Biography, updated 22 June 2007 URL: http://www.dnzb.govt.nz


www.msa.govt.nz/Publications/lighthouses/paringhead.pdf;
Appendices

Appendix 1 - ICOMOS Charter
Appendix 2 - History of cast iron and its use in New Zealand lighthouses
Appendix 3 - History of lantern room and light
Appendix 4 - Cast iron and paint calculations
Appendix 5 - ICC paint coatings
Appendix 1: ICOMOS New Zealand Charter

ICOMOS NEW ZEALAND

Charter for the Conservation of Places of Cultural Heritage Value

PREAMBLE

New Zealand retains a unique assemblage of places of cultural heritage value relating to its indigenous and its more recent peoples. These areas, landscapes and features, buildings, structures and gardens, archaeological and traditional sites, and sacred places and monuments are treasures of distinctive value. New Zealand shares a general responsibility with the rest of humanity to safeguard its cultural heritage for present and future generations. More specifically, New Zealand peoples have particular ways of perceiving, conserving and relating to their cultural heritage.

Following the spirit of the International Charter for the Conservation and Restoration of Monuments and Sites (the Venice Charter 1966), this charter sets our principles to guide the conservation of places of cultural heritage value in New Zealand. It is intended as a frame of reference for all those who, as owners, territorial authorities, tradespersons or professionals, are involved in the different aspects of such work. It aims to provide guidelines for community leaders, organisations and individuals concerned with conservation issues. It is a statement of professional practice for members of ICOMOS New Zealand.

Each section of the charter should be read in the light of all the others. Definitions of terms used are provided in section 22.

Accordingly this charter has been adopted by the New Zealand National Committee of the International Council on Monuments and Sites at its Annual General Meeting on 4 October 1992.

1. The Purpose of Conservation

The purpose of conservation is to care for places of cultural heritage value, their structures, materials and cultural meaning. In general, such places:

   i. have lasting values and can be appreciated in their own right;
   ii. teach us about the past and the culture of those who came before us;
   iii. provide the context for community identity whereby people relate to the land and to those who have gone before;
   iv. provide variety and contrast in the modern world and a measure against which we can compare the achievements of today; and
   v. provide visible evidence of the continuity between past, present and future.

2. Indigenous Cultural Heritage

The indigenous heritage of Maori and Moriori relates to family, local and tribal groups and associations. It is inseparable from identity and well-being and has particular cultural meanings.

The Treaty of Waitangi is the historical basis for indigenous guardianship. It recognises the indigenous people as exercising responsibility for their treasures, monuments and sacred places. This interest extends beyond current legal ownership wherever such heritage exists. Particular knowledge of heritage values is entrusted to chosen guardians. The conservation of places of indigenous cultural heritage value therefore is conditional on decisions made in the indigenous community, and should proceed only in this context. Indigenous conservation precepts are fluid and take account of the continuity of life and the needs of the present as well as the responsibilities of guardianship and association with those who have gone before.
In particular, protocols of access, authority and ritual are handled at a local level. General principles of ethics and social respect affirm that such protocols should be observed.

### 3. Conservation Practice

Appropriate conservation professionals should be involved in all aspects of conservation work. Indigenous methodologies should be applied as appropriate and may vary from place to place. Conservation results should be in keeping with their cultural content. All necessary consents and permits should be obtained.

Conservation projects should include the following:

1. **Definition of the cultural heritage value of the place**, which requires prior researching of any documentary and oral history, a detailed examination of the place, and the recording of its physical condition;
2. **Community consultation**, continuing throughout a project as appropriate;
3. **Preparation of a plan** which meets the conservation principles of this charter;
4. **Implementation** of any planned work; and
5. **Documentation** of any research, recording and conservation work, as it proceeds.

### GENERAL PRINCIPLES

### 4. Conservation Method

Conservation should:

1. Make use of all relevant conservation values, knowledge, disciplines, arts and crafts;
2. Show the greatest respect for, and involve the least possible loss of, material of cultural heritage value;
3. Involve the least degree of intervention consistent with long term care and the principles of this charter;
4. Take into account the needs, abilities and resources of the particular communities; and
5. Be fully documented and recorded.

### 5. Respect for existing evidence

The evidence of time and the contributions of all periods should be respected in conservation. The material of a particular period may be obscured or removed if assessment shows that this would not diminish the cultural heritage value of the place. In these circumstances such material should be documented before it is obscured or removed.

### 6. Setting

The historical setting of a place should be conserved with the place itself. If the historical setting no longer exists, construction of a setting based on physical and documentary evidence should be the aim. The extent of the appropriate setting may be affected by constraints other than heritage value.

### 7. Risk Mitigation

All places of cultural heritage value should be assessed as to their potential risk from any natural process or event. Where a significant risk is determined, appropriate action to minimise the risk should be undertaken. Where appropriate, a risk mitigation plan should be prepared.

### 8. Relocation

The site of an historic structure is usually an integral part of its cultural heritage value. Relocation, however, can be a legitimate part of the conservation process where assessment shows that:

1. The site is not of associated value (an exceptional circumstance); or
ii. relocation is the only means of saving the structure; or
iii. relocation provides continuity of cultural heritage value.

A new site should provide a setting compatible with cultural heritage value.

9. Invasive Investigation

Invasive investigation of a place can provide knowledge that is not likely to be gained from any other source. Archaeological or structural investigation can be justified where such evidence is about to be lost, or where knowledge may be significantly extended, or where it is necessary to establish the existence of material of cultural heritage value, or where it is necessary for conservation work. The examination should be carried out according to accepted scientific standards. Such investigation should leave the maximum amount of material undisturbed for study by future generations.

10. Contents

Where the contents of a place contribute to its cultural heritage value, they should be regarded as an integral part of the place and be conserved with it.

11. Works of Art and Special Fabric

Carving, painting, weaving, stained glass and other arts associated with a place should be considered integral with a place. Where it is necessary to carry out maintenance and repair of any such material, specialist conservation advice appropriate to the material should be sought.

12. Records

Records of the research and conservation of places of cultural heritage value should be placed in an appropriate archive. Some knowledge of place of indigenous heritage value is not a matter of public record, but is entrusted to guardians within the indigenous community.

CONSERVATION PROCESSES

13. Degrees of Intervention

Conservation may involve, in increasing extent of intervention: non-intervention, maintenance, stabilisation, repair, restoration, reconstruction or adaptation. Where appropriate, conservation processes may be applied to parts or components of a structure or site.

Re-creation, meaning the conjectural reconstruction of a place, and replication, meaning to make a copy of an existing place, are outside the scope of this charter.

14. Non-intervention

In some circumstances, assessment may show that any intervention is undesirable. In particular, undisturbed constancy of spiritual association may be more important than the physical aspects of some places of indigenous heritage value.

15. Maintenance

A place of cultural heritage value should be maintained regularly and according to a plan, except in circumstances where it may be appropriate for places to remain without intervention.

16. Stabilisation

Places of cultural heritage value should be protected from processes of decay, except where decay is appropriate to their value. Although deterioration cannot be totally prevented, it should be slowed by providing stabilisation or support.

17. Repair

Repair of material or of a site should be with original or similar materials. Repair of a technically higher standard than the original workmanship or materials may be justified where
the life expectancy of the site or material is increased, the new material is compatible with the old and the cultural heritage value is not diminished. New material should be identifiable.

18. Restoration

Restoration should be based on respect for existing material and on the logical interpretation of all available evidence, so that the place is consistent with its earlier form and meaning. It should only be carried out if the cultural heritage value of the place is recovered or revealed by the process. The restoration process typically involves reassembly and reinstatement and may involve the removal of accretions.

19. Reconstruction

Reconstruction is distinguished from restoration by the introduction of additional materials where loss has occurred. Reconstruction may be appropriate if it is essential to the function or understanding of a place, if sufficient physical and documentary evidence exists to minimise conjecture, and if surviving heritage valued are preserved. Reconstruction should not normally constitute the majority of a place. Generalised representations of typical features or structures should be avoided.

20. Adaptation

The conservation of a place of cultural heritage value is usually facilitated by it serving a socially, culturally or economically useful purpose. In some cases, alterations and additions may be acceptable where they are essential to continued use, or where they are culturally desirable, or where the conservation of the place cannot otherwise be achieved. Any change, however, should be the minimum necessary and should not detract from the cultural heritage value of the place. Any conditions and alterations should be compatible with original fabric but should be sufficiently distinct that they can be read as new work.

21. Interpretation

Interpretation of a place may be appropriate if enhancement of public understanding is required. Relevant protocol should be complied with. Any interpretation should not compromise the values, appearance, structure or materials of a place, or intrude upon the experience of the place.

22. DEFINITIONS

For the purposes of this charter:

adaptation means modifying a place to suit it to a compatible use, involving the least possible loss of cultural heritage value

conservation means the processes of caring for a place so as to safeguard its cultural heritage value

cultural heritage value means possessing historical, archaeological, architectural, technological, aesthetic, scientific, spiritual, social, traditional or other special cultural significance, associated with human activity

maintenance means the protective care of a place

material means physical matter which is the product of human activity or has been modified by human activity

place means any land, including land covered by water, and the airspace forming the spatial context to such land, including any landscape, traditional site or sacred place, and anything fixed to the land including any archaeological site, garden, building or structure, and any body of water, whether fresh or seawater, that forms part of the historical and cultural heritage of New Zealand

preservation means maintaining a place with as little change as possible
reassemble (anastylosis) means putting existing but dismembered parts back together

reconstruction means to build again in the original form using old or new material

reinstatement means putting components of earlier material back in position

repair means making good decayed or damaged material

restoration means returning a place as nearly as possible to a known earlier state by reassembly, reinstatement and/or the removal of extraneous additions

stabilisation means the arrest of the processes of decay

structure means any building, equipment, device or other facility made by people and which is fixed to the land.
Appendix 2: Cast Iron and its use in New Zealand Lighthouses

Paul Cummack

An understanding of the manufacturing process and physical properties of the cast iron is required when deciding what repair methods are suitable for this historic material. Suitable repair methods are discussed in Chapter F, Maintenance.

From 1000 B.C to the fifteenth century, iron ore taken directly from the ground was heated, but not melted, on a charcoal fire. This malleable spongy iron mass, now called wrought iron, was hammered into shape, usually for weapons or tools.

In the fifteenth century air was forced over the iron ore fire. This raised the temperature to 1200 °C and was sufficient to melt the ore. The melt could then be poured into moulds, producing cast iron.¹

In the 1850s cast iron was a perfect choice for lighthouse construction for two principal reasons. Firstly, cast iron is relatively resistant to corrosion because of its microstructure components – graphite and phosphide eutectic. (Eutectic means two compounds melting together at a lower temperature than the parent metal.) These two compounds are not present in steel, which explains why the two materials corrode in different ways. Secondly, cast iron can be cast into virtually any shape that is required for structural or decorative purposes.² Complex shapes involving ‘bolt together’ structural systems were developed.

This prefabricated style of construction facilitated the making of a lighthouse in England. The prefabricated parts were then transported by ship to where required all in a timely, economical manner. This became a large exporting industry. For example the Chance Brothers Birmingham Lighthouse factory, in 1910, occupied an area about the size of Te Papa, Wellington.

Figure Appendix 2-1. The Chance Brothers Lighthouse and Glass Factory in Birmingham. Shows the size of the ‘lighthouse industry’ in England. From web site www.btinternet.com/~k.trethewey/ChanceBrothers.htm
It is quite remarkable that iron heated below 770°C (wrought iron) will remain soft and can be easily worked with hammer and anvil, but will corrode easily, whereas the same material heated above 1200°C will become brittle and can fracture, sometimes explosively, when hammered or under tension, yet remains durable to the elements.

Pencarrow Lighthouse uses both types of iron, the majority of the building is made from carefully designed cast iron panels, and the malleable wrought iron is used in the tension braces around the lantern.

The cast iron panels are most likely to have been cast directly into a hollow carefully prepared in casting sand. The molten cast iron was run into channels which have moulds leading off them, and was fancifully likened to pigs in a litter, hence the name ‘pig iron’.3

This cast iron usually contained 2% to 6% carbon. Sometimes this carbon separated out in plates and impurities in the form of graphite, but remained physically mixed in the iron.45 Without careful regard to these properties, incorrect maintenance techniques, in New Zealand have resulted in:

300mm diameter holes being punched completely through the cast iron wall plates, during sand blasting, when a carbon (graphite) plate was buried under the paint layers; and
Failure of the paint coating for the whole tower, as the primer was not of a type that bonds well to the graphite.

Graphite, like a pencil lead, is easily wiped away in layers and does not provide ready adhesion like that from the rest of the graphite.

The brittleness of the material has been reasonably well understood by past contractors, and there have not been any major panel failures because of this property.

Refer Sheet 7, section F, Maintenance, 50 year painting, for acceptable working practices.

Figure Appendix 2-2  Carbon pocket found after the paint had been stripped from a lighthouse constructed in 1870s  Photo – Bill Koelman.

Cast Iron Usage in New Zealand Lighthouses

In New Zealand the use of cast iron for lighthouse construction occurred in the period 1859 to 1913.
<table>
<thead>
<tr>
<th>DATE</th>
<th>TOWER</th>
<th>TOWER MATERIAL</th>
<th>LANTERN CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1859</td>
<td>Pencarrow</td>
<td>Cast iron octagon</td>
<td>Vertical cantilevered posts bracing across window.</td>
</tr>
<tr>
<td>1865</td>
<td>Tiritiri Matangi</td>
<td>Cast iron cylinder</td>
<td>Diagonal Mullions No bracing across windows</td>
</tr>
<tr>
<td>1866</td>
<td>Somes Island (former)</td>
<td>Cast iron octagon.</td>
<td>Vertical cantilevered Mullions.</td>
</tr>
<tr>
<td>1870</td>
<td>Cape Campbell</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
<tr>
<td>1889</td>
<td>Cuvier</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
<tr>
<td>1894</td>
<td>Stephens Island</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
<tr>
<td>1897</td>
<td>Cape Palliser</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
<tr>
<td>1900</td>
<td>East Island</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
<tr>
<td>1903</td>
<td>Kahurangi Point</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
<tr>
<td>1909</td>
<td>Cape Brett</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
<tr>
<td>1913</td>
<td>Castle Point</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
<tr>
<td>1922</td>
<td>East Cape 7 Moved from East Island</td>
<td>Cast iron cylinder</td>
<td>Triangular Astragal Lantern room</td>
</tr>
</tbody>
</table>


ENDNOTES

Appendix 3 - History of the Pencarrow Lantern Room and Light

Paul Cummack

Lantern Room Glazing

The use of cast iron on an 1850s lighthouse was well conceived. However, the construction of the lantern room was awkward and ungraceful. The posts supporting the roof provided little resistance to torsional wind loads, and braces that could obstruct the light were installed over the window.

Fifteen years later, the design of the bracing, roof support and glazing bars were rationalised. A limited number of modular triangular cast bronze bars were connected via a single coupling to form a geodesic frame that made up a cylindrical tube for the lantern room. This is truly an ingenious solution to such a complex constructional problem given the performance required of each section, and the limited modular number of kit set parts.

After 1900 similar geodetic space frames were used for R27 airships (Zeppelins) where a very limited standardised number of straight components were used to make complex tubes and spheres.¹

Figure Appendix 3-1. Cape Brett Lighthouse, showing the Triangular Glazing Mullion Design. Photo Paul Cummack. Oct 2005
Light

The first light source at Pencarrow was most likely burning colza oil, a derivative of the rape plant. This oil was later replaced with a cheaper paraffin oil. Incandescent kerosene burners were introduced to Pencarrow in 1907. Kerosene oil provided economy with a brilliant light and no wick trimming.

Figure Appendix 3-2 Typical colza or Paraffin light. From the photo collection of Jim Foye of Maritime New Zealand. This was most likely the first light source at Pencarrow. A header tank, not shown, would feed oil from above to the lamp below.
Figure Appendix 3-3. Diagram of Chances Lantern, and air / oil pressurization system. (New Zealand Marine Department Lighthouse Service Technical Manual. Wellington. 1970 Around 1907 the Colza lights were removed and replaced with Kerosene oil lamps. The ‘bicycle’ pump was used to pressurize the air chamber and oil chamber, which then fed the ‘Chances Patent’ lamp illustrated above. This system was used extensively from 1907 until the advent of electric lamps.

Lenses

The original Pencarrow lens was described as a ‘second order, catadioptric’ lens with ‘eclipses’ every 2 minutes.3

An ‘eclipse’ is when an object blocks the light from the viewer’s point of reference. At Pencarrow Lighthouse this occurred when a steel plate moved across the face of the lens and the light could not be seen. On other lighthouses the lens design would cause the eclipse.
‘Second order’ describes the size of the lighthouse, lens, and all its equipment. Generally first order lighthouses will be seen first when approaching a country or ‘land fall’. Second order lighthouses guide a ship around the coast.

‘Catadioptric’ lenses are made up of two lens types, a dioptic lens with a catadioptric lens above and below. These lenses work on two principles.

Firstly, for the middle ‘dioptic lens’, when a ray of light passes from one medium to another medium of different density, the ray of light will bend towards the normal of the denser material. [Refer figure Appendix 3-4.] A dioptic lens is based solely on this property, and will refract light twice, when the ray passes from air to glass, and glass to air.

Second, for the upper and lower ‘catadioptric lens’, if a ray of light hits the inner surface of glass at an angle of incidence less than 41½ degrees, then that ray of light will reflect off this surface of the glass and bounce back. Refer figure Appendix 3-5. It will not refract out of the glass. In a triangular catadioptric prism light would refract into surface A of the prism, then hit the back surface B of the prism at less than 41½ degrees and thus reflect out towards surface C, where it would refract again.

A catadioptic lens group is made up of dioptic lenses in the middle and catadioptic lenses above and below to further enhance the power of the lens. The entire array of triangular prisms make up a ‘fresnel’ lens.

![Figure Appendix 3-4. Dioptric Lens Section. Light reflects ‘twice’ inside the glass lens, New Zealand Marine Department, Lighthouse Service Technical Manual. Wellington. 1970 5.68, Fig 4 –1.2.2 > section 1.2](image)

![Figure Appendix 3-5. Catadioptric Lens Section. Light refracts through one face, reflects off the second face then refracts and exits through the third face of the triangular prism. New Zealand Marine Department, Lighthouse Service Technical Manual. Wellington. 1970](image)

**Eclipse**

Originally a steel plate rotated around the Pencarrow lens causing an illusion of flashes that could distinguish this light from other lights and bush fires in the settlement. After nine months the light was converted to a continuous beam as it was difficult to obtain replacements for the moving parts in remote locations.
The Pencarrow lens was removed from Pencarrow in 1941 and installed at Godley Head. Unverified information received indirectly from a Maritime New Zealand storeman (now retired), suggests that the lens from Pencarrow Lighthouse continues to be used at Godley Head.

![Figure Appendix 3-6. Godley Head Lighthouse Lens. Photo Paul Cummack. June 2006](image)

ENDNOTES - APPENDIX 3 HISTORY OF THE PENCARROW LANTERN ROOM AND LIGHT. PREPARED BY PAUL CUMMACK

Appendix 4 – Cast Iron and Paint Calculations

Number of Panel
Historic notes showed that 480 parcels were delivered to the site. From the exploded axonometric sketch of the construction, we can list in table form below the number of cast iron panels required to build the lighthouse. As 152 cast iron panels of 27 types are required, there must have been a large number of parcels containing other building materials that were delivered to site in ca1858.

<table>
<thead>
<tr>
<th>PANEL POSITION</th>
<th>NUMBER OF PANELS IN ROW</th>
<th>NUMBER OF PANEL TYPES IN ROW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground. Estimate</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Wall Panel row 1</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Wall Panel row 2</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Wall Panel row 3</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Wall Panel row 4</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Wall Panel row 5</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Wall Panel row 6</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Wall Panel row 7</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Wall Panel row 8</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Joists -Grd</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Joists –Level 1</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Joists -Second</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Balcony cantilever</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Handrail</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Floor plate</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Lantern Posts</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Lower lantern panels</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Gutter</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Rafters</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Column Grd</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Column first</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>154</strong></td>
</tr>
</tbody>
</table>

Estimate of Weight of Largest Panel
An estimate of the total weight of the largest cast iron panel can be made. This shows that a team of horses on a whim and/or jury-rig, or other device, would be required to lift the heavy panels into position.

Weight is:
1.9 x0.77 Panel has a surface area of 1.07 x 2.2 x 0.025m thick = 0.057 cubic metres.
1 cubic foot of Cast Iron = 450 lbs & 35.315 cubic metres = 1 m3 = 15,891 lbs
0.4536 lbs to kg implies 15,891 lbs = 7,208 kg / m3
Thus one panel would weigh 0.057 x 7,208 = 424 kg, or just less than half a tonne each.

Estimate – Dry Film Thickness of Paint
Calculations can be made to estimate the time to the next complete strip down of paint. This is a very approximate calculation and a specialist paint inspector will need to access the condition of the paint every seven years.

Dry film thickness (DFT) of about 2000 µm or there is paint failure. Present DFT=1100 µm, plus 150 µm per eight years. Thus expected complete strip down due around 2050AD (maybe). Subject to status quo remaining, no paint failures, and the checks listed in the maintenance schedule.
Appendix 5 - ICC Paint Coatings

The following tables enclosed, contain dry paint film thickness readings, to check future coating thicknesses:

INDEPENDENT COATINGS CONSULTANCY

INSPECTION REPORT
COATING SURVEY

Project: Pencarrow Light House - Wellington
Weather: Fine / Clear
Page: 1 of 5
Date: 16-Feb-06

PREAMBLE
The following is a report on the coating dry film thickness survey carried out on the exterior coating on the Pencarrow Light House. The survey is based on using an electronic gauge to accurately measure the coating film thickness in microns between the metal substrate and the top surface of the coating. Reference to the areas surveyed is shown in an orientation plan of the light house, following page 5 of this report.

Coating Thickness Test
Instrument Used: Elecometer 345 gauge
Calibration: Shim range 24 - 1245 microns
Procedure: Film thickness readings have been taken at randomly selected areas
Accuracy: plus / minus 3%

Summary of Survey

<table>
<thead>
<tr>
<th>Area Reference</th>
<th>No. readings</th>
<th>High</th>
<th>Low</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Elevation 1A</td>
<td>20</td>
<td>1221</td>
<td>649</td>
<td>954</td>
</tr>
<tr>
<td>2. Elevation 1B</td>
<td>20</td>
<td>1287</td>
<td>830</td>
<td>1083</td>
</tr>
<tr>
<td>3. Elevation 1C</td>
<td>20</td>
<td>1284</td>
<td>820</td>
<td>1101</td>
</tr>
<tr>
<td>4. Elevation 1D</td>
<td>20</td>
<td>1207</td>
<td>704</td>
<td>906</td>
</tr>
<tr>
<td>5. Elevation 1E</td>
<td>20</td>
<td>1200</td>
<td>874</td>
<td>1029</td>
</tr>
<tr>
<td>6. Elevation 1F</td>
<td>20</td>
<td>1256</td>
<td>837</td>
<td>1045</td>
</tr>
<tr>
<td>7. Elevation 1G</td>
<td>20</td>
<td>1173</td>
<td>752</td>
<td>999</td>
</tr>
<tr>
<td>8. Elevation 1H</td>
<td>20</td>
<td>1263</td>
<td>881</td>
<td>1050</td>
</tr>
<tr>
<td>9. Elevation 2A</td>
<td>20</td>
<td>1285</td>
<td>731</td>
<td>1084</td>
</tr>
<tr>
<td>10. Elevation 2C</td>
<td>20</td>
<td>1293</td>
<td>718</td>
<td>1119</td>
</tr>
<tr>
<td>11. Elevation 3A</td>
<td>20</td>
<td>1077</td>
<td>566</td>
<td>831</td>
</tr>
<tr>
<td>12. Elevation 3B</td>
<td>20</td>
<td>1223</td>
<td>635</td>
<td>872</td>
</tr>
<tr>
<td>13. Elevation 3C</td>
<td>20</td>
<td>721</td>
<td>447</td>
<td>604</td>
</tr>
<tr>
<td>14. Elevation 3D</td>
<td>20</td>
<td>800</td>
<td>517</td>
<td>633</td>
</tr>
<tr>
<td>15. Elevation 3E</td>
<td>20</td>
<td>881</td>
<td>461</td>
<td>698</td>
</tr>
<tr>
<td>16. Elevation 3F</td>
<td>20</td>
<td>974</td>
<td>535</td>
<td>777</td>
</tr>
<tr>
<td>17. Elevation 3G</td>
<td>20</td>
<td>1033</td>
<td>495</td>
<td>788</td>
</tr>
<tr>
<td>18. Elevation 3H</td>
<td>20</td>
<td>1024</td>
<td>512</td>
<td>789</td>
</tr>
</tbody>
</table>

* Note all readings are listed on page 2,3,4 and 5 of this report.

Signed:

WP Koelman
CBIP Certified Coatings Inspector CI 057
Dated: 16-Feb-06
63 Totara Street, Wainuiomata. Phone: 04 970 3306 Fax: 04 970 3895 Mobile: 0274 997 138
## COATING SURVEY REPORT
### DFT READINGS

<table>
<thead>
<tr>
<th>Project:</th>
<th>Pencarrow Lighthouse - Wellington</th>
<th>Page:</th>
<th>2 of 5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Survey area location - 1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

Sub Total: 4292
TOTAL: 17987
DFT ave: 864.36 Microns

<table>
<thead>
<tr>
<th>Survey area location - 1B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

Sub Total: 5766
TOTAL: 21675
DFT ave: 1083.75 Microns

<table>
<thead>
<tr>
<th>Survey area location - 1C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

Sub Total: 5921
TOTAL: 23221
DFT ave: 1101.06 Microns

<table>
<thead>
<tr>
<th>Survey area location - 1D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

Sub Total: 4194
TOTAL: 19727
DFT ave: 984.35 Microns

<table>
<thead>
<tr>
<th>Survey area location - 1E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

Sub Total: 5139
TOTAL: 20066
DFT ave: 1029.3 Microns

WP Koelman
CBIP Certified Coatings Inspector Cl 057
63 Totara Street, Wainuiomata. Phone: 04 970 3806 Fax: 04 970 3895 Mobile: 0274 997 138

Date: 16 February 2006
## COATING SURVEY REPORT
### DFT READINGS

<table>
<thead>
<tr>
<th>Project:</th>
<th>Pencarrow Lighthouse - Wellington</th>
</tr>
</thead>
<tbody>
<tr>
<td>Page: 3</td>
<td>3 of 5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey area location - 1F</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>837</td>
<td>102</td>
<td>114</td>
<td>124</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>1017</td>
<td>1043</td>
<td>126</td>
<td>1137</td>
<td>1044</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>1035</td>
<td>1121</td>
<td>1015</td>
<td>867</td>
<td>999</td>
</tr>
<tr>
<td>Sub Total</td>
<td>5208</td>
<td>5497</td>
<td>5127</td>
<td>5064</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>20016</td>
<td>5497</td>
<td>5127</td>
<td>5064</td>
<td></td>
</tr>
<tr>
<td>DFT ave:</td>
<td>1045.8 Microns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey area location - 1G</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1121</td>
<td>722</td>
<td>100</td>
<td>770</td>
<td>820</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>1185</td>
<td>905</td>
<td>1003</td>
<td>1075</td>
<td>1146</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>961</td>
<td>1045</td>
<td>1173</td>
<td>1124</td>
<td>1051</td>
</tr>
<tr>
<td>Sub Total</td>
<td>4203</td>
<td>5404</td>
<td>5374</td>
<td>4915</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>19006</td>
<td>5404</td>
<td>5374</td>
<td>4915</td>
<td></td>
</tr>
<tr>
<td>DFT ave:</td>
<td>999.3 Microns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey area location - 1H</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>861</td>
<td>900</td>
<td>1003</td>
<td>867</td>
<td>1186</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>1034</td>
<td>1123</td>
<td>1113</td>
<td>1086</td>
<td>1083</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>1215</td>
<td>1124</td>
<td>1173</td>
<td>967</td>
<td>996</td>
</tr>
<tr>
<td>Sub Total</td>
<td>4629</td>
<td>5521</td>
<td>5277</td>
<td>5187</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>21014</td>
<td>5521</td>
<td>5277</td>
<td>5187</td>
<td></td>
</tr>
<tr>
<td>DFT ave:</td>
<td>1050.7 Microns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey area location - 2A</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1171</td>
<td>1108</td>
<td>1003</td>
<td>731</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>1004</td>
<td>1041</td>
<td>1152</td>
<td>1086</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1285</td>
<td>1120</td>
<td>1104</td>
<td>1047</td>
<td></td>
</tr>
<tr>
<td>Sub Total</td>
<td>5021</td>
<td>5444</td>
<td>5505</td>
<td>5544</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>21654</td>
<td>5444</td>
<td>5505</td>
<td>5544</td>
<td></td>
</tr>
<tr>
<td>DFT ave:</td>
<td>1984.7 Microns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey area location - 2C</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1030</td>
<td>1360</td>
<td>882</td>
<td>718</td>
<td>1064</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>1173</td>
<td>1198</td>
<td>1228</td>
<td>1108</td>
<td>1236</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>1267</td>
<td>1230</td>
<td>1296</td>
<td>946</td>
<td>1296</td>
</tr>
<tr>
<td>Sub Total</td>
<td>4814</td>
<td>5942</td>
<td>6004</td>
<td>5490</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>22380</td>
<td>5942</td>
<td>6004</td>
<td>5490</td>
<td></td>
</tr>
<tr>
<td>DFT ave:</td>
<td>1119.5 Microns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WP Koelman**
CBIP Certified Coatings Inspector CI 057
63 Totara Street, Wainuiomata. Phone: 04 970 3806 Fax: 04 970 3895 Mobile: 0274 997 138

Date: 16 February 2006
## COATING SURVEY REPORT
### DFT READINGS

<table>
<thead>
<tr>
<th>Project:</th>
<th>Pencarrow Light House - Wellington</th>
<th>Page: 4 of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Survey area location - 3A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>850</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>866</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>883</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>1056</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>746</td>
<td>10</td>
</tr>
<tr>
<td>Sub Total</td>
<td>4210</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>16623</td>
<td></td>
</tr>
<tr>
<td><strong>DFT ave:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Survey area location - 3B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>669</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>636</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>719</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>833</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>813</td>
<td>10</td>
</tr>
<tr>
<td>Sub Total</td>
<td>3673</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>17453</td>
<td></td>
</tr>
<tr>
<td><strong>DFT ave:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Survey area location - 3C</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>698</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>690</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>447</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>555</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>405</td>
<td>10</td>
</tr>
<tr>
<td>Sub Total</td>
<td>3549</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>13096</td>
<td></td>
</tr>
<tr>
<td><strong>DFT ave:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Survey area location - 3D</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>598</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>690</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>596</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>571</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>544</td>
<td>10</td>
</tr>
<tr>
<td>Sub Total</td>
<td>2992</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>12673</td>
<td></td>
</tr>
<tr>
<td><strong>DFT ave:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Survey area location - 3E</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>821</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>799</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>544</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>746</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>703</td>
<td>10</td>
</tr>
<tr>
<td>Sub Total</td>
<td>3881</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>13972</td>
<td></td>
</tr>
<tr>
<td><strong>DFT ave:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WP Koelman  
CBIP Certified Coatings Inspector CI 057  
63 Totara Street, Wainuiomata. Phone: 04 970 3806 Fax: 04 970 3895 Mobile: 0274 997 138  

Date: 16 February 2006
## COATING SURVEY REPORT

### DFT READINGS

**Project:** Pencarrow Light House - Wellington  
**Page:** 5 of 5

<table>
<thead>
<tr>
<th>Survey area location</th>
<th>3F</th>
<th>3G</th>
<th>3H</th>
<th>3H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>753</td>
<td>996</td>
<td>603</td>
<td>966</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>739</td>
<td>923</td>
<td>923</td>
<td>916</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>11</td>
<td>13</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>721</td>
<td>712</td>
<td>759</td>
<td>702</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>16</td>
<td>18</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>803</td>
<td>964</td>
<td>983</td>
<td>954</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>675</td>
<td>975</td>
<td>895</td>
<td>895</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>20</td>
<td>19</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>DFT (Microns)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Sub Total  
TOTAL  
DFT ave: 777.26 Microns

Sub Total  
TOTAL  
DFT ave: 738.4 Microns

Sub Total  
TOTAL  
DFT ave: 739.9 Microns

Sub Total  
TOTAL  
DFT ave: 0 Microns

Sub Total  
TOTAL  
DFT ave: 0 Microns

---

*WP Koelman  
Date: 16 February 2006  
CBIP Certified Coatings Inspector C1047
63 Totara Street, Wainuiomata, Phone: 04 970 3806 Fax: 04 970 3895 Mobile: 0274 997 138

Pencarrow Lighthouse Conservation Plan 2009  Page 94